Taylor Lane Wastewater Treatment Plant

IFB No. 6100 CLM460

C.I.P. No. 3353.095

ADDENDUM #2

ADDENDUM #2 IS TOO LARGE TO POST IN ITS ENTIRETY TO THIS WEB SITE

SECTION 00900 ADDENDUM AND ATTACHED PAGES ARE POSTED TO THIS WEB SITE

THE REVISED PLAN SET IS NOT POSTED TO THIS WEB SITE

A COMPLETE ADDENDUM #2 WILL BE MAILED TO ALL PLAN HOLDERS

THE COMPLETE ADDENDUM MAY ALSO BE OBTAINED AT 7TH FLOOR FILE ROOM, SUITE 760, ONE TEXAS CENTER, 505 BARTON SPRINGS ROAD, AUSTIN, TEXAS 78704

ADDENDUM No. 2

Date October 23, 2013

Club Deal 120 Whisper Valley, Limited Partnership

Project Name Taylor Lane Wastewater Treatment Plant

C.I.P. No. 3353.095

This Addendum forms a part of Contract and clarifies, corrects or modifies original Bid Documents, dated September 9th, 2013. Acknowledge receipt of this addendum in space provided on bid form. Failure to do so may subject bidder to disqualification.

A. Project Manual Revisions:

Add the following sections:

1. **SS515 – Fiberglass-Reinforced Polymer-Mortar Pipe for Direct Bury, Gravity Service**
2. **Specification 11306 – Submersible Solids Handling Pumps**
3. **Specification 13100 – Lightning Protection Systems**

Remove the following section(s):

1. **13215 - Submersible Concrete Wet Well (Lift Station)** – The influent wet well shall be polymer concrete per Specification 13219 – Submersible Polymer Wet Well

Remove and replace the following sections:

1. **Table of Contents –** Added SS515 - Fiberglass-Reinforced Polymer-Mortar Pipe for Direct Bury, Gravity Service, Section 13100 – Lightning Protection Systems and Section 11306 – Submersible Solids Handling Pumps; removed Section 13215 – Submersible Concrete Wet Well (Lift Station)
2. **Section 00020 – Invitations for Bids** – Revised bid opening date to October 31, 2013
3. **Section 00810 – Supplemental General Conditions** – Article 11, 11.4.1.2 revised
4. **Section 00830HH – Wage Rates and Payroll Reporting** – Replaced with updated version (1/11/13)
5. **Specification 11201 – Non-Potable Water Pumping System –** Added Flowtronex to list of approved manufacturers; modified warranty period conditions
6. **Specification 11215 – Positive Displacement Air Blowers** – Edits to the Motors and Control Panels sections
7. **Specification 11230 – Odor Control System –** Added Purafil Biological Air Treater (BAT) to list of approved manufacturers; added reference to electrical specifications; added Local/Remote switch
8. **Specification 11243 – Peristaltic Chemical Metering Pump** - Added reference to electrical specifications

9. **Specification 11310 – TriPlex RAS Pumps** - Revised relay and timer requirements; added reference to electrical specifications
10. **Specification 11320 – Grit Removal System** – Added manufacturers to list of approved bidders and other associated edits; hardware shall be 316 Stainless Steel
11. **Specification 11330 – Mechanical Step Screen -** Added reference to electrical specifications; hardware shall be 316 Stainless Steel
12. **Specification 11331 – Screenings Washing Press** - Added reference to electrical specifications; hardware shall be 316 Stainless Steel
13. **Specification 11338 – Circular Secondary Clarifier** - Design criteria revised; added reference to electrical specifications; added Hand/Off/Auto switches; request for process guarantee removed
14. **Specification 11393 – Cloth Disc Filter System** - Added reference to electrical specifications; changed nametags from plastic to phenolic; changed 304SS to 316SS; changed started from IEC rated to NEMA rated
15. **Section 13125 – Metal Building Systems** – Insulation information added
16. **Specification 13390 – Package Control System** – Multiple changes made
17. **Specification 13401 – Instrumentation and Control for Process Systems –** Multiple changes made
18. **Specification 13401.01 – Component Specifications –** Multiple changes made
19. **Specification 13580 – LAN Communication System** – Multiple changes made
20. **Specification 16289 – Surge Protective Devices** – Ratings and terminology updated to reflect latest UL Codes; type 1 SPDs specified instead of Type 2

Add to the following sections:

1. **Section 11305 – Submersible Non-Clog Sewage Pumps (Lift Station)**
   a. Remove Part 3.5.E that states *"Spare pump/motor assembly"*
   b. Parts 2.3.B & 1.2: Replace *"WW-16910 – Control Panel for Submersible Lift Stations"* with *"Section 16480 – Motor Control Center (Lift Station)"*
   c. Part 2.4.B: Remove *"& Spare Pump"*
2. **Section 13218 – FRP Covers** – Add *"Glass-Steel, Inc."* to list of approved manufacturers in Part 1.3
3. **Section 15202 – Jib Crane and Electric Hoist (Lift Station)** – Part 2.2.B.d: Replace *"one-half ton"* with *"one ton"*

B. Drawing Revisions:

Remove and replace the following sheets:

1. **GB-3 – Site Plan A** - Added ribbon curb from access driveway to lift station
2. **GB-4 – Site Plan B** - Added ribbon curb from access driveway to lift station
3. **CB-1 – Erosion and Sedimentation and Tree Protection Plan** - Modified LOC, updated tree protection and silt fence and natural vegetative filter strip
4. **CB-2 – Erosion and Sedimentation Control Plan A** - Modified LOC, updated tree protection and silt fence
5. **CB-3 – Erosion and Sedimentation Control Plan B** - Modified LOC, updated tree protection and silt fence

6. **CB-4 – Erosion and Sedimentation Control Plan C** - Modified LOC, updated tree protection and silt fence
7. **CB-14 – Pond Details** - Added gabion basket wall notes; added 2-sided area inlet
8. **CB-22 – Overall Paving Plan** - Modified 25' wide asphalt pavement with laydown curb on one side
9. **CB-23 – Paving Plan A** - Added ribbon curb from access driveway to lift station
10. **CB-24 – Paving Plan B** - Added ribbon curb from access driveway to lift station
11. **CB-25 – Paving Plan C** - Added ribbon curb from access driveway to lift station and removed sidewalk at entrance
12. **CZ-1 – Standard Civil Details Erosion and Sedimentation Control** - Updated silt fence detail
13. **CZ-5 – Standard Civil Details Site Work** – 1" gate valve removed from Detail 3
14. **CZ-11 – Water and Wastewater Details** – Back-flow preventer detail edits
15. **CZ-13 – Water and Wastewater Details** - Added 12" two way clean-out detail
16. **EB-1 - Electrical Plan Legend Sheet** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
17. **EC-13 - Lift Station Ductbanks** - Section B duct detail shall include 1" conduit for telecom service.
18. **ED-1 - Headworks Electrical Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
19. **ED-2 - BNR Process Basins Electrical Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
20. **EE-1 - Secondary Clarifier Electrical Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
21. **EE-2 - RAS Pump Station Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
22. **EF-1 - Filtration Electrical Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
23. **EG-1 - Disinfection Building Electrical Power Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated. Emergency eyewash and shower stations shall be connected to Main Plant Control Panel so that an alert will be generated if they are used
24. **EG-4 - Chlorine Contact Basin Electrical Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
25. **EG-5 - Cascade Electrical Plan and Sections** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
26. **EH-1 - Sludge Holding Basin Electrical Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
27. **EI-1 - Operations Building Electrical Power Plan** - Provide interlock to disconnect power to VFD in the event of a blower failure. Provide ground bar in MCC room. Connect to telecom ground bar with #1 copper wire. All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated.
28. **EI-3 - Operations Building Electrical One-Line Diagram** - Main Breaker in MCC to be 100% rated. Provide a Surge Protection Device on panels H1, H2, H3, H4, L1, L2, L3, L4. Refer to Addendum 2 Specification 16289 for requirements of surge protection devices.
29. **EI-4 - Fixture Schedule** - Added: Cooper "VT2-232DR-UNV-EB81-WL-U"
30. **EJ-1 - Chemical Building Electrical Plan** - All interior receptacles shall all be GFI type. Exterior receptacles shall be GFI type and Weatherproof rated. Emergency

eyewash and shower stations shall be connected to Main Plant Control Panel so that an alert will be generated if they are used.

31. **MA-2 – Piping Schedule –** LPA Above Ground Exterior changed to SS; WW line edits
32. **MA-4 – Valve Schedule –** NPW check valve deleted and ball valve added
33. **MB-9 – Water Service Connection** – Reference to Sheet CZ-11 – Water & Wastewater Details added
34. **MB-11 – Force Main Plan and Profile** - Updated two way clean-out detail reference number
35. **ME-5 – RAS Pump Station Mechanical Plan & Section** – 2" Air Release Valve specified
36. **MF-1 – Filtration Mechanical Plan** – Note #1 added to reflect wall spool pipe through basin being stainless steel and remaining interconnecting pipe to be Schedule 80 PVC
37. **MG-4 – NPW System Plan and Sections** - Non-Potable Water Plans valve edits; air release assembly size specified
38. **SI-1 – Operations Building Structural Plans** - Building increasing 1½" on all sides to reflect required insulation
39. **SI-2 – Operations Building Structural Plans** - Building increasing 1½" on all sides to reflect required insulation
40. **SI-3 – Operations Building Structural Sections** - Building lug changing from 5½" to 7" and building increasing 1½" on all sides to reflect required insulation
41. **AI-000 – General Information and Code Information** - "Pre-Engineered Metal Building" abbreviation added
42. **AI-200 – Operations Building Floor Plan** - General Finish Note #6 regarding ceilings added; finish Legends revised to include color selections for all finishes
43. **AI-400 – Building and Wall Sections** - Descriptive text added to "Section 3-Wall Section @ MCC"
44. **AI-401 – Section Details** - Descriptive text added to all section details on sheet
45. **AI-402 – Section Details** - Descriptive text added to Section Details 2-Jamb Detail, 3-Jamb Detail, and 4-Head Detail; "7-Detail @ OHD Jamb" and "6-Detail @ Door Jamb" added to sheet

This addendum consists of 348 page(s)/sheet(s).

Approved by OWNER

Approved by ENGINEER/ARCHITECT

STATE OF TEXAS
T. JASON ROBERTS
98233
LICENSED
PROFESSIONAL ENGINEER
10/17/2013

Approved by CITY OF AUSTIN

END

Special Specification Item No. SS515
Fiberglass-Reinforced Polymer-Mortar Pipe for Direct Bury, Gravity Service

SS515.1 Description

This item governs the furnishing and installing of fiberglass-reinforced polymer-mortar (FRPM) pipe in a trench, encasement pipe, tunnel or other installation where the pipe is lifted or carried into place and will convey gravity flow. This item does not apply to pipe where installation requires jacking or other means that subject the pipe to axial loads larger than are required to couple the pipe or where the pipe will be subjected to pressurized flow. For pipe that will subjected to jacking loads, see Special Specification SS516, Fiberglass-Reinforced Polymer-Mortar Pipe for Jacked Installations, Gravity Service.

SS515.2 Submittals

A. Submittals shall conform to requirements of Section 01300.

B. The following information shall be provided, as a minimum, for approval of the pipe:

1. For pipe larger than 24-inch diameter, the manufacturer must provide at least one of the following, as stipulated in Item 510.2(8):
    a. evidence of current ISO registration
    b. evidence of the Owner-approved quality control program
    c. evidence of the Owner-approved independent, third-party materials laboratory that will inspect and test pipe manufactured for the Project
2. Drawings of the proposed pipe, including joint and gasket, and showing dimensions
3. Pipe manufacturer's certification that the chemical composition of the gasket is compatible with the environment to which it will be subjected
4. Certified copies of the most recent production test results for pipe stiffness (ASTM D 2412) of pipe of the same type, liner, grade, class, and diameter as specified for the Project
5. Certified copies of the most recent qualifications test results for long-term chemical resistance (ASTM D 3681), joint tightness (ASTM D 4161), and beam strength (ASTM D 3262) of pipe of the same type, liner, and grade as specified for the Project. Qualification test results shall be from pipe manufactured in the same facility that will produce pipe for the Project and shall be from pipe manufactured of material from the same sources used to produce pipe for the Project.

C. The following information shall be provided, as a minimum, prior to delivery of pipe to the Project:

1. If required by the Owner, manufacturer shall provide layout drawings illustrating placement of each pipe identified with a numbering system, including manhole risers if constructed of FRPM pipe.
2. Drawings of each fitting or manhole riser, identified by location on the Project

D. The following information shall be provided, as a minimum, prior to installation of the pipe:

1. Certified copies of test reports on the elastomer from which the shipment of gaskets was made

2. Certified copies of production test results on pipe manufactured for the Project. Production tests shall be as defined by ASTM D 3262 and shall involve workmanship (inspections for visible defects), dimensions (pipe diameter, length, wall thickness, and end squareness), and pipe stiffness (as determined by ASTM D 2412)

SS515.3 Materials

A. Pipe manufacturer must be listed on Standard Products List WW-509.

B. Pipe

Pipe shall conform to the requirements of ASTM D 3262 and shall be manufactured of glass-fiber-reinforced thermosetting polyester resin mortar with a non-reinforced thermoset liner and non-reinforced polyester resin and sand surface layer. Pipe shall have a minimum stiffness of 72 psi at 5 percent deflection when tested according to ASTM D 2412. Pipe shall meet Designation Code ASTM D 3262-1-2-3 and minimum of D.

All pipe shall be produced by one manufacturer.

C. Joints

Joints shall conform to the requirements of ASTM D 4161. Joints shall be sleeve coupling, bell and spigot coupling, or flush bell and spigot coupling and shall be compatible with the installation procedure. All joint components of the same type that are not manufactured with the pipe shall be produced by one manufacturer.

D. Gaskets

Gaskets shall conform to the requirements of ASTM F 477. All gaskets of the same type and size shall be produced by one manufacturer.

E. Marking

1. Pipe

Each length of pipe shall be marked in at least one location using large, easily legible, permanent letters indicating the nominal pipe size, manufacturer's name (as listed on SPL WW-509), and ASTM designation code. If the Owner requires identification of each pipe length by a numbering system for tracking or installation purposes, manufacturer shall mark such numbers on the inside and outside of the pipe.

2. Gaskets

Markings shall include gasket manufacturer's name or symbol, gasket size and manufacturer's code to differentiate between high- and low-head gaskets.

SS515.4 Source Quality Control

Production tests and qualification tests shall be performed and documented as required by ASTM D 3262.

SS515.5 Rejection

A. Pipe

Pipe shall be subject to rejection whenever the following defects are, in the opinion of the Engineer, of an extent, severity or nature to detrimentally affect the strength or serviceability of the pipe: surface cracking, interlaminar separation, separation of the liner or surface layer from the structural wall, blisters, bubbles, pinholes, pits, foreign inclusions, resin-starved areas, or damage from improper handling or installation. In addition, bulges, dents, ridges and other surface irregularities on the inside of the pipe that result in variation of the inside diameter by more than 1/8 inch from the adjacent unaffected area may be cause for rejection.

B. Gaskets

Gaskets shall be subject to rejection whenever they show surface checking, weathering, or other deterioration, or damage from improper installation.

SS515.6 Installation

A. Handling

Use textile slings or fork lift to lift or move each pipe.

B. Pipe Support

Pipe placed in trenches shall be supported by bedding materials specified in Standard Specification Item 510. Pipe placed in encasement pipe or tunnels shall be supported by rails, casing spacers, or other approved means followed by grouting of the annular space surrounding the pipe, if specified. Pipe shall be laid with uniform bearing under the full length of the pipe barrel.

C. Jointing

Pipe ends and elastomeric gaskets shall be cleaned immediately before joining the pipe and then coated with manufacturer-approved joint lubricant. Pipe shall be coupled using suitable equipment, such as wire rope puller, to pull pipe joints together in a manner that will not damage the pipe or exceed installation forces recommended by the pipe manufacturer. Pipe shall be straight when coupled, then deflected to the specified angle. Deflection shall not exceed manufacturer's recommendations.

D. Tracer Tape

Inductive Tracer Detection Tape shall be placed directly above the centerline of all non-metallic pipe a minimum of 12 inches below the subgrade or a minimum of 18 inches below finished grade on areas outside the limits of pavement. The tracer tape shall be encased in a protective, inert, plastic jacket and color coded according to American Public Works Association Uniform Color Code. Tracer tape shall be placed according to manufacturer's recommendations.

SS515.7 Acceptance Testing

Acceptance testing shall conform to applicable sections of Standard Specification Item 510.

SS515.8 Measurement and Payment

No separate measurement or payment will be made for work or material described under this Special Specification. Payment for will be made using the applicable Bid Item 510-AWW.

SPECIFIC Cross Reference Materials
Special Specification Item No. 515, "Fiberglass-Reinforced Polymer-Mortar Pipe for Direct Bury, Gravity Service"

City of Austin Standard Contract Documents

Designation	Description
Section 01300	Submittals

City of Austin Standard Specification

Designation	Description
Item No. 510	Pipe

City of Austin Special Specification

Designation	Description
Item No. 516	Fiberglass-Reinforced Polymer-Mortar Pipe for Jacked Installation, Gravity Service

City of Austin Water and Wastewater Standards Products Lists (SPL)

Designation	Description
WW-509	Fiberglass Pipe for Wastewater

American Society for Testing and Materials (ASTM)

Designation	Description
D 2412	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
D 3262	Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
D 3681	Standard Test Method for Chemical resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition
D 4161	Standard Specification for "Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
F 477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

PART 1: GENERAL

1.1 Scope of Work

Furnish and install two (2) submersible, non-clog raw sewage pump(s) and one (1) spare impeller as specified herein and as shown on plans.

1.2 Related Specifications

Section 15047 – "Identification"

1.3 Applicable Standards and Specifications

All pump/ motor assemblies shall be designed, constructed, and tested according to the latest applicable sections of AFBMA, AISI, ANSI, ASTM, Hydraulic Institute, IEEE, NEC, NEMA MG-1, NFPA, and UL standards. Requirements listed in the drawings and specifications are considered additional to the standard requirements listed above.

1.4 Acceptable Manufacturers

A. Barnes - models 3SE1044DS and 45E374L

B. Hydromatic

C. Approved Equal

1.5 Submittals

A. Submittals

The Contractor is to submit the following information for approval by the Engineer and Owner prior to start of fabrication of the pumping units.

1. Pumps

   a. Name of pumping unit Manufacturer.
   b. Pump model number.
   c. Rotating speed.
   d. Proposed impeller size.
   e. Maximum impeller size to fit proposed pump case.
   f. Minimum impeller size to fit proposed pump case.

g. Performance curves for like unit showing total dynamic head, capacity, and horsepower from shutoff to beyond the minimum operating head at operating speed.
h. List of materials used in the construction of the pumps. Designate materials using ASTM Standards.
i. Type of wear rings and materials for impeller and case wear rings.
j. Type of pump bearings (radial and axial).
k. Type of mechanical seal and materials of construction.
l. Outline drawing of pumps showing exterior dimensions of pump.
m. Net weight of pump.
n. Net weight of base plate.
o. Pump selection for the Interim II duty condition to ensure Interim I model and horsepower are sufficient to meet the Interim II duty condition with an impeller change.

2. Motor

a. Motor manufacturer's name.
b. Type of motor and/or motor enclosure type.
c. Insulation class and type.
d. Temperature rise over 40°C ambient.
e. Service factor.
f. Frame size.
g. Rated horsepower.
h. Full load speed, rpm.
i. Operating voltage, volts at 60 Hz.
j. Locked rotor current, amps and/or letter code.
k. Full load current, amps.
l. Starting inrush magnetizing current, % of full load, amps.
m. Complete outline drawing showing overall dimensions, location of terminal boxes, mounting provisions, and lifting provisions.
n. Sectional drawing of motor showing all components and a list of materials for each component per ANSI, ASTM, NEMA.
   1) Frame/ enclosure
   2) Stator.
   3) Rotor/ shaft.
   4) Bearings.
   5) Paint or coatings.
o. Net motor weight.
p. Motor shaft diameter at all points.
s. Motor stator winding resistance, ohms.

B. Operation and Maintenance Manuals

The contractor shall submit the following information for approval by the Engineer and Owner prior to equipment start-up.

1. Assembly, installation, alignment, adjustment, and checking instructions.
2. Lubrication and maintenance instructions.
3. Guide to "trouble shooting".
4. Parts list and predicted life for parts subject to wear. Parts list should also list part numbers.
5. Recommended spare parts list.
6. Certified dimensional drawings.
7. Sectional Drawings showing arrangement of internal components.
8. Certified performance curves showing total dynamic head, capacity, and horsepower from shutoff to beyond the minimum operating head at operating speed.
9. All information supplied in the submittals.

C. Certified Report

Furnish 3 copies of a report prepared by the Manufacturer's technical representative certifying satisfactory installation, operation, and in-service placement of units.

1.6 Warranty

For new installations, warranty shall begin upon **FINAL** acceptance of the station.

A. The pumping unit Manufacturer shall warrant the entire pump unit against faulty or inadequate design, improper assembly and erection, defective workmanship and materials, and leakage, breakage, or other failure.

B. The Manufacturer shall furnish a written warranty agreeing to furnish and install FOB Austin, Texas at his own expense, any part of the pumping unit proving defective within twelve (12) months of the acceptance of the unit.

C. The Manufacturer shall also provide a full parts and labor warranty for the motor, its components, and its accessories for one year, and an extended pro-rated 5 year warranty.

1.7 Manufacturer Services

Furnish the services of the Manufacturer's technical representative to check installation, assist Contractor in field testing, start-up testing, making adjustments, and instructing operators and contractor in maintenance and operation procedures.

A. Motor Compatibility

The manufacturer shall ensure that the motor included with the drive is compatible with driven equipment and complies with these specifications.

1.8 Design Standards

A. Duty Condition

BNR-IPR-001/004 shall be 130 gpm @ 21' TDH
BNR-IPR-002/003/005/006/007 shall be 260 gpm @ 12' TDH
BNR-IPR-001/004 shall be 130 gpm @21' TDH

PART 2: PRODUCT

2.1 General

Detailed in this specification are the design, construction and testing of submersible non-clog pump/motor assemblies suitable for sewage service.

2.2 Construction and Materials

A. Pump

1. Volute

The pump volute, motor, and seal housing shall be high quality gray cast iron, ASTM A-48, minimum of Class 30. Outside of the volute shall be coated to prevent corrosion

2. Shaft

The pump shaft shall be constructed of solid 416 stainless steel.

3. Bearings

The solid pump and motor shaft shall be rigid and kept in correct alignment by bearings. The pump shaft shall rotate on two bearings. The upper bearing shall be a single deep grove ball bearing. The lower bearing shall be a single deep grove ball bearing. Bearings shall be anti-friction having a minimum B10 bearing life of 150,000 hours and designed to withstand all stresses to ensure a long service life. Bearing houses are to be designed so that water cannot enter housing. Bearings shall be permanently lubricated.

4. Impeller

Pump impellers shall be enclosed non-clogging type constructed of a minimum ASTM A48 Class 30 cast iron minimum or of bronze. The impeller may be factory trimmed to meet specific performance conditions. Impellers shall be hydraulically balanced at the factory. Wear or field trimming shall not deter the factory balance. The impeller shall be keyed, screwed, or pinned to the shaft and shall be readily removable without the use of a special tool. The impeller shall be locked against rotation in any direction by a stainless steel or bronze impeller nut. The impeller shall be statically and dynamically balanced for smooth performance. Where conditions allow, the impeller shall be an open-type self cleaning impeller complemented by a relief groove in the volute allowing a self cleaning flow path through the pump.

5. Seal Plate

The pump shall be fitted with a seal plate constructed of a minimum ASTM A48 Class 30 cast iron.

6. Mechanical Seals

The pump shall be protected from leakage at the point that the shaft passes through the pump casing by mechanical seals. Mechanical seals must meet the following requirements:

a. The seal shall be a tandem mechanical seal in a cast iron seal housing constructed in two sections with a registered fit.
c. The seal shall be constructed of carbon/ceramic/Buna-N.
d. The upper and lower seal assemblies shall operate in a lubricant reservoir that lubricates the lapped seal faces at a constant rate.
e. Lifetime grease lubrication shall be provided.

7. External Hardware

All external wetted hardware shall be 300 stainless steel.

8. O-Rings

All O-rings shall be made of Buna N Rubber or approved equal.

B. Motor

This specification details the materials and construction for a submersible pump and motor assembly.

1. Construction

   The motors shall be constructed as an integral part of submersible pump/ motor assemblies. Each motor shall be electrically and mechanically suited for the pump to which it shall be applied. The motor shall be compatible with the pump to which it shall be applied and the motor shall operate efficiently, without overheating or abnormal vibration. The motor shall be designed to provide a 20 year life. Motor shall be capable of continuous operation without relying on external fluid contact for cooling.

2. Motor Rating

   Motor shall be Underwriters Laboratories (UL) or Factory Mutual (FM) approved as explosion proof. Rated voltage shall be per contract drawings. Motor shall be rated with a Class B temperature rise. The motor shall comply with NEMA Standard MG-1 and associated ASA and IEEE Standards unless specifically amended hereafter. Motor shall be inverter duty rated.

3. Motor Housing

   Motor shall be constructed of a minimum ASTM Type A-48 Class 30 Cast Iron. The housing shall be coated for corrosion resistance.

5. Shaft

   The motor shaft shall be constructed of solid stainless steel.

6. Bearings - See Pump section, above.

7. Insulation

   Motors shall be UL listed for Class B insulation operating temperature.

8. Motor Power/ Control Wiring and Cable

   a. Motor power lead wires shall be permanently and thermally connected to the stator for structural strength.

   b. Motor lead wires shall be connected to the power cable in a watertight chamber and appropriate watertight seal cable entrance. Pump motor power cable shall be oil and watertight, rated for continuous submerged service. Cable conductors shall be copper, sized and rated per N.E.C. Cable shall be sized using 125 % of motor nameplate.

c. Motor control conductors for thermal and moisture leak sensory shall be rated for continuous submerged service and shall be run in a separate jacketed cable and conduit from the power cable.

d. Power cable shall include a dedicated ground conductor. All conductors shall be permanently identified at both ends.

e. Power/control cable shall be of sufficient length as designated with pump order to allow required power and control termination.

C. Nameplate

1. Pump and Motor

The pump motor assembly shall have a stainless steel nameplate attached to its frame with stainless steel fasteners. The nameplate shall meet the requirements of NEMA MG-1. The following information shall be displayed on the nameplate:

a. Pump manufacturer's name.
b. Pump model number.
c. Pump serial number.
d. Rated capacity in gallons per minute.
e. Rated total dynamic head in feet.
f. Pump speed.
g. Pump bearing information.
h. Motor frame description.
i. Motor horsepower.
j. Service factor.
k. Motor speed.
l. Motor voltage, phases, and frequency.
m. Motor wiring diagram.
n. Motor amperage at full and no load.
o. Tagging in accordance per Section 15047.

2.3 Functional Requirements

A. Operation

1. Pumps

Pumps shall be non-clog submersible pumps capable of passing a 2-inch solid.

2. Motor

a. The manufacturer shall coordinate pump operation so that all physical and operational characteristics of the motor are compatible with the requirements of the pump.
b. The motor shall operate efficiently, without overloading, overheating, or abnormal vibration, throughout the entire range of speed and load for the specified impeller.
c. There shall be no point on the pump curves at which the motor name plate rating is overloaded, even momentarily.
d. Motor shall be capable of bi-directional rotation by changing the electrical phase connections of the motor power lead wires.
e. The motor shall be capable of up to 15 evenly spaced starts per hour.
f. The motor shall be able to operate dry without damage while pumping under load.

2.4 Tools, Spare Parts, and Accessories

A. Guide Rail System

1. Guide Rail

A guide rail system shall be used to direct the pump in proper alignment with the stationary discharge piping. Supports shall not interfere with removal of pump. The rail system and supports shall be corrosion resistant and shall be fabricated of 316 stainless steel. Guide rails for each pump must be supplied by the pump manufacturer to ensure compatibility with supplied equipment. The pump shall be easily removed for inspection or service. Personnel shall have no reason to enter the basin. Supports shall be provided for the guide rail for every 8 feet of rail. The supports shall be evenly spaced along the length of the rail.

2. Guide Brackets

The guide brackets and hardware shall be constructed of 316 stainless steel. Guide brackets for each pump must be supplied by the pump manufacturer to ensure compatibility with supplied equipment.

B. Pump Lifting Chain

Each pumping unit shall be provided with a chain sling. The chain sling is a combination of a stainless steel cable and 3 feet of stainless steel chain, which is

connected to the pump. All associated lifting hardware shall be stainless steel. The free end of the cable is connected to the top of the wet well.

C. Pump Wire / Cable Support

Furnish pump wire/cable support device for suspended support of pump power cables. Device shall be constructed of 316 stainless steel.

PART 3: EXECUTION

3.1 Factory Inspection and Testing

Each pump is to be tested at the factory to determine capacity, shut-off head, rated head, minimum head (for continuous operation), required power, efficiency and as required to develop an accurate performance curve. Certified copies of a report for each test are to be submitted to the Owner. All of the above tests are to be performed in conformity with the requirements and recommendations of the Hydraulic Institute and NEMA MG-1.

3.2 Field Installation and Testing

A. Field Installation

The pump/motor assembly shall be installed according to the manufacturer's recommendations.

B. Field Testing

See Specification WW-01650, “Submersible Startup”.

3.3 Storage and Handling

At all times Contractor shall take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until completion of work.

3.4 Equipment Protection and Restoration

A. All equipment must be boxed, totally enclosed with plastic sheet covering and crated, or otherwise completely enclosed and protected during shipment, handling, and storage.

B. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.

C. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage during shipment.

D. All painted surfaces which are damaged prior to acceptance of equipment shall be re-painted to the satisfaction of the Engineer.

SECTION 13100 - LIGHTNING PROTECTION SYSTEMS

PART 1 GENERAL

1.1 WORK INCLUDED

A. System design.

B. Air terminals, interconnecting conductors, and other system components and accessories.

C. Grounding and bonding for lightning protection.

D. System inspection and certification.

1.2 RELATED WORK

A. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for lightning protection systems.

1. Section 16010 - Basic Electrical
2. Section 16150 - Raceways, Fittings, and Supports
3. Section 16450 - Grounding

B. In the event of conflict involving requirements of lightning protection systems between this Section and any other Sections, the provisions of this Section shall govern.

1.3 APPLICABLE CODES AND STANDARDS

A. The materials and installation shall conform to the minimum requirements and latest revisions of the following codes, standards and regulations wherein they apply:

1. NFPA 70 - National Electrical Code
2. UL 96 - Lightning Protection Components
3. UL 96A – Installation Requirements for Lightning Protection Systems
4. NFPA 780 - Lightning Protection Systems
5. LPI 175 - Standard of Practice for the Design - Installation - Inspection of Lightning Protection Systems

1.4 SYSTEM DESCRIPTION

A. Lightning Protection System: UL 96A Master Labeled system consisting of air terminals on roofs, roof mounted mechanical equipment, stacks, bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors. Lightning protection systems shall be incorporated into the building system by the lightning protection contractor as required for a complete master labeled system.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum three years documented experience and member of the Lightning Protection Institute.

B. Installer: The Contractor for the work covered by this specification shall be recognized as being regularly engaged in the design and installation of lightning protection systems. The Contractor must have minimum three years documented experience and member of the Lightning Protection Institute (LPI). Installer shall be a certified LPI master installer of lightning protection systems.

1.6 COORDINATION

A. Coordinate the work of this Section with concrete, roofing and exterior and interior finish installations.

B. Coordinate all provisions for down conductors and system connections with all trades.

1.7 SUBMITTALS

A. Provide submittals for the following information in addition to and in accordance with Section 16010, Basic Electrical, and Division 01 for submittal requirement.

1. Shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

2. Shop drawings shall include locations of conductors, roof penetrations, floor penetrations, etc., and their compatibility with provisions made during the construction. Once the contract has been established the Contractor shall make a review of provisions being made for the system installation and comment, in writing, with changes or compliance within two weeks of finalizing the contract. Contractor shall coordinate locations of conductors in walls and all penetrations with the appropriate trades: Failure to coordinate these requirements shall not relieve lightning protection Contractor from properly completing its work. This Contractor shall employ the proper trades to provide the chases in walls and roof and floor penetrations required to install the conductors if not coordinated before the floors, walls and roof are installed.

3. Product data showing dimensions and materials of each component, and include indication of listing in accordance with UL 96.

4. As Built Record Drawings: The Contractor shall maintain a master set of As Built Record Drawings that shows changes and any other deviations from the Base Drawings in accordance with Section 26 00 00.

1.8 MASTER LABEL

A. The system design shall equal to or exceed the requirement of UL 96A for a Master "C" Label. Upon completion, the lightning protection systems shall be inspected by a representative of Underwriters Laboratories, Inc. The lightning protection systems must pass UL inspection and wear UL label.

1.9 WARRANTY

A. Provide a warranty for material and installation per Section 16010, Basic Electrical, unless a longer warranty period is required in specific product specifications.

PART 2 PRODUCTS

2.1 GENERAL

A. The system provided under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest approved design.

B. Materials used in connection of the installation of the lightning protection system shall be proved for lightning protection systems by UL. No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversized conductors shall be used.

C. Where a mechanical hazard is involved, conductor size shall be increased to compensate therefore, or suitable protection shall be provided. The conductors may be protected by covering them with molding or tubing made of nonmetallic material.

D. Aluminum materials may not be used except on roofs that utilize aluminum roofing components. When aluminum materials are used, provide all materials of aluminum composition to ensure compatibility, except down conductors and grounding. Provide copper down conductors with bimetal transition at the roof assembly rated for the application.

2.2 CONDUCTORS

A. All conductors shall be stranded copper and of the grade ordinarily required for commercial electrical work generally designated as being 98 percent conductive when annealed. Aluminum conductors may only be used on roofs that are built of aluminum roofing components. Conductor minimum size shall be in compliance with NFPA 780.

2.3 AIR TERMINALS

A. Air terminals shall be copper or copper alloy per UL 96. A copper or copper alloy air terminal intended for use on a chimney shall have a hot-dipped lead coating or equivalent. Class II air terminal shall be of solid construction. Air terminal minimum diameter shall be in compliance with NFPA 780.

2.4 GROUND ROD

A. Ground rod shall be copper-clad steel, ¾-inch diameter by 10 feet in length.

2.5 CONNECTIONS

A. Connector fittings shall be copper or copper alloy per UL 96 and compatible with material type used for air terminals and conductors.

B. All belowground and concealed connections shall be made with exothermic welded connections.

2.6 ROOF PENATRATIONS

A. Roof penetrations shall be accomplished with through-roof fittings specially designed for this purpose. Through-roof fittings shall utilize solid rods with appropriate hardware. Fittings shall incorporate a positive means for sealing around the rod.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as shown on the shop drawings.

C. Beginning of installation means installer accepts existing conditions.

3.2 PROTECTION OF SURROUNDING ELEMENTS

A. Protect elements surrounding work of this Section from damage or disfiguration.

3.3 CONDUCTORS

A. Install in accordance with manufacturer's instructions. Conceal down conductors. Concealed down conductors shall be installed in continuous insulating PVC raceways. Metallic raceways shall not be used.

B. PVC conduit shall not be installed in plenums. If PVC conduit has to be installed in plenum space, the PVC conduit shall have fire rated walls installed creating a chase space for the conduit.

C. The Contractor shall bond each down conductor to the ground rod (Cad-Weld or equivalent) which is bonded to the counterpoise conductors creating a common ground.

D. No bend of a conductor shall form an angle beyond 90 degrees nor shall have a bend radius less than 8 inches per NFPA 780.

3.4 AIR TERMINALS

A. Air terminal height and support shall be in compliance with the requirement of NFPA 780.

B. Air terminals shall not be mounted such they have to be moved to perform maintenance on the equipment they protect.

3.5 GROUND RING ELECTRODE

A. A ground ring electrode encircling the building or structure shall be installed. Lightning protection systems down conductors shall be connected to the ground ring electrode.

B. Interconnect lightning protection ground ring electrode with building ground electrode system.

3.6 ROOF CONNECTIONS

A. Make direct connections to lightning protection system with copper conductor for all roof mounted equipment, enclosures, mast, fan stacks and all metallic objects alike. Provide bonding jumpers across all equipment mounting isolators and ductwork isolators to provide a complete ground path.

B. All antennas shall be grounded.

3.7 ROOF ATTACHMENT AND PENATRATIONS

A. Roof penetration. Contractor shall inform Owner's representative, in advance, of any required roof penetrations and shall obtain approval. Wherever the system penetrates the roof, approved through-roof fittings or sleeves shall be furnished by the lightning protection contractor and installed by the roofing contractor. All patching masonry and structural work shall be furnished and installed by the general contractor.

B. All attachments to roofs must be in strict accordance with the roof manufacturer’s recommendations. The lightning protection contractor shall submit details of all roof attachment to the appropriate roof manufacturer for approval prior to installation. Once the lightning protection system installation is complete, the lightning protection contractor shall engage the appropriate roof manufacturer to inspect all roof attachments on that manufacturer’s roof. Subsequent to the inspection, the roof manufacturer shall furnish the Owner with a letter indicating that all lightning protection systems component roof attachment and penetration are satisfactory and such attachments and penetrations will not in any way to void or reduce the warranty on roof. Any fees for services or inspections provided by the roof manufacturer to accomplish the above related requirements shall be at the expense of the lightning protection contractor.

3.8 COVER-UP INSTECTION

A. Prior to cover-up of concealed components and connections, notify the Owner so that a cover-up inspection can be performed. Correct any deficiencies prior to concealment of components and connections.

3.9 INSPECTION AND MASTER LABEL

A. Upon completion, the lightning protection systems shall be inspected by the representative of the Owner.

B. Obtain the services of Underwriters Laboratories, Inc. to provide inspection and certification of the lightning protection systems. If the system does not pass UL inspection, the Contractor must make corrections to the system in order to pass inspection. Contractor shall furnish the Owner with appropriate approval certificate.

C. Obtain UL Master Label and attach to building at a location as directed by Owner.

3.10 CONFICTS

A. In the event a conflict exists between this specification and any of the referenced standards, the requirements of referenced standards govern.

END OF SECTION

Document Number		Title

VOLUME 1

BIDDING REQUIREMENTS, CONTRACT FORMS, & CONDITIONS OF THE CONTRACT

Pre-Bid Information
00020 04/22/13 Invitation for Bids

Instructions to Bidders
00100 04/22/13 Instructions to Bidders

Information Available to Bidders
00220 05/06/11 Geotechnical Data

Bid Forms
00300U 03/12/12 Bid Form

Supplements to Bid Forms
00400 04/22/13 Statement of Bidder's Experience
00405 09/25/05 Certificate of Non-Suspension or Debarment
00410 05/06/11 Statement of Bidder's Safety Experience
00440 05/06/11 Affidavit - Prohibited Activities
00475 05/06/11 Nonresident Bidder Provisions

Agreement Form
00500 03/12/12 Agreement

Bonds and Certificates
00610 02/23/10 Performance Bond
00620 02/23/10 Payment Bond
00630 08/09/12 Nondiscrimination Certificate
00631 03/12/12 Title VI Assurances Appendix A
00650 07/30/12 Certificate of Insurance
00670 08/09/12 Sales Tax Exemption Certificate
00680 06/05/06 Non-Use of Asbestos Affidavit (Prior to Construction)
00681 06/05/06 Non-Use of Asbestos Affidavit (After Construction)

General Conditions
00700 04/22/13 General Conditions

Supplementary Conditions
00810 04/22/13 Supplemental General Conditions
00820 03/12/12 Modifications to Bidding Requirements and Contract Forms
00830 03/12/12 Wage Rates and Payroll Reporting
00830BC 06/21/13 Wage Rates Building Construction Trades
00830HH 01/11/13 Wage Rates Highway Heavy

Addenda
00900 02/23/10 Addendum

Document Number	Title	

SPECIFICATIONS

Division 1 - General Requirements

01010	04/22/13	Summary of Work
01025	09/04/13	Measurement and Payment
01030	09/04/13	Alternates
01050	09/13/10	Grades Lines & Levels
01095	07/21/03	Reference Standards and Definitions
01096	05/06/11	Stormwater Pollution Prevention Plan (SWPPP)
01200	08/09/12	Project Meetings
01300	04/22/13	Submittals
01352	04/22/13	Sustainable Construction Requirements
01380	08/09/12	Construction Photography & Videos
01385	09/04/13	As-Built Drawings
01500	08/09/12	Temporary Facilities
01505	04/22/13	Construction and Demolition Waste Management
01510	02/23/10	Construction Indoor Air Quality Management
01550	08/09/12	Public Safety and Convenience
01650	09/04/13	Submersible Startup (Lift Station)
01700	09/04/13	Contract Closeout *(Lift Station)*
01700a	09/04/13	Project Closeout
01730	09/04/13	Operation and Maintenance Data
01900	03/12/12	Prohibition of Asbestos Containing Materials
01900a	06/05/06	Statement of Non-Inclusion of Asbestos Containing Material
01900b	06/05/06	Statement of Non-Inclusion of Asbestos Containing Material

VOLUME 2

City Standard Technical Specifications

101S	01/04/11	Preparing Right of Way
102S	08/20/07	Clearing and Grubbing
111S	09/26/12	Excavation
120S	09/26/12	Channel Excavation
130S	09/26/12	Borrow
132S	08/20/07	Embankment
201S	08/20/07	Subgrade Preparation
210S	02/24/10	Flexible Base
220S	02/24/10	Sprinkling for Dust Control
230S	08/20/07	Rolling (Flatwheel)
232S	08/20/07	Rolling (Pneumatic Tire)
234S	08/20/07	Rolling (Tamping)
236S	08/20/07	Proof Rolling
301S	08/20/07	Asphalts, Oils, and Emulsions
306S	02/24/10	Prime Coat
307S	02/24/10	Tack Coat
340S	09/26/12	Hot Mix Asphaltic Concrete Pavement
401S	09/26/12	Structural Excavation and Backfill
402S	11/13/07	Controlled Low Strength Material
503S	02/17/00	Frames, Grates, Rings, and Covers
506	03/15/11	Manholes
507S	03/26/08	Bulkheads

Document Number		Title
509S	09/26/12	Excavation Safety Systems
510	01/02/13	Pipe
511S	09/26/12	Water Valves
SS515	07/15/05	Fiberglass-Reinforced Polymer-Mortar Pipe for Direct Bury, Gravity Service
591S	09/26/12	Riprap for Slope Protection
601S	09/01/11	Salvaging and Placing Topsoil
604S	08/18/10	Seeding for Erosion Control
605S	06/21/07	Soil Retention Blanket
606S	06/21/07	Fertilizer
610S	09/26/12	Preservation of Trees and Other Vegetation
620S	05/23/00	Filter Fabric
627S	09/26/12	Grass-Lined Swale and Grass-Lined Swale with Stone Center
628S	10/30/09	Sediment Containment Dike
639S	08/18/10	Rock Berm
641S	06/21/07	Stabilized Construction Entrance
642S	09/01/11	Silt Fence
700S	09/26/12	Mobilization
702S	05/20/02	Removal and Relocation of Existing Fences
703	09/22/88	Fencing for Excavations
802S	09/26/12	Project Signs

Special Provisions to City Standard Technical Specifications

SP1	09/09/13	Measurement and Payment

Special Specifications

Division 2 – Site Work

02800	Site Requirements (Lift Station)
02805	Chain Link Security Fence (Lift Station)

Division 3 – Concrete

03300	Cast-in-Place Concrete

Division 4 – Masonry

04810	Unit Masonry

Division 5 – Metals

05120	Structural Steel Framing
05310	Steel Decking
05500	Metal Fabrications
05615	Stop Logs

Division 6 – Wood and Plastics

06100	Rough Carpentry
06160	Sheathing
06402	Interior Architectural Woodwork

Document Number	Title

Division 7 – Thermal and Moisture Protection

07210	Building Insulation
07272	Membrane Air Barriers
07620	Sheet Metal Flashing and Trim
07920	Joint Sealants

Division 8 – Doors and Windows

08110	Hollow Metal Doors and Frames
08311	Access Doors and Frames
08331	Overhead Coiling Doors
08520	Aluminum Windows
08710	Door Hardware
08800	Glazing

Division 9 – Finishes

09111	Non-Structural Steel Framing
09250	Gypsum Board
09310	Ceramic Tile
09512	Acoustical Panel Ceilings
09651	Resilient Tile Flooring
09653	Resilient Wall Base and Accessories
09900	Painting and Coatings (Lift Station)
09902	Painting and Protective Coatings (General)
09911	Painting (Building)

Division 10 – Specialties

10200	Louvers and Vents
10265	Wall and Door Protection
10431	Signage
10435	Lift Station Sign
10505	Metal Lockers
10522	Fire Extinguisher (Lift Station)
10522A	Fire Extinguisher Cabinets
10523	Fire Extinguishers
10801	Toilet and Bath Accessories

VOLUME 3

Division 11 – Equipment

11105	Effluent Flow Monitoring System
11110	Packaged Metering Manhole
11201	Non-Potable Water Pumping System
11215	Positive Displacement Air Blowers
11230	Odor Control System
11243	Peristalic Chemical Metering Pump Skids
11280	Stainless Steel Gates
11305	Submersible Non-clog Sewage Pumps (Lift Station)
11306	Submersible Solids Handling Pumps
11310	Triplex RAS Pumps
11320	Grit Removal System

Document Number	Title
11321	Vortex Grit Pumps
11330	Mechanical Step Screen
11331	Screenings Washing Press
11338	Circular Secondary Clarifier
11370	Top Entering Mixers
11375	Fine Bubble Aeration System
11376	Coarse Bubble Aeration System
11380	Onsite Sodium Hypochlorite Generation System
11393	Cloth Disc Filter System
11451	Residential Appliances

Division 12 – Furnishings

12484	Floor Mats and Frames
12491	Horizontal Louver Blinds

Division 13 – Specialties

13035	Lift Station Valve Vaults
13040	Lift Station Flow Meter Vaults
13100	Lightning Protection Sytems
13120	Electrical Control Building (Lift Station)
13125	Metal Building Systems
13218	FRP Covers
13219	Submersible Polymer Wet Well
13220	Polyethylene Upright Storage Tanks
13310	Transit Time Flow Meter (Lift Station)
13390	Package Control Systems
13401	Instrumentation and Control for Process Systems
13401.01	Component Specifications
13401.02	Instrument List
13401.03	Control Narrative
13401.04	I/O List
13580	Local Area Network (LAN) Communication System

VOLUME 4

Division 15 – Mechanical

15042	Testing of Pipelines and Hydraulic Structures
15043	Disinfection of Structures and Pipes
15047	Identification
15050	Mechanical General Provisions
15060	Hangers and Supports
15065	Submersible Piping (Lift Station)
15066	Stainless Steel Pipe
15067	Fiberglass Reinforced Plastic Duct and Dampers
15070	Vibration Isolation
15075	Mechanical Identification
15081	Mechanical Duct Insulation
15083	Mechanical Piping Insulation
15100	Submersible Wastewater Valves (Lift Station)
15104	Mud Valves
15105	Mechanical Piping and Tubes
15106	Telescoping Valves
15109	V-Port Ball Valve

Document Number	Title
15110	Plumbing Valves
15111	Foot Valves
15127	Eccentric Plug Valves
15135	Electric Actuators
15140	Domestic Water and Sanitary Drainage Piping
15150	Swing Check Valves
15177	Emergency Shower and Eye Wash Equipment
15202	Jib Crane and Electric Hoist (Lift Station)
15355	Adjustable Slotted Pipe Skimmers
15410	Plumbing Fixtures
15430	Plumbing Specialties
15485	Electric Domestic Water Heaters
15765	Packaged Air Cooled DX Unit
15767	Electric Heaters
15771	Heat Tracing Cable
15810	Ducts
15820	Duct Accessories
15836	Power Ventilators
15850	Air Outlets and Inlets
15950	Testing, Adjusting and Balancing

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16010	Basic Electrical
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16030	Electrical Testing
16130	Boxes and Cabinets
16140	Wiring Devices
16150	Raceways, Fittings, and Supports
16200	General Wiring Methods
16205	Wire Tagging
16210	Emergency Generator Sets (Lift Station)
16289	Surge Protective Devices
16400	Transient Voltage Surge Protection
16424	Individual Motor Starters
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16450	Grounding
16460	Dry Type Transformers – 600 Volts and Below Primary Rated 150 kVA and Smaller
16470	Panelboards
16480	Motor Control Center (Lift Station)
16485	Electrical Systems Analysis
16490	Automatic Transfer Switch
16515	Interior Lighting
16516	Exterior Lighting
16520	Site Lighting (Lift Station)
16710	PLC Based Remote Telemetry Unit, RTU
16720	Annunciator
16730	Uninterruptible Power Supply (UPS)
16740	Phone System Connection
16915	Float Switches
16941	Submersible Level Transducer
16942	Digital Indicator/Controller
16943	Temperature Transmitter/RTD
16951	Lift Station Calibration and Testing

Document Number	Title

END

Following is a summary of information for this Project. Bidder is cautioned to refer to other sections of the Project Manual, Drawings and Addenda (Bid Documents) for further details.

The Club Deal 120 Whisper Valley, L.P., hereafter called OWNER, is requesting sealed written Bids for furnishing all labor, materials, equipment, supervision, and incidentals, and for performing all Work required for the following Project:

Taylor Lane Wastewater Treatment Plant

Located at: 7535 ½ Taylor Lane

CIP ID# 3353.095 IFB# IFB6100 CLMC460

The Work consists of construction of a wastewater treatment facility including an influent lift station, headworks, aeration basin, secondary clarifiers, sludge holding tank, filtration, chlorine contact basin, and cascade, as well as operations, chemical and disinfection buildings, and all other appurtenances as shown on the construction plans.

Bid Documents may be obtained at One Texas Center, 505 Barton Springs Road, Ste. 760, Austin, TX 78704. Copies will be available in CD format at no cost.

At the time Bid Documents are obtained, Bidder must provide a working e-mail address, so that they will receive any addenda or clarification issued by the Owner.

Sealed Bids will be received at the Contract Management Department, 105 W. Riverside Dr., Suite 210, Austin, Texas 78704 and then publicly opened and read aloud in the **SUITE 210 Conference Room**.

ALL BIDS ARE DUE PRIOR TO (Austin time) 10:00 A.M., October 31, 2013**.**

ALL COMPLIANCE PLANS ARE DUE PRIOR TO (Austin time) 2:00 P.M., October 31, 2013 **.**

BIDS WILL BE OPENED AT (Austin time) 2:00 P.M., October 31, 2013**.**

ALL BIDS AND COMPLIANCE PLANS NOT RECEIVED PRIOR TO THE DATE AND TIME SET FORTH ABOVE WILL NOT BE ACCEPTED FOR CONSIDERATION. The time stamp clock in **SUITE 210** is the time of record and is verified with www.time.gov, the official U.S. time.

All CONTRACTORS must be registered to do business with OWNER prior to submission of a Bid. All Subcontractors must be registered with the OWNER prior to execution of a contract. Prime Contractors are responsible for ensuring that their Subcontractors are registered as vendors with the City of Austin. Registration can be done through the OWNER's on-line Vendor Registration system. Log onto https://www.ci.austin.tx.us/vss/Advantage and follow the directions.

All City procurements are subject to the City's Minority-Owned and Women-Owned Business Enterprise Procurement Program found at Chapter 2-9-A of the City Code, as amended. The Program provides Minority-Owned and Women-Owned Business Enterprises (MBEs/WBEs) or Disadvantaged Business Enterprises (DBEs) full opportunity to participate in all City contracts. Goals for MBE/WBE or DBE participation are stated for each solicitation. Information on achieving the goals or documenting good faith efforts to achieve the goals are contained in the MBE/WBE Procurement Program Package or DBE Procurement Program Package attached to the solicitation. When goals are established, Bidders are required to complete and return the MBE/WBE or DBE Compliance Plan with their Bid. If a Compliance Plan is not submitted prior to the date and time set forth in the solicitation, the Bid will not be accepted for consideration. (See Section 00820 for MBE/WBE requirements on "no goal" solicitations.)

All Bids shall be accompanied by an acceptable Bid guaranty in an amount of not less than five percent (5%) of the total Bid, as specified in Section 00100, Instructions To Bidders.

Performance and payment bonds when required shall be executed on forms furnished by OWNER. Each bond shall be issued in an amount of one hundred percent (100%) of the Contract Amount by a solvent corporate surety company authorized to do business in the State of Texas, and shall meet any other requirements established by law or by OWNER pursuant to applicable law.

Minimum insurance requirements are specified in Section 00810, Supplemental General Conditions.

Minimum wage rates have been established and are specified in Section 00830, Wage Rates and Payroll Reporting.

Contract Time is of the essence and all Work shall be substantially completed within 425 Calendar Days after date specified in the Notice to Proceed, in accordance with the Bid Form, Section 00300. Final completion shall be achieved within 30 Calendar Days after substantial completion. Liquidated damages are $5000.00 per Calendar Day for failure to substantially complete the work and $5000.00 per Calendar Day for failure to achieve final completion within 30 Calendar Days after substantial completion, in accordance with the Bid Form, Section 00300.

OWNER reserves the right to reject any or all Bids and to waive any minor informality in any Bid or solicitation procedure (a minor informality is one that does not affect the competitiveness of the Bid).

A mandatory Pre-Bid Conference will be held on September 17, 2013 (date) at 10:00 A.M. (time)

(Austin time) at Austin Water Utility, 625 E. 10th Street, Suite 105, Austin, Texas 78701 (location)

Austin, Texas. Attendance is mandatory unless otherwise stated. Bidders must attend any mandatory Pre-Bid Conference and are encouraged to attend any non-mandatory Pre-Bid Conference to ensure their understanding of Owner's bidding and contracting requirements, particularly MBE/WBE Procurement Program requirements. If the Pre-Bid Conference is mandatory the Bidder must arrive and sign-in within fifteen (15) minutes of the scheduled start time of the meeting, otherwise the Bidder will not be allowed to submit a Bid for the project.

The persons listed below may be contacted for information regarding the Invitation for Bid. If the Bidder contacts any other City employee, including Council Members and members of Boards and Commissions, the Bidder may be found in violation of Ordinance No. 20111110-052, dated November 10, 2011, regarding Anti-Lobbying and Procurement. The text of that Ordinance may be viewed at http://www.cityofaustin.org/edims/document.cfm?id=161145.

AUTHORIZED CONTACT PERSONS

PROJECT MANAGER, CITY OF AUSTIN: Phillip Jaeger.	Tel: (512) 972-0232
	Email: Phillip.Jaeger@austintexas.gov
PROJECT OWNER: Douglas H. Gilliland	Tel: (817) 788-1000
	Email: douglasg33@aol.com
CONTRACT COMPLIANCE REP.: Kitty Tunnell	Tel: (512) 974-7055
	Email: Kitty.Tunnell@austintexas.gov

END

The Supplemental General Conditions contained herein amend or supplement the General Conditions, Section 00700.

ARTICLE 1 - DEFINITIONS

Add the following definition:

"1.20 Engineer/Architect (E/A): Add the following:

Name: Bury + Partners, Inc.

Address: 221 West Sixth Street, Ste. 600

Austin, Tx. 78701 "

Delete 1.31 and replace with the following definition:

"**1.31** OWNER: Club Deal 120 Whisper Valley, L.P. is designated as Owner of the Project."

Delete 1.32 and replace with the following definition:

"**1.32** Owner's Representative: The designated representative of the OWNER. The Owner's Representative will be Sheffield Asset Management Company (SAMCO)."

Add the following definition:

"1.57 Allowance - Allowance is defined as "a not-to-be-exceeded amount", either individually or in the aggregate, which is established between the Owner and the Contractor as part of its Bid Proposal when the precise scope of a particular line item(s) has not been defined to a level which is adequate for the Contractor to provide a definitive line item pricing for that particular scope of Work. The use of any Allowances by the Contractor will be subject to the Owner's sole approval and it is the Owner's intent to minimize the use of Allowances to the fullest extent possible. For any Allowances which the Owner allows the Contractor to use, the following rules shall apply: (i) Allowances shall cover the cost to the Contractor of the Cost of Work; (ii) Contractor's overhead and profit associated with the stated Allowance shall be included in the Allowance; and (iii) upon completion of the portion of the Work subject to an Allowance, the Contract Amount for that portion of the Work will be adjusted based upon the approved actual cost of the Work, which will not exceed the approved aggregate amount of the Allowances."

ARTICLE 2 - PRELIMINARY MATTERS

2.2 Copies of Documents: Add the following:

"Additional copies of the Project Manual and drawings may be obtained from Bury + Partners, Inc. on the following basis:

Full or partial set of Drawings $2.00 per sheet.

Each set of Project Manual $250.00 each."

2.4 Before Starting Construction:

Delete 2.4.2.6 and replace with the following (changes to the original text are identified by underlining):

"**.6** a preliminary schedule of values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction.

At a minimum, the schedule of values shall be broken out by trade and split between materials and labor. Prices will include an appropriate amount of overhead and profit applicable to each item of Work;"

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.1 Availability of Lands: Add the following:

"CONTRACTOR shall contact OWNER's Transportation Department to obtain a Temporary Use of Right-of-Way Permit prior to beginning construction on any sidewalk/driveway or occupying any parking area/meters within the public right-of-ways."

ARTICLE 5 - BONDS AND INSURANCE

"5.3 Insurance:

5.3.1.1 General Requirements.

.1 CONTRACTOR shall carry insurance in the types and amounts indicated below for the duration of the Contract, which shall include items owned by OWNER in the care, custody and control of CONTRACTOR prior to and during construction and warranty period.

.2 CONTRACTOR must complete and forward the Certificate of Insurance, Section 00650, to OWNER before the Contract is executed as verification of coverage required below. CONTRACTOR shall not commence Work until the required insurance is obtained and until such insurance has been reviewed by OWNER. Approval of insurance by OWNER shall not relieve or decrease the liability of CONTRACTOR hereunder and shall not be construed to be a limitation of liability on the part of CONTRACTOR. CONTRACTOR must also complete and forward the Certificate of Insurance, Section 00650, to OWNER whenever a previously identified policy period has expired as verification of continuing coverage.

.3 CONTRACTOR's insurance coverage is to be written by companies licensed to do business in the State of Texas at the time the policies are issued and shall be written by companies with A.M. Best ratings of B+VII or better, except for hazardous material insurance which shall be written by companies with A.M. Best ratings of A- or better.

.4 All endorsements naming the OWNER as additional insured, waivers, and notices of cancellation endorsements as well as the Certificate of Insurance shall indicate: City of Austin, Contract Management Department, P.O. Box 1088, Austin, Texas 78767.

.1 In addition the OWNER, **Club Deal 120 Whisper Valley, Limited Partnership** shall be added as an additional insured.

.2 In addition to the OWNER, **Sheffield Asset Management Company (SAMCO)** shall be added as an additional insured.

.5 The "other" insurance clause shall not apply to the OWNER where the OWNER is an additional insured shown on any policy. It is intended that policies required in the Contract, covering both OWNER and CONTRACTOR, shall be considered primary coverage as applicable.

.6 If insurance policies are not written for amounts specified below, CONTRACTOR shall carry Umbrella or Excess Liability Insurance for any differences in amounts specified. If Excess Liability Insurance is provided, it shall follow the form of the primary coverage.

.7 OWNER shall be entitled, upon request and without expense, to receive certified copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modification of particular policy terms, conditions, limitations, or exclusions except where policy provisions are established by law or regulations binding upon either of the parties hereto or the underwriter on any such policies.

.8 OWNER reserves the right to review the insurance requirements set forth during the effective period of this Contract and to make reasonable adjustments to insurance coverage, limits, and exclusions when deemed necessary and prudent by OWNER based upon changes in statutory law, court decisions, the claims history of the industry or financial condition of the insurance company as well as CONTRACTOR.

.9 CONTRACTOR shall not cause any insurance to be canceled nor permit any insurance to lapse during the term of the Contract or as required in the Contract.

.10 CONTRACTOR shall be responsible for premiums, deductibles and self-insured retentions, if any, stated in policies. All deductibles or self-insured retentions shall be disclosed on the Certificate of Insurance.

.11 CONTRACTOR shall provide OWNER thirty (30) days written notice of erosion of the aggregate limits below occurrence limits for all applicable coverages indicated within the Contract.

.12 If OWNER owned property is being transported or stored off-site by CONTRACTOR, then the appropriate property policy will be endorsed for transit and storage in an amount sufficient to protect OWNER's property.

.13 The insurance coverages required under this contract are required minimums and are not intended to limit the responsibility or liability of CONTRACTOR.

5.3.1.2 Business Automobile Liability Insurance. Provide coverage for all owned, non-owned and hired vehicles. The policy shall contain the following endorsements in favor of OWNER:

a) Waiver of Subrogation endorsement CA 0444;

b) 30 day Notice of Cancellation endorsement CA 0244; and

c) Additional Insured endorsement CA 2048.

Provide coverage in the following types and amounts:

.1 A minimum combined single limit of $2,000,000 per occurrence for bodily injury and property damage.

5.3.1.3 Workers' Compensation And Employers' Liability Insurance. Coverage shall be consistent with statutory benefits outlined in the Texas Workers' Compensation Act (Section 401). CONTRACTOR shall assure compliance with this Statute by submitting two (2) copies of a standard certificate of coverage (e.g. ACCORD form) to Owner's Representative for every person providing services on the Project as acceptable proof of coverage. The Certificate of Insurance, Section 00650, must be presented as evidence of coverage for CONTRACTOR. Workers' Compensation Insurance coverage written by the Texas Workers Compensation Fund is acceptable to OWNER.

CONTRACTOR's policy shall apply to the State of Texas and include these endorsements in favor of OWNER:

a) Waiver of Subrogation, form WC 420304; and

b) 30 day Notice of Cancellation, form WC 420601.

The minimum policy limits for Employers' Liability Insurance coverage shall be as follows:

.1 $500,000 bodily injury per accident, $500,000 bodily injury by disease policy limit and $500,000 bodily injury by disease each employee.

5.3.1.4 Commercial General Liability Insurance. The Policy shall contain the following provisions:

a) Contractual liability coverage for liability assumed under the Contract and all contracts relative to this Project.

b) Completed Operations/Products Liability for the duration of the warranty period.

c) Explosion, Collapse and Underground (X, C & U) coverage.

d) Independent Contractors coverage (Contractors/ Subcontractors work).

e) Aggregate limits of insurance per project, endorsement CG 2503.

f) OWNER listed as an additional insured, endorsement CG 2010.

g) 30 day notice of cancellation in favor of OWNER, endorsement CG 0205.

h) Waiver of Transfer of Recovery Against Others in favor of OWNER, endorsement CG 2404.

Provide coverages A&B with minimum limits as follows:

.1 A combined bodily injury and property damage limit of $4,000,000 per occurrence and $10,000,000 minimum aggregate.

5.3.1.5 Builders' Risk Insurance. CONTRACTOR shall maintain Builders' Risk Insurance or Installation Insurance on an all risk physical loss form in the Contract Amount. Coverage shall continue until the Work is accepted by OWNER. OWNER shall be a loss payee on the policy. If off-site storage is permitted, coverage shall include transit and storage in an amount sufficient to protect property being transported or stored.

5.3.1.7 Professional Liability Insurance. For Work which requires professional engineering or professional survey services to meet the requirements of the Contract, including but not limited to excavation safety systems, traffic control plans, and construction surveying, the CONTRACTOR or Subcontractors, responsible for performing the professional services shall provide Professional Liability Insurance with a minimum limit of $500,000 per claim and in the aggregate to pay on behalf of the assured all sums which the assured shall become legally obligated to pay as damages by reason of any negligent act, error, or omission committed with respect to all professional services provided in due course of the Work of this Contract.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.6 Permits, Fees: Add the following:

"OWNER will obtain and pay for the following permits, licenses and/or fees:

.1 Site Development Permit.

.2 TPDES Permit to dispose of wastes.

6.7 Laws and Regulations: Add the following:

"**6.7.4** This Work is subject to the Texas Pollution Discharge Elimination System (TPDES) permitting requirements for the installation and maintenance of temporary and permanent erosion and sediment controls and storm water pollution prevention measures throughout the construction period.

OWNER has prepared a Storm Water Pollution Prevention Plan (SWPPP). Reference Section 01096 for this SWPPP.

OWNER shall file the Owner's Notice of Intent and Notice of Termination to the Texas Commission on Environmental Quality (TCEQ). OWNER shall pay the TPDES storm water application fee.

CONTRACTOR's responsibilities are as follows.

.1 File a Notice of Intent (NOI) form with the TCEQ at least two (2) days prior to start of construction activity and pay for the permit. Form is available from OWNER or on the Internet at http://www.tceq.state.tx.us/assets/public/permitting/waterquality/forms/20022.pdf.

The form shall be mailed or submitted online to the TCEQ. If submitting online, the web address is https://www6.tceq.state.tx.us/steers/. If CONTRACTOR has not already registered to use the TCEQ online application submittal service, it will take up to ten (10) Working Days to receive a user name and password. CONTRACTOR shall take this timeframe into consideration if applying online. A Time Extension shall not be granted for this timeframe.

The mailing address is:

Texas Commission on Environmental Quality
Storm Water & General Permits Team; MC-228
P.O. Box 13087
Austin, TX 78711-3087

A copy of the completed Notice of Intent (NOI) form must also be mailed to the local Municipal Separate Storm Sewer Systems (MS4) representative:

TPDES Program Coordinator
City of Austin – WPD – ERM
P.O. Box 1088
Austin, TX 78767

.2 Obtain a signed certification statement from all Subcontractors responsible for implementing the erosion and sediment control measures. This statement shall indicate that the Subcontractor understands the permit requirements. The certified statement forms shall be attached to and become part of the SWPPP.

.3 Post a notice near the main entrance of the Work with the following information.

- The TPDES permit number for the Work or a copy of the NOI if a permit number has not yet been assigned,
- The name and telephone number of a local contact person,
- A brief description of the Work, and
- The location of the SWPPP if the site is inactive or does not have an on-site location to store the plan.

If posting this information near a main entrance is infeasible due to safety concerns, the notice must be posted in a local public building. If the Work is linear (pipeline, highway, etc.), the notice must be placed in a publicly accessible location near where construction is actively underway and moved as necessary. For linear Work, multiple postings of the information may be required by OWNER (e.g. postings at both ends of the Work).

.4 Maintain all erosion and sediment control measures and other protective measures identified in the SWPPP in effective operating condition.

.5 Perform inspections every five (5) working days and after every ½ inch rainfall event, noting the following observations on an inspection form provided by OWNER:

- Locations of discharges of sediment or other pollutants from the site.
- Locations of storm water / erosion / sedimentation controls that are in need of maintenance.
- Locations of storm water / erosion / sedimentation controls that are not performing, failing to operate, or are inadequate.
- Locations where additional storm water / erosion / sedimentation controls are needed.

.6 Maintain at Work site at all times a copy of the SWPPP (with all updates, as described below) and inspection reports.

.7 Update the SWPPP as necessary to comply with TPDES permitting requirements, which includes noting changes in erosion / sedimentation controls and other best management practices that are part of the SWPPP and which may be necessary due to the results of inspection reports. Any SWPPP revisions or updates must be signed and certified by a Certified Professional in Erosion and Sedimentation Control (CPESC) or a Registered Professional Engineer. If the SWPPP includes engineering calculations, then SWPPP must be sealed and signed by a Registered Professional Engineer.

.8 File a Notice of Termination with the TCEQ within thirty (30) days of final stabilization on all portions of the Work site. Form is available from OWNER or on the Internet at http://www.tceq.state.tx.us/assets/public/permitting/waterquality/forms/20023.pdf.

The NOT shall be mailed to:
Storm Water & General Permits Team; MC-228
P.O. Box 13087

Austin, TX 78711-3087
(512) 239-4671

.9 Upon completion of the Work, provide TPDES records to OWNER."

6.11 Safety and Protection: Add the following to paragraph 6.11.3:

"6.11.3 At the minimum, the safety representative will be certified in personal protective equipment, hazard communication, demolition and blasting, trench/excavation, hand and power tools, welding/cutting, cranes/derricks/hoists/conveyors/, scaffolding, confined space, CPR and first aid."

ARTICLE 9 - ENGINEER/ARCHITECT'S STATUS DURING CONSTRUCTION

9.4 Project Representative: Add the following:

"Casey Wauters, P.E. of Bury+Partners, Inc. shall be responsible for review and approval of Contractor Progress Pay Estimates Applications, as well as management of plans and Record Drawings. **"**

ARTICLE 11 - CHANGE OF CONTRACT AMOUNT

11.4 Determination of Value of Work: Add the following to paragraph 11.4.1.2:

"11.4.1.2 In the case of a Change Order determined by a mutually agreed lump sum properly itemized and supported by sufficient substantiating data, including documentation by subcontractors performing the work, to permit evaluation, use the following method:

COMPONENT ONE - The R.S. Means Co., Inc. 'Building Construction Cost Data' - latest edition - shall be used as a basis for evaluating:

1a - the cost of labor (base rate, including fringe benefits),

1b - the cost of material and equipment to be incorporated in the Work, and

1c - the cost of tools, equipment and facilities necessary to accomplish the Work described in the change.

COMPONENT TWO - The costs of payroll taxes and insurance, Liability and Builder's Risk Insurance, shall be calculated as follows:

2a - Payroll taxes and Workers' Compensation Insurance <25% of payroll (Item 1a) (14.65% of 1a for ROCIP Projects)>

2b - Liability and Builder's Risk Insurance <2% of "total costs" (Items 1a, 1b, 1c, and 2a) (.034% of "total costs" for ROCIP Projects)>

COMPONENT THREE - Overhead and profit shall be calculated as follows:

3a - For Subcontractors and for those portions of the Work performed by CONTRACTOR'S own forces:

15% of the first $10,000.00 of costs and 10% of the balance over $10,000.00.

("costs" = Items 1a, 1b, and 1c, above, broken down into Contractor and Subcontractor costs).

3b - For the CONTRACTOR for that portion of the Work performed by Subcontractors:

10% of the first $10,000.00 of the Subcontractor costs and 7.5% of the balance over $10,000.00.

("costs" = Items 1a, 1b, and 1c, above, broken down into Subcontractor costs)

COMPONENT FOUR - Bonds

Performance and Payment Bond according to the following table ("TOTAL COST" = Items 1a, 1b, 1c, 2a, 2b, 3a and 3b,):

DOLLAR VALUE OF CONTRACT			% OF TOTAL COST OF CHANGE ORDER ADDED FOR BOND EXPENSE
100,000	or	less	2.5
100,001	thru	500,000	1.5
500,001	thru	2,500,000	1.0
2,500,001	thru	5,000,000	0.75
5,000,001	thru	7,500,000	0.70
OVER 7,500,000			0.65

- The total costs for the change, whether additive or deductive, shall be the sum total of COMPONENTS ONE - FOUR.

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

13.7 Warranty Period: Add the following:

"**13.7.5** OWNER will utilize a "Warranty Item Form" (attached at the end of this Section) for the purpose of providing Written Notice of warranty defects to CONTRACTOR. CONTRACTOR shall date, sign, complete and return the form to OWNER when the defect is corrected, including such information on or attached to the form to describe the nature of the repairs or corrections that were made. If the defect cannot be corrected in seven (7) Calendar Days, CONTRACTOR shall provide a written explanation to the Owner's Representative describing the repairs needed and the time required to complete the repairs."

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.1 Application for Progress Payment: Delete 14.1.6.3 and replace with the following:

".3 Contract time statement form signed by CONTRACTOR and Owner's Representative. If CONTRACTOR does not agree with the number of accumulated days charged, CONTRACTOR shall file a Claim in accordance with Article 16.1, Filing of Claims."

14.8 Partial Utilization: Delete 14.8.1 and replace with the following (changes to the original text are identified by underlining):

".1 OWNER at any time may request CONTRACTOR to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to Owner's Representative that such part of the Work is substantially complete and request Owner's Representative to issue a <u>notice specifying what portion of the Work is substantially complete for the purpose of payment and what Work remains to be done on the portion being accepted</u>. CONTRACTOR at any time may notify Owner's Representative that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request Owner's Representative to issue a <u>notice specifying what portion of the Work is partially completed for the purpose of payment and what Work remains to be done on the portion being accepted</u>. The provisions of paragraphs 14.7.1 and 14.7.2 will apply with respect to <u>the notice specifying what portion of the Work is partially completed for the purpose of payment and what Work remains to be done on the portion being accepted</u>."

14.11 Final Payment and Acceptance:

Add the following to paragraph 14.11.1:

"If the sole remaining, unfinished item of the Work is revegetation or other permanent erosion control, including, if applicable, tree mitigation, (collectively, the "revegetation"), the CONTRACTOR may execute a zero-cost "Revegetation Change Order" for such Work and post fiscal security acceptable to Owner to ensure completion of the revegetation.

The fiscal security will be a bond, letter of credit, or cash escrow in a form promulgated by OWNER and posted with OWNER's Watershed Protection Department.

Upon receipt of the executed Revegetation Change Order and fiscal security, the Owner's Representative will issue a conditional letter of final acceptance to the CONTRACTOR for the Work, excluding the revegetation, which establishes the Final Completion Date for that Work and initiates the one year warranty period.

This revegetation must be accomplished within 120 Calendar Days of the date of Final Completion of the balance of the Work or such other stipulated time for completion directed in the Change Order. When the revegetation has been established, OWNER will inspect for final acceptance of that portion of the Work and, as applicable, initiate the one year warranty period for that Work.

If the revegetation is not completed within the 120 Calendar Days or such other time set forth in the Change Order, the OWNER, at its option, may complete the Work using the posted fiscal security."

WARRANTY ITEM NO. _____ (PROJECT NAME)

The General Conditions of the Contract require that Warranty Defects be corrected within 7 days after written notice is received.

TO: _____
contractor name address / telephone / fax / email

ATTENTION OF: _____

FROM: _____
project manager name / address / telephone / fax / email

PROJECT: _____
name / location / CIP ID number

END OF ONE YEAR WARRANTY:_____

SUBJECT:_____

[ ] If checked, the damage requires immediate attention. The Contractor has been called.
[ ] If checked, the Consultant has been asked to consult with the Contractor on the problem.

PLEASE CORRECT OR REPAIR THE FOLLOWING ITEM(S):

DATE OF REQUEST_____ **SIGNATURE** _____
Project Manager

xc:
[ ] _____Phone No._____
[ ] _____Phone No._____
[ ] _____Phone No._____
[ ] _____Phone No._____

RESPONSE FROM CONTRACTOR: DATE CORRECTION WAS MADE:_____

The Contractor must endeavor to correct the defect within 7 calendar days after written notice is given. If the defect cannot be corrected in that time, Contractor shall provide a written explanation to the Owner's Representative describing the repairs needed and the time required to complete the repairs.

Description of corrections made:

DATE OF REPLY_____SIGNATURE_____

When the repair is complete, the contractor should return a copy to each of the following:

[ ] _____Phone No._____
[ ] _____Phone No._____
[ ] _____Phone No._____
[ ] _____Phone No._____

END

PREVAILING WAGE RATE DETERMINATION

HEAVY AND HIGHWAY CONSTRUCTION

COUNTY NAME: TRAVIS

Wages based on DOL General Decision:TX130016 01/04/2013 TX16

Classification	Wage Rate	Classification	Wage Rate
Agricultural Tractor Operator	$ 12.69	Laborer, Utility	$ 12.27
Asphalt Distributor Operator	$ 15.55	Loader/Backhoe Operator	$ 14.12
Asphalt Paving Machine Operator	$ 14.36	Mechanic	$ 17.10
Asphalt Raker	$ 12.12	Milling Machine	$ 14.18
Boom Truck Operator	$ 18.36	Motor Grader Operator - Fine Grade	$ 18.51
Broom or Sweeper Operator	$ 11.04	Motor Grader Operator - Rough	$ 14.63
Cement Mason/Concrete Finisher	$ 12.56	Painter - Structures	$ 18.34
Concrete Pavement Finishing Machine		Pavement Marking Machine Operator	$ 19.17
Operator	$ 15.48	Pipelayer	$ 12.79
Crane, Hydraulic 80 tons or less	$ 18.36	Reclaimer/Pulverizer	$ 12.88
Crane, Lattice Boom, 80 tons or less	$ 15.87	Reinforcing Steel Setter	$ 14.00
Crane, Lattice Boom, over 80 tons	$ 19.38	Roller Operator, Asphalt	$ 12.78
Crawler Tractor	$ 15.67	Roller Operator, Other	$ 10.50
Directional Drilling Locator	$ 11.67	Scraper Operator	$ 12.27
Directional Drilling Operator	$ 17.24	Servicer	$ 14.51
Electrician	$ 26.35	Spreader Box Operator	$ 14.04
Excavator, 50,000 lbs. or less	$ 12.88	Structural Steel Worker	$ 19.29
Excavator, over 50,000 lbs.	$ 17.71	Traffic Signal Installer/Light Pole Worker	$ 16.00
Flagger	$ 9.45	Trenching Machine Operator, Heavy	$ 18.48
Form Builder/ Setter, Structures	$ 12.87	Truck Driver Tandem Axle Semi-Trailer	$ 12.81
Form Setter - Paving & Curb	$ 12.94	Truck Driver, Lowboy-Float	$ 15.66
Foundation Drill Operator,		Truck Driver, Single Axle	$ 11.79
Truck Mounted	$ 16.93	Truck Driver, Off Road Hauler	$ 11.88
Front End Loader Operator, 3CY or less	$ 13.04	Truck Driver, Single or Tandem Axle Dump Truck	$ 11.68
Front End Loader Operator, over 3 CY	$ 13.21	Welder	$ 15.97
Laborer, Common	$ 10.50	Work Zone Barricade Servicer	$ 11.85

http://www.wdol.gov/wdol/scafiles/davisbacon/tx.html

The Wage Compliance information detailed below was excerpted from General Decision TX20070043 or other DOL sources.

1. **Additional Trade information:**
   Unlisted classifications needed for work not listed within the scope of the classifications listed may be added upon the advance approval of Contract Procurement. CONTRACTOR shall submit to City of Austin Contract Procurement the following: classification, a bona fide definition of work to be performed and a proposed wage with sample payrolls conforming to area practice **prior** to the start of the job for that type of work. Proposed trade may not be performed by any trade already listed.

2. **Wages**
   For overtime, the basic hourly rate listed in the contract wage determination must be used in computing pay obligations.

3. Proper Designation of Trade

A work classification from the Prevailing Wage Poster for each worker must be made based on the actual type of work he/she performed on the job. In summary the work performed, not the "title" determines the correct worker classification and wage. Each worker must be paid no less than the wage rate on the wage decision for that classification **regardless** of his/her level of skill (exclusive of a bona fide apprentice currently registered in a DOL approved apprentice program - proof of individual registration must be supplied in advance to the City of Austin).

4. Split Classification

If a firm has employees that perform work in more than one classification, it can pay the wage rates specified for each classification ONLY if it maintains accurate time records showing the amount of time spent in each classification. If accurate time records are not maintained, these employees must be paid the highest wage rate of all the classifications of work performed by each worker. Accurate time records tracking how many hours a worker performed the work of one trade and then switched to another trade must be accounted for on a daily basis and reflected on Employer Certified Payroll accordingly.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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SECTION 11201 – NON-POTABLE WATER PUMPING SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. The work under this Section shall consist of furnishing all material, labor, and equipment necessary to furnish and install a factory-assembled non-potable water pumping system, completed and fully functional, as described in this Section and as shown on the Drawings.

B. The system shall be rated for a system flow of 160 gpm at a system pressure of 78 psig and -4 feet of suction lift. The system shall be capable of supplying a minimum flow of 7.5 gpm at a system pressure of 78 psig.

C. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

1.2 SUBMITTALS

A. NPW Water Pumps Shop Drawings: Submit the following at a minimum:

1. Test Reports: Submit certified copies of startup reports.
2. Catalog Data: Submit Manufacturer's literature and illustrations.
3. Shop Drawings:
   a. Dimensions
   b. Components
   c. Assembly details
   d. Materials
4. Pump Curves: Submit Manufacturer's pump curves with design point.
5. Installation Instructions: Submit complete Manufacturer's instructions, including parts lists and recommended spare parts.
6. Weight: Statement of net assembled weight.

B. NPW Water Pumps Certificate of Warranty: Submit per Section 1.6.

C. NPW water Pumps O&M Manual: Submit final drawings, complete maintenance instructions, troubleshooting information, service department contact information, warranty, and spare parts list as applicable.

1.3 QUALITY ASSURANCE

A. Where specified, valves and operators must conform to all applicable AWWA and ANSI standards.

B. Provide Manufacturer's certification that materials meet or exceed minimum requirements as specified.

C. All valves of the same type shall be by a single Manufacturer.

D. Installation shall meet the latest requirements of all local, State and Federal codes.

E. Provide products as specified. No substitutions unless pre-approved by the Engineer.

1.4 ACCEPTABLE MANUFACTURERS

A. The system shall be an TIGERFLOW Series ES-3000-H, Model TESH-(2)1.5GL-10PC-S1-S4 (Triplex) U.L./C-U.L. Listed Engineered packaged water booster system;

B. Flowtronex;

C. Approved equal.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Damages: Repair or replace to satisfaction of Engineer.

B. Seal pipe ends to prevent entry of foreign matter.

C. Store system and accessories in area protected from weather, moisture, or possible damage.

D. Transport and handle items with care to prevent interior or exterior damage.

1.6 WARRANTY

A. The Manufacturer of the non-potable water pumping system shall warrant the system to be of quality construction, free from defects in material and factory workmanship.

B. The system shall be warranted for a period of 12 months from date of startup to be free from defects and physical failures occurring in normal service, when installed in accordance with the Manufacturer's recommendations.

C. The system Manufacturer shall be solely responsible for the system and all related components, warranties, and guarantees by the suppliers of various components will not be accepted.

PART 2 - PRODUCTS

2.1 SYSTEM CAPACITY

A. The unit shall be rated for a total system capacity as shown on the plans and the individual pumps in the system shall be sized to deliver the total flow.

B. The system Manufacturer shall submit individual pump curves and system curves for the Engineer's approval.

2.2 PUMPS AND MOTORS

A. Pumps 1 and 2:

1. Pumps shall be Goulds, series e-SV, Cast Iron, Stainless Fitted, Mechanical Seal Vertical multistage centrifugal type each coupled to a 3600 RPM, 480 Voltage, 3 Phase, 60 Hz, TEFC high efficiency motor.

2. Pumps shall be Model 5SV-6, 25 GPM at 200' TDH, 1.5 HP.

B. Pump 3:

1. Pump shall be Paco, Series LC, Cast iron, bronze fitted, mechanical seal end suction centrifugal type each close-coupled to a 3600 RPM, 480 Voltage, 3 Phase, 60 Hz, TEFC high efficiency motor.

2. Pump shall be Model 1270-9, 130 GPM @ 200' TDH, 10 HP.

2.3 PIPING, VALVES, APPURTENANCES

A. Piping:

1. The unit shall be completely factory assembled and tested, and shall use fusion bonded epoxy coated black iron.

2. Discharge and suction connections shall be ANSI flanges.

B. Valves:

1. The suction lines of the system shall have a foot valve on each line located in the chlorine contact basin.

2. Priming line with option for effluent or fresh water. The line shall have a hydraulically operated pressure reducing control valve with manual delivery pressure adjustment between 2-7 psi.

3. The discharge and suction lines of each pump shall be complete with full-port ball valves.

4. The discharge of each pump shall be furnished with silent check valves.

C. Appurtenances:

1. Over-Temperature Protection: Each pump shall be equipped with an individual combination type non-electric temperature probe and purge assembly with PRV on purge line.

2.4 HYDROPNEUMATIC TANK

A. The system shall be provided with a 185 gallon hydropneumatic bladder tank rated for 200 psi. Model TF-185-E or approved equal.

B. Tank shall be skid mounted with system.

C. Tank shall include an NSF approved replaceable bladder, bottom connection, air fill valve, tank drain valve and gauge.

D. Tank shall be per Section VIII, ASME CODE, and National Board stamped.

2.5 FACTORY PREFABRICATION

A. Provide each system as a complete package system on a structural steel mounting frame, piped, tubed, mounted and wired.

B. Unit shall be factory primed and painted with machine grade finish coat. All welding shall be performed by ASME Section 9 certified welders.

2.6 TESTING

A. The system and all pertinent components shall electrically and hydrostatically tested before shipment, in addition, the system shall be factory tested from 0-100% of flow and pressure.

2.7 PROGRAMMABLE CONTROLLER

A. Scope:

1. Furnish and install 1 U.L. Listed, Nema 4, Modicon M340 or Quantum Series PLC.

   a. U.L./C-U.L. 508 Label

   b. Micro Controller:

      1) Flash Memory
      2) EPROM Latched Main Memory
      3) Multi-Level Security Passwords

   c. See Section 13390 – Packaged Control Systems for all operator interface requirements.

   d. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

2.8 CONTROLS

A. Each lag pump shall be sequenced by pressure sequencing with programmable minimum run timers and time delay relay.

B. The pressure set point shall be field adjustable through a touch screen interface.

C. Pumps 1 and 2 will shut off when Pump 3 is activated due to higher flow demands.

D. Pressure regulating valves will allow Pumps 1 and 2 to turn back on if higher demands require them.

2.9 PAINTING

A. The unit shall be cleaned and painted prior to shipment.

B. The Manufacturer shall supply a quantity of the painting system for the Contractor to apply field touch-ups.

C. Finish coat shall be applied in the field in accordance with Section 09902 - PAINTING.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be governed by National Electrical Code, Uniform Plumbing Code, Uniform Mechanical Code, and the Contract Documents.

3.2 FACTORY REPRESENTATIVE

A. Contractor shall provide a factory authorized representative to approve installation and to provide two (2) hours of start-up and maintenance instruction to Owner's personnel.

B. Instruction shall be provided after all units have been field test and accepted.

END OF SECTION

SECTION 11215 – POSITIVE DISPLACEMENT AIR BLOWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, materials, tools and equipment required to furnish and install, in good workmanlike manner, Positive Displacement (PD) 3-lobe air blower package with integrated pulsation cancellation, sound attenuating enclosures, and control panels.

B. Contractor shall install blower units with enclosure and all external equipment supplied by the blower Manufacturer and shall provide and install all external piping, pipe supports, wiring, conduit, and accessories not provided by the blower Manufacturer for a complete and functional blower system.

C. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

1.2 SUBMITTALS

A. Blower Shop Drawings:

1. Product literature
2. Complete description
3. Dimensions and required clearances
4. Weights
5. Performance curves
6. Layout drawing for all equipment showing installation details
7. A list of all deviations from Drawings and Specifications
8. Affidavits of compliance with referenced standards and codes
9. Manufacturers' Warranty

B. Blower Maintenance and Operating Manuals

1.3 QUALITY ASSURANCE

A. Manufacturers' Qualifications: All equipment furnished under this section shall be furnished by a single Manufacturer who shall assume complete responsibility for the design and performance of the equipment. The Manufacturer shall have a minimum of five (5) years experience in producing blower equipment and shall produce evidence of at least five (5) installations of similar size in satisfactory operation in the United States.

B. Factory Tests: Manufacturer shall factory-test equipment to detect any defects and demonstrate that they will function satisfactorily under all conditions specified. Testing

shall include slip tests and mechanical run tests. Manufacturer shall prepare and submit a written report on the results of remedial action taken, if any.

C. ISO Certification: A CE certified blower Manufacturer with a Quality Control System certified in accordance with ISO 9001 shall supply blowers and appurtenances. Units shall be furnished as a complete system.

1.4 ACCEPTABLE MANUFACTURERS

A. Kaeser Compressors, Inc. from Fredericksburg, VA, Com-paK Plus Design Package EB 421C.

B. Aerzen USA Corporation from Coatesville, PA, Generation 5 Delta Blower Model GM35S.

C. Approved equivalent.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling:

1. Inspect all equipment and materials against reviewed shop drawings at the time of delivery.
2. Equipment and materials damaged or not meeting the requirements of the reviewed shop drawings shall be immediately returned for replacement or repair.

B. Storage:

1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
2. Store materials to permit easy access for inspection and identification. Support all material off of the ground and protect steel members and packaged material from corrosion and deterioration as per Manufacturers' instructions.

1.6 WARRANTY

A. All equipment, structures and appurtenances shall be warranted by the Contractor against defects in materials or workmanship for a period of one (1) year from date of acceptance and/or beneficial use.

B. Rotary blowers shall be warranted against defects in material and workmanship for a period of 66 months from shipment or 60 months from start-up, whichever occurs first. All other package components shall be warranted for a period of 18 months from shipment or 12 months from start-up, whichever occurs first.

C. Blower Manufacturer shall provide an extended service and warranty for a period of 36 months from start-up. This shall include an annual maintenance agreement for this period.

1.7 SPARE PARTS

A. All spare parts requirements as specified in related sections shall apply to the work described in this section.

B. All tools and spare parts shall be properly packed and protected for long-term storage and placed in containers clearly identified in indelible marking as to content. Each part shall be sealed, wrapped, or otherwise protected from corrosion during storage.

C. Provide spare parts for one (1) rebuild.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA:

A. Number of Units: 3

B. Blower Capacity 250-1000 SCFM (via variable speed operation)

C. Discharge Pressure 9.0 PSIG

D. Motor Horsepower 75 HP

E. Sound pressure level with enclosure < 75 dB(A) at 3 feet

2.2 DETAILS OF CONSTRUCTION

A. General

1. Blowers shall be rotary-lobe, dynamically and statically balanced, tri-lobe design with an equalization chamber integral to the blower housing.
2. The blower rotors are to be balanced according to ISO 1940 class Q 2.5. With respect to acceptable vibration levels, the blowers must operate between effective vibration speeds of 2.8 to 7.0 mm/sec. (0.11 to 0.276 inches/sec.) measured at the bearing housing per VDI standard 2056. For acceptance, all blowers must conform to ISO 2373, Machine Group T.
3. With the combination of three (3) lobes and the “equalization” chamber, the pulsations are greatly reduced by the principle of wave interference resulting in a 20 to 35 dB attenuation of the fundamental frequency.

B. Housing

1. Close grained, high strength cast iron construction with DIN inlet and outlet connections. An adapter can be provided for transition from DIN to NPT or ANSI flange as required.
2. Adequately ribbed to prevent distortion.
3. Provided with a built-in "equalization" chamber.
4. Drive-end head-plate is integral to the cylinder.

C. Rotors

1. Stiff-shaft design with the first lateral critical speed shall be at least 120% of the maximum allowable speed.
2. Any torsional natural frequency shall be at least 10% above or 10% below the operating speed range of the blower.
3. The rotor and shaft assembly shall be a one-piece design constructed of ductile iron.
4. Rotors shall be solid or have closed ends.
5. Rotors shall have an integral sealing strip for improved efficiency.

D. Timing Gears

1. Spur type, AGMA Grade 11 equivalent quality with minimum service factor of 1.7 at the maximum operating point.
2. Gears shall be secured by bolting and an interference fit on ground tapered shaft ends.

E. Bearings

1. Type: Cylindrical Roller Bearings.
2. L-10 Life of at least 80,000 hours under constant maximum load.
3. Bearings and gears shall be oil splash lubricated.

F. Seals at Rotor Chamber

1. The seals at both ends of each shaft shall be non-rubbing, vented, labyrinth-type seals, each seal assembly containing four (4) hardened steel piston rings, oil deflector, and grooved, replaceable labyrinth bushing. There are a total of 16 piston ring seals.
2. Provision for venting to atmosphere between the oil-side and the air-side seals shall be included.
3. The use of lip-type seals for internal rotor shaft sealing is not acceptable.
4. Replaceable wear inserts to protect the seal bores in the headplates are required.

2.3 BLOWER PACKAGE

A. The packaged blowers are to be standard engineered designs of a CE certified Manufacturer regularly engaged in the production of packaged blowers to insure single source accountability and shall include the following listed standard features:

1. The packages shall be driven through V-belts and sheaves. The drive assembly shall be of the high capacity type, oil and heat resistant, with a minimum service factor of 1.5.
2. Automatic tensioning of the V-belts by use of a pivoting, swing frame motor base with adjustable spring assistance and visual indication of V-belt tension shall be provided to ensure the V-belts remain properly tensioned with minimal maintenance and to extend V-belt, sheave, and bearing life. Adjustment of the

tensioning device shall be accomplished without removal of the guard or loosening of the motor mounting bolts.

3. The drive guard shall be the Manufacturer's standard sheet metal with provision for ventilation. The installed guard shall be fully enclosed, easily removable, and designed to meet current OSHA recommendations and CE standards.

4. The base shall be an elevated, rigid, fabricated steel design with a solid sub-base. The discharge silencer must be integral to the frame in order to minimize space requirements.

5. The blower shall be mounted horizontally for a compact frame and discharge downward to prevent accumulation of contaminates in the blower cylinder.

6. To prevent transmission of vibration and noise, the base shall include vibration isolators made of rubber in a steel footing. The vibration isolators are to be mounted between the blower base and the package sub-base.

7. Oil drains from the blower drive-end and gear-end lubricating oil sumps shall be piped to the front of the base and shall include valves for ease of maintenance. The drain valves shall be 90° stainless steel ball valves with Teflon™ elastomers. Each valve assembly is to include a fully retained and gasketed threaded cap to prevent accidental discharge of the blower lubricant.

8. The inlet filter shall be integral to the inlet silencer and shall include a washable and reusable polyester element for minimal pressure drop. The filter maintenance cover and element must be removable by hand (without the use of tools).

9. The inlet silencer shall be of the absorptive type, directly connected to the inlet port of the blower, and shall be mounted horizontally.

10. The discharge silencer shall be directly connected to the outlet port of the blower. The discharge silencer shall be mounted horizontally and shall be integral to the base frame. The discharge silencer shall incorporate a combination of absorption, deflection, and diffusion as noise control techniques.

11. The relief valve shall be spring-loaded and factory installed in the shell of the discharge silencer to protect the blower from excessive differential pressures. The relief valve exhaust shall be piped out of the enclosure.

12. A swing-type check valve is to be provided and factory installed on the package to prevent backflow through the blower. The check valve is cast aluminum with high temperature silicone elastomers. The valve must be designed so that, in the event of failure, the valve element is retained in the body.

13. An unloaded start valve may be provided (optional) and factory installed to allow the motor to accelerate prior to system pressurization and eliminate pneumatic shock.

14. An elastomeric compensator/flex connector shall be provided for connection of the packaged blower to the system piping to reduce transmission of structure borne noise as well as prevent unacceptable loading of the silencer connection. Shall be fabricated from an elastomer that is tolerant of high temperatures as recommended by Manufacturer.

15. A sound enclosure shall be provided as standard, shipped fully assembled and shall be the product of the blower Manufacturer to ensure proper integration. The sound enclosure shall be sheet steel construction with powder coat finish. It

shall have acoustic foam insulation and shall provide sound attenuation of up to 20 dB(A). The sound absorbing material must be self-extinguishing and meet the standard of UL 94, Section HFI. The enclosure shall have hinged panels and removable panels to allow maintenance access. Panels shall incorporate locking closures. An installed, integral ventilation fan, sized to provide adequate cooling of the package, shall be provided.

16. A pressure gauge shall be provided, pre-piped and panel mounted, on the sound enclosure.

17. A temperature gauge, with adjustable switching point and contact, shall be provided pre-piped and panel mounted on the sound enclosure.

18. A filter differential pressure gauge shall be provided pre-piped and panel mounted on the sound enclosure.

19. The blower package shall be designed to allow all preventive maintenance to be performed from the front of the package. All utility connections and process connections shall be at the rear of the package.

20. The blower package shall be capable of being installed directly adjacent to another blower package of similar design and shall be capable of mounting next to the wall without maintenance interference.

B. Motors

1. Blower motors shall be totally enclosed and fan cooled, 230/460 volt up to 40 hp, 460 volt 50 hp and above, 3 phase, 60-hertz, Efficiency 1, and EPAct Compliant.

2. Motors shall be compact IEC frame with a top conduit box.

3. 1.15 Service Factor.

4. Supplied, mounted and aligned by the blower Manufacturer.

5. Blower motor shall be compatible with variable frequency drive provided in the MCC.

C. Control Panels

1. Each blower shall be controlled by a simplex Blower Panel, 480 Volts, 3 Ph, 75 HP.

2. Enclosure shall be UL Type 4X 304 Stainless Steel, equipped with the following:

   a. Air Conditioner

   b. Lightning Arrestor

   c. Phase Monitor

   d. Main Circuit Breaker

   e. UL 508 Label

   f. Blower Circuit Breaker (Inside Enclosure)

g. Exhaust Fan Combination Starter

1) Circuit Breaker (Inside Enclosure)
2) NEMA Starter
3) Overloads

h. Control Power Transformer with Primary Fuses

i. Control Power Circuit Breaker

j. Anti Condensate Heater

k. Pilot Devices

1) H-O-A Switches
2) Reset Button
3) Speed Potentiometer

l. Pilot Lights

1) Blower Off
2) Blower Run
3) Blower Discharge Temperature Alarm
4) Blower Motor Temperature Alarm
5) Enclosure Fan Off
6) Enclosure Fan Run
7) Blower Enclosure Temperature Alarm

m. Provisions to Mount and Wire

1) Blower Motor Temperature RTD Relay

Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

2.4 CORROSION PROTECTION

A. Blower – Receives one (1) shop prime coat of chromate free primer followed by two (2) finish coats of a medium-long oil alkyd.

B. Motor – Coated with original manufacturer’s standard machinery enamel.

C. Sound Enclosure – Receives prime coats over galvanized sheet metal material, plus two (2) finish coats of polyurethane enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install blowers in accordance with the Drawings, approved shop drawings, and the Manufacturer's installation instructions. Blower skid shall be anchored to concrete foundation or slab as recommended by the Manufacturer.

B. Align, adjust, and lubricate in accordance with the Manufacturer's instructions and leave in proper working condition.

C. All final electrical connections shall be made by Contractor.

3.2 FIELD QUALITY CONTROL

A. Retain a qualified field serviceman of the Manufacturer for a minimum period of one (1) day with one (1) trip to perform the following services:

1. Equipment Installation:

   a. Inspect the completed installation and note deficiencies, if any.

   b. Assist Owner and Contractor during start-up and adjusting of completed installation.

2. Training:

   a. Instruct plant personnel in the operating and maintenance of the equipment provided under this item.

   b. All procedures shall be covered including preventative maintenance, method of controlling equipment, and troubleshooting.

END OF SECTION

SECTION 11230 – ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. The purpose of this Specification is to establish the minimum requirements for the purchase and installation of an odor control system to be used for the prevention of hydrogen sulfide gas diffusion throughout the wastewater plant system.

B. Labor, materials, equipment and incidentals required to install and test the skid mounted dual-technology bio-trickling odor control system with carbon polishing odor control system (System) complete with all appurtenances as specified herein.

1.2 SUBMITTALS

A. Odor Control Shop Drawings: The Contractor shall submit information as required to show complete compliance with these Specifications. At a minimum this information should include the following:

1. Manufacturer's catalog/data sheets and descriptive literature for each piece of equipment supplied.
2. Technical data on each major piece of equipment including weights of all items greater than 200 lbs.
3. Process and Instrumentation Diagram (P&ID) showing all main equipment components, flow rates and instrumentation.
4. Process control narrative.
5. Equipment offloading and installation instructions with sufficient detail to allow the Contractor to complete the mechanical and electrical installation of all System components.
6. Annual utility and nutrient usage calculations (if applicable).
7. Statement of Manufacturer's Warranty.
8. Information on hazards associated with the System and appropriate safety precautions, including applicable Material Safety Data Sheets (MSDS).

B. Odor Control O&M Manuals: The Contractor shall submit the following information, as a minimum:

1. As-built dimensional drawings showing plan and elevation views of the System and all applicable connections.
2. As-built Process and Instrumentation Diagrams (P&IDs)
3. Detailed bill of material along with specification of System components and materials of construction. The list to include the make, model number and descriptive literature of all items furnished by the Manufacturer.
4. Performance data for the odor control blower, to include curves showing capacity, pressure, horsepower demand and efficiency over the entire operating

range, including blower Manufacturer's descriptive literature and blower model number(s).

5. Special precautions for any components or materials associated with the System and its operation that should be subject to particular safety precautions, including MSDS.

6. Manufacturer's Service Department contact information and service order form.

7. Statement of Manufacturer's Warranty.

8. System startup and restart instructions.

9. Special maintenance procedures, including recommended weekly, monthly and annual preventative maintenance requirements.

10. Troubleshooting guide.

11. Individual Operation and Maintenance instructions for all major system components.

1.3 ACCEPTABLE MANUFACTURERS

A. BioAir Solutions, LLC;

B. Purafil Biological Air Treater (BAT);

C. Approved equal.

1.4 WARRANTY

A. Each system supplied shall have a warranty covering all components. The system shall be warranted complete, free from defects in materials and workmanship for a period of one (1) year after installation. The odor control system Manufacturer shall warrant the synthetic media against defects in material and workmanship for five (5) years after installation.

PART 2 - PRODUCTS

2.1 GENERAL

A. The odor control equipment supplied under this section must be provided by a single Manufacturer who will be solely responsible for the design, delivery and performance of the system. The equipment must be new and unused and meet the detailed specifications and warranty requirements stated herein functional requirements.

2.2 DESIGN REQUIREMENTS

At a minimum, the System shall treat the following and meet the following minimum performance criteria:

A. WWTP BNR & Headworks Basin

Number of vessels	One (1)
Flowrate	400 cfm
Biological Stage Empty Bed Residence Time (EBRT)	Min. 12 seconds

Maximum pressure drop across vessel	1.5” w.c.

Contaminant concentration:

a.	Average hydrogen sulfide concentration	100 ppmv
b.	Peak hydrogen sulfide concentration	200 ppmv
c.	Irrigation water flow	8 gpm
d.	Irrigation water pressure (dynamic)	35 psi

B. Interceptor Lift Station

Number of vessels	One (1)
Flowrate	400 cfm
Biological Stage Empty Bed Residence Time (EBRT)	Min. 12 seconds
Maximum pressure drop across vessel	1.5” w.c.

Contaminant concentration:

a.	Average hydrogen sulfide concentration	100 ppmv
b.	Peak hydrogen sulfide concentration	200 ppmv
c.	Irrigation water flow	8 gpm
d.	Irrigation water pressure (dynamic)	35 psi

C. System Performance requirements:

Average Hydrogen sulfide removal	≥ 99.5% or ≤ 0.10 ppmv in discharge, whichever is higher.
Average Odor removal	≥ 95.0% or ≤ 150 D/T* discharge, whichever is higher.

2.3 OPERATING CONDITIONS

The System shall be suitable to treat air coming from a continuous supply from the odor source. All equipment must be suited to the operating conditions to which it will be subjected and the various compounds/substances with which it will reasonably be expected to come into contact. The operating conditions, at a minimum, include the following:

Duty	Continuous (air supply and odor source)
Location	Outdoors
Inlet air temperature	55 – 100°F
Inlet air relative humidity	60 - 100%
Contaminant	Hydrogen sulfide, organic RSC’s, ammonia, methyl mercaptan and sulfuric acid.

2.4 SYSTEM COMPONENTS

A. System Vessel

1. The System vessel shall be skid mounted, low profile configuration. Each vessel shall consist of one (1) or more stage of media and one GAC polishing stage. The vessel shall be constructed from High Density Polyethylene (HDPE) with UV inhibitor and be designed with adequate strength to support the required media volume.

2. The System skid shall be provided with 304 stainless steel hold down lugs to account for all anticipated loads to comply with local wind code requirements.

B. Media

1. The synthetic structured media shall be high porosity, chemically resistant, engineered synthetic porous material. Organic, carbon derived media, and/or non-synthetic inorganic media or adsorbent materials shall not be allowed.

2. The media characteristics (available surface area, density, and pressure drop) shall be structured and uniform throughout the media bed. Random media types (chips, balls, cubes, etc.) shall not be allowed.

3. Media shall resist compaction or swelling due to varying moisture levels and shall not degrade when subjected to low pH (i.e. pH<2) conditions.

4. The uniform structure of the media shall minimize the potential for short circuiting and encourage a uniform water and airflow pattern over the entire media cross sectional area.

5. Sufficient media shall be provided to ensure the performance requirements listed are met.

6. The carbon polishing bed shall be GAC suitable for the final polishing of organic compounds and to meet the listed requirements.

7. All media shall be pre-installed in the HDPE module (s) prior to shipment to the job site.

C. Irrigation System

1. Each reactor shall be configured with at least one (1) irrigation point which shall distribute the irrigation water evenly over the entire upper surface of the synthetic media layer.

2. Each irrigation system shall be tested by the Manufacturer and a Certificate of Conformity supplied with the shop drawings to show that the nozzle has been tested and meets the Manufacturer's standards for uniform distribution.

3. The irrigation system shall be supplied with a nutrient addition system to provide the macro and micronutrients required by the bacteria for optimal metabolism of the odorous compounds being treated.

D. Control System

1. Reference Specification 113390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16

Specifications. The Manufacturer must comply with all the Specification requirements.

2. Electrical Control Panel (ECP)

The ECP enclosure shall be NEMA 4X and constructed of FRP, and the panel shall be mounted to the vessel skid.

The ECP shall house the necessary electronic components. The system shall be controlled on the basis of time for the irrigation cycle and irrigation time and shall be adjustable to sustain conditions appropriate to the activity of the bacteria. Dry contacts shall be provided for external notification of alarm status. Alarms, at a minimum, shall be provided for low irrigation water flow, high irrigation water flow, no nutrient flow (if applicable) and blower fail. There must be an allowance to manually open the irrigation spray valve (located in the WCP) for the purpose of routine maintenance checks but the valve should be normally closed. A variable frequency drive (VFD) shall be provided in the ECP for the control of the odor control blower.

The ECP shall require a single electrical connection of 120/208V/1 Phase/60Hz. Transformers shall be provided as necessary for power and control voltages.

A Local/Remote switch shall be installed on unit and provide switch position status to Main Control Panel. Refer to project Instrumentation Diagrams for equipment signals required.

3. Irrigation Water Control System

The Irrigation Water Control System (IWCS) shall include valves, motorized ball valves, strainers, instruments and piping for the control of the irrigation system and shall operate from control signals from the ECP.

The IWCS shall allow for a single connection to either a potable water source or suitable final effluent plant water source, as shown on the plans.

The IWCS shall include, if applicable, the nutrient addition system.

E. Odor Control Blower

1. The blower(s) shall be cast aluminum, direct drive pressure blower.

2. Housings - All housings shall be heavy duty cast aluminum construction. All units shall be built with an adjustable discharge housing.

3. Wheels - The wheel shall be of the radial bladed backplate or backward curved design, and shall be cast aluminum construction. Wheels shall be suitable for exhaust purposes where low volume and high pressure applications exist.

4. Motors - Fan motors shall be foot-mounted, standard industrial, inverter duty and continuous duty, ball bearing, variable torque type suitable for operation on voltage, phase and hertz, as listed in the fan schedule. Motor bearings shall have a minimum L-10 life, as defined by AFBMA, of at least 40,000 hours (200,000 hours average life).

5. Balancing - Prior to shipment all fans shall be completely assembled and test run as a unit at the operating speed. Final balance of the completed fan assembly shall be taken by electronic equipment. Records of the vibration readings in the axial, vertical, and horizontal planes shall be maintained and a written copy of this record shall be available upon request.

6. The System shall be less than 75 dBA.

F. Control Area

1. The Control Area shall be fully enclosed. The electrical controls, irrigation water controls, and blower shall be housed within the Control Area such that they shall not be visible during normal operation.

2. The Enclosure shall provide sound attenuation to the blower and the Manufacturer shall guarantee that the system noise shall meet the blower noise requirements listed above.

3. The Control Area shall be securable and lockable with an easily removal access panel the entire height of the control area or hinged access doors.

PART 3 - EXECUTION

3.1 FIELD TESTS

A. Before shipping the equipment, the Manufacturer shall perform shop tests. These tests shall include at a minimum:

1. Visual inspection of all equipment

2. Complete assembly, start-up, and test of blower and calibration for irrigation system.

B. After installation, the Contractor shall contact the Engineer and the Owner to perform system operation test at the site.

1. The performance of the system shall be demonstrated to reduce hydrogen sulfide to meet with the odor control levels set forth in these Specifications.

2. Manufacturer shall make any changes to the system, at his own expense, for compliance with these specifications.

END OF SECTION

SECTION 11243 – PERISTALTIC CHEMICAL METERING PUMP SKIDS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish and install skid-mounted chemical metering pump feed system as specified herein and as shown on plans. The chemical feed system shall include skid assembly containing peristaltic chemical metering pumps, all necessary piping, valves, fittings, supports, electrical controls and accessories as shown on the attached drawing and specified herein. The work of this section includes, but is not limited to, providing a skid mounted peristaltic chemical metering pumps with accessories for the application of various chemicals or slurries. All necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this section or not shall be furnished and installed as required for an installation incorporating the highest standards for this type of service.

B. Chemical Metering System shall be designed, coordinated and supplied by a competent system integrator. The system integrator shall be regularly engaged in the business of designing and assembling liquid chemical feed systems for water treatment and wastewater treatment plant projects. The system integrator shall be responsible for ensuring that a complete functioning system is supplied for the chemical feed system. The system integrator shall be responsible for coordinating and mounting all equipment, piping, valves and appurtenances for the Chemical Feed System.

C. The Contractor shall be responsible for the design, engineering, procurement, calibration, installation and commissioning of rotameters. The number of rotameters to be supplied and installed shall be per the process requirements indicated in the drawings.

1.2 SUBMITTALS

A. Chemical Metering Pump Shop Drawings:

1. Certificate of Compliance or complete list of all deviations from the Drawings and Specifications.
2. Certified dimension prints detailing all required locations of all major components.
3. Calculation sheets shall contain flow rates, feed rates, dilution capacity and other calculations to verify that the design meets the specification requirements.
4. Complete fabrication, assembly, and installation drawings, showing the Manufacturer's dimensions, weights, and loadings, and descriptive information in sufficient detail to show the kind, size, weight, arrangements, operation, component materials and devices, external connections, anchorages and supports required, performance characteristics, and dimensions.
5. Detailed specifications and data covering materials used, parts, instrumentation devices, and other accessories forming a part of the equipment furnished will be submitted for review.
6. Shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.

7. Manufacturer's installation instruction and certification.

8. Electrical data including control wiring. Electrical/pneumatic requirements, schematic diagrams, and details of components including enclosures.

9. Complete motor and drive data.

10. Manufacturer's recommended spare parts.

11. Installation, start-up, and test schedule with installation and test procedures shall be furnished prior to installation of the equipment.

B. Manufacturer's recommendation of suitable rotameters for all chemical discharge lines as shown on drawings that meet the following requirements:

1. Flow Rates as specified for metering pumps shown in Part 1.6.B.4.

2. Materials compatible with each chemical type shown in Part 1.6.B.4 (i.e. non-metallic, glass or plastic). The Contractor shall ensure that all wetted parts are compatible with the process conditions.

C. Certificate of Warranty: Submit per Section 1.9.

D. Chemical Metering Pumps Operation and Maintenance Manuals: Manufacturer to furnish complete and detailed installation, operation, and maintenance manuals to include the following information as a minimum requirement.

1. Assembly, installation, and adjustment instructions.

2. Lubrication and maintenance instructions.

3. Complete descriptive literature of all materials and components furnished.

4. Erection drawings with equipment mark numbers.

1.3 REFERENCE/STANDARDS

A. Design, manufacture, and assembly of elements of the equipment herein specified shall be in accordance with, but not limited to published standards of the following as applicable:

1. American Society of Mechanical Engineers (ASME).

2. American National Standards Institute (ANSI).

3. American Society for Testing Materials (ASTM)

4. National Electric Code (NEC).

5. National Electrical Manufacturer's Association (NEMA).

6. Occupational Safety and Health Administration (OSHA).

7. Underwriters' Laboratories, Inc. (UL).

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment specified herein is intended to be chemical metering system for a municipal water or wastewater application with a proven ability as

manufactured by parties having extensive experience (at least ten (10) installations of the same design, with a minimum of five years successful operation) in the production of such equipment. The chemical metering system shall be fabricated as an integral unit by a single Supplier. The equipment furnished shall be designed, constructed and installed to operate satisfactorily when installed as shown on the Drawings. Equipment furnished shall operate satisfactorily under all operating conditions.

B. Redesign: If submitted equipment requires arrangement differing from that which is indicated on the drawings or specified, prepare and submit for review complete structural, mechanical, and electrical drawings and equipment lists showing all necessary changes and embodying all special features of equipment proposed. Any changes are at no additional compensation and the Contractor will be responsible for all Engineering costs of redesign by the Engineer, if necessary.

1.5 ACCEPTABLE MANUFACTURERS

A. The naming of a Manufacturer in this Section is not an indication that the Manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the Manufacturer may have the capability of engineering and supplying a system that meets the requirements of this specification.

B. All metering pumps, regardless of proposed feed system, shall be from the same Manufacturer and shall be coordinated with individual package system suppliers to maintain uniformity of pumps, spare parts, etc. at the facility.

C. Acceptable Manufacturers

1. Watson-Marlow
2. PeriFlo
3. Blue-White Industries
4. Alternate equipment shall require Engineer's written pre-approval.

1.6 SYSTEM DESCRIPTION

A. General:

1. The Chemical Metering System shall be skid mounted and shall be an integrated equipment package which is designed to automatically meter and feed chemicals.
2. Factory Testing:
   a. Each Chemical Metering System shall be fully assembled and witness tested at the Manufacturer's own shop to ensure compliance with pressure and operational requirements. Any defects or problems shall be corrected prior to shipment. A certified report of compliance and any corrective actions shall be submitted to the Engineer.
   b. Functional Testing: Perform Manufacturer's recommended functional testing, including standard tests, as follows:
      1) Conduct performance testing on each pump and submit the total head, pressure, line amps, and speed of each pump unit.

2) Complete performance testing at design flow and design pressure as specified.

3) Submit all testing results and pump curves as specified.

B. Design Criteria: The chemical metering system shall be designed to meter and feed the chemicals as specified herein. The application shall be based on the following design requirements:

1. Variable Speed Drive with a minimum of 100:1 turndown

2. Maximum power: 1/2 hp, 120 volt, single phase, 60 Hz

3. Duty: Continuous

4. Capacities:

	Feed System		
Type of Chemical	Alum	Sodium Hypochlorite	Sodium Bisulfite
Number of Pumps	2	2	2
Maximum Feedrate (gph)	7	65	2
Minimum Feedrate (gph)	0.05	0.4	0.01
Discharge Pressure (PSI)	60	60	100
Model (Watson Marlow) (PeriFlo)	520 Uman CT13	620 Uman CT22	Qdos 30 CT10
Tube Size	6.4mm	12mm	N/A

1.7 DELIVERY, STORAGE, AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment unit installation is completed and the equipment is ready for operation.

B. Equipment shall be handled and stored in accordance with the Manufacturer's instructions. None of the components of the equipment shall be dropped and all the components shall be examined before installation. No items shall be installed which are found to be defective, and must be repaired to the satisfaction of the Engineer.

C. Factory assembled parts and components shall not be dismantled for shipment or storage unless recommended by the Manufacturer in writing to the Engineer.

D. The finished surfaces of all exposed flanges shall be protected by wooden or equivalent blank flanges, strongly built and securely bolted.

E. Finished iron or steel surfaces not factory painted shall be properly protected to prevent rust and corrosion.

F. No shipment shall be made until approved by the Engineer in writing.

1.8 SPARE PARTS

A. All spare parts requirements as specified in related sections shall apply to the work described in this section.

B. All tools and spare parts shall be properly packed and protected for long-term storage and placed in containers clearly identified in indelible marking as to content. Each part shall be sealed, wrapped, or otherwise protected from corrosion during storage. All tools shall be furnished in labeled steel toolboxes.

C. Provide one (1) spare metering pump of each type supplied.

D. Provide two replacement hose elements for each pump.

E. Provide spare parts as recommended by the pump Manufacturer for two years continuous operation.

F. Provide one (1) spare rotameter per chemical application.

1.9 WARRANTY

A. The Manufacturer shall provide an additional all-inclusive one-year warranty for all equipment with the exception of the metering pump. Metering pump shall have a five (5) year warranty. Warranty period starts from date of startup and Owner acceptance. The submittal shall provide a contract specific warranty document as specified. The warranty shall include normal wear and tear parts. All materials, equipment, and workmanship shall be free from defects in material or workmanship.

B. Manufacturer’s Certification: Provide a letter of certification addressed to the Owner and signed by an authorized representative of the Manufacturer. The letter shall state the following:

1. The equipment will efficiently and thoroughly perform the required functions in accordance with the Contract Documents, the materials are best suited for the chemicals handled, and that the Manufacturer accepts joint responsibility with the Contractor for coordination of equipment, including motors, variable speed drives, controls, and services required for proper installation and operation of the completely assembled and installed unit.

2. The equipment has been installed in accordance with the Manufacturer’s recommendations, and is in proper adjustment and operating condition, the Manufacturer is prepared to warrant the equipment to perform in full compliance with these specifications, and the equipment is ready to be turned over to the Owner for operation.

3. The Manufacturer has inspected the installation and verified training of the Owner’s operations and maintenance personnel upon completion of the system installation.

C. The Contractor shall also furnish the Manufacturer's warranties as published in its literature.

PART 2 - PRODUCTS

2.1 PERISTALTIC METERING PUMP

A. General: Pump components shall be constructed of corrosion resistant materials suitable for the chemical specified. Wetted parts of all metering pumps and appurtenances specified herein shall be confirmed by the Manufacturer to ensure optimum corrosion and erosion free operations for the chemicals involved. Manufacturer shall provide written certification that the equipment and materials have been selected for the chemicals being pumped.

B. Construction:

1. Pumphead

a. Pumphead shall consist of a fixed track, a hinged guard door, and spring-loaded roller rotor assembly. Pump tubing shall be in contact with the inside diameter of the track through an angle of 180 degrees. At all times, one roller shall be fully engaged with the tubing providing complete compression and preventing back flow or siphoning. Tube occlusion and spring tension shall be factory set to accommodate 2.4mm wall thickness tubing and shall not require adjustment

b. Pumphead guard shall be clear for viewing of rotation direction. When closed, the pumphead guard shall seal against the pump track for leak containment and controlled waste through the pumphead waste port in the event of a tube failure. For operator and environmental safety, pumps in which the direction of rotation cannot be visually verified and/or do not have a controlled waste port are not acceptable.

1) Pumphead Assembly

a) Pump Track Geometry must have a minimum 96.6mm swept diameter through a minimum track angle of 180 degrees.

b) Provide high corrosion impact materials as specified.

(1) Track Construction: Polyphenylene Sulfide (PPS)

(2) Guard Construction: Hinged impact-resistance polycarbonate breakaway guard, tool un-lockable for operator safety.

(3) Rotor Construction: Polyphenylene sulfide (PPS)

2) Rotor Assembly

a) Provide rotor assembly that ensures gradual tube occlusion and compensates for tube tolerance:

(1) Twin spring-loaded roller arms located 180 degrees apart, each fitted with stainless steel helical springs and compression roller for occlusion of the tube twice per rotor revolution.

(2) Provide non-compressing guide rollers constructed of corrosion resistant Nylatron.

b) Clutch: Equip rotor with a central handgrip and manually activated clutch to disengage the rotor from the drive for manual rotor rotation during tube loading. Clutch shall automatically reengage rotor to gearbox upon one complete revolution.

c) Mounting: To prevent slip, the rotor assembly shall be axially secured to dogged output shaft of the gearmotor via a slotted collet and central retaining screw.

d) Pumpheads requiring disassembly or special tools for tube changing are not acceptable.

C. Tubing: Thermoplastic tubing shall be designed specifically for use with peristaltic pumps and working pressures as specified. They shall be constructed from the highest quality compounded thermoplastic materials and have a minimum durometer rating of 60 Shore A. Wetted materials shall be Marprene. Tubing lubrication shall be food-grade silicon grease as required per Manufacturer.

D. Connections:

1. Cam-lock, flanged or MNPT port connection size to be determined by model.

E. Leak Detector: Provide one sensor per pump to detect leakage of pumped product in the housing. Sensor shall be interlocked with the controls to signal an alarm and automatically shutdown the pump in the event of a tube or hose failure.

F. Accessories: The following accessories shall be provided with each of the pumps. Material of construction shall be corrosion resistant and compatible with the liquids handled. The pressure rating shall be equal to or greater than the pump rating.

1. Provide ball valves of True Union to provide easy and variable operation.

2. Quick connect or Cam-lock.

3. Diaphragm style In-line Pressure Relief Valve. Pressure Relief Valve shall be of true Union design and field adjustable. Wetted parts shall be compatible with chemical specified.

4. A clear PVC calibration column with FNPT fittings top and bottom shall be provided for measuring pump output. Each column shall have height and diameter such that the measureable capacity of the column is approximately 30 seconds discharge of each pump at maximum pumping capacity or the maximum size column available. Permanently calibrate each column in gallons and tenths.

5. Discharge pressure indicator with isolator, diaphragm type bolted design with bonded diaphragm to housing similar to Ashcroft 200. Pressure indicator shall be a minimum 2 1/2” diameter with an accuracy of ± 0.5% of span and bourdon and socket material of 316 stainless steel, liquid filled with corrosion resistant case ring. Fill fluid shall be compatible with chemical. Pressure range: 0-15 psi.

G. Skid Assembly: The Manufacturer shall provide and be responsible for assembly and testing the complete skid system. Pump and accessories to be piped and wired on a common skid as shown on the Contract Drawings.

1. Skid to be constructed of minimum ½” thick corrosion resistant FRP with structural fiberglass reinforcement to minimize deflection and resin shall be

compatible with chemical specified. Skid shall be wall, table, or floor mounted with 3" minimum sidewall depth for chemical containment. Skid mounted assemblies are to include all accessories, pre-piped and gussetted vertical back panel to rigidly anchor and support controls, pump, and piping. The skid shall be able to withstand the weight of the mounted equipment including the chemical during operation and calibration. Pipe and equipment supports on the skid shall be constructed of corrosion resistant non-metallic material. Anchor bolts shall be 316 stainless steel.

2. Provide solvent welded Schedule 80 PVC piping and fittings.

3. Flexible hoses shall be suitable for the chemical specified and shall be provided for process connections to pumps to allow easy removal of pump tubes during maintenance.

4. Provide skid with process connections as shown on Contract Drawings. The pump, valves, and control panel shall be located on the skid such that they are easily accessible for operation and maintenance.

5. The Manufacturer shall provide brackets, anchors, etc. to support the skid. At Manufacturer's option, provide additional supports at no additional cost to Owner. The Contractor shall coordinate with Manufacturer on the type, size and location of the skid supports designed and furnished.

2.2 ROTAMETER ASSEMBLY

A. Manufacturer to provide diaphragm valves and rotameters on each chemical feed system as shown on the drawing.

B. General – Rotameter shall have self-guided floats, with top and bottom float stops. The pressure drop across the rotameters shall be minimum.

C. Materials - Rotameter material must be compatible with each chemical type shown in Part 1.6.B.4 (i.e. non-metallic, glass or plastic). The Contractor shall ensure that all wetted parts are compatible with the process conditions.

D. Capacities – Rotameters must be capable of measuring full range of flows as specified for metering pumps shown in Part 1.6.B.4.

E. Scales – Scales for rotameters shall be direct reading, marked for 10-100% of flow. The flow rate shall be indicated by the vertical position of the float.

F. Accuracy – Rotameters must provide full scale accuracy of at least ±5%.

G. Installation – Rotameters must be installed in an exact vertical plane to ensure accuracy, with the outlet connection at the top and the inlet connection at the bottom. Only PTFE tape to be used on threaded adapters. Mounts and supports must be carefully aligned with meter body to support plumbing and prevent vibration. Solenoid valves, or other quick opening valves must not be used to prevent sudden bursts of flow.

H. Testing – Rotameters shall be checked and tested after installation to confirm that shipping stops have been removed.

2.3 ELECTRICAL/INSTRUMENTATION JUNCTION PANEL

A. Reference Specification 113390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

B. Junction Panel shall be housed in a NEMA 4X FRP enclosure. All controls necessary for the full automatic operation shall be provided as a component of the metering pump equipment. A minimum of the following shall be provided for each pump.

1. Circuit breaker, sized approximately for each pump.
2. Contacts for transmittal of signals to plant SCADA system for the following:
   a. Analog In - 4-20mA speed. (Flow Control)
   b. Analog In – 4-20mA scale. (Residual Control)
   c. Analog Out - 4-20 mA speed.
   d. Digital In - Run/Stop.
   e. Digital Out - Run/Stop Status.
   f. Digital Out - Leak.
   g. Digital Out – Remote/Manual Status.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment and accessories shall be installed in accordance with the Manufacturer's written recommendations, as approved by the Engineer, and as shown on the Drawings. Mount systems as indicated.

B. The Contractor shall be responsible for installing equipment that the Manufacturer could not ship assembled as an integral part of the system due to shipping restrictions. These items shall be identified on the Manufacturer's approval drawings.

C. Do not begin fabrication or erection prior to submittal approval.

D. The peristaltic chemical metering pump factory certified service Engineer shall inspect the complete installation and provide written certification stating that the installation of the equipment is satisfactory. The certification must also indicate the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and core of the system.

3.2 FIELD INSPECTION AND PERFORMANCE TESTING

A. Functional Test: Prior to start-up, all equipment shall be inspected by the Manufacturer for proper alignment, quiet operation, proper connection and satisfactory performance.

B. Upon written certification from the metering pumps certified service Engineer that the equipment is approved for start-up, the system shall be placed into service in the presence of the Engineer.

C. If the system performance does not meet the Specifications, corrective measure shall be taken to satisfy the conditions specified.

D. Once the system is in operation and performing as specified, a 48-hour operating period will be required, with no interruptions of the equipment, before Owner acceptance and warranty initiation.

E. Any component parts which are damaged as a result of this testing or which fail to meet the requirements of these specifications shall be replaced, reinstalled and re- tested at the Contractor's expense.

END OF SECTION

SECTION 11310 – TRIPLEX RAS PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work under this section includes, but is not limited to, furnishing and installing a factory built triplex pump station as indicated on the project Drawings, herein specified, as necessary for proper and complete performance.

B. Contractor shall furnish and install one factory built base mounted, automatic pump station. The station shall be complete with all equipment specified herein, factory assembled on a common steel base.

C. Principal items of equipment shall include three horizontal, self-priming or screw-centrifugal sewage pumps, V-belt drives, motors, piping, valves, motor control panel, automatic control system, and integral wiring.

D. Factory built pump station design, including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed under PART 2 - PRODUCTS of this section.

E. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

1.2 SUBMITTALS

A. Shop Drawings

Shop drawings shall provide layout of mechanical equipment and anchor bolt locations for station. Contractor piping connections and station access clearances shall be dimensioned relative to the station centerline.

B. Electrical ladder logic drawings

The electrical ladder logic drawings shall illustrate motor branch and control circuits to extent necessary to validate function and integration of circuits to form a complete working system.

C. Support data

Support data shall include catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP). Electrical components used in the motor branch and controls shall be fully described.

D. Operation and Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump station manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pump station supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the station Manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

   a. Functional description of each major component, complete with operating instructions.

   b. Instructions for operating pumps and pump controls in all modes of operation.

   c. Calibration and adjustment of equipment for initial start-up, replacement of control components, or as required for routine maintenance.

   d. Support data for commercially available components not produced by the station Manufacturer, but supplied in accordance with the Specifications, shall be supported by literature from the prime Manufacturer and incorporated as appendices.

   e. Electrical schematic diagram of the pump station circuits shall be in accordance with NMTBA and JIC standards. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the station operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.

   f. Mechanical layout drawing of the pump station and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.

3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these Specifications.

1.3 REFERENCES/STANDARDS

Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted

A. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA)

1. ANSI B16.1 Cast iron pipe flanges and flanged fittings.
2. ANSI/AWWA C115/A21.51 Cast/ductile iron pipe with threaded flanges.
3. ANSI 253.1 Safety Color Code for Marking Physical Hazards.
4. ANSI B40.1 Gages, Pressure and Vacuum.
5. AWWA C508 Single Swing Check Valves.

B. American Society for Testing and Materials (ASTM)

1. ASTM A48 Gray Iron Castings.
2. ASTM A126 Valves, Flanges, and Pipe Fittings.
3. ASTM A307 Carbon Steel Bolts and Studs.
4. ASTM A36 Structural Steel.

C. Institute of Electrical and Electronics Engineers (IEEE)

1. ANSI/IEEE Std 100 Standard Dictionary of Electrical Terms.
2. ANSI/IEEE Std 112 Test Procedure for Polyphase Induction Motors.
3. IEEE Std 242 Protection of Industrial and Control Power Systems.

D. National Electric Code (NEC) / National Electrical Manufacturers Assoc. (NEMA)

1. NEC National Electric Code.
2. NEC 701 National Electric Code article 701.
3. NEMA Std MG1 Motors and Generators.

E. Miscellaneous References

1. Ten-State Standards Recommended Standards for Sewage Works.
2. Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.
3. NMTBA and JIC Std National Machine Tool Builders Association and Joint Industrial Council Standards
4. ISO 9001International Organization for Standardization.

1.4 QUALITY ASSURANCE

A. The pumps and pump station manufacturer must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

B. Upon request from the Engineer, the pump station Manufacturer shall prove financial stability and ability to produce the station within the specified delivery schedules. Evidence of facilities, equipment and expertise shall demonstrate the Manufacturer's commitment to long term customer service and product support.

C. All internal passages, impeller vanes, and recirculation ports shall pass a 3-inch spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with

priming and pump performance shall not be permitted. Upon request from the Engineer, Manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

D. Certified Pump Performance Test

1. Tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4 Acceptance Grade 2B at the specified head, capacity, rated speed and horsepower. The performance tests will validate the correct performance of the equipment at the design head, capacity and speed.

2. For pumps utilizing up to (13 HP) motors; but larger than (1.3 HP), tests shall be conducted in accordance with Hydraulic Institute Standards 14.6.3.4.1, as the specified head, capacity, rated speed and horsepower.

E. Factory System Test

1. All components including the pumps, motors, valves, piping and controls will be tested as a complete working system at the manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational test shall duplicate actual performance anticipated for the complete station.

2. Upon request from the engineer, the operational test may be witnessed by the engineer, and/or representatives of his choice, at the Manufacturer's facility.

F. The Manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.5 ACCEPTABLE MANUFACTURERS

A. Gorman-Rupp Ultra-V series model V3B-B-1

B. WEMCO Hidrostal Model D4K-LT

C. Approved Equal

1.6 DELIVERY, STORAGE AND HANDLING

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Station Manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the Manufacturer's representative of any unacceptable conditions noted with shipper.

1.7 WARRANTY

A. The pump station Manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship for 5 years at 100%. A standard written warranty shall include specific details described below.

1. All equipment, apparatus, and parts furnished shall be warranted for sixty (60) months, excepting only those items that are normally consumed in service, such as oils, grease, packing, gaskets, O rings, etc. The pump station Manufacturer shall be solely responsible for warranty of the station and all components.

B. Components failing to perform as specified by the engineer, or as represented by the Manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the Manufacturer.

C. A start-up report competed by an authorized Manufacturer's representative must be received by Manufacturer within thirty (30) days of the initial date the unit is placed into service. The warranty shall become effective on the date of acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation.

1.8 PERFORMANCE CRITERIA

A. Pumps must be designed to handle return activated sludge. Pumps shall have 4-inch suction connection, and 3-inch discharge connection. Each pump shall be selected to perform under following operating conditions:

1. LOW RAS FLOW

a.	Capacity (GPM) each pump	175
b.	Total Dynamic Head (FT)	4
c.	Minimum TDH (FT)	3
d.	Maximum TDH (FT)	18
e.	Minimum Efficiency (%)	40
f.	Minimum Motor Hp	7.5
g.	Maximum pump speed (RPM)	420
h.	Maximum NPSHr (FT)	3.9
i.	Minimum Solids sphere (Inches)	3

2. HIGH RAS FLOW – ONE PUMP

a.	Capacity (GPM) each pump	550
b.	Total Dynamic Head (FT)	13
c.	Minimum TDH (FT)	3
d.	Maximum TDH (FT)	20
e.	Minimum Efficiency (%)	50
f.	Minimum Motor Hp	7.5
g.	Maximum pump speed (RPM)	900

h.	Maximum NPSHr (FT)	5.6
i.	Minimum Solids sphere (Inches)	3

3. HIGH RAS FLOW – TWO PUMPS

a.	Capacity (GPM) each pump	350
b.	Total Dynamic Head (FT)	18
c.	Minimum TDH (FT)	12
d.	Maximum TDH (FT)	32
e.	Minimum Efficiency (%)	53
f.	Minimum Motor Hp	7.5
g.	Maximum pump speed (RPM)	950
h.	Maximum NPSHr (FT)	5.7
i.	Minimum Solids sphere (Inches)	3

B. Site power furnished to pump station shall be 3 phase, 60 hertz, 460 volts, maintained within industry standards. Voltage tolerance shall be plus or minus 10 percent. Phase-to-phase unbalance shall not exceed 1% average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.

PART 2 - PRODUCTS

2.1 PUMP

A. Pump shall be horizontal, self-priming or screw centrifugal type, designed specifically for handling return activated sludge or industrial waste. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 - GENERAL of this section.

B. The pump Manufacturer should be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.

C. Materials and Construction Features

1. Pump casing shall be cast iron Class 30 or Ductile Iron, ASTM A536, CL 65-45-12 with integral volute scroll. Casing shall incorporate following features:

   a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.

   b. Fill port coverplate, 3 ½” or 3 ¾”diameter, shall be opened after loosening a positive lock clamp bar assembly. In consideration for safety, capscrew threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A non-metallic gasket shall prevent adhesion of the fill port cover to the casing while assuring a reliable seal.

   c. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.

d. Liquid volume and recirculation port design shall be consistent with performance criteria specified.

2. Coverplate shall be cast iron Class 30 or Ductile Iron, ASTM A536, CL 65-45-12. Design must incorporate the following maintenance features:

   a. Retained by hand nuts for complete access to pump interior. Coverplate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.

   b. A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS or Carbon Steel, ASTM A36. Wearplate shall be self-cleaning design ensuring that debris is cleared away and does not collect on the impeller vanes.

   c. In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200 PSI.

   d. Two O-rings of Buna-N material shall seal coverplate to pump casing.

   e. Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.

   f. Easy-grip handle shall be mounted to face of coverplate.

3. Rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate the following features:

   a. Seal plate and bearing housing shall be cast iron Class 30 or Ductile Iron, ASTM A536, CL 65-45-12. Anti-rotation ribs shall be cast into the sealplate to reduce internal wear and maximize component life. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.

      1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.
      2) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.
      3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

   b. Impeller shall be ductile iron or 1020 Cast Steel, ASTM A732, Grade 1A, two vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall be statically or dynamically balanced. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.

c. Shaft shall be AISI 17-4 pH stainless steel.

d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be silicon carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design. An external O-ring secures the stationary seat to the sealplate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be Viton; cage and spring to be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements specified.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

a. Clearances shall be maintained by a four point external shimless coverplate adjustment system, utilizing a four collar and four adjusting screw design allowing for incremental adjustment of clearances by hand as required. Each of the four points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration or accidental operator contact. The four point system also allows for equal clearance gaps at all points between the impeller and wear plate. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings. Clearance adjustment systems that utilize less than four points will not be considered.

b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.

c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. An externally removable suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished from the top of pump without disturbing the suction piping or completely draining the casing. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping

cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.

6. Pump shall include flange kit consisting of two ASA spool flanges that shall be one piece Cast Iron Class 30 or Ductile Iron, ASTM A536, CL 65-45-12 suitable for attachment to suction and discharge ports. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting gauges or other equipment.

D. Serviceability

1. The pump Manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.

2. No special tools shall be required for replacement of any components within the pump.

E. Drain Kit

1. Pumps to be supplied with a drain kit for ease of maintenance. The kit to contain 10' length of reinforced plastic hose with a female quick connect fitting at one end, and factory installed drain fittings in each pump. Fittings include a stainless steel pipe nipple, stainless steel bushing, stainless steel gate valve and aluminum male quick connect fitting.

F. Spare Parts Kit

1. The following minimum spare parts shall be furnished with the pump station:

a. One spare pump mechanical seal (complete with shaft sleeve).

b. One cover plate O-Ring.

c. One rotating assembly O-Ring.

d. One set of impeller clearance adjustment shims.

e. One set of drive belts.

G. Volute Casing Heaters

1. Pump shall be provided with a thermostat mounted to the exterior of the volute casing, and a 250 or 500 watt 115 volt electric heater inserted into the interior of the volute by means of a dedicated port. The heater shall be energized at 43+/-3 degrees F to provide heat to the casing and eliminate the possibility of freezing. Heater probes that must be installed through a pump drain port shall not be acceptable. Heater probes that must be installed through a pump drain port shall not be acceptable.

2.2 PUMP BASE

A. The unit base shall comprise a base plate, perimeter flange, and reinforcements. Base plate shall be fabricated of steel not less than 1/4" thick. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Base plate and/or flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

2.3 VALVES AND PIPING

A. Each pump shall be equipped with a full flow type check valve capable of passing a 3" spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O rings which shall be shall be easily replaceable without requiring access to interior of valve body. All internal hardware shall be stainless steel. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

B. A 3 way plug valve must allow either or all pumps to be isolated from the discharge line. Valve shall pass 3" spherical solids. The plug valve shall be non-lubricated, tapered type. Valve body shall be semi steel with flanged end connections drilled to 125 pound standard. The drip tight shutoff plug shall be mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall have a locking device to hold the plug in the desired position.

C. Automatic Air Release Valves

1. Each pump shall be equipped with an automatic air release valve designed to vent air to atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming or repriming cycle, the valve shall automatically close operating solely on discharge pressure to prevent excess recirculation. A visible indication of valve closure shall be evident. Valves which connect to the suction line or rely on vacuum pumps shall not acceptable.

2. The air release valve shall be constructed of UV-inhibiting, high impact composite polyester containing not less than 30% glass-filler. The valve body shall incorporate an internal passageway that allows all debris to pass through the valve chamber between operational cycles, thus making the valve self-cleaning upon sequential cycles. The valve diaphragms shall be Buna-N, Fluorocarbon or EPDM, and shall incorporate a polyester mesh sufficient to withstand 250 PSI of pressure. Diaphragm materials of lesser-rated durability will not be deemed equal.

3. The vertical valve plunger shall be constructed of Acetal and at least 20% PTFE fluorocarbon filler (DuPont Teflon or equivalent). The independent, dual diaphragms and single, vertical valve plunger shall incorporate a media fluid that passes through an orifice and separates the actions of each. This media fluid will impart sufficient energy for each diaphragm to act on the other to cause a metered stroke, allowing for predictable mechanical movement, thus opening and closing the valve smoothly, preventing chatter and harsh ramming forces. Valves with a single horizontal shaft or that do not incorporate straight-through passageways or media-limiting orifices will not be acceptable. The valve “seat” shall permit a prescribed bypass of the liquid being pumped to ensure that the

valve does not become hydraulically locked in submerged discharge piping configurations.

4. The valve shall employ an externally-adjustable restrictor for applications below four feet of static discharge head. Valves having no means to accurately adjust their action, or which require spring selection and lubrication are unacceptable. Being mechanically maintenance-free, provisions for clearing debris in the internal passageway normally associated with valves of this type are incorporated in the valve design and are accessible with only normal hand tools.

5. The valve body shall incorporate passageways having minimal constrictions and no directional course changes integral to the body of the valve. The inlet shall be 1 inch NPT female and the discharge outlet shall be 1-1/4 inch NPT female, assuring that any debris that makes its way through the valve body will have unobstructed passage back to the source. Valves having smaller throughput, bends or turns that restrict or impede flow and create pockets or traps for debris shall not be acceptable. The valve shall be mounted horizontally, 90 degrees to the vertical plunger by means of an integral mounting bracket.

6. The valve shall be able to operate on applications ranging from four to 400 feet of water column without the need for adjustment or interchange of springs or other parts.

7. Connection of the air release valves to pump station piping shall include stainless steel fittings.

D. Gauge Kit

1. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.

2. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve and diaphragm seal for each gauge line at the point of connection to suction and discharge pipes.

E. Piping

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.

2. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.

3. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

4. Bolt holes shall be in angular alignment within 1/2 degrees between flanges. Flanges shall be faced with a gasket finish having concentric grooves a minimum of 0.01 inch deep by approximately 0.03 inch wide, with a minimum of three grooves on any given surface spaced a maximum of 1/4 inch apart.

F. Supports and Thrust Blocks

1. Contractor must insure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.

2.4 DRIVE UNIT

A. Pump motors shall be 7.5 HP, horizontal TEFC, 1800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified.

B. Drive Transmission

1. Power to pumps transmitted V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.
2. Each drive assembly shall utilize at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive Manufacturer.
3. Precise alignment tolerances of the drive assemblies shall be achieved by means of a belt/sheave laser alignment system resulting in the reduction of vibration, accelerated wear, and premature failure.
4. The pump Manufacturer shall submit power transmission calculations which document the following:
   a. Ratio of pump/motor speed.
   b. Pitch diameter of driver and driven sheaves.
   c. Number of belts required per drive.
   d. Theoretical horsepower transmitted per belt, based on vendor's data.
   e. Center distance between pump and motor shafts.
   f. Arc-length correction factor applied to theoretical horsepower transmitted.
   g. Service factor applied to established design horsepower.
   h. Safety factor ratio of power transmitted/brake horsepower required.

C. Belt guards

1. Pump drives to be enclosed on all sides by a guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed 1/2 inch.
2. Guards must be completely removable without interference from any unit component, and shall be securely fastened and braced to the unit base.

3. Metal to be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed five inches. Tack welds shall not exceed four inch spacing.

4. The guard shall be finished with one coat of gray W.R. non lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.5 FINISH

A. Pumps, piping, and exposed steel framework shall be cleaned prior to painting. Exposed surfaces to be coated with one coat gray W.R. non lift primer and one coat white acrylic alkyd W.R. enamel. Paint shall be low VOC, alkyd based, high solids, semi-gloss white enamel for optimum illumination enhancement, incorporating rust inhibitive additives. The finish coat shall be 1.0 to 1.2 MIL dry film thickness (minimum), resistant to oil mist exposure, solvent contact, and salt spray. The factory finish shall allow for over-coating and touch up after final installation.

2.6 ELECTRICAL CONTROL COMPONENTS

A. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

B. The pump station control panel shall be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer's facility.

C. Panel Enclosure

1. Electrical control equipment shall be mounted within a NEMA 4X stainless steel, dead front type, control enclosure. Door shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on a removable steel back panel secured to enclosure with collar studs.

2. All control devices and instruments shall be secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount and component. All control devices shall be clearly labeled to indicate function.

D. UL Label Requirement

1. Pump station controls shall conform to third party safety certification. The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The enclosure, and all components mounted on the sub panel or control cover shall conform to UL descriptions and procedures.

E. Branch Components

1. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409.

The lowest rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 10 kA, rms symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating.

2. Circuit Breakers and Operating Mechanisms

   a. A properly sized heavy duty circuit breaker shall be furnished for each pump motor. The circuit breakers must be sealed by the manufacturer after calibration to prevent tampering.

   b. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

3. Bypass Motor Starter

   a. An open frame, across the line, NEMA rated magnetic starter with under voltage release, and overload protection on all three phases, shall be furnished for each pump motor. Starters of NEMA size 1 and above shall allow addition of at least two auxiliary contacts. Starters rated "0", "00", or fractional sizesare not acceptable. Power contacts to be double break type made of cadmium oxide silver. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils shall be easily replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability.

   b. Overload relays shall be solid state block type, having visual trip indication with trip-free operation. Electrically resetting the overload will cause one (1) normally open and one (1) normally closed isolated alarm/control contact to reset, thus reestablishing a control circuit. Trip setting shall be governed by solid state circuitry and adjustable current setting. Trip classes shall be 10, 15 and 20. Additional features to include phase loss protection, selectable jam/stall protection and selectable ground fault protection.

   c. An overload reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the control panel door.

   d. 3ea 7.5-hp, 480 volt, 3-phase VFD’s shall be supplied and integrated into the pump control panel for primary pumps speed control (operator selected). The VFD’s will maintain operator selected speed settings. Manual speed pod adjustment knobs will be mounted in the control panel inner door. The Manufacturer shall include an air conditioning unit as required to condition the air used by the VFD.

F. Phase Monitor

1. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage

caused by phase reversal, phase loss, low voltage, and voltage unbalance. An integral time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart when power conditions return to normal.

G. Transient Voltage Surge Suppressor

1. The control panel shall be equipped with a transient voltage surge suppressor to minimize damage to the pump motors and control from transient voltage surges. The suppressor shall utilize thermally protected silicon oxide varistors encapsulated in a non-conductive housing. Mechanical indicators shall be provided on each phase to indicate protection has been lost. The suppressor shall have a surge current rating of 100,000 Amps per phase and a 100kA interrupting rating.

H. Control Circuit

1. A normal duty thermal magnetic circuit breaker shall protect all control circuits by interrupting control power.

2. Pump mode selector switches shall permit manual start or stop of each pump individually, or permit automatic operation based on a 4-20 mA signal from the Plant PLC system to vary the pump flow rate based on the measured plant flow rate. Manually selected high/low set points shall be able to be set by user input. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be oil tight design with contacts rated NEMA A300 minimum.

3. Control logic shall be accomplished using a programmable logic controller (PLC), type Modicon M340 or Modicon Quantum.

4. Electromechanical relays and timers shall be equipped with 120VAC coils and rated Nema A-300 minimum. Timers shall be per specification 13390 – Package Controls Systems.

5. Programmable controls shall operate on 120VAC power and be equipped with 120VAC inputs and hard contact outputs. Outputs shall have an inductive load rating equivalent to a size 4 contactor. Inputs shall incorporate a filter time delay and the overall controller noise immunity shall meet Nema standard ICS 2-230. The power supply to the programmable control shall include an active tracking filter protection system to minimize the effects of electrical noise.

6. Operator interface equipment shall be provided to permit field adjustment of the programmable control timers and counters and shall be mounted on the control panel with other operator controls and displays. See Specification 13390 – Packaged Control Systems for all operator interface terminal requirements.

7. The program logic shall be stored in battery backed random access memory, as well as on a programmable, read only memory module. The memory module shall be included to facilitate field repair or replacement of the programmable control hardware.

8. The O&M manual shall be provided with complete ladder logic program documentation including English names, rung comments, and coil/contact cross-references.

9. The control shall be pre-programmed or wired to provide the following routines:

   a. Pump alternation

b. Excessive pump run time alternation (1-9999 minutes)

c. Jump to idle pump/drive on lead failure

d. Pump start delays after power restoration

e. Flashing alarm/steady acknowledge on all alarm pilot lights

f. Station trouble alarm (115vac and normally open dry contact)

g. Pump high temperature shutdown

h. Motor high temperature

10. The control system shall be equipped with the following dry contacts wired to the terminal blocks:

    a. Pump run - (1) N.O. each pump

    b. Drive fault - (1) N.O. each pump

    c. High pump temperature shutdown - (1) N.O. each pump

    d. High motor temperature - (1) N.O. each pump

    e. Three phase voltage monitor - (1) N.C.

    f. Low water alarm - (1) N.O.

11. Six digit elapsed time meter (non-reset type) shall be connected to each motor starter to indicate total running time of each pump in "hours" and "tenths of hours". An integral pilot light shall be wired in parallel to indicate that the motor is energized and should be running.

12. A high pump temperature protection circuit shall override the automatic control and shut down the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing and connected to a high pump temperature shutdown circuit. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the pump shutdown circuit to interrupt power to the motor. A visible indicator located on the control panel door shall indicate motor stopped due to high pump temperature. The motor shall remain locked out until the pump has cooled and circuit has been manually reset. Automatic reset of this circuit is not acceptable.

13. A duplex ground fault receptacle providing 115 VAC, 60 Hz, single phase current, will be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal magnetic circuit breaker.

14. Auxiliary Power Transformer

    a. The pump system shall be equipped with a 5 KVA step-down transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a pad lockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

15. Wiring

a. The pump station, as furnished by the Manufacturer, shall be completely wired, except for power feed lines to the branch circuit breakers and final connections to remote alarm devices. Any wiring not included by the manufacturer shall be provided by the Contractor at no additional cost to the Owner.

b. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electric Code (NEC).

c. All wiring labels shall comply with requirements as specified in Specification 16200 – General Wiring Methods, and Specification 13390 – Package Controls Systems.

d. Control circuit wiring inside the panel shall comply with requirements as specified in Specification 16200 – General Wiring Methods, and Specification 13390 – Package Controls Systems.

e. Motor branch and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires must be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel. All wiring outside the panel shall be routed through conduit.

f. Control wires connected to door mounted components must be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.

16. Conduit

a. Factory installed conduit shall conform to following requirements:

1) All conduit and fittings to be UL listed.
2) Liquid tight flexible conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
3) Conduit to be supported in accordance with articles 346, 347, and 350 of the National Electric Code.
4) Conduit shall be sized according to the National Electric Code.

17. Grounding

a. Station Manufacturer shall ground all electrical equipment inside the pump station to the control panel back plate. All paint must be removed from the grounding mounting surface before making final connection.

b. The Contractor shall provide an earth driven ground connection to the pump station at the main grounding lug in accordance with the National Electric Code (NEC).

18. Equipment Marking

a. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:

1) Equipment serial number
2) Control panel short circuit rating
3) Supply voltage, phase and frequency
4) Current rating of the minimum main conductor
5) Electrical wiring diagram number
6) Motor horsepower and full load current
7) Motor overload heater element
8) Motor circuit breaker trip current rating
9) Name and location of equipment Manufacturer

b. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.

c. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

2.7 ALARM LIGHT (EXTERNAL)

A. Station Manufacturer will supply one 115 volt AC alarm light fixture with vapor-tight red globe, guard, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe. The alarm light will be shipped loose for installation by the Contractor.

2.8 ALARM HORN (EXTERNAL)

A. Station Manufacturer will supply one 115 volt AC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rain water from collecting in any part of the horn. The alarm horn will be shipped loose for installation by the Contractor.

2.9 UNITARY RESPONSIBILITY

A. In order to unify responsibility for proper operation of the complete pumping station, it is the intent of these Specifications that all system components be furnished by a single supplier (unitary source). The pumping station must be of standard catalog design, totally warranted by the Manufacturer. Under no circumstances will a system consisting of parts compiled and assembled by a Manufacturer's representative or distributor be accepted.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the Manufacturer at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (air release valve or pump drain lines) as required.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.2 FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by owner, an operational test of all pumps, drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed from the clarifiers, Contractor shall supply clear water volume adequate to operate station through several pumping cycles. Observe and record operation of pumps, suction and discharge gage readings, ampere draw, and pump controls. Check calibration of all instrumentation equipment, test manual control devices, and automatic control systems. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturer’s Start-up Services

1. Co-ordinate station start-up with Manufacturer’s technical representative. The representative or factory service technician will inspect the completed installation. He will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

3.3 CLEANING

A. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

3.4 PROTECTION

A. The pump station should be placed into service immediately. If operation is delayed, drain water from pumps and piping. Open motor circuit breakers and protect station controls and interior equipment from cold and moisture.

END OF SECTION

SECTION 11320 – GRIT REMOVAL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work described in this section includes furnishing all labor, equipment, materials, tools and incidentals required for a complete and operable installation of the grit removal system as shown on the Drawings and specified herein. The Manufacturer shall supply the equipment and the general Contractor shall install the equipment.

B. The grit removal system shall process grit slurry from the grit settling channel which has been pumped to the grit removal system via a grit pump station. The grit removal system shall be composed of two (2) units: a collection/washing/classification unit and a dewatering/escalator unit.

C. The grit removal system shall be provided complete with the drive assembly, local wiring, valves, controls, anchor bolts and other appurtenances as specified and as required for a complete operating installation. Interconnecting wiring to be provided by Contractor.

D. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

1.2 SUBMITTALS

A. Grit Removal System Shop Drawings: Shop drawings shall include the following at a minimum:

1. Manufacturer's catalog data and descriptive literature including equipment weights and performance data.
2. General arrangement and dimensional drawings of the grit removal system.
3. Written recommended procedures for job site storage, handling, and installation of the equipment.

B. Grit Removal System Certificate of Warranty: Submit per Section 1.7.

C. Grit Removal System Certificate of Compliance: Submit per Section 1.3.

D. Grit Removal System Manufacturer ISO Certification: Submit per Section 1.3.

E. Grit Removal System Manufacturer Experience: Submit per Section 1.3.

F. Grit Removal System Unit Responsibility Certification: Submit per Section 1.3.

G. Grit Removal System O & M Manual: The operation and maintenance manual shall include the following at a minimum

1. Alignment, adjustment, and repair instructions.

2. Manufacturer's installation instructions.

3. Assembly diagrams.

4. Troubleshooting guide.

5. Lubrication instructions.

H. Recommended spare parts lists and predicted life of parts subjected to wear.

1.3 QUALITY ASSURANCE

A. The materials covered by these Specifications are intended to be standard equipment of proven reliability and as manufactured by a reputable Manufacturer having experience in the production of grit equipment. The equipment furnished shall be designed and constructed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Contract Drawings and operated per the Manufacturer's recommendations.

B. Certificate of Compliance. The Manufacturer shall certify that the grit removal system to be supplied shall be manufactured in strict compliance with these specifications.

C. Manufacturer ISO Certification. The system shall be furnished by a Manufacturer who is ISO 9001:2008 Certified.

D. Manufacturer Experience. Manufacturer shall be successful in the experience of manufacture, operation, and servicing of grit removal systems of type, size, quality, performance, and reliability equal to that specified for a period of not less than ten (10) years. The Manufacturer shall submit evidence of experience having supplied a minimum of ten (10) installations in the United States of similar size to the proposed system. Equipment Manufacturers that fail to supply a certified list of ten (10) installations shall not be acceptable. For each installation, the following information shall be provided:

1. Name and location of the installation.

2. Number, size and type of equipment installed.

3. Month and year placed in operation.

4. Contact name, address and phone number of installation.

E. Unit Responsibility Certification. The complete grit removal system specified shall be furnished by and be the product of one Manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.

F. Extended Warranty. In the absence of verifiable experience, the Manufacturer shall be required to provide an extended warranty and subsequent Performance Bond for the same number of years that the Manufacturer was found lacking in experience from the specified ten (10) year period. The performance bond shall commence with acceptance of the equipment and time described herein and beyond the standard warranty period.

G. Additional Information. If equipment other than that shown on the Contract Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit all information necessary to prove that the proposed equipment meets the requirements of this specification as determined by the Engineer.

H. Redesign Drawings. If equipment other than that shown on the Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit with the request a revised design and layout of the mechanical equipment acceptable to the Engineer. Revised drawings shall show the proposed location of the alternate unit and the area required for withdrawal space of replacement or serviceable components. These drawings shall also show clearances of adjacent equipment and service area required by that equipment. In addition, any changes in architectural, structural, electrical, mechanical and plumbing requirements for the alternate shall also be the responsibility of the Manufacturer requesting approval. This shall include the cost of redesign by all affected designers. Finally, any additional cost incurred by affected subcontractors shall be the responsibility of the Manufacturer and not the Owner.

1.4 MANUFACTURER

A. The naming of a Manufacturer in this Section is not an indication that the Manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the Manufacturer may have the capability of engineering and supplying a system that meets the requirements of this specification.

B. Eutek 24" TeaCup / 1 yd^3/hr Grit Snail grit removal system as manufactured by Hydro International, Hillsboro, OR.

C. Alternate equipment shall require Engineer's written pre-approval.

D. Grit Classifier with cyclone Model EQ 12 as manufactured by OVIVO Envioquip.

E. Hydrogritter Model 18F with cyclone as manufactured by WEMCO a Division of Weir SP, Salt Lake City, UT

F. RoSF4 Size 1 by HUBER Technology, Inc.

G. Units listed under D, E, and F shall supply a system that meets the performance requirements as listed in section 2.1 A of this specification. In addition, Units listed under D, E, and F shall meet the following minimum requirements:

1. All components shall be made of 304 SS construction including but not restricted to tank, screw, and supports.
2. Minimum tank wall thickness: ¼"
3. Minimum clarifier area: 10 ft^2 not including any water area above the screw
4. Clarifier Weir Length: 38" minimum.
5. Screw speed: 2.0 rpm maximum.
6. Screw flight thickness: 3/16" minimum.
7. The stainless steel screw should be fitted with Hi-Chrome replaceable wear shoes to prevent flight deterioration in grit slurry service.

H. Units listed under paragraphs D, E, and F are included for the purpose of providing manufacturer options. However, selecting any of the units listed under paragraphs D, E, and F does not relieve Contractor from his responsibility under Section 1.3 of this specification.

1.5 DESIGN REQUIREMENTS

A. The grit removal system shall:

Remove 90% to 95% of all grit particles with specific gravity of 2.65 greater than or equal to 75 micron with less than 20% (weight) volatile solids and greater than 60% total solids at a pumped design flow of 100 gpm.

B. The grit removal system shall be comprised of the following components:

1. Grit Collection / Washing / Classification unit .
2. Grit Dewatering / Escalator unit.
3. Control Panel.

C. The Grit Collection / Washing / Classification unit shall be a free standing vessel and receive the incoming screened pumped flow. The Grit Collection / Washing / Classification unit shall remove the specified grit particles from the specified peak flow and collect them in an area at the bottom of the unit. The de-gritted effluent shall be discharged via an overflow pipe as shown on the Drawings. The underflow shall be discharged to the Grit Dewatering / Escalator unit.

D. The Grit Dewatering / Escalator unit shall receive the underflow from the Grit Collection / Washing / Dewatering unit and allow the washed grit to settle in its integral clarifier. A slow moving belt shall carry the grit to the point of discharge allowing it to dewater during transport. The washed and dewatered grit shall be discharged to a dewatered grit receptacle (dumpster) for offsite disposal. The de-gritted overflow shall be discharged via an overflow pipe as shown on the Drawings.

E. The grit removal system and all appurtenances shall be supplied by a single Manufacturer.

F. The system to be furnished hereunder shall be made by a Manufacturer regularly engaged in such work and who has furnished similar installations and had them in successful and continuous operation for a minimum period of ten (10) years.

G. Data on performance testing, service history and operation of existing installations using the submitted equipment shall be made available to the Engineer, upon request, for use in determining that the Grit Removal System offered meets the intent of the contract, performance requirements and criteria stated in these Specifications.

1.6 DELIVERY, STORAGE AND HANDLING

A. The equipment and material shall be shipped complete except where partial disassembly is required by transportation regulations or for protection of components.

B. Spare parts shall be packed in containers bearing packing lists clearly designating contents and pieces of equipment for which they are intended.

C. The Contractor shall inspect equipment prior to unloading and notify the Manufacturer of any damage to equipment to effect proper remedial action.

D. The Contractor shall unload, store and safeguard equipment, materials, and spare parts in accordance with Manufacturer’s recommendations.

1.7 WARRANTY

A. The equipment Manufacturer shall warrant its equipment for a period of 12 months following start up. Any product that proves defective in material, workmanship or design within the warranty period shall be, at the discretion of the Owner, modified, repaired or replaced.

1.8 SPARE PARTS

A. The Manufacturer shall provide the following spare parts:

1. Two (2) solenoid valves.

PART 2 - PRODUCTS

2.1 GRIT COLLECTION / WASHING / CLASSIFICATION UNIT

A. Design Data

1.	Number of Units	One (1)
2.	Size	24" diameter
3.	Performance	95% removal of all grit (specific gravity 2.65)
		≥ 75microns at design flow
4.	Influent Solids Concentration	≤ 1.0 %
5.	Design Flow	100 gpm @ 18” headloss
6.	Minimum Flow	83 gpm @ 12” headloss
7.	Peak Flow	250 gpm @ 108” headloss
8.	Influent Connection	3” flanged pipe
9.	Effluent Connection	4” flanged pipe
10.	Underflow Connection	3” flanged pipe
11.	NPW Connection	1.5” NPT
12.	Material of Construction	304 SS
13.	Operation	Continuous/Intermittent 10-15 minutes

B. Operation

1. The Grit Collection / Washing / Classification unit shall be designed to handle screened raw wastewater.
2. The Grit Collection / Washing / Classification unit shall be characterized by a dominant, strong free vortex which utilizes centrifugal and gravitational forces and secondary boundary layer velocities to effect the separation, collection and classification of grit from the unit's inflow.
3. Defining characteristics of the dominant free vortex / secondary boundary layer velocity type units are as follows:

a. Dominating increasing tangential velocity profile toward the center of the unit.

b. The ability to handle increasing flows with no loss of the specified grit removal efficiency and with increasing headloss requirements.

c. The ability to classify (wash) the grit from lighter organic material to meet the specified organic solids content.

d. No requirements for electrical or mechanical components, flow deflecting / guiding weirs or baffles, or compressed air lines within the unit to meet the specified performance.

e. Continuous removal of washed, clean grit.

4. The Grit Collection / Washing / Classification unit shall be all-hydraulic with no moving parts within the unit.

5. Vortex grit units which do not have a dominant, strong free vortex / secondary boundary layer velocity and whose performance decreases with increasing flow shall not be allowed.

6. The grit underflow from the Grit Collection / Washing / Classification unit shall be transported by gravity to the Grit Dewatering / Escalator unit.

7. Flushing/fluidizing water shall be intermittently supplied to the Grit Collection / Washing / Classification unit.

C. Construction

1. The Grit Collection / Washing / Classification unit shall be fabricated from stainless steel. The dished and flanged heads shall be ¼-inch thick. The vessel walls shall be 3/16-inch thick.

2. The Grit Collection / Washing / Classification unit shall be designed to withstand a maximum working pressure of 14.7 psig. The actual maximum pressure at the inlet shall be no more than 14.7 psig.

3. All flanges shall be rotatable and conform to ANSI B16.1 bolt patterns.

4. A minimum 18 inch diameter access shall be provided in the top of the Grit Collection / Washing / Classification unit. All internal elements shall be removable from inside the unit.

5. The Grit Collection / Washing / Classification unit shall be free standing on three (3) legs and mounted above a Grit Dewatering / Escalator unit. Clearance shall be provided between the bottom of the grit underflow pipe and the clarifier surface of the Grit Dewatering / Escalator.

D. Valves and Accessories

1. The Grit Collection / Washing / Classification Unit shall be supplied with the following equipment to regulate and automate the system:

a. One (1) 3” diameter electrically actuated cast iron plug valve to isolate the underflow

b. One (1) 1.5” diameter bronze ball valve for main water supply shut off.

c. One (1) 1.5” diameter bronze ball valve to regulate flushing water supply.

d. One (1) 1.5” diameter NEMA 4X brass solenoid valve to automate the flushing water supply.

e. One (1) 1” diameter bronze ball valve to regulate fluidizing water supply.

f. One (1) 1” diameter NEMA 4X brass solenoid valve to automate the fluidizing water supply.

2. The Grit Collection / Washing / Classification Unit shall be supplied with a flow controller to limit the underflow into the Grit Dewatering Escalator.

2.2 GRIT DEWATERING / ESCALATOR UNIT

A. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

B. Design Data

1.	Number of Units	One (1)
2.	Maximum Grit Load	1.0 cy/hr
3.	Performance	95% removal of all grit (specific gravity 2.65) ≥ 75 microns with less than 20% volatile solids and greater than 60% total solids
4.	Belt Width	6”
5.	Clarifier size:	48” square
6.	Minimum Free Water Surface area	10.0 ft3
7.	Motor	0.33 Hp, TENV
8.	Overflow Connection	6” diameter flanged pipe
9.	Drain Connection	3” diameter flanged pipe
10.	NPW Connection	1” diameter NPT
11.	Body Material:	304 SS
12.	Belt Material	Neoprene Rubber, re-inforced with Polyester and Aluminum

C. Operation

1. The Grit Dewatering / Escalator unit shall be designed to capture and dewater concentrated, washed grit slurry from the Grit Collecting / Washing / Classification unit.

2. The Grit Dewatering / Escalator unit clarifier shall be designed based on a settling rate not to exceed 7.5 gpm/ft^2.

3. The tailroll mechanism shall be self-cleaning. As the belt rotates with the tailroll at the bottom of the unit, the belt cleats shall lift from the belt to provide a gap of at least 1 inch. The Grit Dewatering / Escalator unit belt shall be provided with 2" openings to allow transfer of fine solids internal to the belt to the underside of each cleat. The tailroll shall be fitted with a scraper, which shall also function as an internal belt scraper.

D. Construction

1. The Grit Dewatering / Escalator unit shall be provided with an integral square clarifier which shall provide at least 3 inches of freeboard.
2. The housing for the Grit Dewatering / Escalator unit belt shall be fitted under the clarifier. The housing for the Grit Dewatering / Escalator unit belt shall be stainless steel with urethane bonded to the internal surfaces. The belt housing shall be inclined at 30 degrees.
3. The belt housing shall be provided with clean out plates and one (1) flanged drain.
4. The Grit Dewatering / Escalator unit shall be supplied with a belt made of 1/8-inch x 1/32-inch two-ply polyester reinforced continuous conductor belting. The belt cleats shall be 3-3/8" X 4-9/16" of molded 60 Durometer neoprene and aluminum reinforced and shall be vulcanized on the belt. The cleats shall attach to the belt with minimum 5/32-inch thick neoprene hinges.
5. The Grit Dewatering / Escalator unit shall be provided with a 9-3/4-inch diameter lagged headroll. The headroll shall be adjustable to allow take-up of slack in the Grit Dewatering / Escalator belt. Adjustment of the headroll shall not affect the headroll retainer plate, scraper, or drive unit.
6. The Grit Dewatering / Escalator unit shall be provided with a headroll scraper having ¼-inch thick high density polyethylene (HDPE) contact surfaces with a ¼-inch thick HDPE retainer plate. Both retainer plate and scraper shall be loaded to keep belt cleats closed tightly around the headroll during operation.
7. The Grit Dewatering / Escalator unit shall be provided with a tailroll designed to mount internally to the unit belt housing with external sealed bearings.
8. The Grit Dewatering / Escalator unit support structure shall be as shown on the general arrangement drawing and anchored to a stable base.
9. The Grit Dewatering / Escalator unit shall be supplied with a factory installed rinse bar system. The system shall include:
   a. Two (2) spray bars located above the belt and below the clarifier liquid level to enhance grit washing.
   b. One (1) spray bar located at the bottom of the clarifier as a tailroll area rinse.

E. Drive Unit

1. The Grit Dewatering / Escalator unit shall be provided with a drive unit consisting of the motor and the helical gear reducer, mounted as a single integrated unit. All Bearings shall be anti-friction, ball, or roller type bearings.
2. The motor shall be 3 phase, 460 VAC, 60 Hz, NEMA Design B, TENV enclosure.
3. The helical gear reducer shall have hardened alloy steel gears accurately cut to shape.

4. A mechanical torque-limiting clutch shall be mounted on the headroll gear assembly to prevent an accidental overload of the drive unit and belt.

5. The drive speed shall be adjusted by a variable speed drive housed in the control enclosure. The belt speed shall be adjustable from 1-5 ft/min.

F. Valves and Accessories

1. The Grit Dewatering / Escalator unit shall be supplied with the following equipment to regulate and automate the system:

   a. One (1) 3" diameter eccentric cast iron plug valve located on the unit drain.

   b. One (1) 1" diameter NEMA 4X brass solenoid valve to automate the water to the rinse bar system.

   c. Two (2) 1" diameter bronze ball valves to manually shut off flow to the rinse bar system.

   d. One (1) 1" diameter bronze globe valve to manually regulate flow to the tailroll spray bar.

   e. One (1) 3/4" diameter bronze ball valve to manually shut off the top rinse bars.

   f. One (1) 0.5-5 gpm acrylic flow meter.

2. The Grit Dewatering / Escalator unit shall be supplied with one (1) motion sensor installed on the side of the Grit Dewatering / Escalator unit to detect movement of the headroll scraper arm.

2.3 CONTROLS AND INSTRUMENTATION

A. Reference Specification 113390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

B. Control Panel

1. One (1) control panel shall be furnished, completely pre-wired and tested.

2. The control panel shall adhere to the following specifications:

a.	Enclosure Rating	NEMA 4X
b.	Material	304SS
c.	Voltage	480 Volt
d.	Phase	3 Phase
e.	Frequency	60 Hz
f.	Load	TBD
g.	Logic	Relay

3. The Control panel shall contain all timers, starters, switches, indicator lights, and other components necessary to operate the following equipment:

   a. One (1) Collection / Grit Washing / Classification unit

b. One (1) Grit Dewatering / Escalator unit

c. Two (2) Grit Pumps

4. The control panel shall be supplied with a Transformer with 480 volt primary winding and 120 volt secondary winding with fused secondary.

5. The control panel shall be supplied with applicable control relays and time delay relays with a minimum one (1) extra normally closed and one (1) extra normally opened contact is provided for each relay.

6. Where remote monitoring is required, the panel shall be provided with all dry contacts necessary.

7. The panel door layout shall include the following items:

a. Front panel mounted combination main disconnect switch and circuit breaker

b. Back lit, push-to-test Power On indicating light

c. System three (3) position HOA switch

d. System Emergency Stop push button

e. System Alarm Reset push button (optional)

f. Grit Collection / Washing / Classification unit three (3) position HOA switch

g. Grit Collection / Washing / Classification unit drain valve three (3) position HOA switch

h. Grit Collection / Washing / Classification unit drain valve OPEN indicating light

i. Grit Collection / Washing / Classification unit fluidizing water ON/OFF switch.

j. Grit Collection / Washing / Classification unit fluidizing water valve OPEN indicating light

k. Grit Collection / Washing / Classification unit flushing water valve OPEN indicating light

l. Grit Collection / Washing / Classification unit flushing water valve three (3) position HOA switch

m. Grit Collection / Washing / Classification unit auto drain three (3) position HOA switch

n. Grit Collection / Washing / Classification unit WET/DRY/REMOTE three (3) position switch

o. Grit Dewatering / Escalator unit running light

p. Grit Dewatering / Escalator unit three position HOA switch

q. Grit Dewatering / Escalator unit fail indicating light

r. Grit Dewatering / Escalator unit manual STOP push button

s. Grit Dewatering / Escalator unit manual START push button

t. Grit Dewatering / Escalator unit manual speed potentiometer

u. Grit Dewatering / Escalator unit rinse water valve three (3) position HOA switch

v. Grit Dewatering / Escalator unit rinse water valve OPEN indicating light

w. Grit Dewatering / Escalator unit FAIL RESET push button

x. Grit Dewatering / Escalator unit LOCAL/REMOTE switch for escalator speed control

y. Grit Pump #1 running light

z. Grit Pump #1 three (3) position HOA switch

aa. Grit Pump #1 fail indicating light

bb. Grit Pump #1 manual START push button

cc. Grit Pump #1 manual STOP push button

dd. Grit Pump #2 running light

ee. Grit Pump #2 three (2) position HOA switch

ff. Grit Pump #2 fail indicating light

gg. Grit Pump #2 manual START push button

hh. Grit Pump #2 manual STOP push button

2.4 SEQUENCE OF OPERATION

A. The system shall be controlled to provide automatic or manual operation, manual starting and stopping and system shut down when a fault is detected.

B. Clarified plant water shall be supplied and distributed between the Grit Collection / Washing / Classification unit and the Grit Dewatering / Escalator unit.

C. Grit Collection / Washing / Classification unit:

1. Screened raw wastewater shall be pumped to the Grit Collection / Washing / Classification unit intermittently using grit pumps. For grit pumps sequence of operation, refer to specification 11321 - Vortex Grit Pumps.

2. An accumulating timer (AT) shall reset and begin timing out when a signal is received indicating flow to the Grit Collection / Washing / Classification unit. The signal shall be initiated by the grit pump run signal. The AT regulates the length of time between Grit Blowdown Sequences (GBS). When the AT times out it shall send a signal to initiate a GBS. The timing between, and duration of, the grit blowdown sequence is site specific; the AT should be adjustable between 5 min to 8 hr, normally set at 3 hrs. The panel shall be equipped with two (2) timers, one (1) for dry weather, and one (1) for wet weather. For higher grit loads, the wet weather timer shall increase the frequency of the Grit Blowdown Sequence as compared with the dry weather timer. The timer being used shall be selected by a local switch or by remote contact closure on terminals provided in the panel.

3. The fluidizing timer (FT) shall reset and begin to time out when the AT signals the start of a GBS. The FT shall send a signal to open the solenoid valve on the 1" diameter fluidizing line. The water flowing into the fluidizing line shall agitate and clean the grit collected in the bottom of the Grit Collection / Washing / Classification unit’s sedimentation cone. When the FT times out, the 1" diameter solenoid valve shall close. The FT shall be adjustable from 0-6 minutes, normally set at 30 seconds.

4. Time out of the FT shall send a signal to the underflow timer (UT); the UT shall reset and begin to time out. The UT shall send a signal to open a 3" diameter electrically actuated plug valve. When the valve opens, the grit collected in the bottom of the sedimentation cone shall flow down to the Grit Dewatering / Escalator unit. When the UT times out the plug valve shall close. The grit underflow timer (UT) shall be adjustable from 0 - 60 min. It shall normally be set for 1 min.

5. Time out of the UT shall send a signal to the flushing/purging timer (PT); the PT shall reset and begin to time out. The PT shall send a signal to open a 1.5" diameter solenoid valve. Water shall flow into the grit underflow line and flush or purge the grit underflow line of residual grit. When the PT times out, the solenoid valve shall close. The flushing / purging timer (PT) shall be adjustable from 0-60 min. it shall normally be set for 1 min.

6. Concurrent with the closing of the 3" diameter plug valve, the AT is set back to zero and begins accumulating Grit Collection / Washing / Classification unit inflow time again.

7. The unit shall have an automatic drain feature that can be turned off and on as desired. The Automatic drain shall enable the unit to be drained whenever influent stops flowing to the unit. This is used to provide for freeze protection or maintenance.

D. Grit Dewatering / Escalator unit

1. The Grit Dewatering / Escalator unit belt shall run whenever grit slurry is being transported to the unit.

2. While the dewatering unit is running, water shall be directed to the tailroll self-cleaning mechanism and grit rinse system.

3. The belt speed shall be adjustable via a manual speed control potentiometer on the control panel or by remote signal (4-20 ma) from the plant DCS.

4. A motion sensor shall be installed on the side of the Grit Dewatering / Escalator unit takeup frame and shall detect movement of the headroll scraper arm. Lack of motion of the headroll scraper arm shall indicate lack of belt movement, drive unit failure and/or scraper arm overload. Lack of belt movement or scraper arm overload shall interrupt signal from the motion sensor to the timer. If the motion sensor fails to reset the timer, the Grit Dewatering / Escalator unit shall stop and the failure light shall illuminate.

5. After a System Shut Down, the Grit Dewatering / Escalator unit shall continue to operate for a pre-determined amount of time to allow for the removal and dewatering of all grit accumulated in the clarifier. The off delay timer shall be adjustable from 0-60 minutes with a typical delay off time of 15 minutes.

2.5 UTILITY REQUIREMENTS

A. Water

1. The Grit Collection / Washing / Classification Unit shall require a minimum supply of 30 gpm clarified non-potable water supplied at a regulated 50 psig ± 5 psi.

2. The Grit Dewatering / Escalator unit shall require a minimum supply of 5 gpm clarified non-potable water supplied at a regulated 50 psig ± 5 psi.

B. Electrical

1. The system shall require one (1) 480 VAC, three phase electrical service connection to operate.

2.6 MATERIALS AND FINISHES

A. Materials

1. All stainless steel used for the fabrication of the equipment shall conform to the following standards:

a.	Plate and Sheet	ASTM A 167 ASTM A 240
b.	Bar	ASTM A 276 ASTM A 479
c.	Tube	ASTM A 312

B. Exterior Surfaces Finishes

1. All surfaces shall be free of sharp edges, weld spatter and residue. All welds shall be ground smooth.
2. All stainless steel surfaces shall be acid washed.

PART 3 - EXECUTION

3.1 START-UP, TRAINING AND MANUFACTURER'S SERVICES

A factory trained representative for the equipment specified herein shall be present at the jobsite and/or classroom designated by the Owner for a maximum of four (4) 8-hour man-days (two (2) visits) for installation inspection, plant startup, functional testing, and operator instructions; travel time excluded. A minimum of 30 days notice is required to schedule Manufacturer's services.

3.2 FUNCTIONAL TESTING

Prior to plant startup, all equipment shall be inspected for proper alignment, operation, connection, and satisfactory operation by means of a functional test. It is the General Contractor's responsibility to duly notify the Manufacturer of any inabilities to perform functional testing prior to operator training.

3.3 MANUFACTURER'S CERTIFICATE

Provide Manufacturer's certificate of installation and commissioning following functional testing and startup.

END OF SECTION

SECTION 11330 – MECHANICAL STEP SCREEN

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install one (1) fully automatic mechanical step screen for collecting and removing debris from the incoming wastewater flow.

B. The step screen shall be provided complete with all accessories, spare parts, mounting, anchor bolts and other appurtenances as specified and as may be required for a complete and operating installation.

C. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

1.2 SUBMITTALS

A. Step Screen Shop Drawings: Shall include the following at a minimum:

1. Certified shop and erection drawings showing construction details, dimensions, anchor bolt locations and field connections.
2. Descriptive literature, bulletins, and catalogs of the equipment, including details of the motor, gear reducer and lubrication points.
3. Installation, operation, and start-up procedures including lubrication requirements.
4. Complete motor data.
5. Total weight of the equipment including the weight of the single largest item.
6. A list of spare parts that are supplied with the project

B. Step Screen Design Report: Submit screen Manufacturer hydraulic calculations based on the specific channel characteristics of this project. The report shall consider both 0% and 30% screen blinding scenarios at both average and peak flow conditions and it shall show the following results at a minimum:

1. Screen head losses
2. Upstream and downstream water velocities
3. Upstream and downstream water levels and free board

C. Step Screen Certificate of Warranty: Submit per Section 1.8.

D. Step Screen Certificate of Compliance: Submit per Section 1.4.

E. Step Screen Manufacturer Experience: Submit per Section 1.4.

F. Step Screen O & M Manual: The operation and maintenance manual shall include the following at a minimum:

1. Contact name, address, and telephone number of the nearest competent service representative who can furnish parts and technical service.
2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
3. Operating, maintenance and troubleshooting information.
4. Complete maintenance parts list.
5. Complete connection, interconnecting and assembly diagrams.
6. Approved shop drawings including complete electrical information.

1.3 REFERENCES/STANDARDS

A. AGMA - American Gear Manufacturers Association

B. NEMA - National Electrical Manufacturers Association

C. AFBMA - American Federation of Bearing Manufacturers Association

D. ASTM - American Society for Testing and Materials

E. AWS - American Welding Society

F. SSPC - Steel Structures Painting Council

G. ANSI - American National Standards Institute

H. UL - Underwriters Laboratory

1.4 QUALITY ASSURANCE

A. The materials covered by these Specifications are intended to be standard equipment of proven reliability and as manufactured by a reputable Manufacturer having experience in the production of screening equipment. The equipment furnished shall be designed and constructed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Contract Drawings and operated per the Manufacturer's recommendations.

B. Certificate of Compliance. The Manufacturer shall certify that the Step Screen to be supplied shall be manufactured in strict compliance with these specifications.

C. Manufacturer Experience. Manufacturer shall be successful in the experience of manufacture, operation, and servicing of Step Screens of type, size, quality, performance, and reliability equal to that specified for a period of not less than ten (10) years. The Manufacturer shall submit evidence of experience having supplied a minimum of fifty (50) installations in the United States of similar size to the proposed system. For each installation, the following information shall be provided:

1. Name and location of the installation.
2. Number, size and type of equipment installed.
3. Month and year placed in operation.
4. Contact name, address and phone number of installation.

D. Extended Warranty. In the absence of verifiable experience, the Manufacturer shall be required to provide an extended warranty and subsequent Performance Bond for the same number of years that the Manufacturer was found lacking in experience from the specified ten (10) year period. The performance bond shall commence with acceptance of the equipment and time described herein and beyond the standard warranty period.

E. Additional Information. If equipment other than that shown on the Contract Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit all information necessary to prove that the proposed equipment meets the requirements of this specification as determined by the Engineer.

F. Redesign Drawings. If equipment other than that shown on the Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit with the request a revised design and layout of the mechanical equipment acceptable to the Engineer. Revised drawings shall show the proposed location of the alternate unit and the area required for withdrawal space of replacement or serviceable components. These drawings shall also show clearances of adjacent equipment and service area required by that equipment. In addition, any changes in architectural, structural, electrical, mechanical and plumbing requirements for the alternate shall also be the responsibility of the Manufacturer requesting approval. This shall include the cost of redesign by all affected designers. Finally, any additional cost incurred by affected subcontractors shall be the responsibility of the Manufacturer and not the Owner.

1.5 ACCEPTABLE MANUFACTURERS

A. The naming of a Manufacturer in this Section is not an indication that the Manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the Manufacturer may have the capability of engineering and supplying a system that meets the requirements of this specification.

B. Model ESR-S23 Stair Screen as manufactured by Vulcan Industries, Inc. of Missouri Valley, Iowa.

C. Step Screen Flexible Model SSF 4000/426/6 High-Efficiency (HE) Type as manufactured by Huber Technology, Inc.

D. Alternate equipment shall require Engineer's written pre-approval.

1.6 DESIGN REQUIREMENTS

A. Number of Units One (1)

B. Average Flow 1.0 MGD

C.	Peak Flow Rate	3.0 MGD
D.	Flow Channel Width	1’-8”
E.	Flow Channel Depth	4’-0”
F.	Free Board:	2’ minimum (@ 30% blinding)
G.	Discharge Height EL.	460.54’
H.	Channel Top EL.	457.50’
I.	Channel Bottom EL.	453.50’
J.	Slot Width / Spacing	1/4-inch (6 mm)
K.	Setting Inclination	57 degrees from horizontal (maximum)

1.7 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the Manufacturer’s recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

B. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.

C. Temporarily connect equipment with built in motor space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.

D. The step screen shall be shipped complete including the motor. The support arms and discharge chute shall be shipped separate. The local control station shall be pre-wired to the screen and shall be attached via a bolted connection to one of the support arms. The unit shall be erected and lubricated in strict accordance with the instructions of the Manufacturer's field engineer.

1.8 WARRANTY

A. The equipment supplier shall warrant that its equipment shall be free from defects in material and workmanship; and that it will replace or repair, F.O.B. its factory, any part or parts returned to it, which examination shall show to have failed under normal use and service by the user within eighteen (18) months following initial shipment or twelve (12) months following operation start up, whichever occurs first.

PART 2 - PRODUCTS

2.1 GENERAL

A. The step screen furnished shall positively remove debris from the incoming wastewater by means of fixed and movable lamellas. The lamellas shall be secured within a framework that is installed in the concrete channels as shown on the Contract Drawings. During each cleaning cycle, the movable lamellas shall rotate one complete revolution (or one step), which will transport the screenings material up to the next set of fixed lamellas. The movable lamellas will then finish their rotation and return to their original position. A positive means of stopping the movable lamellas at the original position shall be incorporated into the design. Multiple revolutions during normal flow are not acceptable. This intermittent cycling will raise the screenings upward and subsequently out of the channel at the point of discharge into the appropriate receiving device.

B. Designs employing the use of endless moving media, cables and hydraulic cylinders or raking mechanisms to remove debris from the channel are not acceptable. The use of two or more motors to complete a screen cleaning cycle is not acceptable.

C. The design shall be such to ensure that all maintenance can be accomplished at the operating floor level. No part of the drive system including bearings, linkage, bushings or shafts shall be located below the water surface at maximum design flow. Designs that utilize drive systems that rely on gravity or otherwise do not provide a forceful mechanical action in the downward stroke of the movable lamella package are specifically not acceptable. The drive output shaft rotation shall be constant and in one direction in order to reduce maintenance requirements.

2.2 FRAME ASSEMBLY

A. The frame assembly shall be of a one piece, formed structural design and shall provide a rigid, secure unit capable of withstanding all operating forces when installed in accordance with the Manufacturer's instruction. The frame assembly shall consist of two side frames, a base plate, two drive plates, fixed lamella support members, movable lamella support members and two frame support legs with pivot pins. The drive plates shall be mounted within the side frame and shall be connected to the movable lamella support members.

B. The frame assembly shall be designed to mount into the channel without the need for recesses in the channel walls or channel floor. Neoprene side seals shall be attached to the side frames with 304 stainless steel retainers and hardware to seal between the screen and channel walls.

C. The side frames shall extend fully from the channel invert to the top of the unit and shall be arranged to pivot out of the channel for maintenance. The frame shall be designed to clear all fixed screenings receiving devices when the screen is pivoted out of the channel for maintenance. The side frames shall be manufactured from 304 stainless steel with a minimum thickness of 0.16-inch (4 mm).

2.3 LAMELLAS

A. The screening surface of the step screen shall consist of alternating fixed and movable step-shaped lamellas. The steps on the lamellas shall be of the same size, nominally 2-3/8-inch deep by 4-1/4-inch tall, except for the lowest step, which shall be of a low profile design. The distance from the bottom of the channel to the top of the bottom step shall not exceed 2-1/2-inches. The downstream side of the lower moveable lamellas shall be provided with half-moon shaped teeth to slice through any debris that may accumulate on the fixed lamella support members. All lamellas shall be attached to either the fixed or movable lamella support members.

B. The lamellas in the screening area shall have a slot width (or spacing) of 1/4-inch (6mm). Fixed lamellas shall be provided with replaceable plastic spacers on each side to maintain the proper spacing and prevent metal-to-metal contact between the lamellas.

C. The lower portion of the fixed lamellas shall be furnished with thick polypropylene sleeves to ensure proper spacing and prevent metal-to-metal contact between the lamellas. The lower portion of the movable lamellas shall be provided with half-moon shaped teeth to penetrate through fine grit and sand during operation. The lower lamellas shall be manufactured from 304 stainless steel with a thickness of 2 mm.

D. The upper portion of the fixed lamellas and movable lamellas shall be constructed of U.V. stabilized polypropylene with a nominal thickness of 7 mm. The bar spacing between the fixed and movable lamellas in the transport zone shall be 1 mm or less. The thick lamellas shall help to ensure that stringy material does not fall through the screen prior to discharge.

2.4 DIRECTING PLATE

A. The step screen shall be provided with a directing plate at the base of the machine perpendicular to the flow and level with the lowest step on the lamellas. The directing plate shall direct heavier material, such as grit and gravel, onto the top shelf of the bottom row of steps on the lamellas to prevent a build-up of material in front of the screen.

B. The directing plate shall be manufactured from 304 stainless steel and shall be provided with a replaceable nylon brush to seal between the downstream edge of the plate and the upstream edge of the bottom row of steps.

2.5 ENCLOSURE PANELS

A. The portion of the step screen located above the top of the channel on both the upstream and downstream sides shall be shrouded in removable enclosure panels. The drive compartment shall be shrouded separately. The drive shall be fully enclosed to protect it from the atmosphere in the channel. Panels shall be secured in place with ¼ turn keyed latches.

B. The enclosure panels shall be manufactured of 304 stainless steel with a minimum thickness of 20-gauge. The panels shall be formed with engineered bends to help prevent deflection. Flat plate covers are not acceptable.

2.6 DRIVE ASSEMBLY

A. The step screen shall be furnished with an integrated drive assembly consisting of a TEFC electric motor with a bevel type gear reducer, drive shaft, bearings, sprockets and dual drive chains.

B. The motor shall be a minimum 1.0 horsepower, 230/460 volt, 3 phase, 60 Hertz with a service factor of 1.15. The motor shall be rated at 40°C ambient with Class F insulation and shall have a Class B temperature rise at full load. The nominal motor speed shall be 1800 rpm.

C. Gear reducers shall be bevel gear type with ball or roller bearings throughout with all moving parts immersed in oil. Shafts shall be of high strength alloy steel ground to required tolerances. All ball or roller bearings shall be rated and manufactured by a member of the Antifriction Bearing Manufacturer's Association. At least one bearing on each shaft shall be of the combined radial and thrust type.

D. Gear reducer units shall meet the standards of the American Gear Manufacturers Association.

E. The drive assembly shall be capable of elevating the weight of the movable lamellas plus the maximum debris load.

F. The chain and sprocket transmission system shall consist of endless dual chain, an upper sprocket connected to a bearing in a fixed housing and a lower sprocket connected to a bearing in a pivoting housing. The drive system shall be identical on each side of the screen.

1. The drive system shall be designed so that the lower sprocket, lower bearing assembly and associated chain are located above the maximum water level. Designs that utilize sprockets, bearings, linkage or bushings located below the maximum water level are not acceptable.
2. The lower bearing assembly shall be designed to pivot or slip to automatically accommodate uneven chain stretch.
3. The chain shall be arranged in the same plane as the fixed lamella package and the same plane as the movable lamella package when in the parked position to ensure maximum efficiency in the drive system.
4. Automatic shock absorber type chain tensioning devices shall be provided to ensure that the drive chains maintain proper tension and to eliminate the need for adjustment.

2.7 DISCHARGE CHUTE

A. A fully shrouded and easily removable discharge chute shall be provided at the point of discharge to interface with and direct screenings into the inlet hopper on the washing press. The discharge chute shall be manufactured from 304 stainless steel.

2.8 CONTROLS

A. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

B. The step screen shall be cycled on and off by control signals from the main control panel. The screen shall be cycled by a demand signal generated from a differential level controller. The controller shall be located within the main control panel and shall measure the head loss across the screen. Once a preset level has been reached, a signal in the form of a dry contact closure is generated for starting the screen. Once directed to start, the screen will be cycled on and off by a repeat cycle timer until the head loss is reduced to a preset operating level. Differential level shall be measured by ultrasonic transducers mounted upstream and downstream of the screen. Two (2) Echomax transducers, fabricated stainless steel brackets and anchor bolts and a sufficient length of cable shall be provided as part of the differential level system.

C. The step screen shall also be controlled by an adjustable interval timer from the main control panel. Once a preset time interval has been reached, the timer shall automatically start the screen, even when the differential level controller has not directed the screen to start. Once the timer has started the screen, the screen shall operate for a preset period of time but at a minimum for one complete step to be taken (3 seconds).

D. The control system, both local and main, shall be designed and manufactured by the same company that furnishes the mechanical screen.

E. Local controls shall consist of a NEMA 4X local control station with a mushroom head EMERGENCY STOP push-button. The local controls and motor shall be pre-wired to a terminal strip located inside the local control station. The control station shall be mounted on one of the screen support legs.

F. One (1) NEMA 4 home position limit switch to stop the movable lamella package at a predetermined position after each cleaning cycle. Limit switch shall be single pole, double throw (SPDT) and rated not less than 10 amps at 120 volt AC.

G. Furnish one (1) main control panel for the step screen. The main control panel shall be totally enclosed, front access type with top/side/bottom entry. The panel shall be manufactured by a U.L. listed control panel facility and shall bear a U.L. label. Construction of the control panel enclosure shall be NEMA 4X, 316 stainless steel with indicating devices and switches mounted on the front door. The controls for the screen may be included in the control panel for the press if the same Manufacturer provides the screen and the press.

H. Main control panel wiring shall be color-coded, labeled, neatly cabled and supported in nonflammable wiring raceways. Wiring shall be per Specification 13390 – Package Controls Systems.

I. The control panel wiring shall contain all power and control devices shown on the Contract Drawings (wiring diagrams), which shall include, but not be limited to, the following:

1. One (1) control power ON-OFF selector switch.

2. One (1) HAND-OFF-AUTO selector switch for operation of the step screen drive.

3. One (1) red pilot light for “Screen Run” indication.

4. One (1) amber pilot light for “Over Current” indication.

5. One (1) white pilot light for control power.

6. One (1) momentary “reset” push-button for over current reset.

7. Spare contact for remote indication of “Over Current” status.

8. Control relays, wiring and circuitry required to implement the control logic.

9. One (1) full voltage NEMA rated starter. The magnetic starter shall be of the heater less design and provide phase loss protection, short circuit self-protection and thermal memory. The solid-state overload shall be self-powered.

10. One (1) circuit breaker.

11. One (1) 120 VAC step down control transformer.

12. One (1) adjustable interval timer mounted on DIN rail to automatically initiate operation of the step screen.

13. One (1) Milltronics HydroRanger 200 differential level controller to sense the differential in water level upstream and downstream of the step screen.

14. One (1) adjustable repeat cycle timer mounted on DIN rail that shall be activated by a signal from the differential level controller.

15. One (1) current sensing relay. The current sensing relay shall continuously monitor the motor current to prevent damage due to a jam obstruction or a unit malfunction. An over current condition that causes motor shutdown shall cause an alarm to sound. The alarm shall be manually reset prior to the unit returning to normal operation.

16. One (1) elapsed time meter.

17. All switches, pushbuttons and pilot lights shall be NEMA rated components. IEC rated components are not acceptable.

2.9 SEQUENCE OF OPERATION

A. The step screen shall be manually operable from the main control panel.

B. The screen shall be cycled by a demand signal generated from a differential level controller. The differential level controller located within the remote control panel shall measure the head loss across the screen. Once a preset level differential has been reached, a signal in the form of a dry contact closure is generated for starting the screen. Once directed to start, the screen will be cycled on and off by a repeat cycle timer until the head loss is reduced to a preset operating differential level. Ultrasonic transducers mounted upstream and downstream of the screen shall measure differential level.

C. The step screen shall also be controlled by an adjustable interval timer from the main control panel. Once a preset time interval has been reached, the timer shall automatically start the screen, even when the differential level controller has not directed the screen to start. Once the timer has started the screen, the screen shall operate for a preset period of time but at a minimum for one complete step to be taken (3 seconds).

2.10 FASTENERS

A. All fasteners and anchor bolts shall be 304 stainless steel unless otherwise indicated in this specification. Anchor bolts shall be provided for mounting support arms. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly.

2.11 LUBRICATION

A. The Manufacturer shall state in the operating manual the amount of and specification for any lubricant required.

2.12 PROTECTIVE COATINGS

A. Stainless steel and plastic components shall not be painted. The stainless steel structural components and enclosure panels shall be bead blasted or passivated after fabrication to remove embedded iron, surface rust and weld burn. All other surfaces shall be blast cleaned to an SSPC-SP6 finish, removing all dirt, rust, scale and foreign materials.

B. Cleaned surfaces shall be shop primed with one (1) coat of TNEMEC 69-1212 primer, or equal, to attain a minimum dry film thickness of 2.5 mils. The motor and gear reducer shall be finish coated and shall be painted the same color. The drive chain shall be coated with a suitable lubricant.

2.13 SPARE PARTS

A. The Contractor shall furnish the following spare parts for each screen:

1. Three (3) movable stainless steel lamellas
2. Three (3) fixed stainless steel lamellas
3. Twenty-five (25) plastic spacers

B. All spare parts shall be properly packed in a white wooden box, labeled and stored where directed by the Owner or Engineer.

PART 3 - EXECUTION

3.1 TESTING

A. The step screen shall be factory assembled and factory run tested prior to shipment. The main control panel shall also be factory tested with the equipment prior to shipment.

B. The screen shall also be field tested after erection in the presence of the Owner and Engineer to confirm and verify the structural and mechanical compliance to the specification. The field acceptance test shall include demonstrating that the screen operates without vibration, jamming or overheating and perform its specified function satisfactorily.

3.2 INITIAL START-UP AND TRAINING

A. The Contractor shall provide the services of a factory-employed service technician who shall adequately inspect the installation, test the equipment furnished under this Contract and instruct the Owner's operating personnel in its maintenance and operation. Factory-employed service technicians are required. Manufacturer's sales representatives are not deemed acceptable to provide the start-up service. The services of the technician shall be provided as follows:

1. One (1) trip and two (2) days of service to inspect and certify the installation prior to startup and provide Owner's personnel in proper operation and maintenance of the equipment. Start-up service can be combined with the start-up service for the press if the same Manufacturer provides both pieces of equipment.

END OF SECTION

SECTION 11331 – SCREENINGS WASHING PRESS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install one (1) automatic washing press for the reduction of organic content, moisture and volume from screenings material removed from the incoming wastewater flow by a step screen.

B. The washing press shall be designed to accommodate screenings taken from the flow stream from a municipal wastewater treatment plant. A wedge wire drain and a screw mounted nylon brush shall be required to help protect against blinding of the drain.

C. The washing press shall be provided complete with the drive assembly, local wiring, valves, controls, spare parts, anchor bolts and other appurtenances as specified and as required for a complete operating installation.

D. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

1.2 SUBMITTALS

A. Washing Press Shop Drawings: Shop drawings shall include the following at a minimum:

1. Certified shop and erection drawings showing construction details, dimensions, anchor bolt locations and field connections.
2. Descriptive literature, bulletins, and catalogs of the equipment, including details of the motor, gear reducer and lubrication points.
3. Installation, operation, and start-up procedures including lubrication requirements.
4. Complete motor data.
5. Total weight of the equipment including the weight of the single largest item.
6. A list of spare parts that are supplied with the project

B. Washing Press Certificate of Warranty: Submit per Section 1.8

C. Washing Press Certificate of Compliance: Submit per Section 1.4.

D. Washing Press Manufacturer Experience: Submit per Section 1.4.

E. Washing Press O & M Manual: The operation and maintenance manual shall include the following at a minimum:

1. Contact name, address, and telephone number of the nearest competent service representative who can furnish parts and technical service.

2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.

3. Operating, maintenance and troubleshooting information.

4. Complete maintenance parts list.

5. Complete connection, interconnecting and assembly diagrams.

6. Approved shop drawings including complete electrical information.

1.3 REFERENCES/STANDARDS

A. AGMA - American Gear Manufacturers Association

B. NEMA - National Electrical Manufacturers Association

C. AFBMA - American Federation of Bearing Manufacturers Association

D. ASTM - American Society for Testing and Materials

E. AWS - American Welding Society

F. SSPC - Steel Structures Painting Council

G. ANSI - American National Standards Institute

H. UL - Underwriters Laboratory

1.4 QUALITY ASSURANCE

A. The materials covered by these specifications are intended to be standard equipment of proven reliability and as manufactured by a reputable Manufacturer having experience in the production of screenings washing equipment. The equipment furnished shall be designed and constructed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Contract Drawings and operated per the Manufacturer's recommendations.

B. Certificate of Compliance. The Manufacturer shall certify that the washing press to be supplied shall be manufactured in strict compliance with these specifications.

C. Manufacturer Experience. Manufacturer shall be successful in the experience of manufacture, operation, and servicing of washing presses of type, size, quality, performance, and reliability equal to that specified for a period of not less than ten (10) years. The Manufacturer shall submit evidence of experience having supplied a minimum of fifty (50) installations in the United States of similar size to the proposed system. Equipment Manufacturers that fail to supply a certified list of 50 installations shall not be acceptable. For each installation, the following information shall be provided:

1. Name and location of the installation.

2. Number, size and type of equipment installed.

3. Month and year placed in operation.

4. Contact name, address and phone number of installation.

D. Extended Warranty. In the absence of verifiable experience, the Manufacturer shall be required to provide an extended warranty and subsequent Performance Bond for the same number of years that the Manufacturer was found lacking in experience from the specified ten (10) year period. The performance bond shall commence with acceptance of the equipment and time described herein and beyond the standard warranty period.

E. Additional Information. If equipment other than that shown on the Contract Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit all information necessary to prove that the proposed equipment meets the requirements of this specification as determined by the Engineer.

F. Redesign Drawings. If equipment other than that shown on the Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit with the request a revised design and layout of the mechanical equipment acceptable to the Engineer. Revised drawings shall show the proposed location of the alternate unit and the area required for withdrawal space of replacement or serviceable components. These drawings shall also show clearances of adjacent equipment and service area required by that equipment. In addition, any changes in architectural, structural, electrical, mechanical and plumbing requirements for the alternate shall also be the responsibility of the Manufacturer requesting approval. This shall include the cost of redesign by all affected designers. Finally, any additional cost incurred by affected subcontractors shall be the responsibility of the Manufacturer and not the Owner.

1.5 ACCEPTABLE MANUFACTURERS

A. The naming of a Manufacturer in this Section is not an indication that the Manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the Manufacturer may have the capability of engineering and supplying a system that meets the requirements of this specification.

B. Model EWP 250/600 Washing Press as manufactured by Vulcan Industries, Inc. of Missouri Valley, Iowa.

C. Wash And Press (WAP) Size 2 as manufactured by Huber Technology, Inc.

D. Alternate equipment shall require Engineer's written pre-approval.

1.6 DESIGN REQUIREMENTS

A.	Number of Units	One (1)
B.	Screenings Capacity	Up to 33 cubic feet / hour (batch service)
		Up to 99 cubic feet / hour (continuous service)
C.	Organic Removal	90%

D. Volume Reduction 50% minimum

E. Wash Water Requirements 19 gpm at 35 psi minimum (intermittent usage)

1.7 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

B. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.

C. Temporarily connect equipment with built in motor space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.

D. The washing press shall be shipped complete including the motor and inlet hopper. The discharge piping shall be shipped separate. The local control station shall be an integral part of the solenoid valve manifold and four (4) solenoid valves shall be pre-wired to the terminal strip inside the local control station. The unit shall be erected and lubricated in strict accordance with the instructions of the Manufacturer's field engineer.

1.8 WARRANTY

A. The equipment supplier shall warrant that its equipment shall be free from defects in material and workmanship; and that it will replace or repair, F.O.B. its factory, any part or parts returned to it, which examination shall show to have failed under normal use and service by the user within eighteen (18) months following initial shipment or twelve (12) months following operation start up, whichever occurs first.

PART 2 - PRODUCTS

2.1 GENERAL

A. The washing press shall be provided to reduce the organic content, moisture content and volume of screenings material from the step screen. Screenings material shall enter the inlet hopper and be transported by the rotating screw into the washing zone. In the washing zone, wash water is sprayed through the hollow shaft screw and into the screenings material to help dissolve and remove organic material.

B. During normal flow conditions, the washing press shall be operated in a forward and reverse sequence via a programmable logic controller (PLC). The screenings will be transported into the washing zone where the screw shall stop rotation. Wash water will then be injected through the hollow shaft screw and into the screenings. The screw will then reverse, bring the screenings out of the washing zone and stop rotation to allow the washing zone to be flushed. The screw then once again operates in the forward direction and repeats the washing sequence. This adjustable washing process shall be repeated a minimum of six (6) times to ensure thorough cleaning of the screenings material.

C. During peak loading conditions, the washing process shall automatically switch to operate in the forward direction to handle the larger amount of screenings with only short intervals of reversing to ensure that material does not accumulate on the shaft of the screw.

D. Four (4) manual ball valves shall be provided, one (1) for each solenoid valve, to allow personnel to isolate the solenoid valves or throttle the amount of wash water.

2.2 INLET HOPPER

A. The inlet hopper shall be designed to direct screenings material from the step screen into the screw housing. The inlet hopper shall be constructed of 304 stainless steel. All attachment hardware shall be constructed of 304 stainless steel.

2.3 SCREW HOUSING

A. The screw housing and associated components shall be constructed of 304 stainless steel. The inlet flange shall have a minimum thickness of 15/16-inch and the outlet flange shall have a minimum thickness of 9/16-inch. The outlet flange shall incorporate a 12-inch pipe bolt pattern for connection to the discharge pipe.

B. The dewatering section shall incorporate anti-rotation bars around the complete circumference to contain the screenings material and prevent rotation of the screenings during the dewatering process. Counter sunk perforations shall be provided in the dewatering zone to allow the removal of the filtrate during compaction. Wash water inlets shall be provided on the top of the washing zone and on the top of the dewatering zone for automatic periodically flushing.

C. A hinged cover for the dewatering section shall be held in place by a latching system to allow easy inspection. A resilient seal shall be mounted to the cover to form a watertight seal with the screw housing. Designs that utilize covers that rely on tools for removal or designs where the cover is not removable are not acceptable.

D. The bottom of the housing shall contain a 1/2-inch thick, 304 stainless steel wedge wire section for drainage. The wedge wire section shall be constructed of individual profiled bars and shall have 2 mm linear openings. Round or slotted perforated holes in the drainage area are specifically excluded.

2.4 HOLLOW SHAFT SCREW

A. The hollow-shaft screw shall be constructed of alloy steel and it shall have a nominal outside diameter of 8-1/2 inches. The shaft shall be a minimum of 2-1/2 inches in diameter. The shaft shall be hollow with perforations located in the washing zone to allow wash water to be injected into the screenings from the inside out. Designs incorporating only radial or external spraying from the outside of the screw housing are not acceptable.

B. The outer flights shall be cold formed from continuous lengths of steel bar with a minimum thickness of 3/4-inch. After fabrication the screw shall be precision machined to ensure that it is concentric along its length. The distance between the flights shall be

arranged to allow transportation into the washing zone and compaction in the dewatering zone.

C. The screw shall have a minimum Brinell hardness of 200 and hard facing shall be applied to the end of the screw to extend the useful service life.

D. A stainless steel reinforced nylon brush shall be attached to the hollow shaft screw with setscrews in the drainage area to help prevent debris from blinding the drain. To reduce wear on the brush, the design shall be such that the screw shall not be allowed to rest in the press housing. The screw shall be fully supported and cantilevered off of the thrust bearing.

2.5 THRUST BEARING

A. An independent, stainless steel axial thrust bearing shall be flange mounted to the drive and flange mounted to the press body. The thrust bearing shall fully support the screw and handle the load created during compaction and reversal of the screw. The thrust bearing shall have a fabricated stainless steel housing and shall utilize self-aligning double tapered roller bearings located between two sets of double lip seals. The flanges on the housing shall have a 9/16-inch minimum thickness. Designs that utilize the bearing inside the gear reducer are not acceptable.

B. An O-ring seal shall be mounted in a machined groove on the face of the bearing to seal against the press body. The screw shall be cantilevered off the thrust bearing to prevent the screw from resting inside the screw housing.

2.6 DRIVE ASSEMBLY

A. The washing press shall be complete with an integrated drive assembly consisting of a TEFC electric reversing motor close-coupled to a gear reducer.

B. The motor shall be a 5.0 horsepower, 230/460 volt, 3 phase, 60 Hertz with a service factor of 1.15. The motor shall be rated at 40°C ambient with Class F insulation and shall have a Class B temperature rise at full load. The nominal motor speed shall be 1800 rpm.

C. The gear reducer shall be a parallel shaft helical gear reducer having a minimum 105:1 gear ratio. The gear reducer shall have a minimum output torque rating of 18,500 in/lbs at 15 rpm.

D. The gear reducer shall have ball or roller bearings throughout with all moving parts immersed in oil. Gears shall be of alloy steel with threads precision ground and polished after casehardening. Shafts shall be of high strength alloy steel ground to required tolerances. All ball or roller bearings shall be rated and manufactured by a member of the Antifriction Bearing Manufacturer's Association. At least one bearing on each shaft shall be of the combined radial and thrust type.

2.7 DRAIN PAN

A. A drain pan shall be mounted to the bottom of the screw housing along the full length of the housing. The pan shall be sloped towards the drain and it shall be provided with a

flushing nozzle on the dewatering end and a minimum 4-inch diameter drainpipe on the drive end. The pan shall be held in place by a latching system to allow fast and easy removal. Designs that utilize drain pans that rely on tools for removal or designs where the drain pan is not removable are not acceptable.

B. The drain pan shall incorporate a resilient seal along its top edge to form a watertight seal with the screw housing. The drain pan shall be constructed of a minimum 14-gauge 304 stainless steel.

2.8 DISCHARGE PIPE

The discharge pipe shall be mounted to the pipe flange on the press body and designed to transport the washed, dewatered and compacted screenings to the appropriate receiving device. The discharge pipe shall be constructed of 304 stainless steel pipe and shall be of the configuration as shown on the Contract Drawings.

2.9 CONTROLS

A. The washing press shall be cycled on and off by control signals from the main control panel. The washing press shall be capable of being cycled by a screen cycle counter.

B. The control system, both local and main, shall be designed and manufactured by the same company that furnishes the washing press.

C. Local controls shall consist of a NEMA 4X local control station with a mushroom head EMERGENCY STOP push-button.

D. The local controls and solenoid valves shall be factory wired to a terminal strip located inside the local control station. Four (4) brass body solenoid valves, four (4) manual 316 stainless steel ball valves and a pressure gauge shall be provided as part of a valve wash water manifold. The solenoid valves shall be activated by the PLC in the main control panel to provide wash water intermittently during cleaning and flushing cycles. The local control station and valve manifold shall be mounted on a common floor mounted 304 stainless steel support stand.

E. Furnish one (1) main control panel for the washing press and associated step screen. The main control panel shall be totally enclosed, front access type with top/side/bottom entry. The panel shall be manufactured by a U.L. listed control panel facility and shall bear a U.L. label. Construction of the control panel enclosure shall be NEMA 4X, 316 stainless steel with indicating devices and switches mounted on the front door.

F. Main control panel wiring shall be color-coded, labeled, neatly cabled and supported in nonflammable wiring raceways. Wiring shall be per Specification 13390 – Package Controls Systems.

G. The control panel wiring shall contain all power and control devices shown on the Contract Drawings, which shall include, but not be limited to, the following:

1. One (1) control power On-Off selector switch.
2. One (1) red pilot light for “Running” indication.

3. One (1) amber pilot light for “Over Current” indication.

4. One (1) amber pilot light for “Motor Overload” indication.

5. One (1) white pilot light for control power.

6. One (1) momentary “common reset” push-button for over current/overload reset.

7. One (1) programmable logic controller (PLC). The PLC shall be a Modicon M340 with on-board Ethernet port.

8. One (1) human machine interface (HMI) located on the exterior of the control panel. The HMI shall be a Magelis.

9. One (1) surge arrestor to protect the PLC.

10. One (1) line filter to control line-to-ground noise to the PLC.

11. One (1) interposing relay on each PLC output.

12. One (1) surge suppressor on each interposing relay on the PLC outputs.

13. One (1) five port Ethernet switch.

14. One (1) 24VDC power supply for the Ethernet switch and OIT.

15. One (1) elapsed time meter.

16. One (1) 480 VAC to 120 VAC control power transformer.

17. One (1) Full voltage NEMA rated reversing starter. The magnetic starter shall be of the heater-less design and provide phase loss protection, short circuit self-protection and thermal memory. The solid-state overload shall be self-powered.

18. One (1) current sensing relay (CSR). The CSR shall continuously monitor the motor current to prevent damage due to a jam obstruction or a unit malfunction. If the preset/adjustable current setting is reached, the equipment will be shut down and an alarm signal generated. The cause of the alarm should be investigated and corrected. The alarm shall be manually reset prior to the unit returning to normal operation.

19. Spare contact for remote indication of “Over Current” alarm.

20. Spare contact for remote indication of “Motor Overload” alarm.

21. Spare contact for remote indication of “Running”.

22. Control logic shall be PLC based with timers and counters written in ladder logic. Timers and counters shall be adjustable via an operator interface on the exterior of the control panel.

23. One (1) HAND-OFF-AUTO switch.

24. One (1) FORWARD-OFF-REVERSE switch.

25. One (1) INITIATE push-button.

26. One (1) circuit breaker.

H. All selector switches, pushbuttons and pilot lights shall be NEMA rated components. IEC rated components are not acceptable.

I. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

2.10 SEQUENCE OF OPERATION

A. The washing press shall be manually operable from the main control panel.

B. The washing press shall be operated in an automatic washing mode during normal flow events via a programmable logic controller (PLC) in the main panel. The press controller will count the number of screen cycles and when the operator adjustable number of cycles is met, the washing mode operation begins. The screenings will be transported into the washing zone where the screw shall stop rotation in the forward direction. Wash water will then be injected through the hollow shaft screw and into the screenings. The screw will then reverse, bring the screenings out of the washing zone and stop rotation to allow the washing zone to be flushed. The screw then once again operates in the forward direction and repeats the washing sequence. This adjustable washing process shall be repeated a minimum of six (6) times to ensure thorough cleaning of the screenings material. The screw will then rotate in the forward direction to transport the screenings to the compaction zone for dewatering and ejection into the discharge pipe.

C. The washing press shall be operated in an automatic storm mode during high flow events via a programmable logic controller (PLC) in the main panel. The screenings will be transported directly into the compaction zone upon a signal from the screen high differential level set point. Upon activation in the storm mode, the screw will run in the forward direction with short intervals of screw reversal to insure the screenings do not accumulate on the shaft of the screw. The storm mode of operation shall insure that the washing press will keep up with the automatic operation of the screen during high flow events.

2.11 FASTENERS

A. All fasteners and anchor bolts shall be 304 stainless steel unless otherwise indicated in this specification. Anchor bolts shall be provided by the Manufacturer for mounting the washing press and the solenoid valve manifold/local control station support stand. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly.

2.12 LUBRICATION

A. The Manufacturer shall state in the operating manual the amount of and specification for any lubricant required.

2.13 PROTECTIVE COATINGS

A. Stainless steel and plastic components shall not be painted. The stainless steel structural components and enclosure panels shall be bead blasted and passivated after fabrication to remove embedded iron, surface rust and weld burn. All other surfaces shall be blast cleaned to an SSPC-SP6 finish, removing all dirt, rust, scale and foreign materials.

B. Cleaned surfaces shall be shop primed with one (1) coat of TNEMEC 69-1212 primer, or equal, to attain a minimum dry film thickness of 2.5 mils. The motor and gear reducer shall be finish coated and shall be painted the same color.

2.14 SPARE PARTS

A. The Contractor shall furnish the following spare parts for the washing press:

1. Two (2) solenoid valves
2. Two (2) sets of wear bars and attachment hardware (if applicable)
3. One (1) stainless steel reinforced nylon brush for hollow shaft screw

B. All spare parts shall be properly packed in a white wooden box, labeled and stored where directed by the Owner or Engineer.

PART 3 - EXECUTION

3.1 TESTING

A. The washing press shall be factory assembled and factory run tested prior to shipment. The main control panel shall also be factory tested with the equipment prior to shipment.

B. The washing press shall also be field tested after erection in the presence of the Owner and Engineer to confirm and verify the structural and mechanical compliance to the specification. As a minimum, field testing shall include demonstration that the washing press can pass four (4) 12-inch long oak 2x4's, four (4) red bricks and four (4) 12-inch long pieces of 4-inch diameter Schedule 80 PVC pipe. The field acceptance test shall include demonstrating that the washing press operates without vibration, jamming or overheating and perform its specified function satisfactorily.

3.2 INITIAL START-UP AND TRAINING

A. The Contractor shall provide the services of a factory-employed service technician who shall adequately inspect the installation, test the equipment furnished under this Contract and instruct the Owner's operating personnel in its maintenance and operation. Factory-employed service technicians are required. Manufacturer's sales representatives are not deemed acceptable to provide the start-up service. The services of the technician shall be provided as follows:

1. One (1) trip and two (2) days of service to inspect and certify the installation prior to startup and provide Owner's personnel in proper operation and maintenance of the equipment. Start-up service can be combined with the start-up service for the step screen if the same Manufacturer provides both pieces of equipment. Service shall also include four (4) hours of program specific training.

END OF SECTION

SECTION 11338– CIRCULAR SECONDARY CLARIFIER

PART 1 – GENERAL

1.1 DESCRIPTION

A. The Contractor shall furnish and install equipment for two (2) center-drive type circular secondary clarifiers, supported on a stationary influent column, with the flow entering at the bottom of the influent column and flowing upward to the inlet openings and dispersed into the tank through the EDI and flocculating feedwell. The equipment shall include a center drive unit and torque control, walkway and platform with handrail, stationary influent column, energy dissipating inlet (EDI), center feedwell, rotating drive shaft, plow-style rake arms with blades, anchor bolts, scum skimmers, scum box, effluent weir, scum baffle, spray bars, and all other appurtenances required or shown on the Drawings.

1.2 SUBMITTALS

A. Circular Secondary Clarifier Shop Drawings: Submit for review the following at a minimum:

1. Certified Drawings. Certified general arrangement drawings showing all important details and materials of construction, dimensions, loads on supporting structures and anchorage location.

2. Circular Secondary Clarifier Product Data. Descriptive literature, bulletins, and/or catalogs of the equipment.

3. Drive Unit. Complete data on motors and speed reducers.

4. Electrical Schematics. Electrical schematics for all control equipment to be furnished.

5. Drive Unit Design Calculations. Calculations documenting the AGMA rating of the drive unit and life of the main bearing prepared and signed by a registered professional Engineer.

6. Torque Overload Device Product Data. Complete descriptive information and electrical schematic for torque overload device.

7. Sludge Transport Calculations. Complete sludge transport calculations substantiating the rake blade design, rake tip speed, and floor slope.

8. Circular Secondary Clarifier Design Calculations. Complete process calculations substantiating the sizing of the EDI, outlets, and outer feedwell. These calculations shall be based on parameters from the Manufacturer's operating experience. These parameters shall be verified by data presented from successful operating installations.

B. Circular Secondary Clarifier. Certificate as Warranty: Submit per Section 1.6.

C. Circular Secondary Clarifier Manufacturer's Experience: The submittal shall include data from a minimum of five (5) successfully operating installations that verify the experience of the Manufacturer. Data shall include performance verification of influent flow rate (Q), hydraulic loading (OFR), effluent suspended solids (ESS), return sludge solids concentration (RSS), return activated sludge flow rate (RAS) for secondary clarifiers, and waste sludge flow rate (WAS).

D. Clarifier ISO 9001 Certification: To show evidence of being able to provide the quality of equipment and services described in this specification, the equipment supplier shall submit their ANAB-accredited ISO 9001 quality system certification. AIAO-BAR accredited systems are not a recognized equivalent and are therefore specifically prohibited. The quality procedures shall provide for a means of qualifying all sub-vendors and shall specify that the fabrication facility is a critical vendor and shall require inspection. The quality system shall be audited on-site by a third-party independent registrar at least annually. Certification shall remain in effect throughout the project start-up.

E. Circular Secondary Clarifier O&M Manuals: Submit Operation and Maintenance Manuals in accordance with this specification.

1.3 ACCEPTABLE MANUFACTURERS

A. The circular secondary clarifier equipment shall be as manufactured by the following:

1. Ovivo USA (formerly Enviroquip, Inc. of Austin, Texas)

2. Ovivo USA (formerly EIMCO Water Technologies, LLC)

3. WesTech Engineering, Inc.; Salt Lake City, UT.

4. Walker Process Equipment, Div. of McNish Corp.

5. Or Engineer pre-approved equal.

1.4 QUALITY ASSURANCE

A. All the equipment specified under this Section shall be furnished by a single, reputable Manufacturer who meets the experience requirement, as specified in this section, and is qualified in the manufacture of said equipment, as specified in Section 1.3.

B. The equipment supplier shall have at least 15 years experience in the design, application, and supply of circular secondary clarifiers in water or wastewater treatment plants, and shall submit a list of not less than 25 operating installations of secondary clarifiers with plow rake blades and EDI as evidence of meeting the experience requirement. This experience shall be evidenced by process performance data that is submitted showing actual data on a minimum of five existing installations that are operating successfully as required in the submittal section.

1.5 DELIVERY AND HANDLING

A. The Contractor shall store the supplied equipment in accordance with the Manufacturer's recommendations and instructions. Gear reducers and motors shall be stored in buildings or trailers which have concrete or wooden floor, a roof and fully enclosed walls, and will protect the equipment from dust, dirt, and moisture. Equipment provided with space heaters shall be connected to a temporary power source to provide continuous operation of the heaters until the site is ready for installation. Rotate all shafts with bearings on a monthly basis. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

1.6 WARRANTY

A. Warranty: A written supplier's warranty shall be provided for the equipment specified in this section. The warranty shall be for a minimum period of five (5) years from start-up or 66 months from time of equipment shipment, whichever comes first. Such warranty shall cover all defects or failures of materials or workmanship which occur as the result of normal operation and service except for normal wear parts (i.e. squeegees, skimmer wipers, etc.).

PART 2 – PRODUCTS

2.1 DESIGN CRITERIA

A. Circular Secondary Clarifier design shall conform to the following:

1. Influent flow rates per clarifier (MGD - w/o recycle)
   - Design (avg. flow): 0.5 MGD
   - Maximum (max. daily flow): 1.5 MGD
2. Volume per clarifier (Mgal approx.): 0.113
3. Design recycle rate (MGD): 0.5
4. Max. recycle rate (MGD): 1.0
5. Tank diameter (ft.): 40
6. Side water depth (ft.): 12.0
7. Freeboard (ft.): 2
8. Bottom slope (ft./ft.): 1:12
9. Column pipe diameter (in.): 18"
10. Scum box width (ft.): 2.0
11. Motor HP: 0.75
12. Torque (ft.-lbs.)
    - Design running: 16,600
    - Momentary peak: 33,200

13. Mechanism rotation: Clockwise

14. Rake arm tip speed: 8-12 ft/min

2.2 GENERAL DESIGN

A. Description: The secondary clarifier mechanism shall be of the center drive type, mounted on a walkway which spans the tank radius and bears on a center column. Flow shall enter the energy dissipating inlet through an influent feed pipe and then proceed into the feedwell through tangential gates near the water level for further energy dissipation and settling. The secondary clarifier shall be designed to remove settled sludge from the bottom of the tank and floating scum from around the periphery of the tank.

The secondary clarifier shall perform the following integrated functions:

1. Dissipate energy and control localized currents.

2. Separate solids from the clear liquid.

3. Evenly withdraw the clear liquid.

4. Transport and thicken settled sludge.

5. Prevent sludge dilution at withdrawal point.

6. Remove scum from the secondary clarifier surface.

B. Materials: All structural steel shall conform to the requirements of ASTM A36. Steel pipe used for structural members shall conform to ASTM A53. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of 1/4" unless otherwise noted. All aluminum shall be type 5052, 6061, 6063, or 2014 alloy unless noted. All stainless steel shall be 304SS.

C. Fabrication: Shop fabrication and welding of structural members shall be in accordance with the latest edition of the “Structural Welding Code”, AWS D1.1, of the American Welding Society. All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16" fillet weld. Intermittent welding shall not be allowed.

D. Edge Grinding: Sharp projections of cut or sheared edges of ferrous metals shall be ground to a radius by multiple passes of a power grinder as required to ensure satisfactory coating adhesion.

E. Shop Surface Preparation/Coating: All submerged and non-submerged steel shall be hot dip galvanized after fabrication per ASTM A-123. All non-submerged iron and steel surfaces, except the drive unit, shall be field cleaned and painted to ensure paint compatibility and assign unit responsibility for the coating system. The drive unit shall be coated with the supplier’s standard enamel paint system.

F. Structural Design: The ratio of un-braced length to least radius of gyration (slenderness ratio) shall not exceed the values listed in the AISC manual. For angles, the radius of

gyration shall be taken about the Z-Z axis. In addition, all structural members and connections shall be designed so that the unit stresses will not exceed AISC allowable stresses by more than one-third when subject to loading of the previously listed peak torque. All steel design shall be in accordance with the AISC Manual of Steel Construction, latest edition, and the Uniform Building Code (UBC), latest edition.

2.3 DRIVE UNIT

A. Design Parameters: The drive unit shall be designed for the torque values previously listed. It shall turn the mechanism at the design collector tip speed. The drive unit shall be capable of producing and withstanding the previously listed momentary peak torque while starting.

Any and all welding on the drive unit shall be done using E70XX weld rod.

B. Physical Characteristics: The drive unit shall consist of a motor, speed reducer(s), main gear, and support base. The drive shall be mounted on the walkway and support the entire rotating load of the mechanism. All speed reducers shall be fully enclosed and running in oil. Support base for the drive shall be of welded steel or cast iron to assure rigidity. Lubricant and dust seals shall be provided. Lubrication fittings shall be readily accessible.

C. Sludge pick-up style secondary clarifiers shall include the following characteristics:

The center drive assembly mounted to the center pier shall consist of a cast iron turntable base with ball race, and an internal forged steel spur gear designed such that the gear, bearing balls, and raceways can be removed for service or replaced without removing the access bridge, gear housing, or disconnecting the drive cage and anything attached thereto from the drive assembly. All repairs or replacement of drive components can be performed without dewatering the collector basin or disrupting the flow through the basin. All work should be performed with the aid of only a portable hoist with no more than a one-ton capacity. The disassembly, and removal of the main gear and bearing without disconnecting the drive cage must be demonstrated to the Owner and Engineer during the field check-out by the Manufacturer.

The main gear shall be an internal cut spur gear which shall be of AISI 1045 forged steel, hardened to 250/300 BHN, having a 99,000 psi yield strength. The main gear shall have teeth with a diametral pitch and length to produce 16,600 ft.-lbs. continuous operating torque as calculated by AGMA 2001-B88. The gear shall have a minimum 30.0" pitch diameter. The gear teeth shall be stressed to no more than one-third of the yield strength (47,000 psi) at the continuous rated output torque.

The main bearing shall have a minimum 35" ball race diameter and 1¼" diameter chrome alloy balls with nylon spacers. The bearing balls shall run completely submerged in an oil bath protected by dust seals and an automatic condensate drain. The bearing balls shall be of Type 52100 steel hardened to 60/66 Rc. The bearing balls shall rotate in a full circle four-point contact raceway having a 60-degree contact angle for the transfer of large thrust and overturning moment loading. The raceway shall be induction hardened to 60 Rc for a depth of 3/16"

and ground to shape. Strip Liner style bearings comprised of 4 or more strips of hardened steel will not be acceptable.

A separate circular cast iron load and torque transfer ring with heavy cast iron mounting pads for the drive cage shall be bolted to the inner rotating race of the gear-bearing. Each of the four mounting pads shall have provision for four fasteners.

The main gear housing shall be a heavy casting of high strength Class 40B gray iron. The housing shall be adequately proportioned and stiffened to support the entire rotating weight of the mechanism, the access bridge, and all possible dead and live loads anticipated for the life of the equipment. The housing shall be circular in shape to conform with the general geometry of the spur gear bearing and load plate, and shall provide a containment for the oil bath lubrication of the spur gear and bearing.

The main gear housing shall be fitted with oil fill ports and an oil level sight glass. Two drains shall be provided to assure the complete removal of spent oil and condensate from the housing. One drain shall be fitted with a condensate sight glass and drain assembly. The center opening of the housing shall be fitted with a removable steel floor plate for access to the oil and condensate drain. The main housing shall also be fitted with a minimum of eight mounting/leveling bolts, 1" in diameter.

The spur gear shall be driven by an internal pinion. The pinion shall be machined from AISI Type 4140 alloy steel, quenched and tempered to 350/400 BHN hardness. The pinion shall be keyed to and driven by a low speed shaft mounted between bearing assemblies to offset the overhung load produced by gear meshing.

The intermediate reducer shall be a heavy duty commercially available helical gear set. The gears shall run in oil and shall include antifriction bearings throughout. The entire gear set shall be totally enclosed in a cast iron housing and shall bolt to the top of the spur gear housing.

The intermediate reducer shall be driven by a directly coupled primary helical reducer. The primary gear reducer shall be commercially available, enclosed in a cast iron housing. The primary reducer shall be directly coupled to a 1725 RPM, 3/60/460, TEFC, flange motor of the standard "Severe Duty" classification for hostile environments. Motors shall be NEMA Design Class B employing Class F insulation with 1.15 SF.

D. Overload Protection: An overload device shall be provided in a stainless steel or aluminum, weatherproof enclosure. The device shall be actuated by torque generated from the main drive, which shall operate two independently adjustable switches (the alarm switch at 100 percent of design running torque and the motor cutout switch at 120 percent of design running torque). These two switches shall be factory adjusted to accurately calibrate the alarm torque value and the overload position. A visual torque indicator shall be provided and oriented so that it may be read from the walkway. It shall be calibrated from 0 to 160 percent of design running torque.

E. Speed Reducing Unit: The speed reducing unit shall consist of cycloidal, helical, or planetary speed reducers.

The main ring gear of cycloidal drives shall be made of high carbon chromium bearing steel and be fixed to the drive casing. An eccentric bearing on the high speed shaft shall roll cycloidal discs of the same material around the internal circumference of this main ring gear. The lobes of the cycloid disc shall engage successively with pins in the fixed ring gear. The movement of the cycloid discs shall be transmitted then by pins to the low speed shaft. Speed reducer efficiency shall be a minimum of 90% per reduction stage.

Speed reducer helical or planetary gearing shall be manufactured to AGMA standards and shall provide at least 95% power transmission efficiency per stage. The speed reducer shall have a minimum service factor of 1.25 based on the output torque rating of the drive.

The reducers shall be fitted with radial and thrust bearings of proper size for all mechanism loads and be oil or grease lubricated. As a safety feature, the speed reducer shall be back driveable to release any stored energy as the result of an over torque condition.

If chain and sprocket are employed, the gearmotor primary speed reducer shall drive a secondary worm gear reducer through a #60 roller chain and steel sprockets enclosed in a galvanized 22 gauge steel guard. A constant speed motor shall drive the speed reducer. The roller chain shall not exceed a minimum tensile strength greater than 4 times the chain pull based on momentary peak torque and the power rating shall not exceed the transmitted power (based on continuous running torque) by a 1.5 (minimum).

F. Motor: The motor shall be a squirrel cage, induction type, TEFC, ball bearing heavy duty unit of ample power for starting and operating the mechanism without overload, with a minimum service factor of 1.15, and have bearings with a minimum B10 rating of 50,000 hours. Each motor will be NEMA Design B employing Class F insulation designed for an ambient temperature of 40 degree C.

Power supply to the equipment shall be 480 volt, 60 hertz, 3 phase.

2.4 CENTER COLUMN

A. A stationary center column shall be provided which shall serve as the influent pipe. One end shall have a 1-1/4 inch support flange for bolting to the foundation with a minimum of eight (8) 1-1/4 inch diameter anchor bolts as shown on the plans. A similar flange shall be provided at the top of the column for supporting and securing the center drive assembly. Minimum center column thickness shall be 1/4".

B. Influent openings shall be provided in the upper portion of the column to allow unrestricted passage of the flow into the energy dissipating feedwell. Influent velocity shall be reduced by providing a total inlet port area a minimum of 135 percent of the center column cross sectional area.

2.5 WALKWAY AND PLATFORM

A. Walkway: One (1) 36" wide walkway and platform with handrails shall be supported by the tank wall at one outer end and the center column on the other, and shall be designed to safely withstand a live load of 50 pounds per square foot. Deflection shall not exceed L/360 when both the dead load and live loads are applied. It shall consist of two trusses or beams with 1-1/4" x 3/16" aluminum I-bar grating between the trusses or beams. The walkway shall be diagonally braced against lateral movement, and provided with handrails 42" high, of double-row 1-1/2" diameter horizontal aluminum pipe, and 1/4" x 4" high kickplates on both sides. Walkway trusses may serve as the handrail if the top chord is 3'-6" above the walking surface.

Stainless steel bearing plates, UHMW-PE slide plates, and anchor bolts for the wall support shall be provided by the equipment supplier and installed by the Contractor. Bearing plate dimensions and anchor bolt diameter, length, quantity, and arrangement shall be per the equipment supplier. The Contractor shall block out or otherwise modify the tank or support structure to accommodate walkway and supports, if required.

B. Center Drive Platform: A center drive platform shall be provided which allows 24" clearance outside the center drive components. It shall consist of 1/4" aluminum checkered plate with necessary stiffeners and supports, resting on the drive unit and center column, and provided with connections to the walkway. The entire platform shall be surrounded by handrails 42" high of double-row 1-1/2" diameter horizontal aluminum pipe with 1/4" x 4" high kickplates.

2.6 INFLUENT AND SLUDGE REMOVAL

A. The drive cage shall be provided with connections for the two sludge rake arms and feedwell supports. The cage shall be bolted to the drive unit, which shall rotate the cage with the attached arms and feedwell. The cage and each arm shall be designed to withstand 150 percent of the design running torque of the drive without over stressing the members. Loading to develop the torque shall be considered as uniform loads applied to each arm individually.

The rotating cage shall have adequate structural strength to support the entire rotating mechanism, including rake arms, scum scraper and support, scum skimmer, and feedwell. Design shall accommodate dead load plus live load and torque with an adequate factor of safety to eliminate deflection or vibration.

B. Energy Dissipating Inlet: A circular energy dissipating inlet with bottom shall be designed to diffuse the liquid into the feedwell in a tangential direction without excessive disturbance or formation of vertical velocity currents. The EDI shall be designed to positively prevent sludge from depositing within the EDI and shall include bottom drain holes.

The detention time of the EDI shall be included in the submittal with the design calculations and shall show proper process application as evidenced by the required successful operating installations.

The EDI shall include an upper rim angle for stiffness. Multiple tangential diffuser gates shall be provided to induce a clockwise tangential flow velocity between the EDI and

feedwell and specifically preclude any vertical currents. The vertical wall of the gates shall be curved at a constant radius and shall not restrict the flow. The tangential baffles shall extend past the gate openings at least the same distance as the opening width. The gates shall have a fixed bottom to prevent vertical currents as the flow exits the EDI.

The EDI shall be made of not less than 3/16" thick steel plate with necessary stiffening angles.

C. Feedwell: The flocculating feedwell shall be located outside of the EDI to diffuse the liquid into the tank without disturbance or formation of velocity currents. Baffled openings shall be provided near the water surface to allow scum to exit the feedwell.

The supports for the feedwell shall be located above the liquid extending from the cage. No feedwell support or feedwell spliced connection shall be contained within the annular space formed between the feedwell and EDI. The depth of the feedwell shall be such as to provide proper detention time and an exit velocity at maximum flow that will not scour the settled sludge. The diameter, depth, detention time, and exit velocities shall match the process application calculations as evidenced by the required successful operating installations.

The feedwell shall be made of not less than 3/16" thick steel plate with necessary stiffening angles.

D. Inlet Pipe: A steel inlet pipe shall be provided for delivering influent into the feedwell. The pipe shall discharge vertically into the EDI and be supported from the tank wall.

E. Sludge Rake Arms: The mechanism shall include two sludge rake arms of steel construction with plow-shaped steel scraper blades and adjustable stainless steel squeegees. Squeegees shall be fastened to the rake blades with stainless steel fasteners.

Scraper blades shall be designed for sufficient sludge transport capacity to handle the design solids loading rate, with the depth of the blade varying from a minimum at the tank periphery to a maximum at the tank center.

Blades shall properly convey settled sludge to the center sludge cone. The arm supports shall be adjustable at the shaft to assure an even grout thickness over the tank bottom.

The rake speed shall be sufficient to transport the necessary volume of sludge to the sludge outlet, but shall not resuspend settled sludge.

2.7 SCUM REMOVAL

A. General: The secondary clarifier Manufacturer shall furnish a minimum of one (1) skimming device as part of each clarifier mechanism. The skimming mechanism shall be arranged to sweep the surface of the sedimentation compartment, automatically removing scum and floating material to a scum box at the periphery of the tank.

B. Skimmer Construction: The rotating scum skimmer shall include a horizontal steel plate skimmer blade supported by vertical steel members extending up from the rake arms. The blade shall extend tangentially from a point 6" away from the influent feedwell to the hinged scum skimmer assembly at the tank periphery.

C. Scum Skimmer Assembly: A hinged scum skimmer assembly shall be mounted on the outer end of the skimmer blade. The hinged scum skimmer assembly shall be designed to form a pocket for trapping the scum. The hinged arrangement shall insure continual contact and proper alignment between wiper blade, scum baffle, and ramp as the blade travels up the scum box ramp. The wiper blade shall have a wearing strip on its outer end, which contacts the scum baffle and a neoprene strip on its lower and inner edge. The neoprene wipers shall be a minimum 1/4" thickness. The scum is trapped as the wiper blade meets the ramp and is raised up the ramp to be deposited into the scum trough for disposal.

D. Scum Box: The scum box shall be a minimum of 2' wide, supported from the tank wall and connected to the scum withdrawal piping. It shall be made of 1/4" thick welded steel plate. The box shall have a scum trough, vertical steel sides, and a sloping approach ramp that extends from 1 1/2" above water level to 5 1/2" below. A similar ramp shall be provided at the opposite end to allow the skimmer blade to lower back to the operating position. A flexible connector shall be provided for connection to the Contractor supplied scum withdrawal piping in the tank wall.

E. Scum Flushing Valve: A valve shall be attached to the scum box which automatically opens and allows clarified liquid into the scum box to flush out solids. The valve shall actuate at every pass of the scum skimmer over the scum box, allowing sufficient delay after deposit of the solids before flushing begins. Delay and flush duration shall be adjustable. The valve shall be constructed of oil impregnated UHMW-PE disks with stainless steel rods and stainless steel hardware. The opening and closing of the scum flushing valve shall be one smooth continuous movement. The valve shall provide 0 to 20 gallons of flush water per each pass of the skimmer assembly.

F. Scum Baffle: The baffle shall consist of 1/4" thick x 12" deep fiberglass sections. The baffle sections shall be curved and fastened to the launder wall with adjustable FRP support brackets, stainless steel fasteners, and anchor bolts.

2.8 EFFLUENT REMOVAL

A. Launder: A rectangular effluent launder shall be provided around the perimeter of the tank. The launder shall be formed as part of the concrete wall. A drop-out box shall be provided in the bottom of the launder at one point for collection and discharge of the clarified effluent.

B. Weir: An adjustable weir shall be provided around the periphery of the tank at the water surface for removal of clarified effluent.

The weir shall consist of 1/4" thick x 9" deep fiberglass sections with 2 1/2" deep 90 degree v-notches at 6" intervals. The weir sections shall be curved and fastened to the launder wall with special large washers, anchor bolts, and hex nuts to allow vertical adjustment. To prevent leakage all surfaces between the launder walls and weir plates shall be given a seal coat of suitable mastic by the erection Contractor.

2.9 ELECTRICAL

A. The equipment supplier shall furnish all electrical items specifically called for in this Specification section. The Contractor shall supply and install all other electrical items required to place the equipment into service.

Reference Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

A Hand/Off/Auto switch shall be installed on scum sprayers and clarifier drives. Provide switch position status to Main Control Panel. Refer to project Instrumentation Diagrams for equipment signals required.

Scum sprayers and clarifier drive shall allow for remote control from main control panel.

The Contractor shall supply and install all field wiring required including but not limited to proper size wire, conduit, fittings, and supports.

2.10 ANCHORAGE AND FASTENERS

A. Anchor Bolts: All anchor bolts shall be a minimum of 1/2” diameter and made of type 304 stainless steel. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.

B. Fasteners: All structural fasteners shall be a minimum of 1/2” diameter and made of type 304 stainless steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The equipment shall be installed properly to provide a complete working system. Installation shall follow the supplier’s recommendations.

A 2" layer of grout shall be applied to the tank floor in strict accordance with the Manufacturer's recommendations. Screed boards shall be supplied by the erecting Contractor.

B. Manuals: The equipment supplier shall furnish six (6) copies of operation and maintenance manuals which will be retained at the installation site to assist plant operators. The manual shall include the supplier’s erection and assembly recommendations and a complete list of recommended spare parts.

C. Shop Assembly and Inspection: The equipment specified herein shall be factory assembled as far as practical to verify that all mating parts can be field assembled. All mating parts shall be trial fit and match-marked. The Manufacturer shall submit certification of shop trial assembly and photographs of assembly before shipment. The customer and installing Contractor shall be given the opportunity to witness the shop assembly.

Shop inspection shall be performed by a qualified inspector and certified by the Manufacturer. The inspection shall be documented and all deficiencies noted, corrected, re-inspected and final completion formally authorized. Final shipment authorization shall be by the Manufacturer to ensure completion of all fabrication, assembly, and inspection requirements. Inspection records and evidence of inspector qualification shall be submitted to the Owner upon request.

D. Field Service: The equipment supplier shall provide the service of a qualified representative for three (3) trip(s) and four (4) day(s) to inspect the mechanism installation, lubrication, torque test, assist in start-up, and instruct plant personnel in the proper operation and maintenance of the mechanism.

E. Field Testing:

1. Torque Tests: The clarifier mechanism shall be field torque tested. The purpose of the torque test is to verify the structural integrity of the mechanism structural steel design and center drive unit. The testing shall be carried out under the supervision of the equipment Manufacturer's representative and as approved by the Engineer before the mechanisms are accepted and placed into operation.

2. The torque test shall consist of securing the rake arms by cables to anchor bolts installed by the Contractor in the tank floor at locations specified by the equipment Manufacturer. A load shall be applied gradually to the scraper arm by means of a ratchet lever and cylinder connected to the cable assembly.

3. The magnitude of the applied load shall be measured by calculating the torque from the distance of the line of action of each cable to the center line of the mechanism. A reading shall be taken at the 150% value of the drive design torque.

4. The Manufacturer's service representative shall verify that the alarm, motor cut-out, and backup safety motor cut-out switches are properly set and are in proper operation to protect the clarifier mechanism as specified.

F. Operation Tests: The mechanism shall be operated in a dry tank for a minimum of 4 continuous hours before flow is allowed to enter the system. There shall be no binding, jerky, or unusual motion exhibited during this run in period. Motor amperage shall be checked at least hourly for any unusual or higher than normal figures. After the unit has successfully passed this initial test, flow shall be introduced into the tank and the same 4 hour observation test run. If the unit should fail under any of these conditions, the test shall be halted and the problem corrected. If, after several attempts, the unit does not successfully pass the field test, the faulty portion of the equipment shall be repaired or replaced and the test re-run.

END OF SECTION

SECTION 11393 – CLOTH DISC FILTER SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish all labor, materials, equipment and incidentals required for installation of one (1) Cloth Disc Filter System as shown on the Contract Drawings and as specified herein.

B. The filter system shall be provided complete with all accessories, spare parts, mounting, anchor bolts and other appurtenances as specified and as may be required for a complete and operating installation.

C. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

1.2 SUBMITTALS

A. Filter Shop Drawings: Shall include the following at a minimum:

1. Certified shop and erection drawings showing all important details of construction dimensions, anchor bolt locations, and field connections.
2. Descriptive literature, bulletins, and catalogs of the equipment, including details.
3. Installation, operation, and start-up procedures including lubrication requirements.
4. Complete motor data.
5. A list of spare parts that are supplied with the project.
6. Hydraulic Profile through the filter showing the following:
   a. Influent weir length
   b. Influent weir elevation
   c. Influent weir nappe at design and peak flow
   d. Effluent weir length
   e. Effluent weir elevation
   f. Effluent weir nappe at design and peak flow
7. The submittal data shall be prepared, in its entirety, by the equipment Manufacturer. Shop drawings prepared by the Manufacturer's sales representative, fabrication shop or other than the listed Manufacturers shall not be acceptable. No additions or modifications to the Manufacturer's submittal will be accepted, with the sole exception of a cover sheet provided by the Manufacturer's local representative.

B. Filter Design Report. Submit filter Manufacturer design report including influent and effluent design conditions, parameters and assumptions, design calculations, hydraulic and solids loading and recommended filter equipment. The design report shall consider both average and peak flow conditions. Calculations shall verify the effective filtration surface area.

C. Filter Certificate of Warranty: Submit per Section 1.7.

D. Filter Certificate of Compliance: Submit per Section 1.3.

E. Filter Manufacturer Experience: Submit per Section 1.3.

F. Filter Unit Responsibility Certification: Submit per Section 1.3.

G. Filter O & M Manual: The Filter System operations and maintenance manual shall include the following at a minimum:

1. Contact name, address, and telephone number of the nearest competent service representative who can furnish parts and technical service.
2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
3. Operating, maintenance and troubleshooting information.
4. Complete maintenance parts list.
5. Complete connection, interconnecting and assembly diagrams.
6. Approved Shop Drawings.

1.3 QUALITY ASSURANCE

A. The materials covered by these Specifications are intended to be standard equipment of proven reliability and as manufactured by a reputable Manufacturer having experience in the production of screening equipment. The equipment furnished shall be designed and constructed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Contract Drawings and operated per the Manufacturer's recommendations.

B. Certificate of Compliance. The Manufacturer shall certify that the Filter System to be supplied shall be manufactured in strict compliance with these specifications.

C. Unit Responsibility Certification. The complete Filter System specified shall be furnished by and be the product of one Manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.

D. Manufacturer Experience. The filter supplier shall have experience in the design, manufacture and service of cloth disc media filters for a minimum of ten (10) years and shall be able to demonstrate a minimum of fifty (50) successful installations within the United States utilizing similar equipment in municipal wastewater applications with cloth media.

E. Extended Warranty. In the absence of verifiable experience, the Manufacturer shall be required to provide an extended warranty and subsequent Performance Bond for the same number of years that the Manufacturer was found lacking in experience from the specified ten (10) year period. The performance bond shall commence with acceptance of the equipment and time described herein and beyond the standard warranty period.

F. Additional Information. If equipment other than that shown on the Contract Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit all information necessary to prove that the proposed equipment meets the requirements of this specification as determined by the Engineer.

G. Redesign Drawings. If equipment other than that shown on the Contract Drawings is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the Manufacturer requesting approval to submit with the request a revised design and layout of the mechanical equipment acceptable to the Engineer. Revised drawings shall show the proposed location of the alternate unit and the area required for withdrawal space of replacement or serviceable components. These drawings shall also show clearances of adjacent equipment and service area required by that equipment. In addition, any changes in architectural, structural, electrical, mechanical and plumbing requirements for the alternate shall also be the responsibility of the Manufacturer requesting approval. This shall include the cost of redesign by all affected designers. Finally, any additional cost incurred by affected subcontractors shall be the responsibility of the Manufacturer and not the Owner.

1.4 ACCEPTABLE MANUFACTURERS

A. The naming of a Manufacturer in this Section is not an indication that the Manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the Manufacturer may have the capability of engineering and supplying a system that meets the requirements of this specification.

B. Model ADFSC-54x4E-PC AquaDisk filter as manufactured by Aqua-Aerobic Systems, Inc., Loves Park, Illinois.

C. Model 2206-2F Discfilter as manufactured by Kruger, Inc.

D. Alternate equipment shall require Engineer's written pre-approved.

1.5 PERFORMANCE AND DESIGN PARAMETERS

A. The filter system shall be capable of filtering effluent from a Secondary process and shall be suitable for use after a BNR process. Design shall be for:

1. 0.5 MGD Average Daily Flow
2. 1.5 MGD Maximum Daily Flow

B. Filter influent total suspended solids (TSS) concentration shall be 15 mg/l daily average and 20 mg/l maximum at average daily flow rate.

C. Filter effluent total suspended solids concentration shall not be greater than 5 mg/l based on a monthly average.

D. Filter system shall not exceed a hydraulic loading rate of 4.9 gpm/sf at peak flow.

E. Nominal media filtration rating shall not exceed 10 microns. Filter systems utilizing media greater than 10 microns shall not be accepted.

1.6 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

1.7 WARRANTY

A. The Manufacturer shall provide a written warranty against defects in materials and workmanship. Manufacturer shall warrant the goods provided by the Manufacturer to be free from defects in materials and workmanship under normal conditions and use for a period of one (1) year from the date the goods are put into service, or eighteen (18) months from shipment of equipment, whichever first shall occur. This warranty shall not apply to any goods or parts which have been altered, applied, operated or installed contrary to the Manufacturer's instructions or subject to misuse, chemical attack/degradation, negligence or accident.

1.8 SPARE PARTS

A. The Manufacturer shall provide the following spare parts with the Filter System:

1. 2 HP Backwash Pump with motor.
2. ½ HP Gearbox with motor.
3. 2" Backwash/Solids Waste Valve and actuator.
4. One (1) full disk change/replacement.
5. One (1) pressure transducer.

PART 2 - PRODUCTS

2.1 GENERAL

A. The filter system shall include the following components:

1. Basin Mounting Brackets and Hardware
2. Drive Assembly
3. Centertube Assembly with Four (4) Cloth Media Discs

4. Backwash System
5. Backwash/Waste Pump Assembly
6. Valves
7. Influent Weir
8. Pressure Transducer Assembly
9. Float Switch
10. Vacuum Transmitter
11. Electrical Controls with Internal Components

B. All motors, pumps, and bearings shall be designed for continuous duty and long operating life in a high humidity atmosphere. All motors and pumps shall be 460 volt, 60 hertz, 3 phase.

C. Components such as gear reducers, pumps, motors, valves, and actuators shall be provided with standard recommended Manufacturer's paint, unless otherwise specified.

D. Through the wall spool piping and all external piping shall be provided by the installing Contractor. Effluent weir assembly shall be provided by the installing Contractor.

2.2 FILTER BASIN

A. The filter system shall be installed in a concrete basin. The concrete basin dimensions including filter basin, pump vault, effluent chamber and effluent channel shall be as shown on the Contract Drawings. The filter system shall be provided with a 3" manually operated butterfly drain valve in order to drain the filter basin. The butterfly drain valve shall be provided with ductile iron body, aluminum bronze disk, stainless steel shaft and EPDM seat. The butterfly drain valve shall be Nibco or approved equal.

2.3 BASIN MOUNTING, BRACKETS AND HARDWARE

A. The filter basin shall be fitted with 304 stainless steel mounting brackets to accommodate attachment of the filter components to inside of the basin. All mounting brackets shall be attached to the inside of the filter basin wall with 304 stainless steel wedge anchors and hardware. Through the wall spool piping and all filter external piping shall be provided by the installing Contractor.

2.4 DRIVE ASSEMBLY

A. The Filter System shall include an adjustable drive assembly with a gearbox, nylon drive sprocket, acetal drive chain with 304 stainless steel link pins, and a 304 stainless steel chain guard. The gearbox shall be parallel in-line helical type with a 1/2 HP drive motor rated for 460 volt, 3 phase, 60 Hz. Gear reducer shall be Nord or approved equal. Drive motor shall be Nord, Weg, Baldor, or approved equal.

B. To reduce energy demand, the drive assembly shall rotate the discs only during backwash. Systems requiring constantly rotating discs during filtration will not be

acceptable. Belt drive systems or systems with multiple drive units per filter will not be acceptable.

2.5 CENTERTUBE ASSEMBLY

A. The centertube assembly shall include a minimum 3/16" thick 304 stainless steel centertube weldment, driven sprocket, wheel assemblies, 304 stainless steel disk segment rods, and frame and cloth assemblies. The centertube assembly shall also include a Viton v-ring effluent port seal. The driven sprocket shall be multi segment made of UHMW polyethylene. All fasteners shall be stainless steel.

2.6 FILTER CLOTH ASSEMBLIES

A. The filter basin shall include four (4) cloth disc assemblies. Cloth shall be of fiber pile construction having a nominal filtration rating of 10 microns. Granular media filter systems shall not be allowed. The cloth media shall have an active filter depth of 3 to 5 mm to provide additional collisions between solids particles and the media within the media depth, resulting in capture of solids across a broader particle range. The cloth depth shall also provide storage of captured solids, reducing backwash volumes while maintaining an operational headloss. The pile cloth shall be free chlorine resistant cloth.

B. The filter system shall have a total of 215.2 square feet of minimum effective submerged filtration area.

C. Each of the four (4) cloth disc assemblies shall have a minimum of 53.8 square feet of effective submerged filtration area. Effective submerged filtration area is defined as only the portion of the disc that is submerged during filtration. Any disc area that is not submerged shall not be considered as effective area. Each disc shall be divided into no more than six (6) segments and shall be easily removable for service.

D. During filtration, the filter system shall operate in a static condition with no moving parts. The filter system shall provide for the collection of filtered solids on the outside of the cloth media surface to allow for the direct contact of cleaning systems. Filtered effluent shall be used for backwashing. The filter flow path shall be from the outside of the disc to the inside.

E. Effective Filtration Area. Only the media surface located below the effluent weir elevation shall be considered as effective filtration area since it is submerged and available for filtration 100% of the time. Media surface fused directly to the support structure such that water cannot pass through the media shall not be considered part of the effective filtration area.

F. The operator shall be able to bring a drained filter on line by simply opening the influent isolation device. If the filter design is such that it must be filled with water before the influent isolation device is opened to prevent damage to the filter media, an automated process that sequentially brings the filter back on line with a single switch shall be provided to prevent accidental media damage. The automated process shall activate a minimum 6" diameter motorized valve to fill the filter with effluent or other clean water source in not more than five minutes, verify that the filter is full, and open the motorized influent isolation device.

G. Designs that utilize a moving vacuum head as the sole means of solids removal will not be acceptable.

2.7 BACKWASH SYSTEM

A. The backwash function shall incorporate a pump that draws filter effluent through the cloth as the media rotates past the fixed backwash shoe, thereby removing accumulated solids from the cloth surface. Each disc shall be cleaned by a minimum of two backwash shoes, one on each side. The backwash shoes shall remain in a fixed position. Springs shall be used to maintain the proper tensioning of the backwash shoe against the media surface. Neither the cloth / support assemblies nor the backwash shoes shall include any gridwork overlays or other interferences that would prevent direct contact of the backwash shoes with the cloth fibers.

B. The backwash system shall include 304 stainless steel backwash shoe supports with 316 stainless steel springs, UHMW backwash shoes, reinforced PVC flexible hose with stainless steel hose clamps. The backwash shoe shall be in direct contact with the cloth to ensure effective media cleaning.

2.8 BACKWASH/WASTE PUMP ASSEMBLY

A. The backwash/waste pump assembly shall include one (1) backwash/waste pump, valves and gauges. The external piping shall include backwash and solids waste valves, two (2) 3” recirculation ball valves, one (1) 3” manually operated flow control gate valves, vacuum gauge, and pressure gauge.

B. The backwash/waste pump shall be shipped loose for field installation by the installing Contractor. Backwash piping between the filter basin and pump as well as piping following the pump shall be supplied by the installing Contractor. Installing Contractor shall supply unions or flanges for service, and interconnecting wiring.

C. The backwash/waste pump shall be a Gorman Rupp model 12B20-B, externally mounted centrifugal pump. Pump shall be provided with a 2 HP, 460 volt, 3 phase, 60 Hz motor and operate at 1750 RPM. Pump shall be rated for 130 gpm at 23 ft TDH. Motor shall be Baldor, Teco, Weg or approved equal. Each pump shall be provided with a painted steel stand with wedge anchors. Backwashing shall be initiated by basin water level, timer, or manually through the operator interface. Operator shall have the ability to specify backwash time interval elapses through the operator interface. The backwash water shall be pressurized by the filter’s backwash/waste pump for discharging from the filter system. Systems utilizing non-pressurized backwash flow will not be accepted.

D. Pump manually operated threaded gate valve shall be class 125 bronze with screw in bonnet, non-rising stem, and solid wedge. Valve shall conform to MSS SP-80 and shall be Nibco or approved equal.

E. The 3” threaded ball valves shall be a two-piece, full port, with a brass body. Valves and shall be Nibco or approved equal.

F. The vacuum gauge shall have a minimum 2.5” dial with all stainless steel welded construction, 0-30” Hg vacuum range, liquid filled, ¼” NPT process connection, 316

stainless steel bourdon tube and tip material, and bronze socket material, Ashcroft or approved equal.

G. The pressure gauge shall have a 2.5" dial with a black painted steel case, 0-15 psi, heat resistant polycarbonate window, ¼" NPT process connection, "C" shaped bronze bourdon tube, and brass socket material, Ashcroft or approved equal.

H. Filtering shall not be interrupted during normal backwashing and solids waste discharge.

2.9 VALVES

A. The Filter System shall include two (2) 2" backwash valves. Valves shall be 2 piece, flanged end, ASTM A351 Grade CF8M stainless steel body, 316 stainless steel ball and stem, fullport, with a 115 volt, single phase, 60 Hz, open / close service electric actuator. Valve / actuator combination shall be TCI / RCI (RCI, a division of Rotork), Nibco, or equal. Valve actuator shall include a compartment heater and limit switch feedback to the microprocessor in both the open and closed positions.

B. The Filter System shall include one (1) 2" solids waste valve. Valve shall be 2 piece, flanged end, ASTM A351 Grade CF8M stainless steel body, 316 stainless steel ball and stem, fullport, with a 115 volt, single phase, 60 Hz, open / close service electric actuator. Valve / actuator combination shall be TCI / RCI (RCI, a division of Rotork), Nibco, or equal. Valve actuator shall include a compartment heater and limit switch feedback to the microprocessor in both the open and closed positions.

C. The Filter System shall include a solids waste removal system consisting of perforated manifold, mounted on the floor of the filter basin. The manifold shall be designed to siphon settled solids for waste discharge through the backwash/waste pump. The operation of the solids waste removal system shall be automatic with user adjustable intervals and duration through the operator interface. Filter Systems that are designed without a solids waste removal system will not be acceptable.

2.10 INDIVIDUAL FILTER ISOLATION

A. The Filter System shall include isolation upstream as shown on Contract Drawings and provided by the installing Contractor.

2.11 INFLUENT WEIR BOX

A. The Filter System shall include a 304 stainless steel influent weir box. The weir box shall be mounted to the filter basin interior using 304 stainless steel wedge anchors and hardware. The basin wall must be smooth and plumb to facilitate a quality installation.

B. Filter systems without an influent weir box will not be accepted.

2.12 PRESSURE TRANSDUCER

A. Furnish one (1) KPSI Model 710 submersible pressure transducer unit constructed of stainless steel to monitor and report liquid level. Unit shall monitor the water level in the filter basin. Transducer shall utilize a diffused silicone semiconductor sensor protected

by an integral stainless steel diaphragm with seal fluid. Transducer output shall be a 4-20 mA signal over a 0-5 psi range. Electrical connection shall be 2-wire, loop powered through a shielded integral cable comprised of 22 AWG conductors and separate drain wire. Pressure transducer shall be provided with a mounting bracket and hardware.

2.13 FLOAT SWITCH

A. A float switch shall be furnished to indicate emerging overflow level. The float switch shall be Anchor Scientific Model GSI 40NONC-STO or approved equal. The float shall contain a non-mercury switch, chemical resistant polypropylene casing hermetically sealed and a PVC #18 AWG three conductor cable. Switch rating shall be minimum 4.5 amps non-inductive at 120 VAC.

2.14 VACUUM TRANSMITTER

A. The vacuum transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of 1 standard atmosphere to full vacuum. Transmitter shall be an IFM Effector PX series or approved equal.

2.15 CONTROL SYSTEM

A. Reference Specification 13390 – Package Controls Systems, Specification 13401 – Instrumentation and Control for Process Systems, Specification 13580 – Local Area Network (LAN) Communication System and all Division 16 Specifications. The Manufacturer must comply with all the Specification requirements.

B. The automatic and manual controls for operation of the Filter System shall be furnished fully assembled, wired and pre-programmed in a NEMA rated and UL certified control enclosure. Controls shall be provided to control or monitor equipment as described in the Contract Drawings. The control system shall include the following control components and practices:

C. Control Panel Wiring and Assembly

1. All control enclosures shall be custom assembled and wired in an Underwriters Laboratories (UL) certified cabinet shop using quality materials and labor. Short circuit rating of control enclosure shall be 5 kA RMS symmetrical @ 480VAC (120VAC)(240VAC) maximum.

2. All control panel wiring shall comply with Specification 13390 – Package Controls Systems.

3. All wires shall be clearly marked with an identification number consistent with the wiring schematic drawing. Wire markers shall comply with Specification 16200 – General Wiring Methods, and Specification 13390 – Package Controls Systems.

4. Wiring inside the control panel shall be run in PVC wiring duct rated for continuous temperatures up to 122° F (50°C). Devices mounted in the enclosure door shall have wires run in spiral wrap to avoid pinch points when opening and closing the door.

5. Control components mounted internal and external to the enclosure shall be mounted with stainless steel hardware and clearly labeled with a phenolic identification nametag. The tag shall be white with black lettering.

D. Control Panel Quality Assurance

1. All Control panels shall be UL certified. Testing by Manufacturer's electrical Engineer prior to releasing for shipment shall be completed. Testing shall consist of the following:

   a. Point to point testing of all wiring prior to application of power

   b. Intended supply voltage shall be applied to the enclosure

   c. All components shall be tested for proper operation and calibration

   d. The PLC and operator interface program shall be loaded and functionally checked

   e. All components shall be checked to confirm proper mounting specifications have been followed

   f. Enclosure shall be inspected for defects and repaired if necessary

   g. All labeling of wires and devices are correct, properly installed and clean

2. The Manufacturer shall finalize the factory checkout by completing a control panel checklist to document all testing completed above. This document must be signed by Manufacturer's electrical Engineer, prior to release for shipment.

3. Upon the successful completion of the control testing of the enclosure assembly, all applicable documentation (i.e. finalized drawing set, signed control checklist cover page, device data sheets, etc.) shall be placed in the drawing pocket of the enclosure.

E. Control Enclosure

1. The automatic controls shall be provided in a UL listed, NEMA Type 4X 316 stainless steel (14 gauge) wall mounted enclosure that provides insulation and protection for electrical controls and components from highly corrosive environments indoors and outdoors. Enclosure shall include a seamless foam-in-place gasket to assure watertight and dust-tight seal. An internal 3-point latch and 316SS padlocking POWERGLIDE® handle shall be provided. Enclosures shall be unpainted, with a smooth #4 brushed finish. Enclosure shall include a painted white mild steel (12 gauge) sub-panel mounted with collar studs. Enclosure shall be manufactured by Hoffman or approved equal.

F. Corrosion Inhibitor

1. Each control enclosure assembly shall be provided with corrosion inhibitors to protect interior electrical components from damage caused by high humidity. The corrosion inhibitors shall be installed prior to shipment to provide protection during shipment and storage of the enclosure.

2. The corrosion inhibitor shall be Hoffman AHCI5E or approved equal.

G. Air Conditioner

1. A thermostat controlled air conditioner with noise suppression shall be supplied to protect control components mounted inside the enclosure from high temperatures, humidity and ambient air contaminants. The air conditioner shall be constructed of brushed finish stainless steel 304 material and provide NEMA 4X Type protection from outdoor and hose-down applications. The air conditioner unit shall use CFC-free or environmentally safe refrigerant that is universally accepted. The air conditioner shall be manufactured by Hoffman or approved equal.

H. Main Disconnect Circuit Breaker

1. A UL listed, automatic molded case 3-pole disconnect breaker shall be provided in the control enclosure(s). The primary function of the disconnect switch shall be to provide a means to manually open a circuit and automatically open a circuit under overload or short circuit conditions. The disconnect breaker shall have a door mounted operating mechanism with trip indication. Power distribution connectors shall be mounted integrally to the circuit breaker for multiple load connections. Integral connectors shall be provided. The disconnect circuit breaker shall be a Square D/FAL, HDL, JDL, LAL, MGL, PGL or approved equal.

I. Motor Starter

1. A UL listed Self-Protected Combination Motor Controller shall be provided for all motors. The starter shall combine all the functions of a disconnect, circuit breaker, contactor and overload relay in a coordinated motor controller. The starter shall be an NEMA rated starter, provide a minimum 42 kA interrupt rating, a padlockable isolation knob and a 600 VAC insulation rating. Contactor coil voltage shall be rated for 120 VAC. Mechanical-life of 15 million make/break operations. Overload protection shall be class 10 and be ambient compensated. Motor starters shall be Schneider Electric TESYS U or approved equal.

J. Transformer

1. A step-down multi-tap transformer shall be supplied when there is a necessity to reduce incoming 3-phase power to 120 VAC single-phase. The transformer power wire connections (incoming and outgoing) shall be protected with a finger-safe cover to protect against accidental contact. Primary and secondary fuse protection shall be provided. Transformer shall be UL listed and of continuous wound construction with vacuum impregnated with non-hygroscopic thermosetting varnish. Transformer shall be Square D 9070T or approved equal.

K. Transformer Primary and Secondary Fuse

1. Properly rated fuses and fuse blocks shall be provided for primary and secondary protection of the transformer. Each fuse shall be equipped with a thermoplastic cover to protect against accidental contact. Clip style fuse block shall be rated up to 600 VAC and 100 amps, dual element, time delay fuses shall be rated up to 600 VAC. Fuse blocks and fuses shall be UL listed. Fuses shall be Littelfuse

Class CC or approved equal. Fuse blocks and fuse covers shall be manufactured by Marathon or approved equal.

L. Circuit Breaker

1. All single phase branch or supplementary circuits shall be protected with a single-pole, C-Curve rated circuit breaker. Circuit breakers shall be rated for 240 VAC maximum, 50/60 Hz and UL 489 listed. Supplementary and branch protection circuit breakers shall be Merlin Gerin Multi 9 or approved equal.

M. Fuses

1. Properly rated fuses and fuse holders shall be provided for protection of individual control devices (discrete and analog signals) mounted outside of the enclosure. Each fuse shall be housed in a hinged type fuse block to protect against contact with the fuse. Fuses shall be rated up to 250 VAC and be Littelfuse or approved equal. Fuse holders for discrete devices shall be rated to 600 VAC and 30 Amps. Fuse holders for analog devices shall be rated to 300 VAC and 15 Amps. Fuse holders shall be Allen Bradley 1492 or approved equal

N. Operator Device

1. Operator devices (pushbuttons and selector switches) shall be mounted through the control enclosure door for manual operation of the filter. Transformer type pilot lights and illuminated pushbuttons shall be provided for indication of an operation status. Lights shall be a 6 VAC incandescent type lamp. Color coding shall be applied as required and is as follows:

   a. Amber – Alarm active, caution

   b. Green – Valve open, motor running

   c. Red – Valve closed

   d. White - Information

2. All operator devices shall be UL Listed, 30.5mm style, NEMA Type 4X rated, oil and water tight with finger safe guards located on the contact blocks to prevent accidental contact with wire connections. Operator device function shall be identified with an engraved white Gravoply nameplate with black letters. Operator devices shall be Allen-Bradley 800H, Square D 9001, or approved equal.

O. High Frequency Noise Filter

1. A UL listed active tracking filter shall be provided to protect the PLC and HMI power feeds from high-frequency noise and low-energy transients. It shall be designed for a single phase input voltage of 120/240VAC operating at 47 to 63 Hz. The unit shall reduce normal mode transients to plus or minus 2 volts, provide surge capacity of 45,000 amps and protect in all modes (Line to neutral, line to ground and neutral to ground). The noise filter shall be an Islatrol IC+ or approved equal.

P. Ground Fault Duplex Receptacle

1. A UL listed ground fault circuit interrupter (GFCI) duplex receptacle shall be provided within the panel for instrument (e.g. programming terminal, modem, etc.) use only. The receptacle shall be protected with a 5 Amp circuit breaker. The receptacle shall carry a 20A / 120VAC rating. The electro-mechanical circuit interrupter shall be double-pole and trip free (GFCI protection and shall not be overridden by holding reset button). Built-in transient suppression shall protect GFCI's internal circuitry from voltage transients. Receptacle shall be Hubbell DRUBGFI20 or approved equal.

Q. 24 Volt DC Power Supply

1. A UL listed, industrial grade, compact power supply shall be supplied to provide 24 VDC power to such rated components. The power supply shall be DIN rail mounted and functional with input voltage of 100 to 240 VAC (single-phase) incoming control power. The power supply shall have a green LED which shall be illuminated when output voltage is "OK". The power supply shall be an Allen Bradley 1606 or approved equal.

R. Control Relays

1. UL listed control relays for general control purposes shall be supplied with a pilot light to indicate when the coil is in an energized state. The relay socket shall be panel or DIN rail mounted inside the enclosure. The relays shall provide the following ratings: 120VAC coil, 10A contact rating (thermal), 250 VAC insulation rating and 5 million mechanical life cycles. Relays shall comply with Specification 13390 – Package Controls Systems.

S. Terminal Block

1. Standard feed-through screw terminal blocks, DIN rail mounted, shall be supplied for all point to point wiring connections. All terminals shall be numbered per the wiring schematic with printed markers. Terminals shall carry a 600V AC/DC voltage rating. Terminal blocks shall be compatible with PLC.

T. Programmable Logic Controller

1. Automatic operation of the Filter shall be controlled through a Modicon M340 programmable logic controller (PLC) mounted inside the main control panel. The PLC components shall consist of a base unit, expansion I/O modules, and memory module. All input and output points supplied (including unused) shall be wired to terminal blocks.

2. Reference Specification 13390 – Package Controls Systems.

U. Human Machine Interface

1. The control system shall be equipped with a 15" Magelis operator interface that provides control display screens. These screens shall be used by the operator to monitor and control filter status, setpoint and alarm information.

2. The Interface shall allow the Operator access to adjust the following operating parameters:

a. Backwash interval

b. Backwash duration

c. Solids Waste interval

d. Solids Waste duration

e. Number of Backwashes between Solids Waste intervals

3. The operator interface shall provide information to assist the Operator in assessing the status of the filter system. The interface screen shall display, at minimum, the following parameters:

a. Water level in the filter

b. Time since last Backwash

c. Time since last Solids Waste withdrawal

d. Elapsed time on the Drive Motor

e. Elapsed time on the Backwash/Waste Pump

f. Total Backwash time and cycles

g. Total Solids Waste withdrawal time and cycles

4. The operator interface shall allow the Operator to:

a. Initiate Backwash

b. Control all electric actuated valves

5. The interface shall display the alarm history. The alarm history shall include the time and date of the most recent 25 alarms along with the description of the alarm.

6. The interface shall also display current alarms, including the date, time and a description of the alarm.

7. As a diagnostic aid to the Operator, the interface shall display the time between Backwashes for the most recent 40 Backwashes.

8. The operator interface shall be a 15" Magelis color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The rated operating temperature shall be 32°F to 131°F (0°C to 55°C).

9. A sun shield constructed of 304 stainless steel shall be mounted over the operator interface to provide protection and visibility of operator screens in outdoor applications.

PART 3 - EXECUTION

3.1 START-UP, TRAINING AND MANUFACTURER'S SERVICES

A. The equipment Manufacturer shall furnish the services of a factory trained representative for a maximum of two (2) trips and six (6), eight hour days at the jobsite to inspect the installing Contractor's equipment installation, supervise the initial operation of the equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance.

B. If additional service is required due to the mechanisms not being fully operational, at the time of service requested by the Contractor, the additional service days will be at the Contractor's expense.

3.2 FUNCTIONAL TESTING

A. Prior to plant startup, all equipment shall be inspected for proper alignment, operation, connection, and satisfactory operation by means of a functional test. It is the General Contractor's responsibility to duly notify the Manufacturer of any inabilities to perform functional testing prior to operator training.

3.3 MANUFACTURER'S CERTIFICATE

A. Provide Manufacturer's certificate of installation and commissioning following functional testing and startup.

END OF SECTION

SECTION 13125 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes metal building systems that consist of integrated sets of mutually dependent components including structural framing**,** roof panels, wall panels, soffit panels and accessories.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for concrete foundations, slabs, and anchor-bolt installation.
2. Division 04 Section "Unit Masonry" for exterior and load-bearing walls fabricated from concrete masonry units.
3. Division 07 Section "Thermal Insulation" for insulation installed in metal roof and wall panel assemblies.
4. Division 08 Section "Hollow Metal Doors and Frames."
5. Division 08 Section "Overhead Coiling Doors."
6. Division 08 Section "Aluminum Windows."
7. Division 08 Section "Door Hardware" for hardware to the extent not specified in this Section.
8. Division 09 painting Sections for finish painting of shop-primed structural framing.
9. Division 09 Section "Gypsum Board" for installing gypsum board as part of metal panel assemblies.
10. Division 10 Section "Louvers and Vents" for metal louvers.

1.3 DEFINITIONS

A. Bay: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured normal to end wall (outside face of end-wall girt) for end bays.

B. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).

C. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).

D. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame or knee).

E. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).

F. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span.

G. Terminology Standard: Refer to MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.4 SYSTEM DESCRIPTION

A. General: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, metal roof panels and accessories complying with requirements indicated.

1. Provide metal building system of size and with spacings, slopes, and spans indicated.

B. Primary Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

D. Secondary Frame Type: Refer to Drawings.

E. Eave Height: Refer to Drawings.

F. Bay Spacing: Refer to Drawings.

G. Roof Slope: Refer to Drawings.

H. Roof System: Manufacturer's standard vertical-rib, standing-seam metal roof panels.

I. Wall System: Manufacturer’s standard field assembled “R”-Panel vertical rib wall panels.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal building systems capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Engineer metal building systems according to procedures in MBMA's "Metal Building Systems Manual" and the 2009 International Building Code.
2. Design Loads: Per the 2009 IBC and as indicated on the Drawings.
3. Design Loads: As required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures" and the 2009 International Building Code.
4. Live Loads: Include vertical loads induced by the building occupancy indicated on Drawings. Include loads induced by maintenance workers, materials, and equipment for roof live loads.

a. Floor Framing and Special Loads: Refer to Drawings for point loads from non-metal building framing members.

5. Wind Loads: Include horizontal loads according to the 2009 International Building Code.
6. Collateral Loads: Include additional dead loads of 10 psf in addition to the weight of metal building system for permanent items such as sprinklers, mechanical systems, electrical systems, and ceilings.
7. Load Combinations: Design metal building systems to withstand the most critical effects of load factors and load combinations as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures" and the 2009 International Building Code.
8. Deflection Limits: Engineer assemblies to withstand design loads with deflections no greater than the following:

   a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
   b. Spandrel Beams: Horizontal deflection of 1/360 of the span typical, except 1/500 for masonry veneer areas.
   c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
   d. Metal Wall Panels: Horizontal deflection of 1/240 of the span.

9. Design secondary framing system to accommodate deflection of primary building structure and construction tolerances, and to maintain clearances at openings.
10. Provide metal panel assemblies capable of withstanding the effects of loads and stresses indicated, based on testing according to ASTM E 1592.

B. Seismic Performance: Design and engineer metal building systems capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads" and the 2009 International Building Code.

C. Thermal Movements: Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Air Infiltration for Metal Roof Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft. .

E. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft.

F. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

1.6 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:

1. Structural-framing system.
2. Metal roof panels.
3. Metal Wall Panels
4. Insulation and vapor retarders.
5. Flashing and trim.
6. Accessories.

B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Anchor-Bolt Plans: Submit anchor-bolt plans before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
3. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

   a. Show provisions for attaching roof curbs, service walkways, platforms and pipe racks.

4. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

   a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.

5. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

   a. Flashing and trim.
   b. Gutters.
   c. Downspouts.
   d. Louvers.

C. Samples for Initial Selection: For each type of building component with factory-applied color finish.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below.

1. Metal Roof and Wall Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.

2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
3. Vapor Retarders: Nominal 6-inch-square Samples.
4. Accessories: Nominal 12-inch- long Samples for each type of accessory.

E. Product Certificates: For each type of metal building system, signed by product manufacturer.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

   a. Name and location of Project.
   b. Order number.
   c. Name of manufacturer.
   d. Name of Contractor.
   e. Building dimensions including width, length, height, and roof slope.
   f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
   g. Governing building code and year of edition.
   h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
   i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
   j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
   k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

F. Welding certificates.

G. Erector Certificate: Signed by manufacturer certifying that erector complies with requirements.

H. Manufacturer Certificate: Signed by manufacturer certifying that products comply with requirements.

I. Qualification Data: For Erector, manufacturer and professional engineer.

J. Material Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

K. Source quality-control test reports.

L. Field quality-control test reports.

M. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor retarders. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

N. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

O. Maintenance Data: For metal panel finishes to include in maintenance manuals.

P. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

A. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

B. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.

1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

C. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.

D. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

E. Source Limitations: Obtain primary metal building system components, including structural framing and metal panel assemblies, through one source from a single manufacturer.

F. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal building system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

G. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

H. Structural Steel: Comply with AISC's "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," or AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings," for design requirements and allowable stresses.

I. Cold-Formed Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members," or AISI's "Load and Resistance Factor Design Specification for Steel Structural Members," for design requirements and allowable stresses.

J. Fire-Resistance Ratings: Where indicated, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Combustion Characteristics: ASTM E 136.
2. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
3. Metal panels shall be identified with appropriate markings of applicable testing and inspecting agency.

K. Surface-Burning Characteristics: Provide field-insulated metal panels having thermal insulation and vapor-retarder-facing materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less, unless otherwise indicated.
2. Smoke-Developed Index: 50 or less, unless otherwise indicated.

L. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical corner wall metal panel, including soffit, as shown on Drawings; approximately 48 inches square by full thickness, including insulation, supports, attachments, and accessories.
2. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

M. Pre-Erection Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to metal building systems including, but not limited to, the following:

1. Inspect and discuss condition of foundations and other preparatory work performed by other trades.
2. Review structural load limitations.
3. Review and finalize construction schedule and verify availability of materials, Erector's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.
5. Review weather and forecasted weather conditions and procedures for unfavorable conditions.

N. Preinstallation Roof Assembly Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

1. Examine purlin and rafter conditions for compliance with requirements, including flatness and attachment to structural members.
2. Review structural limitations of purlins and rafters during and after roofing.
3. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
4. Review temporary protection requirements for metal roof panel assembly during and after installation.
5. Review roof observation and repair procedures after metal roof panel installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness and with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements:

1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.10 COORDINATION

A. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

B. Coordinate installation of roof curbs, equipment supports and roof penetrations, which are specified in Division 07 Section "Roof Accessories."

C. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam, metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alliance Steel, Inc.
2. American Buildings Company.
3. American Steel Building Company, Inc.; Division of NCI Building Systems, LLP.
4. Behlen Mfg. Co.
5. Butler Manufacturing Company.
6. Ceco Building Systems; Division of Robertson-Ceco Corporation.
7. Crown Metal Buildings, Inc.
8. Gulf States Manufacturers, Inc.
9. Mesco Metal Buildings; Division of NCI Building Systems, LLP.
10. Metallic Metal Building Company; Division of NCI Building Systems, LLP.
11. Star Building Systems; Division of Robertson-Ceco Corporation.
12. VP Buildings, Inc.; a United Dominion Company.

2.2 STRUCTURAL-FRAMING MATERIALS

A. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

B. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

C. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.

D. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.

F. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80 , or High-Strength Low Alloy Steel (HSLAS), Grades 45 through 70.

G. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G60 coating designation; mill phosphatized.

H. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G90 coating designation.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating.

I. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders," with steel-angle, top- and bottom-chord members; with end- and top-chord arrangements as indicated and required for primary framing.

J. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders," with steel-angle, top- and bottom-chord members; with end- and top-chord arrangements as indicated and required for secondary framing.

K. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.

1. Finish: Plain.

L. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.
2. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with splined ends.

   a. Finish: Plain.

M. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

N. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Plain.

O. Threaded Rods: ASTM A 307, Grade A .

1. Nuts: ASTM A 563 heavy hex carbon steel.
2. Washers: ASTM F 436 hardened carbon steel.
3. Finish: Plain.

P. Primer: SSPC-Paint 15, Type I, red oxide.

2.3 MATERIALS FOR FIELD-ASSEMBLED METAL PANELS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Aluminum-Zinc Alloy-Coated Steel Sheet (Glavalume): ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating designation.
   2. Surface: Smooth, flat finish.
   3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings:

      a. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight), with a minimum total dry film thickness of 1.5 mil. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions, except as modified below:

         1) Humidity Resistance: 2000 hours.
         2) Salt-Spray Resistance: 2000 hours.

      b. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil.

2.4 THERMAL INSULATION FOR FIELD-ASSEMBLED METAL PANELS

A. Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; and with a flame-spread index of 25 or less. Roof: One layer of R-19 insulation and R-5 thermal block on top of purlins with continuous R-11 with Liner system as required by the 2012 International Energy conservation code. Walls: R-13 PEMB insulation over wall girts with continuous Extruded Polystyrene rigid insulation board on top. Min R-value of 6.5 (1-1/2" insulation thickness)

B. Retainer Strips: 0.019-inch-thick, formed, galvanized steel or PVC retainer clips colored to match insulation facing.

C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
   1. Fasteners for Metal Roof Panels: Self-drilling Type 410 stainless-steel or self-tapping Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal panels.
   2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
   3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

D. Metal Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
2. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.6 FABRICATION, GENERAL

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual": Chapter IV, Section 9, "Fabrication and Erection Tolerances."

C. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.7 STRUCTURAL FRAMING

A. General:

1. Primary Framing: Shop fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

a. Make shop connections by welding or by using high-strength bolts.
b. Join flanges to webs of built-up members by a continuous submerged arc-welding process.
c. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin or girt web, so flange compressive strength is within allowable limits for any combination of loadings.

d. Weld clips to frames for attaching secondary framing members.
e. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary structural members with specified primer after fabrication.

2. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

a. Make shop connections by welding or by using non-high-strength bolts.
b. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary structural members with specified primer after fabrication.

B. Primary Framing: Manufacturer's standard structural primary framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

a. Slight variations in span and spacing may be acceptable if necessary to meet manufacturer's standard, as approved by Architect.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
3. Frame Configuration: One-directional sloped.
4. Exterior Column Type: Tapered.
5. Rafter Type: Tapered.

C. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

D. Secondary Framing: Manufacturer's standard secondary framing members, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Fabricate framing from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from minimum 0.0598-inch-thick steel sheet, built-up steel plates, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.

a. Depth: As indicated.

2. Purlins: Steel joists of depths indicated.

3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch- thick steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch (25-mm) diameter, cold-formed structural tubing to stiffen primary frame flanges.
5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
6. Base or Sill Angles: Minimum 3-by-2-by-0.0598-inch zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Minimum 0.0598-inch-thick, steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0598-inch- thick, structural-steel sheet.
9. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inch- thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

E. Bracing: Provide adjustable wind bracing as follows:

1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50; or ASTM A 529/A 529M, Grade 50; minimum 1/2-inch-diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
2. Cable: ASTM A 475, 1/4-inch- diameter, extra-high-strength grade, Class B zinc-coated, 7-strand steel; with threaded end anchors.
3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
4. Rigid Portal Frames: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
5. Fixed-Base Columns: Fabricate from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
7. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

F. Bolts: Provide plain finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dipped galvanized bolts for structural-framing components that are galvanized.

G. Factory-Primed Finish: Apply specified primer immediately after cleaning and pretreating.

1. Prime primary, secondary, and end-wall structural-framing members to a minimum dry film thickness of 1 mil.

   a. Prime secondary steel framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2. Prime galvanized members with specified primer, after phosphoric acid pretreatment.

2.8 METAL ROOF PANELS

A. Vertical-Rib, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

1. Material: Aluminum-zinc alloy-coated steel sheet, 0.0269 inch thick.

   a. Exterior Finish: Fluoropolymer with SRI of 78 or better.
   b. Color: As selected by Architect from manufacturer's full range.

2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel, aluminum-zinc alloy-coated steel, or stainless-steel sheet.
3. Joint Type: Panels snapped together.
4. Joint Type: Mechanically seamed, folded as standard with manufacturer.
5. Panel Coverage: 16 inches.
6. Panel Height: 1 1/2 inches.
7. Uplift Rating: UL 90.

2.9 FIELD-ASSEMBLED METAL WALL PANELS

A. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Aluminum-zinc alloy-coated steel sheet, 0.0269 inch (0.70 mm)] thick.
   a. Exterior Finish: Fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range
2. Major-Rib Spacing: 12 inches (305 mm).
3. Panel Coverage: 36 inches (914 mm).
4. Panel Height: 0.75 inch (19 mm).

2.10 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and flush surface; with flush joint between panels; with 1-inch-wide flange for attaching interior finish; designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps.

1. Material: Aluminum-zinc alloy-coated steel sheet, 0.0269 inch thick.

   a. Exterior Finish: Fluoropolymer.
   b. Color: As selected by Architect from manufacturer's full range.

2. Panel Coverage: 16 inches.
3. Panel Height: 1 inch.

2.11 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1 inch standoff; fabricated from extruded polystyrene.

C. Flashing and Trim: Formed from minimum 0.0159-inch-thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Opening Trim: Minimum 0.0269-inch-thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

D. Gutters: Formed from minimum 0.0159-inch-thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch-long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters; spaced 36 inches o.c.
2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

E. Downspouts: Formed from 0.0159-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot-long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters; spaced 10 feet o.c.

F. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.13 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform the following tests and inspections and to submit reports.

B. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special Inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.

1. Special inspections will not be required if fabrication is performed by a manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.

a. After fabrication, submit certificate of compliance with copy to authorities having jurisdiction certifying that Work was performed according to Contract requirements.

C. Tests and Inspections:

1. Bolted Connections: Shop-bolted connections shall be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1 and the following inspection procedures, at inspector's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Erector, listing conditions detrimental to performance of work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with Erector present, for compliance with requirements and metal building system manufacturer's tolerances.

1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing true to line, level, plumb, rigid, and secure. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

   a. Joint Type: Snug tightened or pretensioned.

G. Secondary Framing: Erect framing true to line, level, plumb, rigid, and secure. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.
5. Bolt joists to supporting steel framework using high-strength structural bolts, unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
6. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.4 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations.

1. Install ridge and hip caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Field-Assembled, Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
6. Provide metal closures at peaks, rake edges, rake walls, and each side of ridge and hip caps.

C. Field-Assembled, Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal roof panels.
2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels; on side laps of ribbed or fluted metal panels; and elsewhere as needed to make metal panels weatherproof to driving rains.
4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
   2. Shim or otherwise plumb substrates receiving metal wall panels.
   3. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
   4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
   5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
   6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   7. Install screw fasteners in predrilled holes.
   8. Install flashing and trim as metal wall panel work proceeds.
   9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated, or if not indicated, as necessary for waterproofing.
   10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws.
   11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Field-Assembled, Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
   1. Field-Insulated Assemblies: Install thermal insulation as specified. Install metal liner panels over insulation on interior side of girts at locations indicated. Fasten with exposed fasteners as recommended by manufacturer.

3.6 METAL SOFFIT PANEL INSTALLATION

A. Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.7 THERMAL INSULATION INSTALLATION FOR FIELD-ASSEMBLED METAL PANELS

A. General: Install insulation concurrently with metal wall panel installation, in thickness indicated to cover entire wall, according to manufacturer's written instructions.

   1. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
   2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
   3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths with both sets of facing tabs sealed to provide a complete vapor retarder.
   4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation with both sets of facing tabs sealed to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Two-layers Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.

3.8 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

E. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform the following tests and inspections and to submit reports.

B. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports.

C. Tests and Inspections:

1. High-Strength, Field-Bolted Connections: Connections shall be inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1 and the following inspection procedures, at inspector's option:

   a. Liquid Penetrant Inspection: ASTM E 165.
   b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   c. Ultrasonic Inspection: ASTM E 164.
   d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

3.10 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

D. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 13125

SECTION 13390 - PACKAGE CONTROL SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. The Institute of Electrical and Electronics Engineers, Inc. (IEEE): C62.41, IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
2. International Society of Automation (ISA): S50.1, Compatibility of Analog Signals for Electronic Process Instruments.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. AB 1, Molded Case Circuit Breakers and Molded Case Switches.
   c. ICS 2, Industrial Control Devices, Controllers and Assemblies.
4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
5. Underwriters Laboratories Inc. (UL): 508A, Standards for Safety, Industrial Control Panels.

1.2 SYSTEM DESCRIPTION

A. Assemble panels and install instruments, plumbing, and wiring in equipment manufacturer's factories.

B. All packaged control systems, PLC-based, relay logic or other, must allow and have a means of local manual mode operation while meeting the requirements as stated herein.

C. Test panels and panel assemblies for proper operation prior to shipment from equipment manufacturer's factory.

1.3 SUBMITTALS

A. Action Submittals:

1. Bill of material, catalog information, descriptive literature, wiring diagrams, and Shop Drawings for components of control system.
2. Catalog information on electrical devices furnished with system.
3. Shop Drawings, catalog material, weight, shipping splits, conduit entrances, anchor bolt pattern and dimensional layout drawings for control panels and enclosures.
4. Indicate all options, special features, ratings and deviations from this Section.

5. Panel elementary diagrams of prewired panels. Include in diagrams control devices and auxiliary devices, for example, relays, alarms, fuses, lights, fans, and heaters.

6. Plumbing diagrams of preplumbed panels and interconnecting plumbing diagrams.

7. Interconnection wiring diagrams that include numbered terminal designations showing external interfaces.

8. List of IO points that will be transferred between the main plant PLC and the packaged system PLC, with the PLC point addresses.

B. Informational Submittals:

1. Testing Related Submittals:

a. Operational Readiness Tests (ORT) Submittals:

1) Preliminary Test Procedures: Outlines of proposed tests, forms, and checklists.
2) Final Test Procedures: Proposed test procedures, forms, and checklists.
3) Test Documentation: Copy of signed off test procedures when tests are completed.

b. Performance Acceptance Tests (PAT) Submittals:

1) Preliminary Test Procedures: Outlines of proposed tests, forms, and checklists.
2) Final Test Procedures: Proposed test procedures, forms, and checklists.
3) Test Documentation: Copy of signed off test procedures when tests are completed.

2. Programmable Controller Submittals:

a. Complete set of user manuals.

b. Fully documented ladder logic listings.

c. Function listing for function blocks not fully documented by ladder logic listings.

d. Cross-reference listing.

3. Manufacturer’s list of proposed spares, expendables, and test equipment.

4. Manufacturer’s Certificate of Proper Installation.

5. Austin Water Utilities (AWU) Standard Programming Interface Spreadsheets.

6. O&M Manual with Control Narratives and Standard Operating Procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers and related equipment as recommended by capsule manufacturer.

1.5 EXTRA MATERIALS

A. Spares, Expendables, and Test Equipment:

1. Selector Switch, Pushbutton, and Indicating Light: 20 percent, one minimum, of each type used.
2. Light Bulb: 100 percent, 2 minimum, of each type used.
3. Fuse: 100 percent, 5 minimum, of each type used.
4. Surge Suppressors: 20 percent, one minimum, of each type used.
5. PLC Components: 20%, minimum of each type of PLC rack, I/O module, CPU, Communication module.

PART 2 - PRODUCTS

2.1 SIGNAL CHARACTERISTICS

A. Analog Signals:

1. 4 to 20 mA dc, in accordance with compatibility requirements of ISA S50.1.
2. Unless otherwise specified or shown, use Type 2, two-wire circuits.
3. Transmitters: Load resistance capability conforming to Class L.
4. Fully isolate input and output signals of transmitters and receivers.

B. Pulse Frequency Signals: dc pulses whose repetition rate is linearly proportional to process variable over 10:1 range. Generate pulses by contact closures or solid-state switches.

1. Power source: Less than 30V dc.

C. Discrete Signals:

1. Two-state logic signals.
2. Utilize 120V ac sources for control and alarm signals.
3. Alarm signals shall be normally open, close to alarm isolated contacts rated for 5-ampere at 120V ac and 2-ampere at 30V dc.

2.2 CORROSION PROTECTION

A. Corrosion-Inhibiting Vapor Capsule Manufacturers:

1. Northern Instruments; Model Zerust VC.
2. Hoffmann Engineering; Model A-HCI.

2.3 CONTROL PANEL

A. Panel Construction and Interior Wiring: In accordance with the National Electrical Code (NEC), UL 508, state and local codes, and applicable sections of NEMA, ANSI, and ICECA.

B. Conform to NEMA ratings as specified in individual equipment sections.

C. Minimum Metal Thickness: 12 gauge.

D. NEMA 250, Type 4X Panels: Type 316 stainless steel construction for panels located outdoors and steel NEMA 12 for panels located indoors, unless otherwise specified.

E. All control panel enclosures shall incorporate removable back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar studs. Back panel shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any components.

F. Doors:

1. Continuous hinge, Three-point latching, quarter turn, pad-lockable, mechanisms in accordance with NEMA 250 Type 1 and 12 panels with doors higher than 18 inches.
2. For other doors, stainless steel quick release clamps.

G. Cutouts shall be cut, punched, or drilled and finished smoothly with rounded edges.

H. Access: Front, suitable for installation with back and sides adjacent to or in contact with other surfaces, unless otherwise specified.

I. Temperature Control:

1. Size panels to adequately dissipate heat generated by equipment mounted on or in the panel.
2. Furnish cooling fans with air filters if required to dissipate heat.
3. For panels outdoors or in unheated areas, furnish thermostatically controlled heaters to maintain temperature above 40 degrees F.

J. Push-to-Test Circuitry: For each push-to-test indicating light, provide a fused push-to-test circuit.

K. Lighting: Minimum of one hand switch controlled internal 40-watt fluorescent light for panels 12 cubic feet and larger.

L. Minimum of one 120-volt GFCI duplex receptacle for panels 12 cubic feet and larger.

M. For all Free-standing control panels housing a PLC, provide fold out self kit as manufactured by enclosure manufacturer.

N. Finish:

1. Metallic External Surfaces (Excluding Aluminum and Stainless Steel): Manufacturer's standard gray unless otherwise specified.

2. Internal Surfaces: White enamel.

O. Panel Manufacturers:

1. Hoffman.

2. H.F. Cox.

P. Breather and Drains: Furnish with NEMA 250, Type 4 and 4X panels.

1. Manufacturer and Product: Cooper Crouse-Hinds; ECD Type 4X Drain and Breather; Drain Model ECD1-N4D, Breather Model ECD1-N4B.

Q. Canopy: install permanent canopy for sun protection and for maintenance personnel working in panel during rain. See Drawing EZ-3 for canopy construction and installation details.

2.4 CONTROL PANEL ELECTRICAL

A. UL Listing Mark for Enclosures: Mark stating "Listed Enclosed Industrial Control Panel" per UL 508A.

B. I&C and electrical components, terminals, wires, and enclosures UL listed.

C. All control components shall mounted in one common enclosure and shall physically be separated from any electrical components being powered by more than 120V ac. Control switches hall be provided to operated each motor either manually or automatically.

D. Control Panels without Motor Starters:

1. Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.

2. Locate to provide clear view of and access to breakers when door is open. Group on single subpanel. Provide typed directory.

3. Circuit Breakers:

a. Coordinate for fault in branch circuit trips, branch breaker, and not main breaker.

b. Branch Circuit Breakers: 15 amps at 250V ac.

c. Breaker Manufacturers and Products:

1) Heineman Electric Co.; Series AM.

2) Airpax/North American Philips Controls Corp.; Series 205.

E. Control Panels with Three-Phase Power Supplies and Motor Starters:

1. All PLC and control components shall be installed in an isolated section of Control Panel from sections containing 480 V powered devices/components.

2. Interlock main circuit breaker with panel door.

   a. Mount logic controls, branch circuit breakers, overload reset switches, and other control circuit devices.

   b. Mount operator controls and indications on front access door.

3. Circuit Breakers:

   a. In accordance with NEMA AB 1.

   b. 35,000-ampere RMS symmetrical rating, minimum at 480 volts, unless otherwise specified.

   c. Breakers, except Motor Branch Breakers: Molded case thermal magnetic.

   d. 35,000-ampere RMS symmetrical rating, minimum at 480 volts, unless otherwise specified in package system equipment specification sections.

   e. Tripping: Indicate with operator handle position.

4. Magnetic Motor Starters:

   a. Full voltage, NEMA ICS 2, Class A, Size O minimum.

   b. Include three-pole bimetallic or eutectic alloy thermal overload relays sized for each motor.

   c. Manual reset type with reset button mounted on panel door.

   d. A six digit, non-resettable elapsed time meter shall be connected to each motor starter.

5. Motor Control: 120V ac (except intrinsically safe circuits where applicable).

   a. Power Control Transformer:

      1) Sufficient capacity to serve connected load, including 200VA for duplex outlet plus 100VA (minimum).

      2) Limit voltage variation to 15 percent during contact pickup.

      3) Fuse one side of secondary winding and ground the other.

      4) Furnish primary winding fuses in ungrounded conductors.

6. Power Monitoring Relay:

   a. Protect three-phase equipment from single phasing, phase imbalance, or phase reversal.

   b. Separate, isolated contact outputs to stop motors and activate alarm light during abnormal conditions.

c. Transient Voltage Protection: 10,000 volts.

d. Manufacturer and Product: Furnas; Class 47.

7. Power Distribution Blocks: Furnish to parallel feed tap on branch circuit protective devices. Do not “leap frog” power conductors.

8. Terminations for Power Conductors: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

9. Auxiliary contacts shall be provided for remote run indication and indication of each status and alarm condition. Additional controls shall be provided as specified herein, as required by the detailed mechanical equipment requirements, Division 16, and as shown on the Drawings.

F. Wiring:

1. ac Circuits:

a. Type: 600-volt, Type SIS tinned stranded copper.

b. Size: For current to be carried, but not less than 14 AWG.

2. Analog Signal Circuits:

a. Type: 300-volt, Type 2 stranded copper, twisted shielded pairs.

b. Size: 16 AWG, minimum.

3. Other dc Circuits.

a. Type: 600-volt, Type SIS tinned stranded copper.

b. Size: 14 AWG, minimum.

4. Separate analog and other dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.

5. Color Coding:

FUNCTION	COLOR CODE
• Control/status signal wiring. This does not apply to control/status signal wiring that are scheduled for interface with remote Programmable Logic Controller (PLC).	Red
• Control wiring to relay coils (L1 & L2 terminals or H&N terminals) that are not generated from a PLC Discrete Output point (DO) Gray 120Vac power supply	Gray

wiring to instrumentation and control devices that are not generated from a PLC Discrete Output point (DO).	
• Alarm Wiring.	Yellow
• Wiring to instrument control cabinet interior lights/receptacle.	Black=Hot White=Neutral
• Control/status signal wiring to Programmable Logic Controller (PLC) – Discrete Input Modules.	Violet
• Control/status signal wiring from Programmable Logic Controllers (PLC's) – Discrete Output Modules.	Pink

6. Enclose wiring in plastic wiring ducts.
7. Wire Identification: Numbered and tagged at each termination.
   a. Wire Tags: Yellow, Machine printed, heat shrink.
   b. Character size shall be a minimum of 1/8" in height.
   c. Manufacturers:
      1) Raychem or Owner Approved equal.

G. Wiring Interface:

1. For analog and discrete signal, terminate at numbered terminal blocks.
2. For special signals, terminate power (240 volts or greater) at manufacturer's standard connectors.
3. For panel, terminate at equipment on/with which it is mounted.

H. Terminal Blocks:

1. Quantity:
   a. For external connections.
   b. Wire spare or unused panel mounted elements to their panels' terminal blocks.
   c. Spare Terminals: 20 percent of connected terminals, but not less than 10.
2. General: Group to keep 120V ac circuits separate from 24V dc circuits.
   a. Connection Type: Screw connection clamp.
   b. Compression Clamp:
      1) Hardened steel clamp with transversal grooves penetrating wire strands providing a vibration-proof connection.

2) Guides strands of wire into terminal.

c. Screws: Hardened steel, captive, and self-locking.

d. Current Bar: Copper or treated brass.

e. Insulation:

1) Thermoplastic rated for minus 55 to plus 110 degrees C.

2) Two funnel shaped inputs to facilitate wire entry.

f. Mounting:

1) Rail.

2) Terminal block can be extracted from an assembly without displacing adjacent blocks.

3) End Stops: One at each end of rail, minimum.

g. Color Code:

FUNCTION	COLOR CODE
• TERMINAL BLOCKS for 120Vac control/status/alarm signal wiring. This applies to all control/status signal wiring and including 120Vac control/status signal interface wiring with Programmable Logic Controller (PLC) and Alarm wiring.	Red
• TERMINAL BLOCKS for 120Vac control wiring to relay coils (L1 & L2 terminals or H&N terminals) including those that are generated from a PLC Discrete Output point (DO).	Red
• TERMINAL BLOCKS for 120Vac power supply wiring to instrumentation and control devices and communication instruments.	Black
• Wiring to instrument control cabinet interior lights/receptacle/exhaust-fans.	Black
• Ground wiring terminal blocks, including shield wiring terminal blocks within the 4-20 mAdc signal wiring.	Green
• Terminal Blocks for 4-20mAdc process signal wiring positive (+) and negative (-) terminals.	White
• Terminal Blocks for ModBus and ModBus+ communication wiring.	Orange

h. Wire Preparation: Stripping only.

i. Jumpers: Allow jumper installation without loss of space on terminal or rail.

j. Marking System:

1) Terminal number shown on both sides of terminal block.

2) Allow use of preprinted and field marked tags.

3) Terminal strip numbers shown on end stops.

4) Mark terminal block and terminal strip numbers as shown.

3. Terminal Block, 120-Volt Power:

a. Rated Voltage: 600V ac.

b. Rated Current: 30 amp.

c. Wire Size: 22 through 10 AWG.

d. Rated Wire Size: 10 AWG.

e. Color: Gray body.

f. Spacing: 0.25 inch, maximum.

g. Manufacturer and Product: Entrelec; Type M4/6.

4. Terminal Block, Ground:

a. Wire Size: 22 through 12 AWG.

b. Rated Wire Size: 12 AWG.

c. Color: Green and yellow body.

d. Spacing: 0.25 inch, maximum.

e. Grounding: Ground terminal blocks electrically grounded to the mounting rail.

f. Manufacturer and Product: Entrelec; Type M4/6.P.

5. Terminal Block, Blade Disconnect Switch:

a. Use: Provide one for each discrete input and output field interface wire.

b. Rated Voltage: 600V ac.

c. Rated Current: 10 amp.

d. Wire Size: 22 through 12 AWG.

e. Rated Wire Size: 12 AWG.

f. Color: Gray body, orange switch.

g. Spacing: 0.25 inch, maximum.

h. Manufacturer and Product: Entrelec; Type M4/6.SN.

6. Terminal Block, Fused, 24V dc:

a. Rated Voltage: 600V dc.

b. Rated Current: 6.3 amp.

c. Wire Size: 22 through 12 AWG.

d. Rated Wire Size: 12 AWG.

e. Color: Gray body.

f. Fuse: 5 by 20 GMA fuses.

g. Fuse Marking: Fuse amperage rating shown on top of terminal block.

h. Indication: LED diode 24V dc.

i. Leakage Current: 5.2 mA, maximum.

j. Spacing: 0.32 inch, maximum.

k. Manufacturer and Product: Entrelec; Type M4/6.SFD.

7. Terminal Block, Fused, 120V ac:

a. Rated Voltage: 600V ac.

b. Rated Current: 6.3 amp.

c. Wire Size: 22 through 12 AWG

d. Rated Wire Size: 12 AWG.

e. Color: Gray body.

f. Fuse: 5 by 20 GMA fuses.

g. Fuse Marking: Fuse amperage rating shown on top of terminal block.

h. Indication: Neon lamp 110V ac.

i. Leakage Current: 1.8 mA, maximum.

j. Spacing: 0.32 inch, maximum

k. Manufacturer and Product: Entrelec; Type M4/6.SFL.

I. Grounding: Internal copper grounding bus for ground connections on panels, consoles, racks, and cabinets.

J. Relays:

1. General:

a. Relay Mounting: Plug-in type socket, 11 pin tubular octal base.

b. Relay Enclosure: Provide dust cover.

c. Socket Type: Screw terminal interface with wiring.

d. Socket Mounting: Rail.

e. Furnish holddown clips.

2. Control Circuit Switching Relay, Nonlatching:

a. Type: Compact general purpose plug-in.

b. Contact Arrangement: 3 Form C contacts.

c. Contact Rating: 10A at 28V dc or 240V ac.

d. Contact Material: Silver cadmium oxide alloy.

e. Coil Voltage: As noted or shown.

f. Coil Power: 1.8 watts (dc), 2.7VA (ac).

g. Expected Mechanical Life: 10,000,000 operations.

h. Expected Electrical Life at Rated Load: 100,000 operations.

i. Indication Type: Neon or LED indicator lamp.

j. Push-to-test button.

k. Manufacturer and Product: Potter and Brumfield; Series KUP.

3. Control Circuit Switching Relay, Latching:

a. Type: Dual coil mechanical latching relay.

b. Contact Arrangement: 2 Form C contacts.

c. Contact Rating: 10A at 28V dc or 120V ac.

d. Contact Material: Silver cadmium oxide alloy.

e. Coil Voltage: As noted or shown.

f. Coil Power: 2.7 watts (dc), 5.3VA (ac).

g. Expected Mechanical Life: 500,000 operations.

h. Expected Electrical Life at Rated Load: 50,000 operations.

i. Manufacturer and Product: Potter and Brumfield; Series KB/KBP.

4. Control Circuit Switching Relay, Time Delay:

a. Type: Adjustable time delay relay. Settable for time delays of 0.05 seconds to 999 minutes.

b. Contact Arrangement: 2 Form C contacts.

c. Contact Rating: 10A at 240V ac.

d. Contact Material: Silver cadmium oxide alloy.

e. Coil Voltage: As specified or shown.

f. Operating Temperature: Minus 10 to 55 degrees C.

g. Repeatability: Plus or minus 2 percent.

h. Delay Time Range: Select range such that time delay setpoint fall between 20 to 80 percent or range.

i. Time Delay Setpoint: As specified or shown.

j. Mode of Operation: As specified or shown.

k. Adjustment Type: Integral potentiometer with knob external to dust cover.

l. Manufacturer and Products: Square D.

1) Class 9050, type JCK70 or Owner approved equal.

K. Intrinsic Safety Barriers:

1. Intrinsically Safe Relays: Monitor discrete signals that originate in hazardous area and are used in a safe area.

a. Manufacturer and Product: MTL, Inc.; Series MTL 5000.

2. Intrinsically Safe Barriers: Interface analog signals as they pass from hazardous area to safe area.

a. Manufacturer and Product: MTL, Inc.; Series MTL 5000.

L. Programmable Controllers:

1. See Section 13401, Instrumentation and Control for Process System, for all PLC requirements.

M. Operator Interface Unit (OIU):

1. See Section 13401, Instrumentation and Control for Process System, for all OIU requirements.

N. Front-of-Panel Devices in Conjunction with NEMA 250, Type 1 and 12 Panels:

1. All Front of Panel devices shall be:

a. The same among all panels.
b. 30 mm, industrial type.

2. Potentiometer Units:

a. Three-terminal, oiltight construction, resolution of 1 percent and linearity of plus or minus 5 percent.

b. Single-hole, panel mounting accommodating panel thicknesses between 1/8 and 1/4 inch.

c. Include legend plates with service markings.

d. Manufacturers and Products:

1) Allen-Bradley; Model 800T.

2) Eaton/Cutler-Hammer; Model 10250T.

3. Indicating Lights:

a. Heavy-duty, Type Light Emitting Diode (LED), push-to-test type, oiltight, industrial type with integral transformer for 120V ac applications.

b. Screwed on prismatic glass lenses in colors noted and factory engraved legend plates for service legend.

c. Manufacturers and Products:

1) Eaton/Cutler-Hammer; Type 10250T.

2) General Electric; CR2940U.

4. Pushbutton, Momentary:

a. Heavy-duty, oiltight, industrial type with full guard and momentary contacts rated for 10 amperes continuous at 120V ac.

b. Standard size legend plates with black field and white markings for service legend.

c. Manufacturers and Products:

1) Square D; Class 9001, Type K.

2) Eaton/Cutler-Hammer; Type T.

3) General Electric; Type CR-2940.

5. Selector Switch:

a. Heavy-duty, oiltight, industrial type with contacts rated for 120V ac service at 10 amperes continuous.

b. Standard size, black field, legend plates with white markings, for service legend.

c. Operators: Black knob type.

d. Single-hole mounting, accommodating panel thicknesses from 1/16 inch to 1/4 inch.

e. Manufacturers and Products for Units with up to Four Selection Positions:

1) Eaton/Cutler-Hammer; Type T.

2) Square D; Type K.

O. Front-of-Panel Devices Used in Conjunction with NEMA 250, Type 4X Panels:

1. Potentiometer, Watertight:

a. Three-terminal, heavy-duty NEMA 250, Type 4X watertight construction, resolution of 1 percent and linearity of plus or minus 5 percent.

b. Single-hole, panel mounting accommodating panel thicknesses between 1/8 and 1/4 inch.

c. Include engraved legend plates with service markings.

d. Manufacturer and Product: Allen-Bradley; Bulletin 800H.

2. Indicating Lights, Watertight:

a. Heavy-duty, push-to-test type, NEMA 250, Type 4X watertight, industrial type with integral transformer for 120V ac applications and corrosion-resistant service.

b. Screwed on prismatic lenses and factory engraved legend plates for service legend.

c. Manufacturers and Products:

1) Square D; Type SK.

2) Allen-Bradley; Type 800H.

3. Pushbutton, Momentary, Watertight:

a. Heavy-duty, NEMA 250, Type 4X watertight, industrial type with momentary contacts rated for 120V ac service at 10 amperes continuous and corrosion-resistant service.

b. Standard size, black field, legend plates with white markings for service legend.

c. Manufacturers and Products:

1) Square D; Type SK.

2) Allen-Bradley; Type 800H.

4. Selector Switch, Watertight:

a. Heavy-duty, NEMA 250, Type 4X watertight, industrial type with contacts rated for 120V ac service at 10 amperes continuous and corrosion-resistant service.

b. Standard size, black field, legend plates with white markings, for service legend.

c. Operators: Black knob type.

d. Single-hole mounting, accommodating panel thicknesses from 1/16 to 1/4 inch.

e. Manufacturer and Products:

1) Square D; Class 9001, Type SK.

2) Allen-Bradley; Type 800H.

P. Uninterruptable Power Supply (UPS):

1. All Control Panels with PLCs shall require a UPS rated for the appropriate temperatures inside of that panel.

2. See Section 13401, Instrumentation and Control for Process System, for all UPS requirements.

2.5 INSTRUMENT TAG NUMBERS

A. A shorthand tag number notation is used. For example:

AI-1-12(2)(3)[pH]

Notation	Explanation
AI	ISA designator for Analysis Indicator
1	Unit process number
12	Loop number
(2)	First unit number; number of same component types in a given loop; -1 and 1-2 in this example
(3)	Second unit number; number of same component types with same first unit number in a given loop; -1, -2, and -3 in this example
[pH]	Same notation shown at 2 o'clock position on ISA circle symbol on Process and Instrument Diagram

B. In this example, AI-1-12(2)(3)[pH] is shorthand for:

AI-1-12-1-1[pH], AI-1-12-1-2[pH], AI-1-12-1-3[pH]

AI-1-12-2-1[pH], AI-1-12-2-2[pH], AI-1-12-2-3[pH]

2.6 NAMEPLATES, NAMETAGS, AND SERVICE LEGENDS

A. Nametags: Permanently mounted bearing entire ISA tag number.

1. Component Nameplates:—Panel Face: Component identification located on panel face under or near component.
   a. Location and Inscription: As shown.
   b. Materials: Laminated plastic attached to panel with stainless steel screws.
   c. Letters: 3/16-inch white on black background, unless otherwise noted.
2. Component Nameplates—Back of Panel and back of Panel Door: Component identification located on or near component inside of enclosure.
   a. Inscription: Component tag number.
   b. Materials: Adhesive backed, laminated plastic.
   c. Letters: 3/16-inch white on black background, unless otherwise noted.
      1) Field Mounted: Engraved Type 316 stainless steel, 22-gauge minimum thickness, attached with stainless steel.

3. Supply blank nameplates for spare units and used spaces.

4. Service Legends (Integrally Mounted with Instrument) and Nameplates:

   a. Engraved, rigid, laminated plastic type with adhesive back. Furnish service legends and nameplates to adequately describe functions of panel face mounted instruments.
   b. Color: White with black letters.
   c. Letter Height: 3/16 inch.
   d. For each panel, face mounted laminated nameplate inscribed with the panel name and tag number. Color shall be white with black letters 1/2 inch high.

B. Standard Light Colors and Inscriptions: Unless otherwise specified in individual equipment specifications, use the following color code and inscriptions:

Tag	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Green
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Amber
FAIL	FAIL	Amber
HIGH	HIGH	Amber
AUTO	AUTO	White
MANUAL	MANUAL	Yellow
LOCAL	LOCAL	White
REMOTE	REMOTE	Yellow
FORWARD	FORWARD	Red
REVERSE	REVERSE	Blue

1. Lettering: Black on white and amber lenses; white on red and green lenses.
2. Standard Pushbutton Colors and Inscriptions:
   a. Use following unless otherwise noted:

Tag Function	Inscription(s)	Color
OO	ON OFF	Black Black
OC	OPEN CLOSE	Black Black
OCA	OPEN CLOSE AUTO	Black Black Black
OOA	ON OFF AUTO	Black Black Black
MA	MANUAL AUTO	Black Black
SS	START STOP	Black Black
RESET	RESET	Black
EMERGENCY STOP	EMERGENCY STOP	Red

b. Lettering Color:
   1) Black on white and yellow buttons.
   2) White on black, red, and green buttons.

2.7 ELECTRICAL SURGE AND TRANSIENT PROTECTION

A. Equip control panels with surge-arresting devices to protect equipment from damage as a result of electrical transients induced in interconnecting lines from lightning discharges and nearby electrical devices.

B. Suppressor Locations:

1. At point of connection between an equipment item, including ac powered transmitters, and power supply conductor (direct-wired equipment).
2. On analog pairs at each end when the pair travels outside of building.
3. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to design of equipment.

C. Suppressor Design:

1. Construction: First-stage, high-energy metal oxide varistor and second-stage, bipolar silicon avalanche device separated by series impedance; includes grounding wire, stud, or terminal.
2. Response: 5 nanoseconds maximum.
3. Recovery: Automatic.

4. Temperature Range: Minus 20 degrees C to plus 85 degrees C.

5. Enclosure Mounted: Encapsulated inflame retardant epoxy.

D. Suppressors on 120V ac Power Supply Connections:

1. Occurrences: Tested and rated for a minimum of 50 occurrences of IEEE C62.41 Category B test waveform.

2. First-Stage Clamping Voltage: 350 volts or less.

3. Second-Stage Clamping Voltage: 210 volts or less.

4. Power Supplies for Continuous Operation:

a. Four-Wire Transmitter or Receiver: Minimum 5 amps at 130V ac.

b. All Other Applications: Minimum 30 amps at 130V ac.

E. Suppressors on Analog Signal Lines:

1. Test Waveform: Linear 8-microsecond rise in current from 0 amp to a peak current value followed by an exponential decay of current reaching one-half the peak value in 20 microseconds.

2. Surge Rating: Tested and rated for 50 occurrences of 2,000-amp peak test waveform.

a. dc Clamping Voltage: 20 percent to 40 percent above operating voltage for circuit.

b. dc Clamping Voltage Tolerance: Plus or minus 10 percent.

c. Maximum Loop Resistance: 18 ohms per conductor.

F. Manufacturers and Products:

1. Analog Signals Lines: Emerson Edco PC-642 or SRA-64 series.

2. 120V ac Lines: Emerson Edco HSP-121.

3. 480-Volt, Three-Phase Power Supplies: Square D Model SDSA3650.

4. Field Mounted at Two-Wire Instruments:

a. Encapsulated in stainless steel pipe nipples.

b. Emerson Edco SS64 series.

5. Field Mounted at Four-Wire Instruments: With 120V ac outlet, ac circuit breaker, and 10-ohm resistor on signal line, all in enclosure.

a. Enclosure:

1) NEMA 4X Type 316 stainless steel with door.

2) Maximum Size: 12 inches by 12 inches by 8 inches deep.

b. Emerson Edco; SLAC series.

G. Grounding:

1. Coordinate surge suppressor grounding in field panels and field instrumentation as specified in Section 1645, Grounding for Electrical Systems, and suppressor manufacturer's requirements.

2. Provide control panels with an integral copper grounding bus for connection of suppressors and other required instrumentation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Repair any damage to factory applied finish using touch up paint furnished by the control panel Manufacturer.

B. Any work not installed according to the Drawings and this Specification shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.

3.2 ELECTRICAL POWER AND SIGNAL WIRING

A. Restrain control and signal wiring in control panels by plastic ties or ducts. Secure hinge wiring at each end so bending or twisting will occur around the longitudinal axis of wire. Protect bend area with a sleeve.

B. Arrange wiring neatly, cut to proper length, and remove surplus wire. Install abrasion protection for wire bundles passing through holes or across edges of sheet metal.

C. Use manufacturer's recommended tool with sized anvil for crimp terminations. No more than one wire may be terminated in a single crimp lug. No more than two lugs may be installed on a single screw terminal.

D. Do not splice or tap wiring except at device terminals or terminal blocks.

3.3 PLC PROGRAMMING

A. General

1. PLC Hardware to be used by packaged equipment Vendor shall be as specified in the contract bid specifications. As a minimum, the processor used to interface to the Owner's SCADA system shall support the Schneider Electric Unity Pro programming software.

2. Vendor shall use latest version of Schneider Electric Unity Pro programming software, unless otherwise directed by Owner.

3. PLC and HMI Programming Workshops: Vendor shall schedule a minimum of two workshops with the Owner to demonstrate programming and intended programming deliverables.

B. Program Organization and Structure

1. The overall program shall be broken down into meaningful sections of code related to the operations of the equipment. As a minimum, include the following program sections:

    a. Communications - All registers that are being written to or being read from the Vendor's package system PLC from the Owner's SCADA equipment shall be grouped into one section of the program. Register addresses used for interfacing to Owner's SCADA system shall be placed in a contiguous block of registers to facilitate read and write operations.

    b. Section Control - (if code includes variables to enable/disable sections of code).

    c. Process Control - If the process is complex and/or the section is very large, this section should be further broken down into permissive section(s), alarming section(s) and control section(s).

    d. Input/Output (I/O) Processing – This section includes data manipulation of physical inputs and outputs such as analog scaling, totalizing, etc.

    e. PLC Time Synchronization and Heartbeat – This section shows the registers that are to be used to synchronize the PLC's clock with the Owner's SCADA system and to determine whether the Vendor's PLC logic is executing (heartbeat) to be monitored by the Owner's SCADA system.

2. Vendor is to follow the Owner's software tagging convention for all tags being read from or written into by the Owner's SCADA system. If the Vendor elects to use their own software tagging convention in their programs that control the equipment within their own package system, then the PLC(s) that is used to interface with the Owner's SCADA system needs to include a set of registers that will be labeled with the Owner's software tagging convention and be "mapped" to the corresponding set of registers that are used by the Vendor's software program. The mapping of these registers is to be clearly labeled in the program and indicated on the Field I/O spreadsheet to be provided at the end of the job.

3. All program sections are to be clearly labeled with text that describes what the section of code does. As a minimum, include the key wording for each section as described above.

4. Provide comment lines within the sections of code to describe what the various parts of the section do, especially for those areas where the function is performing is not evident or is complex to follow.

5. All software tags in the program are to follow a structured naming convention and be clearly labeled with meaningful text descriptions to make it easy to understand what the tag represents and what function it is performing in the program.

6. Ensure that none of the programs developed have security controls enabled, i.e. password protection on DFB's, restrictions on uploading or editing program, etc.

C. Program Details

1. Vendor is to use IEC programming languages supported by Unity Pro, and in general adopt the following guidelines.

    a. Use Derived Function Blocks (DFB) language as much as practical to standardize on process control functions.

    b. Use Structured Text (ST) language for Calculations and I/O Mapping routines.

    c. Use IEC Ladder Logic (LL) and Function Blocks (FB) for control logic and to include in DFB's.

2. Standardize the program sections and program elements (DFB, ST, etc.) as much as possible into modular and/or functional pieces of code for repetitive and often use sections of code to simplify the program and minimize its size.

3. Vendor is to set up a Custom Library for standard program elements like DFB's and FB's.

4. Use Topological (Unity Pro) Addressing on both Quantum and M340 PLCs for registers associated with physical I/O, i.e. %I1.3.2 and %Q1.4.3, instead of State Ram addressing (%M) since State Ram addressing convention does not reference the physical I/O location, but topological addressing does.

5. Use eBool variables if there may be a reason to keep track of previous values (history) or there is a need to look at a leading or falling edge in the signal.

6. Avoid using IEC BMDI function blocks on any of the PLC programs since Unity Pro is not able to search for registers contained within the range of that block.

7. Use IO Scanner for communication between PLC's where possible to facilitate the set-up and troubleshooting of registers that are being moved from one PLC to another.

8. Code should be designed to avoid using force bits for the logic to execute properly. Inadvertent un-forcing of bits will cause the program behave unexpectedly.

9. Do not initialize %MW values during a cold start or a program download. Doing so can cause stored values such as runtime to be over written. Ensure this option is unchecked in the programming software if the option is available.

D. Documentation and Deliverables

1. As part of their Operations and Maintenance Manual, Vendor is to include, but not be limited to the following:

    a. Control Narratives that include:

        1) The various control modes of operation; i.e. remote automatic, remote manual, local automatic, local manual, maintenance mode, etc.

        2) Identification of and description of all permissive and shutdown signals that are required to operate the equipment or that will shut the equipment down.

3) Identification of all set points and process variables that are Operator adjustable with a description of what they do and how they affect the operation of the equipment.

b. Field I/O and Host Pack and Peer to Peer spreadsheets (provided by Owner) to document the various software tags associated with the package equipment.

c. Instrument Index spreadsheet showing all instrumentation on their package equipment and calibration information including, but not limited to; instrument tag name, input range, units, control loop description, scaling, trip set points, etc.

2. Vendor is to provide a copy of all program files installed in the production system and source files of all documentation listed above.

3.4 TESTING AND START UP

A. See Section 13401, Instrumentation and Control for Process System, for all Testing and Start up requirements.

3.5 WARRANTY

A. Manufacturer shall warrant equipment to be free from defects in materials and workmanship for a period no less than the controlled equipment warranty. Warranty shall be two years from date of substantial completion .

3.6 PROTECTION

A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.

B. During Work, periodically replace capsules in accordance with capsule manufacturer's recommendations. Replace capsules at Substantial Completion.

END OF SECTION

SECTION 13401 - INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
   b. A276, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
   c. A312, Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes.
   d. B32, Standard Specification for Solder Metal.
   e. B88, Standard Specification for Seamless Copper Water Tube.
2. International Society of Automation (ISA):
   a. S5.1, Instrumentation Symbols and Identification (NRC ADOPTED).
   b. PR12.6, Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations.
   c. S5.4, Standard Instrument Loop Diagrams.
   d. S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
   e. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. ICS 1, General Standards for Industrial Control and Systems.
4. National Institute of Standards and Technology (NIST).
5. Underwriters Laboratory, Inc. (UL): 508A, Standard for Safety, Industrial Control Panels.

1.2 SUMMARY

A. Work Includes:

1. Engineering, furnishing, installing, calibrating, adjusting, testing, documenting, starting up, and Owner training for complete Process Instrumentation and Control (PIC) for the facilities as shown on the Drawings.

2. Major parts are:

a. Primary elements, transmitters, and control devices.

b. Control system network.

c. One freestanding control panel including the following major components:

1) One programmable logic controller (PLC).

2) One uninterruptable power supply (UPS).

3) One Ethernet network switch.

4) One communication modem.

d. One Lift Station Control Panel/RTU including the following major components:

1) One programmable logic controller (PLC).

2) One uninterruptable power supply (UPS).

3) One Ethernet network switch.

4) One communication modem.

e. Interfaces with the packaged control systems.

1.3 SCOPE OF WORK:

A. CONTRACTOR shall provide and install the field instruments and control panels as shown on the Contract Drawings at the Lift Station and Taylor Lane Wastewater Treatment Plant (WWTP).

B. CONTRACTOR shall install the Control System network to provide a complete fully functional communication system between the Lift Station, the Taylor Lane WWTP and the Lift Station Telemetry System (at Walnut Creek WWTP), as shown on the Contract Drawings.

C. CONTRACTOR shall install the Programmable Logic Controllers (PLC) and the SCADA system to monitor and control the equipment installed with this project as shown on the Contract Documents.

D. The Application Engineering Services (AES) Provider shall configure and program the PLC and HMI SCADA application for both the main plant and the Lift Station that shall be provided by the Contractor. The Contractor shall provide the Early Delivery System (EDS) as determined by the EDS submittal and deliver it to the AES Provider. The EDS system shall be delivered to the AES Provider with 60 days of project Notice to Proceed. The AES Provider shall notify the Contractor to pick up the EDS equipment upon programming completion for installation in the control panels, prior to the Factory Acceptance Tests (FAT). The AES shall assist in both FAT and PAT testing as described herein. The AES shall be performed by CH2M HILL Incorporated, in Austin Texas.

E. The AES Provider shall be responsible for programming and coordination for transmitting the data points from the main plant PLC into the packaged system control panels (and PLCs). The AES Provider shall configure and program the control and SCADA system based on the standards of the existing City of Austin Lift Station Telemetry System.

F. PLC and HMI Programming Workshops: AES Provider shall schedule a minimum of two workshops with the Owner to demonstrate programming and intended programming deliverables.

1.4 DEFINITIONS

A. Abbreviations:

1. LCP: Local Control Panel.
2. MCC: Motor Control Center.
3. MCP: Master Control Panel
4. PAT: Performance Acceptance Test.
5. PIC: Process Instrumentation and Control.
6. PLC: Programmable Logic Controller.
7. EDS: Early Delivery System.
8. OIT: Operator Interface Terminal

B. Rising/Falling: Terms used to define actions of discrete devices about their setpoints.

1. Rising: Contacts close when an increasing process variable rises through setpoint.
2. Falling: Contacts close when a decreasing process variable falls through setpoint.

C. Signal Types:

1. Analog Signals, Current Type:
   a. 4 mA to 20 mA dc signals conforming to ISA S50.1.
   b. Unless otherwise indicated for specific PIC Subsystem components, use the following ISA 50.1 options:
      1) Transmitter Type: Number 2, two-wire.
      2) Transmitter Load Resistance Capacity: Class L.
      3) Fully isolated transmitters and receivers.
2. Analog Signals, Voltage Type: 1 to 5 volts dc within panels where a common high precision dropping resistor is used.
3. Discrete signals, two-state logic signals using dc or 120V ac sources as indicated.
4. Pulse Frequency Signals:

a. Direct current pulses whose repetition rate is linearly proportional to process variable.

b. Pulses generated by contact closures or solid state switches as indicated.

c. Power source less than 30V dc.

5. Special Signals: Other types of signals used to transmit analog and digital information between field elements, transmitters, receivers, controllers, and digital devices.

D. Instrument Tag Numbers:

1. A shorthand tag number notation is used in the Loop Specifications. For example: AI-1-2(2)(3)[pH].

Notation	Explanation
AI	ISA designator for Analysis Indicator.
1	Unit process number.
2	Loop number.
(2)	First unit number; number of same component types in a given loop; -1 and -2 in this example.
(3)	Second unit number; number of same component types with same first unit number in a given loop; -1, -2, and –3 in this example.
[pH]	Same notation shown at 2 o'clock position on ISA circle symbol on P&ID.

2. In this example, AI-1-12(2)(3)[pH] is shorthand for:

AI-1-12-1-1[pH], AI-1-12-1-2[pH], AI-1-12-1-3[pH]
AI-1-12-2-1[pH], AI-1-12-2-2[pH], AI-1-12-2-3[pH]

1.5 SUBMITTALS

A. Action Submittals:

1. General:

a. Shop Drawings, full-scaled details, wiring diagrams, catalog cuts, and descriptive literature.

b. Identify proposed items and options. Identify installed spares and other provisions for future work (for example, reserved panel space; unused components, wiring, and terminals).

c. Legends and Abbreviation Lists: Complete definition of symbols and abbreviations used on this Project (for example, engineering units,

flow streams, instruments, structures, and other process items used in nameplates, legends, and data sheets).

2. Bill of Materials: List of required equipment.

   a. Group equipment items by enclosure and field, and within an enclosure, as follows:

      1) I&C Components: By component identification code.

      2) Other Equipment: By equipment type.

   b. Data Included:

      1) Equipment tag number.

      2) Description.

      3) Manufacturer, complete model number, and all options not defined by model number.

      4) Quantity supplied.

      5) Component identification code where applicable.

3. Catalog Cuts: I&C Components, Electrical Devices, and Mechanical Devices:

   a. Catalog information, mark to identify proposed items and options.

   b. Descriptive literature.

   c. External power and signal connections.

   d. Scaled drawings showing exterior dimensions and locations of electrical and mechanical interfaces.

4. Component Data Sheets: Data sheets for I&C components.

   a. Format and Level of Detail: In accordance with ISA-S20.

   b. Include component type identification code and tag number on data sheet.

   c. Specific features and configuration data for each component:

      1) Location or service.

      2) Manufacturer and complete model number.

      3) Size and scale range.

      4) Setpoints.

      5) Materials of construction.

      6) Options included.

   d. Name, address, and telephone number of manufacturer's local office, representative, distributor, or service facility.

5. Sizing and Selection Calculations:

   a. Primary Elements: Complete calculations plus process data used. Example, for flow elements, minimum and maximum values, permanent head loss, and assumptions made.

   b. Controlling, Computing and Function Generating Modules: Actual scaling factors with units and how they were computed.

6. Panel Construction Drawings:

   a. Scale Drawings: Show dimensions and location of panel mounted devices, doors, louvers, and subpanels, internal and external.

   b. Panel Legend: List front of panel devices by tag numbers, nameplate inscriptions, service legends, and annunciator inscriptions.

   c. Bill of Materials: List devices mounted within panel that are not listed in panel legend. Include tag number, description, manufacturer, and model number.

   d. Construction Details: NEMA rating, materials, material thickness, structural stiffeners and brackets, lifting lugs, mounting brackets and tabs, door hinges and latches, and welding and other connection callouts and details.

   e. Construction Notes: Finishes, wire color schemes, wire ratings, wire and terminal block, numbering and labeling scheme.

7. Panel Control Diagrams: For discrete control and power circuits.

   a. Diagram Type: Ladder diagrams. Include devices, related to discrete functions, that are mounted in or on the panel and that require electrical connections. Show unique rung numbers on left side of each rung.

   b. Item Identification: Identify each item with attributes listed.

      1) Wires: Wire number and color. Cable number if part of multiconductor cable.

      2) Terminals: Location (enclosure number, terminal junction box number, or MCC number), terminal strip number, and terminal block number.

      3) Discrete Components:

         a) Tag number, terminal numbers, and location (“FIELD”, enclosure number, or MCC number).

         b) Switching action (open or close on rising or falling process variable), setpoint value and units, and process variable description (for example, Sump Level High).

      4) Relay Coils:

         a) Tag number and its function.

b) On right side of run where coil is located, list contact location by ladder number and sheet number. Underline normally closed contacts.

5) Relay Contacts: Coil tag number, function, and coil location (ladder rung number and sheet number).

c. Show each circuit individually. No “typical” diagrams or “typical” wire lists will be permitted.

d. Ground wires, surge protectors, and connections.

e. Circuit Names: Show names corresponding to Circuit and Raceway Schedule for circuits entering and leaving a panel. Refer to Division 16, Electrical.

8. Panel Wiring Diagrams: Show point-to-point and terminal-to-terminal wiring within panel.

9. Loop Diagrams: Individual wiring diagram for each analog or pulse frequency loop.

a. Conform to the minimum requirements of ISA S5.4.

b. Under Paragraph 5.3 of ISA S5.4, include the information listed under subparagraphs 2 and 6.

c. Drawing Size: Individual 11-inch by 17-inch sheet for each loop.

d. Divide each loop diagram into areas for panel face, back-of-panel, and field.

e. Show:

1) Terminal numbers, location of dc power supply, and location of common dropping resistors.

2) Switching contacts in analog loops and output contacts of analog devices. Reference specific control diagrams where functions of these contacts are shown.

3) Tabular summary on each diagram:

a) Transmitting Instruments: Output capability.

b) Receiving Instruments: Input impedance.

c) Loop Wiring Impedance: Estimate based on wire sizes and lengths shown.

d) Total loop impedance.

e) Reserve output capacity.

4) Circuit and raceway schedule names.

10. Interconnecting Wiring Diagrams:

a. Diagrams, device designations, and symbols in accordance with NEMA ICS 1.

b. Diagrams shall bear electrical Subcontractor’s signature attesting diagrams have been coordinated with Division 16, Electrical.

c. Show:

1) Electrical connections between equipment, consoles, panels, terminal junction boxes, and field mounted components.

2) Component and panel terminal board identification numbers, and external wire and cable numbers.

3) Circuit names matching Circuit and Raceway Schedule.

4) Intermediate terminations between field elements and panels (for example, to terminal junction boxes and pull boxes).

5) Pull boxes.

11. Installation Details: Include modifications or further details required to adequately define installation of I&C components.

12. List of spares, expendables, test equipment and tools.

13. Additional Equipment Recommended: List of, and descriptive literature for, additional spares, expendables, test equipment and tools recommended. Include unit prices and total costs as specified in Section 01025, Measure and Payment.

14. Communications and Digital Networks Diagrams:

a. Scope: Includes connections to packaged system PLCs, Ethernet network, and the City of Austin Lift Station Telemetry System.

b. Show:

1) Interconnected devices, both passive and active.

2) Device names and numbers.

3) Terminal numbers.

4) Communication Media: Type of cable.

5) Connection Type: Type of connector.

6) Node and device address numbers.

7) Wire and cable numbers and colors.

15. Early Delivery System:

a. Scope: Includes main plant PLC and Operator Workstation with the appropriate software packages required for the AES to perform the programming and configuration of the main plant panel components. The EDS submittal shall delivered to the Engineer for review within 30 days of project Notice to Proceed.

B. Informational Submittals: For PIC equipment, provide Manufacturer's Certificate of Proper Installation and readiness for operation.

1. Owner Training Plan with the following information included:

a. Course outline

b. Scheduling requirements
c. Instructor's certifications/resume showing appropriate qualifications.

2. Operation and Maintenance (O&M) Manuals: In accordance with Section 01730, Operation and Maintenance Manuals, unless otherwise specified in this section.

a. Content and Format:

1) Complete sets O&M manuals.

2) Sufficient detail to allow operation, removal, installation, adjustment, calibration, maintenance and purchasing replacements for each PIC component.

3) Final versions of Legend and Abbreviation Lists.

4) Manual format in accordance with Section 01730, Operation and Maintenance Manuals.

b. Include:

1) Process and Instrumentation Diagrams: One reproducible copy of revised P&ID to reflect as-built PIC design.

2) Refer to paragraph Shop Drawings for the following items:

a) Bill of Materials.

b) Catalog Cuts.

c) Component Data Sheets.

d) Panel Control Diagrams.

e) Panel Wiring Diagrams, one reproducible copy.

f) Panel Plumbing Diagrams, one reproducible copy.

g) Loop Diagrams, one reproducible copy.

h) Interconnecting Wiring Diagrams, one reproducible copy.

i) Application Software Documentation.

3) Device O&M manuals for components, electrical devices, and mechanical devices include:

a) Operations procedures.

b) Installation requirements and procedures.

c) Maintenance requirements and procedures.

d) Troubleshooting procedures.

e) Calibration procedures.

f) Internal schematic and wiring diagrams.

g) Component Calibration Sheets from field quality control calibrations.

4) List of spares, expendables, test equipment and tools provided.

5) List of additional spares, expendables, test equipment and tools recommended.

3. Testing Related Submittals:

a. Operational Readiness Tests (ORT) Submittals:

1) Preliminary Test Procedures: Outlines of proposed tests, forms, and checklists.

2) Final Test Procedures: Proposed test procedures, forms, and checklists.

3) Test Documentation: Copy of signed off test procedures when tests are completed.

b. Performance Acceptance Tests (PAT) Submittals:

1) Preliminary Test Procedures: Outlines of proposed tests, forms, and checklists.

2) Final Test Procedures: Proposed test procedures, forms, and checklists.

3) Test Documentation: Copy of signed off test procedures when tests are completed.

1.6 QUALITY ASSURANCE

A. Calibration Instruments: Each instrument used for calibrating PIC equipment shall bear the seal of a reputable laboratory certifying that instrument has been calibrated within the previous 12 months to a standard endorsed by the NIST.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide Site and warehouse storage facilities for PIC equipment.

B. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers, and related equipment as recommended by the capsule manufacturer.

C. Prior to installation, store items in dry indoor locations. Provide heating in storage areas for items subject to corrosion under damp conditions.

D. Cover panels and other elements that are exposed to dusty construction environments.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Standard Environmental Requirements: Unless otherwise noted, design equipment for continuous operation in these environments:

1. Freestanding Panel and Consoles:

a. Inside, Air Conditioned: NEMA 1.

b. Inside: NEMA 12.

2. Smaller Panels and Assemblies (that are not Freestanding):

   a. Inside, Air Conditioned: NEMA 12.

   b. All Other Locations: NEMA 4X.

3. Field Elements: Outside.

B. Environmental Design Requirements: Following defines the types of environments referred to in the above.

1. Inside, Air Conditioned:

   a. Temperature:

      1) Normal: 60 to 85 degrees F.

      2) With Up to 4-Hour HVAC System Interruptions: 40 to 105 degrees F.

   b. Relative Humidity:

      1) Normal: 10 percent (winter) to 70 percent (summer).

      2) With Up to 4-Hour HVAC System Interruption: 10 to 100 percent.

   c. NEC Classification: Nonhazardous.

2. Inside:

   a. Temperature: 20 to 104 degrees F.

   b. Relative Humidity: 10 to 95 percent noncondensing.

   c. NEC Classification: Nonhazardous.

3. Inside, Corrosive:

   a. Temperature: Minus 20 to 104 degrees F.

   b. Relative Humidity: 10 to 95 percent noncondensing.

   c. Corrosive Environment: Hydrogen sulfide gas.

   d. NEC Classification: Nonhazardous.

4. Outside:

   a. Temperature: 20 to 104 degrees F.

   b. Relative Humidity: 10 to 95 percent noncondensing, rain, snow, freezing rain.

   c. NEC Classification: Nonhazardous.

5. Outside, Corrosive:

   a. Temperature: 20 to 104 degrees F.

   b. Relative Humidity: 10 to 95 percent noncondensing, rain, snow, freezing rain.

   c. Corrosive Environment: Hydrogen sulfide gas.

d. NEC Classification: Nonhazardous.

1.9 SEQUENCING AND SCHEDULING

A. Activity Completion: The following is a list of key activities and their completion criteria:

1. Shop Drawings: Reviewed and approved.
2. Quality Control Submittals: Reviewed and accepted.
3. Hardware Delivery: Hardware delivered to Site and inventoried by Owner.
4. PAT: Completed and required test documentation accepted.

B. PIC Substantial Completion: When Engineer issues Certificate of Substantial Completion.

1. Prerequisites:
   a. All PIC Submittals have been completed.
   b. PIC has successfully completed PAT.
   c. Owner training plan is on schedule.
   d. All spares, expendables, and test equipment have been delivered to Owner.

C. PIC Acceptance: When Engineer issues a written notice of Final Payment and Acceptance.

1. Prerequisites:
   a. Certificate of Substantial Completion issued for PIC.
   b. Punch-list items completed.
   c. Final revisions to O&M manuals accepted.
   d. Maintenance service agreements for PIC accepted by Owner.

D. Prerequisite Activities and Lead Times: Do not start the following key Project activities until the prerequisite activities and lead times listed below have been completed and satisfied:

Activity	Prerequisites and Lead Times
Submittal reviews, including the EDS, by Engineer	Engineer acceptance of Submittal breakdown and schedule.
Provide Early Delivery System (EDS) to the AES Provider's Facility	Engineer acceptance of EDS Submittal
Hardware purchasing, fabrication, and assembly	Associated shop drawing Submittals completed.
Shipment	Completion of PIC Shop Drawing Submittals and preliminary O&M manuals.

Activity	Prerequisites and Lead Times
Owner Training	Owner training plan completed
PAT	ORT completed with all required documentation available, Startup, Owner training, and PAT procedures completed; notice 4 weeks prior to start.

PART 2 - PRODUCTS

2.1 GENERAL

A. PIC functions as shown on Drawings and as required for each loop. Furnish equipment items as required. Furnish all materials, equipment, and software, necessary to effect required system and loop performance.

B. First Named Manufacturer: PIC design is based on first named manufacturers of equipment and materials.

1. If an item is proposed from other than first named manufacturer, obtain approval from Engineer for such changes in accordance with Article Submittals.
2. If using proposed item requires other changes, provide work and equipment to implement these changes. Changes that may be required include, but are not limited to: different installation, wiring, raceway, enclosures, connections, isolators, intrinsically safe barriers, software, and accessories.

C. Like Equipment Items:

1. Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.
2. Implement all same or similar functions in same or similar manner. For example, control logic, sequence controls, and display layouts.

2.2 CONTROL NARRATIVES

A. Location: Article Supplements.

B. Organization: By unit process and loop number.

C. Functional Requirements for Control Loops:

1. Shown on Drawings and Process and Instrumentation Diagrams (P&ID). P&ID format and symbols are in accordance with ISA S5.1, except as specified or shown on Drawings.
2. Supplemented by Loop Specifications.

D. Subheadings for Each Loop:

1. Functions: Clarifies functional performance of loop, including abstract of interlocks.

   a. Components: Lists major components for each loop. Information listed include: Tag numbers.

   b. Component Identification Codes: Alphanumeric codes of required components. Refer to Component Specification referenced in Article Supplements.

   c. Component Names and Options: Required to tailor general Component Specifications to specific application. For example, special materials, mounting, size, unit range, scale, setpoints, and controller options.

2.3 I&C COMPONENTS

A. Components for Each Loop: Major components for each loop are listed in Instrument List referenced in Article Supplements. Furnish all equipment that is necessary to achieve required loop performance.

B. Component Specifications: Generalized specifications for each type of component are located in Article Supplements.

2.4 NAMEPLATES AND TAGS

A. Panel Nameplates: Enclosure identification located on the enclosure face.

1. Location and Inscription: As shown.
2. Materials: Laminated plastic attached to panel with stainless steel screws.
3. Letters: ½-inch white on black background, unless otherwise noted.

B. Component Nameplates:—Panel Face: Component identification located on panel face under or near component.

1. Location and Inscription: As shown.
2. Materials: Laminated plastic attached to panel with stainless steel screws.
3. Letters: 3/16-inch white on black background, unless otherwise noted.

C. Component Nameplates—Back of Panel and back of Panel Door: Component identification located on or near component inside of enclosure.

1. Inscription: Component tag number.
2. Materials: Adhesive backed, laminated plastic.
3. Letters: 3/16-inch white on black background, unless otherwise noted.

D. Legend Plates for Panel Mounted Pushbuttons, Lights, and Switches.

1. Inscription: Refer to:

a. Table under paragraph Standard Pushbutton Colors and Inscriptions.

b. Table under paragraph Standard Light Colors and Inscriptions.

c. P&IDs in Drawings.

2. Materials: Stainless steel, keyed legend plates. Secured to panel by mounting nut for pushbutton, light, or switch.

3. Letters: Black on gray or white background.

E. Service Legends: Component identification nameplate located on face of component.

1. Inscription: As shown.

2. Materials: Adhesive backed, laminated plastic.

3. Letters: 3/16-inch white on black background, unless otherwise noted.

F. Nametags: Component identification for field devices.

1. Inscription: Component tag number.

2. Materials: 16-gauge, Type 304 stainless steel.

3. Letters: 3/16-inch imposed.

4. Mounting: Affix to component with 16- or 18-gauge stainless steel wire or stainless steel screws.

2.5 ELECTRICAL REQUIREMENTS

A. In accordance with Division 16, Electrical.

B. I&C and electrical components, terminals, wires, and enclosures: UL Listed.

C. Wires within Enclosures:

1. ac Circuits:

a. Type: 600-volt, Type SIS tinned stranded copper.

b. Size: For current to be carried, but not less than 14 AWG.

2. Analog Signal Circuits:

a. Type: 300-volt stranded copper, twisted shielded pairs.

b. Size: 16 AWG, minimum.

3. Other dc Circuits.

a. Type: 300-volt, Type SIS tinned stranded copper.

b. Size: For current carried, but not less than 14 AWG.

4. Special Signal Circuits: Use manufacturer’s standard cables.

5. Wire Identification: Numbered and tagged at each termination.

a. Wire Tags: Yellow, Machine printed, heat shrink.

b. Character size shall be a minimum of 1/8” in height.

c. Manufacturers:

1) Raychem or Owner Approved equal.

6. Color Coding:

FUNCTION	COLOR CODE
• Control/status signal wiring. This does not apply to control/status signal wiring that are scheduled for interface with remote Programmable Logic Controller (PLC).	Red
• Control wiring to relay coils (L1 & L2 terminals or H&N terminals) that are not generated from a PLC Discrete Output point (DO) Gray 120Vac power supply wiring to instrumentation and control devices that are not generated from a PLC Discrete Output point (DO).	Gray
• Alarm Wiring.	Yellow
• Wiring to instrument control cabinet interior lights/receptacle.	Black=Hot White=Neutral
• Control/status signal wiring to Programmable Logic Controller (PLC) – Discrete Input Modules.	Violet
• Control/status signal wiring from Programmable Logic Controllers (PLC's) – Discrete Output Modules.	Pink

D. Wires entering or leaving enclosures, terminate and identify as follows:

1. Analog and discrete signal, terminate at numbered terminal blocks.
2. Special signals, terminated using manufacturer's standard connectors.
3. Identify wiring in accordance with Division 16, Electrical.

E. Terminal Blocks for Enclosures:

1. Quantity:
   a. Accommodate present and spare indicated needs.
   b. Wire spare PLC I/O points to terminal blocks.
   c. One wire per terminal for field wires entering enclosures.
   d. Maximum of two wires per terminal for 18-WG wire for internal enclosure wiring.
   e. Spare Terminals: 20 percent of all connected terminals, but not less than 10 per terminal block.

2. General:

a. Connection Type: Screw compression clamp.

b. Compression Clamp:

1) Complies with DIN-VDE 0611.

2) Hardened steel clamp with transversal groves that penetrate wire strands providing a vibration-proof connection.

3) Guides strands of wire into terminal.

c. Screws: Hardened steel, captive and self-locking.

d. Current Bar: Copper or treated brass.

e. Insulation:

1) Thermoplastic rated for minus 55 to plus 110 degree C.

2) Two funneled shaped inputs to facilitate wire entry.

f. Mounting:

1) Standard DIN rail.

2) Terminal block can be extracted from an assembly without displacing adjacent blocks.

3) End Stops: Minimum of one at each end of rail.

g. Color Code:

FUNCTION	COLOR CODE
• TERMINAL BLOCKS for 120Vac control/status/alarm signal wiring. This applies to all control/status signal wiring and including 120Vac control/status signal interface wiring with Programmable Logic Controller (PLC) and Alarm wiring.	Red
• TERMINAL BLOCKS for 120Vac control wiring to relay coils (L1 & L2 terminals or H&N terminals) including those that are generated from a PLC Discrete Output point (DO).	Red
• TERMINAL BLOCKS for 120Vac power supply wiring to instrumentation and control devices and communication instruments.	Black
• Wiring to instrument control cabinet interior lights/receptacle/exhaust-fans.	Black
• Ground wiring terminal blocks, including shield wiring terminal blocks within the 4-20 mAdc signal wiring.	Green

- Terminal Blocks for 4-20mAdc process signal wiring positive (+) and negative (-) terminals. — White
- Terminal Blocks for ModBus and ModBus+ communication wiring. — Orange

h. Wire preparation: Stripping only permitted.

i. Jumpers: Allow jumper installation without loss of space on terminal or rail.

j. Marking System:

1) Terminal number shown on both sides of terminal block

2) Allow use of preprinted and field marked tags.

3) Terminal strip numbers shown on end stops.

4) Mark terminal block and terminal strip numbers as shown on Panel Control Diagrams and Loop Diagrams.

5) Fuse Marking for Fused Terminal Blocks: Fuse voltage and amperage rating shown on top of terminal block.

k. Test Plugs: Soldered connections for 18 AWG wire.

1) Pin Diameter: 0.079 inch.

2) Quantity: 1.

3) Manufacturer and Product: Entrelec; Type FC2.

3. Terminal Block, General-Purpose:

a. Rated Voltage: 600V ac.

b. Rated Current: 30 amp.

c. Wire Size: 22 AWG to 10 AWG.

d. Rated Wire Size: 10 AWG.

e. Color: Grey body.

f. Spacing: 0.25 inch, maximum.

g. Test Sockets: One screw test socket 0.079-inch diameter.

h. Manufacturer and Product: Entrelec; Type M4/6.T.

4. Terminal Block, Ground:

a. Wire Size: 22 AWG to 12 AWG.

b. Rated Wire Size: 12 AWG.

c. Color: Green and yellow body.

d. Spacing: 0.25 inch, maximum.

e. Grounding: Ground terminal blocks electrically grounded to the mounting rail.

f. Manufacturer and Product: Entrelec; Type M4/6.P.

5. Terminal Block, Blade Disconnect Switch:
    a. Rated Voltage: 600V ac.
    b. Rated Current: 10-amp.
    c. Wire Size: 22 AWG to 12 AWG.
    d. Rated Wire Size: 12 AWG.
    e. Color: Grey body, orange switch.
    f. Spacing: 0.25 inch, maximum.
    g. Manufacturer and Product: Entrelec; Type M4/6.SN.T.
6. Terminal Block, Fused, 24V dc:
    a. Rated Voltage: 600V dc.
    b. Rated Current: 16-amp.
    c. Wire Size: 22 AWG to 10 AWG.
    d. Rated Wire Size: 10 AWG.
    e. Color: Grey body.
    f. Fuse: 0.25 inch by 1.25 inches.
    g. Indication: LED diode 24V dc.
    h. Spacing: 0.512 inch, maximum.
    i. Manufacturer and Product: Entrelec; Type M10/13T.SFL.
7. Terminal Block, Fused, 120V ac:
    a. Rated Voltage: 600V ac.
    b. Rated Current: 16-amp.
    c. Wire Size: 22 AWG to 10 AWG.
    d. Rated Wire Size: 10 AWG.
    e. Color: Grey body.
    f. Fuse: 0.25 inch by 1.25 inches.
    g. Indication: Neon Lamp 110V ac.
    h. Leakage Current: 1.8 mA, maximum.
    i. Spacing: 0.512 inch, maximum
    j. Manufacturer and Product: Entrelec; Type M10/13T.SFL.
8. Terminal Block, Fused, 120V ac, High Current:
    a. Rated Voltage: 600V ac.
    b. Rated Current: 35 amps.
    c. Wire Size: 18 AWG to 8 AWG.
    d. Rated Wire Size: 8 AWG.
    e. Color: Grey.

f. Fuse: 13/32 inch by 1.5 inches.

g. Spacing: 0.95 inch, maximum.

h. Manufacturer and Product: Entrelec; Type MB10/24.SF.

F. Grounding of Enclosures:

1. Furnish isolated copper grounding bus for signal and shield ground connections.

2. Ground bus grounded at a common signal ground point in accordance with National Electrical Code requirements.

3. Single Point Ground for Each Analog Loop:

a. Locate at dc power supply for loop.

b. Use to ground wire shields for loop.

c. Group and connect shields in following locations:

1) Isolated ground bus in panel.

4. Ground terminal block rails to ground bus.

G. Analog Signal Isolators: Furnish signal isolation for analog signals that are sent from one enclosure to another. Do not wire in series instruments on different panels, cabinets, or enclosures. Isolator shall be 24 Vdc or 120 Vac powered. Loop powered isolators are not acceptable.

H. Power Distribution within Panels:

1. Feeder Circuits:

a. One or more 120V ac, 60-Hz feeder circuits as shown on Drawings.

b. Make provisions for feeder circuit conduit entry.

c. Furnish terminal board for termination of wires.

2. Power Panel: Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.

a. Locate to provide clear view of and access to breakers when door is open.

b. Breaker sizes: Coordinate such that fault in branch circuit will blow only branch breaker but not trip the main breaker.

1) Branch Circuit Breaker: 15 amps at 250V ac.

c. Breaker Manufacturers and Products: Refer to Division 16, Electrical.

3. Circuit Wiring: P&IDs and Control Diagrams on Drawings show function only. Use following rules for actual circuit wiring:

a. Devices on Single Circuit: 20, maximum.

b. Multiple Units Performing Parallel Operations: To prevent failure of any single branch circuit from shutting down entire operation, do not group all units on same branch circuit.

c. Branch Circuit Loading: 12 amperes continuous, maximum.

d. Panel Lighting and Service Outlets: Put on separate 15-amp, 120V ac branch circuit.

e. Provide 120V ac plugmold for panel components with line cords.

I. Signal Distribution:

1. Within Panels: 4 mA to 20 mA dc signals may be distributed as 1 to 5V dc.

2. Outside Panels: Isolated 4 mA to 20 mA dc only.

3. All signal wiring twisted in shielded pairs.

J. Signal Switching:

1. Use dry circuit type relays or switches.

2. No interruption of 4 mA to 20 mA loops during switching.

3. Switching Transients in Associated Signal Circuit:

a. 4 mA to 20 mA dc Signals: 0.2 mA, maximum.

b. 1 to 5V dc Signals: 0.05V, maximum.

K. Relays:

1. General:

a. Relay Mounting: Plug-in type socket, 11 pin tubular octal base.

b. Relay Enclosure: Furnish dust cover.

c. Socket Type: Screw terminal interface with wiring.

d. Socket Mounting: Rail.

e. Provide holddown clips.

2. Signal Switching Relay:

a. Type: Dry circuit.

b. Contact Arrangement: 2 Form C contacts.

c. Contact Rating: 0 to 5 amps at 28V dc or 120V ac.

d. Contact Material: Gold or silver.

e. Coil Voltage: As noted or shown.

f. Coil Power: 0.9 watts (dc), 1.2VA (ac).

g. Expected Mechanical Life: 10,000,000 operations.

h. Expected Electrical Life at Rated Load: 100,000 operations.

i. Indication Type: Neon or LED indicator lamp.

j. Seal Type: Hermetically sealed case.

k. Manufacturer and Product: Potter and Brumfield; Series KH/KHA.

3. Control Circuit Switching Relay, Nonlatching:

a. Type: Compact general-purpose plug-in.

b. Contact Arrangement: 3 Form C contacts.

c. Contact Rating: 10A at 28V dc or 240V ac.

d. Contact Material: Silver cadmium oxide alloy.

e. Coil Voltage: As noted or shown.

f. Coil Power: 1.8 watts (dc), 2.7VA (ac).

g. Expected Mechanical Life: 10,000,000 operations.

h. Expected Electrical Life at Rated Load: 100,000 operations.

i. Indication Type: Neon or LED indicator lamp.

j. Push to test button.

k. Manufacturer and Product: Potter and Brumfield; Series KUP.

4. Control Circuit Switching Relay, Latching:

a. Type: Dual coil mechanical latching relay.

b. Contact Arrangement: 2 Form C contacts.

c. Contact Rating: 10A at 28V dc or 120V ac.

d. Contact Material: Silver cadmium oxide alloy.

e. Coil Voltage: As noted or shown.

f. Coil Power: 2.7 watts (dc), 5.3VA (ac).

g. Expected Mechanical Life: 500,000 operations.

h. Expected Electrical Life at Rated Load: 50,000 operations.

i. Manufacturer and Product: Potter and Brumfield; Series KB/KBP.

5. Control Circuit Switching Relay, Time Delay:

a. Type: Adjustable time delay relay. Settable for time delays of 0.05 seconds to 999 minutes.

b. Contact Arrangement: 2 Form C contacts.

c. Contact Rating: 10A at 240V ac.

1) Contact Material: Silver cadmium oxide alloy.

d. Coil Voltage: As noted or shown.

e. Operating Temperature: Minus 10 to 55 degrees C.

f. Repeatability: Plus or minus 2 percent.

g. Delay Time Range: Select range such that time delay setpoint fall between 20 to 80 percent of range.

h. Time Delay Setpoint: As noted or shown.

i. Mode of Operation: As noted or shown.

j. Adjustment Type: Integral potentiometer with knob external to dust cover.

k. Manufacturer and Products: Square D.

1) Class 9050, type JCK70 or Owner approved equal.

L. Power Supplies:

1. Furnish to power instruments requiring external dc power, including two-wire transmitters and dc relays.

2. Convert 120V ac, 60-Hz power to dc power of appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that instruments being supplied can operate within their required tolerances.

3. Provide output over voltage and over current protective devices to:

a. Protect instruments from damage due to power supply failure.

b. Protect power supply from damage due to external failure.

4. Enclosures: NEMA 1 in accordance with NEMA 250.

5. Mount such that dissipated heat does not adversely affect other components.

6. Fuses: For each dc supply line to each individual two-wire transmitter.

a. Type: Indicating.

b. Mount so fuses can be easily seen and replaced.

M. Internal Panel Lights for Freestanding Panels:

1. Type: Switched 100-watt incandescent back-of-panel lights.

2. Quantity: One light for every 4 feet of panel width.

3. Mounting: Inside and in the top of back-of-panel area.

4. Protective metal shield for lights.

N. Service Outlets for Freestanding Panels:

1. Type: Three-wire, 120-volt, 15-ampere, GFCI duplex receptacles.

2. Quantity:

a. For panels 4 feet wide and smaller: One.

b. For panels wider than 4 feet: One for every 4 feet of panel width, two minimum per panel.

3. Mounting: Evenly spaced along back-of-panel area.

O. Internal Panel Lights and Service Outlets for Smaller Panels:

1. Internal Panel Light: Switched 100-watt incandescent light.

2. Service Outlet: Breaker protected 120-volt, 15-amp, GFCI duplex receptacle:

P. Uninterruptable Power Supply (UPS):

1. All Control Panels with PLCs shall require a UPS rated for the appropriate temperatures inside of that panel and as specified herein.

Q. Standard Pushbutton Colors and Inscriptions: Use following color code and inscriptions for pushbuttons, unless otherwise noted in Instrument List, Article Supplements.

Tag Function	Inscription(s)	Color
OO	ON OFF	Black Black
OC	OPEN CLOSE	Black Black
OCA	OPEN CLOSE AUTO	Black Black Black
OOA	ON OFF AUTO	Black Black Black
MA	MANUAL AUTO	Black Black
SS	START STOP	Black Black
RESET	RESET	Black
EMERGENCY STOP	EMERGENCY STOP	Red

a. Lettering Color:

1) Black on white and yellow buttons.

2) White on black, red, and green buttons.

R. Standard Light Colors and Inscriptions: Use following color code and inscriptions for service legends and lens colors for indicating lights, unless otherwise noted in Instrument List, Article Supplements.

Tag Function	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Green
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Green
FAIL	FAIL	Amber
HIGH	HIGH	Red

Tag Function	Inscription(s)	Color
AUTO	AUTO	White
MANUAL	MANUAL	Yellow
LOCAL	LOCAL	White
REMOTE	REMOTE	Yellow

1. Lettering Color:
   a. Black on white and amber lenses.
   b. White on red and green lenses.

2.6 ELECTRICAL TRANSIENT PROTECTION

A. General:

1. Function: Protect elements of PIC against damage due to electrical transients induced in interconnecting lines by lightning and nearby electrical systems.

2. Implementation: Provide, install, coordinate, and inspect grounding of surge suppressors at:
   a. Connection of ac power to PIC equipment including panels, consoles assembles, and field mounted analog transmitters and receivers.
   b. At the field and panel, console, or assembly connection of signal circuits that have portions of the circuit extending outside of a protective building.
3. Construction: First-stage high energy metal oxide varistor and second-stage bipolar silicon avalanche device separated by series impedance. Includes grounding wire, stud, or terminal.
4. Response: 5 nanoseconds maximum.
5. Recovery: Automatic.
6. Temperature Range: Minus 20 degrees C to plus 85 degrees C.

B. Suppressors on 120V ac Power Supply Connections:

1. Occurrences: Tested and rated for a minimum of 50 occurrences of IEEE 587 Category B test waveform.
2. First-Stage Clamping Voltage: 350 volts or less.
3. Second-Stage Clamping Voltage: 210 volts or less.
4. Continuous Operation: Power supplies for one four-wire transmitter or receiver: 5 amps minimum at 130V ac. All other applications: 30 amps minimum at 130V ac.

C. Suppressors on Analog Signal Lines:

1. Test Waveform: Linear 8 microsecond rise in current form 0 amps to a peak current value followed by an exponential decay of current reaching one half the peak value in 20 microseconds.

2. Surge Rating: Tested and rated for 50 occurrences of 2,000-amp peak test waveform.

   a. dc Clamping Voltage: 20 to 40 percent above operating voltage for circuit.

   b. dc Clamping Voltage Tolerance: Less than plus or minus 10 percent.

   c. Maximum Loop Resistance: 18 ohms per conductor.

D. Physical Characteristics:

1. Mounted in Enclosures: Encapsulated inflame retardant epoxy.

2. For Analog Signals Lines: EDCO PC-642 or SRA-64 series.

3. For 120V ac Lines: EDCO HSP-121.

4. Field Mounted at Two-Wire Instruments: Encapsulated in stainless steel pipe nipples. EDCO SS64 series.

5. Field Mounted at Four-Wire Instruments: With 120V ac outlet, ac circuit breaker, and 10-ohm resistors on signal lines, all in enclosure.

   a. Enclosure: NEMA 4X fiberglass or Type 316 stainless steel with door.

      1) Maximum Size: 12 inches by 12 inches by 8 inches deep.

   b. Manufacturer and Product: EDCO; SLAC series.

E. Installation and Grounding of Suppressors: As shown. See Surge Suppressor Installation Details. Grounding equipment, installation of grounding equipment, and terminations for field mounted devices are provided under Division 16, Electrical.

2.7 MECHANICAL SYSTEMS

A. Flow Element, Rotameter, Purge:

1. For air service, unless otherwise noted.

2. Materials: Glass tube, fiberglass body, stainless steel float, nylon ball check valve.

3. Direct-Reading Scale Length: 2-1/2 inches, minimum.

4. Scale Ranges: 0 to 2.5 scfh for air service or 0 to 10 gph for water service.

5. Integral inlet needle valves.

6. Integral Differential Pressure Regulators:

   a. For water service.

   b. For air service for level ranges greater than 10 feet of water.

7. Manufacturers and Products:

a. Fischer & Porter; Series 10A3130.

b. Brooks; Series DS-1350.

B. Manifold, Three-Valve Equalizing:

1. Type: For isolation and equalization of differential pressure transducers.
2. Materials: 316 Stainless steel.
3. Manufacturers and Products:
   a. Anderson, Greenwood and Co.; Type M1.
   b. Evans.

C. Pressure Gauge: For other than process variable measurement.

1. Dial Size: Nominal 2-inch dial size.
2. Accuracy: 2 percent of span.
3. Scale Range: Such that normal operating pressure lies between 50 and 80 percent of scale range.
4. Connection: ¼-inch NPT through bottom, unless otherwise noted.
5. Manufacturers and Products:
   a. Ashcroft Utility; Gauge Series 1000.
   b. Marsh; Standard Gauge Series.
   c. Ametek U.S.; Gauge Series P500.
   d. Acculite; Series 2000.

D. Valve, Needle:

1. Materials: Stainless steel body with 0.020-inch orifice.
2. Manufacturers and Products:
   a. Whitey; Model 21RF2.
   b. Hoke; 3700 Series.

E. ON/OFF Valves:

1. Type: Ball valve.
2. Materials: Stainless steel.
3. Manufacturers and Products:
   a. Whitey; Series 41 through Series 43.
   b. Hoke; Flomite 7100 Series.

F. Regulating Valves:

1. Type: Needle valves, with regulating stems and screwed bonnets.

2. Materials: Stainless steel.
3. Manufacturers and Products:
    a. Whitey; Catalog No. RF or RS.
    b. Hoke; 3100 through 3300 Series.

G. Valve, Three-Way:

1. Type: Ball valve.
2. Materials: Stainless steel with nylon handle.
3. Manufacturers and Products:
    a. Whitey; Series 41 through Series 43.
    b. Hoke; Selecto-Mite Series.

H. Valve, Four-Way:

1. Type: Four-way, two-position ball valve.
2. Materials:
    a. Body and Stem: Type 316 stainless steel.
    b. Handle: Black nylon.
    c. Packing Gland: Teflon.
3. Ball and stem bed, one-piece assembly.
4. Machined handle stops and directional nameplates.
5. Manufacturers and Products:
    a. Whitey; Series 457.
    b. Hoke; Multi-Mite Series.

I. Spool Valve:

1. Type: Five-port arrangement as shown, two-position, push-to-operate knob attached to the spool stem, and spring return.
2. Materials: Aluminum construction with Teflon impregnated aluminum spool, stainless steel spring, and Buna-N O-rings.
3. Port Connection: ¼-inch OD tube fittings.
4. Manufacturer and Product: Norgren; T71DAOO-TSO-TKO.

J. Solenoid Valve, Two-Way:

1. Type: Globe valve directly actuated by solenoid and not requiring minimum pressure differential for operation.
2. Materials:
    a. Body: Brassed globe valves.
    b. Valve Seat: Buna-N.

3. Size: As noted and normally closed or opened, as noted.

4. Coil: 115V ac, unless noted otherwise.

5. Solenoid Enclosure: NEMA 4.

6. Manufacturer and Product: ASCO; Red Hat Series 8260.

K. Pressure Regulator, Air:

1. Provide air at reduced pressures, as shown, constant to within plus or minus 10 percent for flows from 0 to 300 scfh with 100 psi supply pressure.

2. Setscrew for outlet pressure adjustment.

3. Integral filter and relief valve.

4. Manufacturers and Products:

a. Masoneilan; Series 77-4.

b. Fisher; Series 67FR.

L. Pressure Regulator, Water:

1. Materials:

a. Body: Bronze.

b. Spring Case: Cast iron.

c. Seat Rings: Brass.

d. Valve Disk and Holder: Buna-N and bronze.

e. Diaphragm: Buna-N diaphragm.

2. Sizing: For maximum of 7 psi offset pressure.

3. Manufacturers and Products:

a. Fisher; Controls Type 95H or 95L.

b. Masoneilan; Series 17.

M. Test Tap:

1. Manufacturers and Products:

a. Imperial-Eastman; quick-disconnect couplings No. 292-P and caps No. 259-P.

b. Crawford Fitting Co.; Swagelok quick-connects Series QC4 and caps QC4-DC.

c. Parker; CPI Series precision quick couplings.

N. Plastic Tubing and Fittings:

1. Tubing: Polyethylene capable of withstanding 190 psig at 175 degrees F.

   a. Manufacturers and Products:

      1) Dekoron; Type P.

      2) Imperial Eastman; Poly-Flo black instrument tubing.

2. Fittings:

   a. Type: Stainless Steel compression.

   b. Manufacturers and Products:

      1) Imperial Eastman; Poly-Flo tube fittings.

      2) Dekoron; E-Z fittings.

O. Stainless Steel Tubing: ASTM A312, Type 316, seamless, soft annealed, as shown on Drawings, 0.065-inch wall.

P. Stainless Steel Fittings:

1. Compression Type:

   a. Materials: Stainless steel, ASTM A182 forged bodies or ASTM A276 barstock bodies, Type 316, flareless.

   b. Manufacturers and Products:

      1) Swagelok tube fittings.

      2) Parker Flodar; BA Series.

      3) Parker CPI tube fittings; Parker A-LOK dual ferrule tube fittings.

Q. Tubing Raceways:

1. Cable tray systems complete with tees, elbows, reducers, and covers.
2. Size in accordance with manufacturer's recommendations for the intended service.
3. Materials: as noted.
4. Manufacturers:

   a. Globetray.

   b. Cope.

2.8 TEST EQUIPMENT AND TOOLS

Item	Qty.	Options and Model
Digital Multimeter	1	Fluke Model 87V/E Industrial Electrician Combo Kit with test leads, removable test probes, long reach alligator clips, magnetic hanger, temperature probe, and carrying case.
Clamp-on Ammeter	1	3-1/2-digit display unit with protective case; TES Model 3040 or Fluke Model 337E.
DC Digital Process Signal Calibrator	1	Portable, two-channel, with test leads, rechargeable batteries, charger, and carrying case; Transmation Model 1045-01.
Small Tool Kit	1	Kit of instrument maintenance tools in soft, zipper case; Jensen Tools Model JTK-47CG Field Engineer's Kit.
Large Tool Kit	1	Kit of instrument maintenance tools in high-density polyethylene case; Jensen Tools Model JTK-17LST.
Screw Starters	1	Kits of slotted screw starters with magnetic retrievers; Jensen Tools Model 23B021 and 23B023.
Terminal Kit	1	Kit of solderless terminals and cable ties; Jensen Tools Model 23B210

2.9 SPARE PARTS

Description	Percent of Each Type and Size Used	No Less Than
dc power supplies	20	2
Fuses	20	5
Indicating light bulb	20	10
Relays	20	3
Terminal Blocks	10	10
Hand Switches	10	5

Component (Code)	Quantity	Option
Dissolved Oxygen Analyzer (A20)	1	With Clean Feature
Chlorine Residual Analyzer (A24)	1	
Thermal Mass Flow Meter (F51)	1	
Configuration Software for Operator Interface Unit: Vijeo Designer	2	Licenses to be issues in Owner's name.
PLC Components (Y50, Y50A)		See Spare Part requirements in Supplement, Component Specifications.

2.10 EXPENDABLES

Item	Quantity
Chemicals for analyzers	Manufacturer's recommended 2-year supply
Corrosion-inhibiting vapor capsules	Manufacturer's recommended 2-year supply

2.11 FABRICATION

A. General:

1. Panels with external dimensions and instruments arrangement as shown on Drawings.
2. Panel Construction and Interior Wiring: In accordance with the National Electrical Code, state and local codes, NEMA, ANSI, UL, and ICECA.
3. Fabricate panels, install instruments, wire, and plumb, at the PIC factory.
4. Electrical Work: In accordance with Division 16, Electrical.

B. Factory Assembly: Assemble panels at the manufacturer's factory. No fabrication other than correction of minor defects or minor transit damage shall be done on panels at Site.

C. UL Listing Mark for Enclosures: Mark stating "Listed Enclosed Industrial Control Panel" per UL 508A.

D. Wiring Within PIC Panels:

1. Restrain by plastic ties or ducts or metal raceways.
2. Hinge Wiring: Secure at each end so that bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.

3. Arrange wiring neatly, cut to proper length, and remove surplus wire.

4. Abrasion protection for wire bundles which pass through holes or across edges of sheet metal.

5. Connections to Screw Type Terminals:

   a. Locking-fork-tongue or ring-tongue lugs.

   b. Use manufacturer's recommended tool with required sized anvil to make crimp lug terminations.

   c. Wires terminated in a crimp lug, maximum of one.

   d. Lugs installed on a screw terminal, maximum of two.

6. Connections to Compression Clamp Type Terminals:

   a. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.

   b. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.

7. Only one wire shall be terminated at device terminals or terminal blocks.

8. Terminate 24V dc and analog signal circuits on separate terminal block from ac circuit terminal blocks.

9. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.

10. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.

11. Plastic Wire Ducts Fill: Do not exceed manufacturer's recommendation.

E. Temperature Control:

1. Freestanding Panels:

   a. Nonventilated Panels: Size to adequately dissipate heat from equipment mounted inside panel or on panel.

   b. Ventilated Panels (as allowed by Environmental requirements described herein):

      1) Furnish with louvers and forced ventilation as required to prevent temperature buildup from equipment mounted inside panel or on panel.
      2) For panels with backs against wall, furnish louvers bottom of panel sides.
      3) For panels without backs against wall, furnish louvers bottom of panel back.
      4) Louver Construction: Stamped sheet metal.
      5) Ventilation Fans:
         a) Furnish where required to provide adequate cooling.
         b) Create positive internal pressure within panel.

c) Fan Motor Power: 120V ac, 60-Hz, thermostatically controlled.

6) Air Filters: Washable aluminum, Hoffman Series A-FLT.

2. Refrigerated System: Furnish where heat dissipation cannot be adequately accomplished with natural convection or forced ventilation. Smaller Panels (that are not freestanding): Size to adequately dissipate heat from equipment mounted inside panel or in panel face.

3. Space Heaters:

a. Thermostatically controlled to maintain internal panel temperatures above dew point.

F. Freestanding Panel Construction:

1. Materials: Sheet steel, unless otherwise shown on Drawings with minimum thickness of 10-gauge, unless otherwise noted.

2. Panel Fronts:

a. Fabricated from a single piece of sheet steel, unless otherwise shown on Drawings.

b. No seams or bolt heads visible when viewed from front.

c. Panel Cutouts: Smoothly finished with rounded edges.

d. Stiffeners: Steel angle or plate stiffeners or both on back of panel face to prevent panel deflection under instrument loading or operation.

3. Internal Framework:

a. Structural steel for instrument support and panel bracing.

b. Permit panel lifting without racking or distortion.

4. Lifting rings to allow simple, safe rigging and lifting of panel during installation.

5. Adjacent Panels: Securely bolted together so front faces are parallel.

6. For all freestanding control panels housing a PLC, provide fold out self kit as manufactured by enclosure manufacturer.

7. Doors: Full height, fully gasketed access doors where shown on Drawings.

a. Latches: Three-point, Southco Type 44.

b. Handles: “D” ring, foldable type.

c. Hinges: Full length, continuous, piano type, steel hinges with stainless steel pins.

d. Rear Access Doors: Extend no further than 24 inches beyond panel when opened to 90-degree position.

e. Front and Side Access Doors: As shown on Drawings.

G. Nonfreestanding Panel Construction:

1. Based on environmental design requirements required and referenced in Article Environmental Requirements, provide the following:

   a. For panels listed as inside, air conditioned:

      1) Enclosure Type: NEMA 12 in accordance with NEMA 250.
      2) Materials: Steel.

   b. For all other panels:

      1) Enclosure Type: NEMA 4X in accordance with NEMA 250.

      2) Materials: Type 316 stainless steel.

2. Metal Thickness: 14-gauge, minimum.

3. Doors:

   a. Rubber-gasketed with continuous hinge.

   b. Stainless steel lockable quick-release clamps.

4. Manufacturers:

   a. Hoffman Engineering Co.

   b. Rittal.

H. Factory Finishing:

1. Enclosures:

   a. Stainless Steel and Aluminum: Not painted.

   b. Nonmetallic Panels: Not painted.

   c. Steel Panels:

      1) Sand panel and remove mill scale, rust, grease, and oil.

      2) Fill imperfections and sand smooth.

      3) Paint panel interior and exterior with one coat of epoxy coating metal primer, two finish coats of two-component type epoxy enamel.

      4) Sand surfaces lightly between coats.

      5) Dry Film Thickness: 3 mils, minimum.

      6) Color: Manufacturer’s standard.

2. Manufacturer’s standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment with light gray color.

2.12 CORROSION PROTECTION

A. Corrosion-Inhibiting Vapor Capsule Manufacturers:

1. Northern Instruments; Model Zerust VC.

2. Hoffmann Engineering Co; Model A-HCI.

2.13 SOURCE QUALITY CONTROL

A. Scope: Inspect and test entire PIC to ensure it is ready for shipment, installation, and operation.

B. Location: Manufacturer's factory or Engineer approved staging Site.

C. Test: Exercise and test all functions.

D. Temporary PLC software configuring to allow PLC testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. For equipment not provided by PIC, but that directly interfaces with the PIC, verify the following conditions:

1. Proper installation.
2. Calibration and adjustment of positioners and I/P transducers.
3. Correct control action.
4. Switch settings and dead bands.
5. Opening and closing speeds and travel stops.
6. Input and output signals.

3.2 INSTALLATION

A. Material and Equipment Installation: Retain a copy of manufacturers' instructions at Site, available for review at all times.

B. Electrical Wiring: As specified in Division 16, Electrical.

C. Mechanical Systems:

1. Drawings for PIC Mechanical Systems are diagrammatic and not intended to specifically define element locations or piping and tubing run lengths. Base materials and installations on field measurements.
2. Copper and Stainless Steel Tubing Support: Continuously supported by an aluminum tubing raceway system.
3. Plastic Tubing Supports: Except as shown on Drawings, provide continuous support in conduits or by aluminum tubing raceway system.
4. Install tubing conduit for plastic tubing and tubing raceways parallel with, or at right angles to, structural members of buildings. Make vertical runs straight and plumb.
5. Tubing and Conduit Bends:

a. Tool-formed without flattening, and all of same radius.

b. Bend Radius: Equal to or larger than conduit and tubing manufacturer's recommended minimum bend radius.

c. Slope instrument connection tubing in accordance with installation details.

d. Do not run liquid filled instrument tubing immediately over or within a 3-foot plan view clearance of electrical panels, motor starters, or mechanical mounting panel without additional protection. Where tubing must be located in these zones, shield electrical device to prevent water access to electrical equipment.

e. Straighten coiled tubing by unrolling on flat surface. Do not pull to straighten.

f. Cut tubing square with sharp tubing cutter. Deburr cuts and remove chips. Do not gouge or scratch surface of tubing.

g. Blow debris from inside of tubing.

h. Make up and install fittings in accordance with manufacturer's recommendations. Verify makeup of tube fittings with manufacturer's inspection gauge.

i. Use lubricating compound or TFE tape on stainless steel threads to prevent seizing or galling.

j. Run tubing to allow, for example, clear access to doors, controls, and control panels; and to allow for easy removal of equipment.

k. Provide separate support for components in tubing runs.

l. Supply expansion loops and use adapters at pipe, valve, or component connections for proper orientation of fitting.

m. Keep tubing and conduit runs at least 12 inches from hot pipes.

n. Locate and install tubing raceways in accordance with manufacturer's recommendations. Locate tubing to prevent spillage, overflow, or dirt from above.

o. Securely attach tubing raceways to building structural members.

6. Enclosure Lifting Rings: Remove rings following installation and plug holes.

D. Removal or Relocation of Materials and Equipment:

1. Remove from Site materials that were part of the existing facility but are no longer used, unless otherwise directed by Engineer to deliver to Owner.

2. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.

3.3 FIELD FINISHING

A. Refer to Section 09902, Painting and Protective Coatings.

3.4 FIELD QUALITY CONTROL

A. Startup and Testing Team:

1. Thoroughly inspect installation, termination, and adjustment for components and systems.
2. Complete onsite tests.
3. Complete onsite training.
4. Provide startup assistance.

B. Operational Readiness Test (ORT) Inspections and Calibrations: Prior to startup, inspect and test to ensure that entire PIC is ready for operation. All ORT loop status tests shall be from field control device (i.e. instrument, field panel, MCC handswitch).

1. Loop/Component Inspections and Calibrations:

a. Check PIC for proper installation, calibration, and adjustment on a loop-by-loop and component-by-component basis.

b. Prepare component calibration sheet for each active component (except simple hand switches, lights, gauges, and similar items).

1) Project name.
2) Loop number.
3) Component tag number.
4) Component code number.
5) Manufacturer for elements.
6) Model number/serial number.
7) Summary of functional requirements, for example:

a) Indicators and recorders, scale and chart ranges.
b) Transmitters/converters, input and output ranges.
c) Computing elements' function.
d) Controllers, action (direct/reverse) and control modes (PID).
e) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).

8) Calibrations, for example:

a) Analog Devices: Actual inputs and outputs at 0, 10, 50, and 100 percent of span, rising and falling.
b) Discrete Devices: Actual trip points and reset points.
c) Controllers: Mode settings (PID).

9) Space for comments.

c. These inspections and calibrations will be spot checked by Engineer.

2. Leak Test: In accordance with Section 15042, Testing of Pipelines and Hydraulic Structures.

C. Performance Acceptance Tests (PAT):

1. General:

a. Test all PIC elements to demonstrate that PIC satisfies all requirements. AES shall participate in all PAT testing. PICS contractor shall coordinate all PAT testing with AES.

b. Test Format: Cause and effect.

1) Person conducting test initiates an input (cause).

2) Specific test requirement is satisfied if correct result (effect) occurs.

c. Procedures, Forms, and Checklists:

1) Conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.

2) Describe each test item to be performed.

3) Have space after each test item description for sign off by appropriate party after satisfactory completion.

d. Required Test Documentation: Test procedures, forms, and checklists. All signed by Engineer and Contractor.

e. Conducting Tests:

1) Provide special testing materials, equipment, and software.

2) Wherever possible, perform tests using actual process variables, equipment, and data.

3) If it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation.

4) Define simulation techniques in test procedures.

f. Coordinate PIC testing with Owner and affected Subcontractors.

1) Excessive Test Witnessing: Refer to Supplementary General Conditions.

2. Test Requirements:

a. Once facility has been started up and is operating, perform a witnessed PAT on complete PIC to demonstrate that it is operating as required. Demonstrate each required function on a paragraph-by-paragraph and loop-by-loop basis.

b. Perform local and manual tests for each loop before proceeding to remote and automatic modes.

c. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed

to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.

d. Make updated versions of documentation required for PAT available to Engineer at Site, both before and during tests.

e. Make one copy of O&M manuals available to Engineer at the Site both before and during testing.

f. Refer to referenced examples of PAT procedures and forms in Article Supplements.

3.5 MANUFACTURER'S SERVICES

A. Specialty Equipment: For following equipment, provide the services of a qualified manufacturer's representative during installation, startup, and demonstration testing and Owner training. Provide original equipment manufacturers' services for:

1. Component Code A20 Dissolve Oxygen Analyzer.
2. Component Code A24 Residual Chlorine Analyzer.

B. Each Clamp-On Ultrasonic Flow Indicator and Transmitter shall be calibrated on-site by the manufacturer (as required herein) using a portable ultrasonic flow meter. The calibration should be coordinated with and witnessed by the City of Austin Water and Wastewater Department. However, the calibration shall consist of running the pumps individually as well as jointly. The permanent flow meters shall be calibrated with the portable flow meters on each location. The meter readings shall be verified by the City of Austin Water and Wastewater Department as well as the equipment manufacturer and the PICS.

3.6 TRAINING

A. General:

1. Provide an integrated training program to meet specific needs of Owner's personnel.
2. Include training sessions, classroom and field, for managers, engineers, operators, and maintenance personnel.
3. Provide instruction on up to four working shift(s) as needed to accommodate the Owner's personnel schedule.
4. Owner reserves the right to make and reuse video tapes of training sessions.
5. All training related to PLC and HMI application programming shall be provided by AES.

B. Operations and Maintenance Training:

1. Include a review of O&M manuals and survey of spares, expendables, and test equipment.
2. Use equipment similar to that provided or currently owned by Owner.

3. Provide separate dedicated training sessions for instrument technicians. Training shall be suitable for instrument technicians with at least a 2-year associate engineering or technical degree, or equivalent education and experience in electronics or instrumentation. O&M training for instrument technicians shall be separate from any other O&M training.

C. Operations Training:

1. For Plant Operations Staff:
   a. Training Session Duration: three 8-hour instructor days.
   b. Number of Training Sessions: two.
   c. Location: Site.
   d. Content: Conduct training on loop-by-loop basis.
      1) Loop Functions: Understanding of loop functions, including interlocks for each loop.
      2) Loop Operation: For example, adjusting process variable setpoints, AUTO/MANUAL control transfer, AUTO and MANUAL control, alarm acknowledgement and resetting.
      3) Interfaces with other control systems.

2. For Instrument and Electrical Staff:
   a. Training Session Duration: three 8-hour instructor days.
   b. Number of Training Sessions: two.
   c. Location: Site.
   d. Content: Conduct training on loop-by-loop basis.
      1) Loop Functions: Understanding of loop functions, including intended functionality for field instrument applications.
      2) Understanding all set-up and troubleshooting procedures for field instrumentation components.
      3) Review of wiring diagrams and schematics to understand intended logic and functions.

3. For SCADA & PLC Programming Staff:
   a. Training Session Duration: three 8-hour instructor days.
   b. Number of Training Sessions: two.
   c. Location: Site.
   d. Content: Conduct training on loop-by-loop basis.
      1) Loop Functions: Understanding of loop functions, including intended functionality for field instrument applications.
      2) Understanding all configuration and troubleshooting procedures for SCADA components including but not limited to:
         a) PLCs
         b) SCADA workstations
         c) OIUs
         d) Network switches
         e) Communication modems

3) Review of all technical support resources provide in O&M manuals and local contacts for manufacturer's representatives.

D. Maintenance Training:

1. Training Session Duration: three 8-hour instructor days.
2. Number of Training Sessions: two.
3. Location: Project Site.
4. Content: Provide training for each type of component and function provided.
   a. Loop Functions: Understanding details of each loop and how they function.
   b. Component calibration.
   c. Adjustments: For example, controller tuning constants, current switch trip points, and similar items.
   d. Troubleshooting and diagnosis for components.
   e. Replacing lamps, chart paper, fuses.
   f. Component removal and replacement.
   g. Periodic maintenance.

3.7 CLEANING/ADJUSTING

A. Repair affected surfaces to conform to type, quality, and finish of surrounding surface.

B. Cleaning:

1. Prior to closing system using tubing, clear tubing of interior moisture and debris.
2. Upon completion of Work, remove materials, scraps, and debris from interior and exterior of equipment.

3.8 PROTECTION

A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.

B. Periodically replace capsules in accordance with capsule manufacturer's recommendations. Replace capsules just prior to Final Payment and Acceptance.

3.9 SUPPLEMENTS

A. Supplements listed below, following "End of Section," are part of this Specification.

1. Component Specifications.

2. Instrument List.

3. Control Narratives.

4. PLC Input and Output List.

5. Instrument Calibration Sheet: Provides detailed information on each instrument (except simple hand switches, lights, and similar items).

6. I&C Valve Adjustment Sheet: Each sheet shows detailed information for installation, adjustment, and calibration of a given valve.

7. Performance Acceptance Test Sheet: Describes the PAT for a given loop. The format is mostly free form.

    a. Lists the requirements of the loop.

    b. Briefly describes the test.

    c. Cites expected results.

    d. Provides space for check off by witness.

END OF SECTION

COMPONENT	**MANUFACTURER**	**PROJECT**
Code:	Name:	Number:
Name:	Model:	Name:
	Serial #:	

FUNCTIONS

	RANGE	VALUE	UNITS	COMPUTING FUNCTIONS? Y / N	CONTROL? Y / N
Indicate? Y / N	Chart:			Describe:	Action? direct / reverse Modes? P / I / D
Record? Y / N	Scale:				SWITCH? Y / N Unit Range:
Transmit/	Input:				Differential: fixed/adjustable
Convert? Y / N	Output:				Reset? automatic / manual

ANALOG CALIBRATIONS							**DISCRETE CALIBRATIONS**					**Note No.**
REQUIRED			AS CALIBRATED				REQUIRED			AS CALIBRATED		
Input	Indicated	Output	Increasing Input		Decreasing Input		Number	Trip Point	Reset Pt.	Trip Point	Reset Pt.	
			Indicated	Output	Indicated	Output		(note rising or falling)		(note rising or falling)		
							1.					
							2.					
							3.					
							4.					
							5.					
							6.					
CONTROL MODE SETTINGS:			P:	I:	D:		7.					

#	**NOTES:**	**Component Calibrated and Ready for Startup**
		By:
		Date:

EXAMPLE - ANALYZER/TRANSMITTER

COMPONENT	MANUFACTURER	PROJECT
Code: *A7*	Name: *Leeds & Northrup*	Number: *WDC30715.B2*
Name: *pH Element & Analyzer/Transmitter*	Model: *12429-3-2-1-7*	Name: *UOSA AWT PHASE 3*
	Serial #: *11553322*	

FUNCTIONS

	RANGE	VALUE	UNITS	COMPUTING FUNCTIONS? N	CONTROL? N
Indicate? Y Record? N	Chart:			Describe:	Action? direct / reverse Modes? P / I / D
	Scale:	*1-14*	*pH units*		SWITCH? N Unit Range:
Transmit/	Input:	*1-14*	*pH units*		Differential: fixed/adjustable
Convert? Y	Output:	*4-20*	*mA dc*		Reset? automatic / manual

ANALOG CALIBRATIONS							DISCRETE CALIBRATIONS					Note
REQUIRED			AS CALIBRATED				REQUIRED			AS CALIBRATED		**No**
Input	Indicated	Output	Increasing Input		Decreasing Input		Number	Trip Point	Reset Pt.	Trip Point	Reset Pt.	
			Indicated	Output	Indicated	Output		(note rising or falling)		(note rising or falling)		
1.0	*1.0*	*4.0*	*1.0*	*4.0*	*1.0*	*3.9*	1.	*N.A.*		*N.A.*		
2.3	*2.3*	*5.6*	*2.2*	*5.5*	*2.3*	*5.6*	2.					*1.*
7.5	*7.5*	*12.0*	*7.5*	*11.9*	*7.5*	*12.0*	3.					
12.7	*12.7*	*18.4*	*12.7*	*18.3*	*12.6*	*18.3*	4.					
14.0	*14.0*	*20.0*	*14.0*	*20.0*	*14.0*	*20.0*	5.					
							6.					
CONTROL MODE SETTINGS:			P: *N.A.*	I:	D:		7.					

#	NOTES:	**Component Calibrated and Ready for Startup**
	1. Need to recheck low pH calibration solutions.	By: *J.D. Sewell*
		Date: *Jun-6-12*
		Tag No.: AIT-12-6[pH]

CH2M HILL **I&C VALVE ADJUSTMENT SHEET**
Rev.06.05.12

PARTS	Project Name:	Project Number:
Body	Type:	Mfr:
	Size:	Model:
	Line Connection:	Serial #:
Operator	Type:	Mfr:
	Action:	Model:
	Travel:	Serial #:
Positioner	Input Signal:	Mfr:
	Action:	Model:
	Cam:	Serial #:
Pilot Solenoid	Action:	Mfr:
	Rating:	Model:
		Serial #:
I/P Converter	Input:	Mfr:
	Output:	Model:
	Action:	Serial #:
Position Switch	Settings:	Mfr:
	Contacts:	Model:
		Serial #:
Power Supply	Type:	Air Set Mfr:
	Potential:	Model:
		Serial #:

ADJUSTMENTS	Initial	Date	**VERIFICATION**	Initial	Date
Air Set			Valve Action		
Positioner			Installation		
Position Switches			Wire Connection		
I/P Converter			Tube Connection		
Actual Speed					

REMARKS:	**Valve Ready for Startup**
	By:
	Date:
	Tag No.:

CH2M HILL **I&C VALVE ADJUSTMENT SHEET**
Rev.06.05.12
EXAMPLE

PARTS	Project Name: *SFO SEWPCP*	Project Number: *SFO10145.G2*
Body	Type: *Vee-Ball*	Mfr: *Fisher Controls*
	Size: *4-inch*	Model: *1049763-2*
	Line Connection: *159 # ANSI Flanges*	Serial #: *1003220*
Operator	Type: *Pneumatic Diaphragm*	Mfr: *Fisher Controls*
	Action: *Linear - Modulated*	Model: *4060D*
	Travel: *3-inch*	Serial #: *2007330*
Positioner	Input Signal: *3-15 psi*	Mfr: *Fisher Controls*
	Action: *Direct - air to open*	Model: *20472T*
	Cam: *Equal percentage*	Serial #: *102010*
Pilot Solenoid	Action:	Mfr:
	Rating: *None*	Model:
		Serial #:
I/P Converter	Input: *4-20 mA dc*	Mfr: *Taylor*
	Output: *3-15 psi*	Model: *10-T-576-3*
	Action: *Direct*	Serial #: *1057-330*
Position Switch	Settings: *Closed / Open 5 deg, rising*	Mfr: *National Switch*
	Contacts: *Close / Close*	Model: *1049-67-3*
		Serial #: *156 &157*
Power Supply	Type: *Pneumatic*	Air Set Mfr: *Air Products*
	Potential: *40 psi*	Model: *3210D*
		Serial #: *1107063*

ADJUSTMENTS	Initial	Date	VERIFICATION	Initial	Date
Air Set	*JDS*	*Jun-06-12*	Valve Action	*JDS*	*Jun-03-12*
Positioner	*JDS*	*Jun-06-12*	Installation	*JDS*	*Jun-03-12*
Position Switches	*JDS*	*Jun-06-12*	Wire Connection	*JDS*	*Jun-04-12*
I/P Converter	*JDS*	*Jun-07-12*	Tube Connection	*JDS*	*Jun-04-12*
Actual Speed	*JDS*	*Jun-07-12*			

REMARKS: *Valve was initially installed backwards.*	**Valve Ready for Startup**
Observed to be correctly installed May-25-12	By: *J.D. Sewell*
	Date: *Jun-07-12*
	Tag No.: *FCV-10-2-1*

CH2M HILL **PERFORMANCE ACCEPTANCE TEST SHEET**
Rev.06.05.12

Project Name:	Project No.:

Demonstration Test(s): For each functional requirement of the loop:
(a) List and number the requirement. (b) Briefly describe the demonstration test.
(c) Cite the results that will verify the required performance. (d) Provide space for signoff.

Forms/Sheets Verified	By	Date	**Loop Accepted By Owner**
Loop Status Report			By:
Instrument Calibration Sheet			Date:
I&C Valve Calibration Sheet			
Performance Acceptance Test	By	Date	
Performed			
Witnessed			Loop No.:

CH2M HILL **PERFORMANCE ACCEPTANCE TEST SHEET** **Rev.06.05.12**

EXAMPLE

Project Name: *SFO SEWPCP Plant Expansion*	Project No.: *SFO12345.C1*

Demonstration Test(s): For each functional requirement of the loop:
(a) List and number the requirement. (b) Briefly describe the demonstration test.
(c) Cite the results that will verify the required performance. (d) Provide space for signoff.

1. MEASURE EFFLUENT FLOW

1.a With no flow, water level over weir should be zero and

FIT indicator should read zero. *Jun-20-12 BDG*

2. FLOW INDICATION AND TRANSMISSION TO LP & CCS

With flow, water level and FIT indicator should be related by expression

*Q(MGD) = 429*H**(2/3) (H = height in inches of water over weir).*

Vary H and observe that following.

2.a Reading of FIT indicator. *Jun-6-12 BDG*

2.b Reading is transmitted to FI on LP-521-1. *Jun-6-12 BDG*

2.c Reading is transmitted and displayed to CCS. *Jun-6-12 BDG*

H(measured)	*0*	*5*	*10*	*15*
Q(computed)	*0*	*47.96*	*135.7*	*251.7*
Q(FIT indicator)	*0*	*48.1*	*137*	*253*
Q(LI on LP-521-1)	*0*	*48.2*	*138*	*254*
Q(display by CCS)	*0*	*48.1*	*136.2*	*252.4*

Forms/Sheets Verified	By	Date	**Loop Accepted By Owner**
Loop Status Report	*J.D. Sewell*	*May-18-12*	By: *J.D. Smith*
Instrument Calibration Sheet	*J.D. Sewell*	*May-18-12*	Date: *Jun-6-12*
I&C Valve Calibration Sheet	*N.A.*		
Performance Acceptance Test	By	Date	
Performed	*J. Blow MPSDC Co.*	*Jun-6-12*	
Witnessed	*B.deGlanville*	*Jun-6-12*	Loop No.: *30-12*

SECTION 13401.01 - COMPONENT SPECIFICATIONS

PART 1 - GENERAL

1.1 COMPONENT SPECIFICATIONS

A. A20 Dissolved Oxygen Element and Transmitter, Nonmembrane Luminescent (LDO):

1. General:
   - a. Function: Continuous measurement of dissolved oxygen (DO) concentration of process fluid.
   - b. Type: Luminescent or fluorescence sensor.
   - c. Parts: Element (sensor), transmitter (analyzer), external power supply, interconnecting cable, mounting hardware, and ancillaries.
2. Performance:
   - a. Range: 0 to 20 ppm.
   - b. Sensor Accuracy:
     - 1) Measurement: plus or minus 0.2 percent of span.
     - 2) Temperature: plus or minus 0.2 degrees C.
   - c. Response Time: Less than 40 seconds to 90 percent of value upon step change.
3. Element:
   - a. Luminescent or fluorescent sensor.
   - b. Process Temperature Range: 32 degrees F to 122 degrees F.
   - c. Submersion Depth: 350 feet maximum.
   - d. Sensor Cable: Integral 33 feet of cable. Provide additional length as required.
   - e. Junction Box: Provide junction or termination box and extension cable as required.
   - f. Mounting: 1-1/2 UNF - 12 UNF thread.
4. Transmitter:
   - a. Display:
     - 1) Graphic dot matrix LCD to display DO.
     - 2) Auxiliary Readout:
       - a) Temperature.
       - b) Diagnostic warnings.
       - c) Error messages.
       - d) Other information.
   - b. Ambient Conditions:

1) Temperature minus 4 degrees F to plus 140 degrees F.

2) Humidity: 0 to 95 percent, relative, noncondensing.

c. Signal Interface:

1) Analog Output:

a) Two isolated 4 mA to 20 mA dc for load impedance up to 500 ohms.

b) Either output configurable for DO or temperature.

2) Relay Outputs:

a) Three SPST; 5 amps resistive, 115V ac/230V ac/30V dc.

b) Each relay assignable to either DO or temperature.

c) Function:

(1) Control: Settings for fail safe on/off, high/low phasing, setpoint, deadband, and on/off displays.

(2) Alarm: Settings for fail safe on/off, high alarm point, high alarm point deadband, low alarm point, low alarm point deadband, and on/off relays.

3) Serial Communication: If and as noted.

d. Enclosure: NEMA 4X/IP66 polycarbonate/aluminum.

e. Mounting Hardware: Suitable to support panel, surface, horizontal pipe, and vertical pipe mounting.

f. Power Requirements: 120V ac, 60-Hz.

g. Stainless steel equipment tag.

5. Accessories:

a. Unless otherwise noted, provide submersion mounting hardware and mounting bracket as required to perform appropriate installation.

b. Provide sun shield for transmitter display.

6. Manufacturers and Products:

a. Hach; sc100 LDO Analysis System.

b. Insite IG; Model 1000 Dissolved Oxygen Analyzer.

c. Environmental Instruments; FL-3 Dissolved Oxygen Analyzer.

d. Royce Technologies; Model 98/9810 Dissolved Oxygen Sensor/Analyzer.

B. A24 Chlorine Residual Analyzer, Colorimetric:

1. General:

a. Function:

1) Measure and indicate residual chlorine (free or total, as noted) of sample.

2) Transmit proportional analog (and, if noted, network) signal.

b. Type: Aqueous buffered colorimetric indicator (DPD).

c. Parts: Analyzer/transmitter, reagent, and accessories.

2. Performance:

a. Species Measured: Free residual chlorine, unless otherwise noted.

b. Service: Water treatment plant, unless otherwise noted.

c. Process Range: As noted.

d. Analyzer Range: 0 mg/L to 5 mg/L residual chlorine.

e. Accuracy: Whichever is greater:

1) Plus or minus 5 percent of reading or 0.05 mg/L.

f. Minimum Detection: 0.035 mg/L.

g. Batch Analysis Cycle Time: 2.5 minutes.

h. Sample Inlet Pressure:

1) To Instrument: 1 psig to 5 psig with 1.5 psig optimum.

2) To Sample Conditioning System: 1.5 psig to 75 psig.

i. Sample Flow Required: 200 ml to 500 ml per minute.

j. Sample Temperature Range: 41 degrees F to 104 degrees F.

k. Operating Temperature Range: 41 degrees F to 104 degrees F.

l. Operating Humidity: 90 percent at 104 degrees F.

m. Interferences:

1) Other oxidizing agents.

2) Hardness greater than 1,000 mg/L as $CaCO_3$.

3. Features:

a. Conversion from free to total by changing reagents.

b. Automatic self-testing diagnostics.

c. LCD Display:

1) Three-digit measurement readout.

2) Six-character alphanumeric scrolling text line.

d. Linear peristaltic pump.

e. Sample cell/mixing system.

f. Light Source:

1) Class 1 LED with a peak wavelength of 520 nm.

2) 50,000 hours estimated minimum life.

4. Enclosure:

a. IP62 (indoor use) industrial plastic with two clear polycarbonate windows.

b. Mounting: Wall.

c. Dimensions: 14W by 17H by 8D inches, nominal.

5. Signal Interface:

a. Analog Output:

1) 4 mA to 20 mA dc isolated output suitable for a load impedance up to 500 ohms.

2) Minimum and maximum span values operator programmable.

b. Discrete Outputs:

1) Two alarm outputs.

2) Each with SPDT contacts rated at 5 amp resistive at 230V ac.

c. Aquatrend Network Ready: If noted.

6. Process Connections:

a. Sample Inlet: 1/4-inch OD tube, quick-disconnect fitting.

b. Drain Connection: 1/2-inch flexible hose and hose barb.

c. Air Purge: If noted.

1) 1/4-inch OD tubing.

7. Power: 115/230V ac, 50 Hz, switch selectable.

8. Accessories:

a. Flowmeter.

b. 1-year maintenance kit with pre-assembled tubing.

c. Sample Conditioning Kit: Allows analyzer to function with inlet pressure up to 75 psig.

1) Water Treatment Plants: 1/4-inch tubing.

2) Wastewater Treatment Plants: 1/2-inch tubing.

d. Reagents: 12 reagent kits (free or total chlorine, as applicable), each sufficient for 30 days' operation.

1) Each kit consists of:

a) DPD Indicator Powder.

b) Chlorine Buffer Solution, 500 ml.

c) Chlorine Indicator Solution, 500 ml.

9. Manufacturer and Product: Hach Company; Model CL17.

C. F4 Flow Element and Transmitter, Electromagnetic:

1. General:

   a. Function: Measure, indicate, and transmit the flow of a conductive process liquid in a full pipe.

   b. Type:

      1) Electromagnetic flowmeter, with operation based on Faraday's Law, utilizing the pulsed dc type coil excitation principle with high impedance electrodes.

      2) Full bore meter with magnetic field traversing entire flow-tube cross section.

      3) Unacceptable are insert magmeters or multiple single point probes inserted into a spool piece.

   c. Parts: Flow element, transmitter, interconnecting cables, and mounting hardware. Other parts as noted.

2. Service:

   a. Stream Fluid:

      1) As noted.

      2) Suitable for liquids with a minimum conductivity of 5 microS/cm and for demineralized water with a minimum conductivity of 20 microS/cm.

   b. Flow Stream Descriptions: If and as described below.

3. Operating Temperature:

   a. Element:

      1) Ambient: Minus 5 to 140 degrees F, typical, unless otherwise noted.

      2) Process: Minus 5 to 140 degrees F, typical, unless otherwise noted.

   b. Transmitter:

      1) Ambient: Minus 5 to 140 degrees F, typical, unless otherwise noted.

      2) Storage: 15 to 120 degrees F, typical, unless otherwise noted.

4. Performance:

   a. Flow Range: As noted.

   b. Accuracy: Plus or minus 0.5 percent of rate for all flows resulting from pipe velocities of 2 to 30 feet per second.

   c. Turndown Ratio: Minimum of 10 to 1 when flow velocity at minimum flow is at least 1 foot per second.

5. Features:

a. Zero stability feature to eliminate the need to stop flow to check zero alignment.

b. No obstructions to flow.

c. Very low pressure loss.

d. Measures bi-directional flow.

6. Process Connection:

a. Meter Size (diameter inches): As noted.

b. Connection Type: 150-pound ANSI raised-face flanges; AWWA C207, Table 2 Class D; or wafer style depending on meter size, unless otherwise noted.

c. Flange Material: Carbon steel, unless otherwise noted.

7. Power (Transmitter): 120V ac, 60-Hz, unless otherwise noted.

8. Element:

a. Meter Tube Material: Type 304 or 316 stainless steel, unless otherwise noted.

b. Liner Material:

1) Teflon, unless otherwise noted.

2) For potable water service, must have appropriate approvals.

c. Liner Protectors: Covers (or grounding rings) on each end to protect liner during shipment.

d. Electrode Type: Flush or bullet nose as recommended by the manufacturer for the noted stream fluid.

e. Electrode Material: Type 316 stainless steel or Hastelloy C, unless otherwise noted.

f. Grounding Ring:

1) Required, unless otherwise noted.

2) Quantity: Two, unless otherwise noted.

3) Material: Type 316 stainless steel, unless otherwise noted.

g. Enclosure: NEMA 4X, minimum, unless otherwise noted.

h. Submergence:

1) Temporary: If noted.

2) Continuous (up to 10 feet depth), NEMA 6P/IP68: If noted.

i. Direct Buried (3 to 10 feet): If noted.

j. Hazardous Area Certification:

1) Class 1, Division 2, Groups A, B, C, D: If noted.

2) Class 1, Division 1, Groups A, B, C, D, and FM approved: If noted.

3) Class 1, Division 1, Groups C, D, and FM approved: If noted.

9. Transmitter:

a. Mounting: Surface (wall), unless otherwise noted.

b. Display: Required, unless otherwise noted.

1) Digital LCD display, indicating flow rate and total.

2) Bi-directional Flow Display: Required, unless otherwise noted.

a) Forward and reverse flow rate.

b) Forward, reverse and net totalization.

c. Parameter Adjustments: By keypad or non-intrusive means.

d. Enclosure: NEMA 4X, minimum, unless otherwise noted.

e. Empty Pipe Detection:

1) If noted.

2) Drives display and outputs to zero when empty pipe detected.

10. Signal Interface (at Transmitter):

a. Analog Output:

1) Isolated 4 mA to 20 mA dc for load impedance from 0 ohm to at least 500 ohms minimum for 24V dc supply.

2) Supports Superimposed Digital HART protocol: If noted.

b. Discrete Outputs: If noted.

1) Two discrete outputs, typical, rated for up to 30 volts, typical.

2) Programmable as noted for the following typical parameters:

a) Totalizer pulse, high/low flow rates, percent of range, empty pipe zero, fault conditions, forward/reverse, etc.

c. Discrete Input: If noted.

1) Contact closure, configured as noted for the following typical parameters: reset totalizer, change range, hold output constant, drive output to zero, and low flow cutoff, etc.

d. Other: As noted.

11. Cables:

a. Types: As recommended by manufacturer.

b. Lengths: As required to accommodate device locations.

12. Built-in Diagnostic System:

a. Features:

1) Field programmable electronics.

2) Self-diagnostics with troubleshooting codes.

3) Ability to program electronics with full scale flow, engineering units, meter size, zero flow cutoff, desired signal damping, totalizer unit digit value, etc.

4) Initial flow tube calibration and subsequent calibration checks.

13. Factory Calibration:

a. Calibrated in an ISO 9001 and NIST certified factory.

b. Factory flow calibration system must be certified by volume or weight certified calibration devices.

c. Factory flow calibration system shall be able to maintain calibration flow rate for at least 5 minutes for repeatability point checks.

14. Factory Ready for Future In situ Verifications: If noted.

a. Original meter parameter values available from vendor by request.

15. Accessories:

a. In situ Verification System: If noted.

1) Quantity: One complete system provided for the project.

2) Verifies quantitatively that the meter and signal converter's present condition is the same as originally manufactured.

3) Physical access to the flow-tube not required.

4) Meet standards established by the National Testing Laboratory.

5) Tests and stores over 50-meter parameters related to primary coils, electrodes, interconnecting cable and signal converter.

6) Verification standard shall be plus or minus 1 percent of wet calibration for meters produced using the calibration verification service, or plus or minus 2 percent for standard meters.

7) Windows-based software

b. Primary Simulation System: If noted.

1) Quantity: One complete system provided for the project.

2) Verifies proper operation of the signal converter by simulating the flow meter's output signal.

a) Generates pulsed dc excitation signal with a reference voltage of 70 mV.

b) Generated signal ranges from 0 to 99 percent (0 to 32.8 feet per second) with a resolution of 0.1 percent.

c) Switch selectable for forward, reverse and zero flow rate.

3) Verifies various input and output signals.

16. Manufacturers:

a. ABB Automation MagMaster (includes Transmitter):

1) 10D1475 Mini-Mag (size: 1/10 to 4 inches).

2) MFE (size: 1/2 to 24 inches).

3) Plus MFF (size: 8 to 84 inches).

b. Emerson Process Management, Rosemount Division:

1) Model 8705 (flanged) and Model 8711(wafer) flow tubes.

2) Model 8712 (surface) and Model 8732 (integral) transmitters.

c. Endress & Hauser, Inc. Flow Measuring System:

1) Promag 50/53H (size: 1/12 o 4 inches).

2) Promag 50/53P (size: 1/2 to 24 inches).

3) Promag 50/53W (size: 1 to 78 inches).

D. F38A Flow Element and Transmitter, Ultrasonic, Transit Time/Doppler:

1. General:

a. Function: Measure flowrate of ultraclean to dirty liquids, including multiphase liquids with gas bubbles, liquid droplets, and entrained solids.

b. Type: Transit time and Doppler operating principle, automatically selected; single channel, clamp-on transducers.

c. Parts: Transit time and Doppler transducers, transmitter, mounting hardware, and interconnecting cable.

2. Service:

a. Process Fluid: Wastewater.

b. Pipe Material: Ductile Iron.

c. Pipe Size: As noted.

3. Performance:

a. Process Flow Range: As noted.

b. Accuracy:

1) Transit-time Mode: Plus or minus 2 percent of velocity, typical for velocities greater than 1 fps.

2) Doppler Mode: Plus or minus 3 percent of velocity, typical for velocities greater than 1 fps.

c. Operating Temperature:

1) Liquid: Minus 40 degrees F to plus 250 degrees F, unless otherwise noted.

2) Transmitter: Zero to plus 140 degrees F.

4. Features:

a. Automatic Transfer: Display and 4 mA to 20 mA input shall automatically transfer between Doppler and transit-time modes based on signal strength/quality in transit-time mode.

b. Transducer Type: Clamp-on, both Doppler and transit-time pair.

c. Mounting:

1) Transit-Time:

a) Track mount for pipe sizes from 1/2 inch to 5 inches.

b) Mounting frame for larger pipe sizes.

2) Doppler: Chain or strap kit that maintains positioning of transducers while removed for maintenance.

5. Transmitter:

a. Enclosure: NEMA 4X epoxy-coated aluminum, unless otherwise noted.

b. Keypad: 33-key with tactile feedback.

c. Display:

1) Backlit LCD graphic displays, configurable 128-pixel by 240-pixel.

2) Display flow data, logged data, diagnostics.

d. Datalogger:

1) One megabyte capacity, minimum.

2) Programmable for log units, update times, start and stop times.

3) Time stamped data.

4) Downloadable via terminal emulation.

6. Interconnecting Cable: Weatherproof, length as required (50-foot minimum).

7. Signal Interface:

a. Two isolated 4 mA to 20 mA dc outputs for load impedance of 0 ohm to 550 ohms for 24V dc power supply without load adjustments, unless otherwise noted.

1) 4 mA to 20 mA outputs (one for Doppler and one for transit time) shall be wired in series with the inactive output functioning as a passive portion of the loop.

b. RS-232 serial interface.

c. Alarm Relays: Four SPDT, unless otherwise noted.

8. Power: 120V ac, 50/60Hz, unless otherwise noted.

9. Manufacturer's View and Remote Programming Microsoft WINDOWS compatible Software.

10. Manufacturer and Product: Panametrics; Model XMT868.

E. F51 Flow Element and Transmitter, Thermal Mass Flow:

1. General:

a. Function: Directly measure, indicate, and transmit mass flow of gas in pipe.

b. Type: Insertion type, thermal dispersion detection probe using platinum resistance temperature detectors (RTD).

c. Parts: Elements, transmitter, and interconnecting cable.

2. Performance:

a. Process Gas: As noted or shown.

b. Range for Air at 70 Degrees F and 14.7 psia:

1) As noted, within the following:

a) 0.25 to 1,600 standard fps.

b) 0.25 to 200 actual fps.

c. Calibrated Span: As noted.

d. Accuracy:

1) Flow: Plus or minus 1 percent of reading plus 0.5 percent full scale.

2) Temperature: Plus or minus 2 degrees F.

e. Repeatability:

1) Flow: Plus or minus 0.5 percent of reading.

2) Temperature: Plus or minus 1 degree F.

f. Temperature, Operating:

1) Flow Element: Minus 50 degrees F to plus 350 degrees F, unless otherwise noted.

2) Transmitter Housing: 0 degree F to plus 150 degrees F.

g. Pressure, Operating, Flow Element: Up to 50 psig, unless otherwise noted.

3. Flow Element:

a. Features:

1) Insertion Length: As noted or manufacturer's recommendation.

2) Wetted Surfaces Materials: Type 316 stainless steel with nickel braze, unless otherwise noted.

b. Process Connection:

1) Line Size: As noted or shown.

2) Connection Type: Retractable sensor with graphite-packed gland with 1-1/4-inch MNPT, unless otherwise noted.

3) Connection Material: Type 316 stainless steel, unless otherwise noted.

c. Sensor Enclosure:

1) Type: Aluminum, NEMA 4X, rated for Classes 1 and 2, Divisions 1 and 2, Groups B, C, D, E, F, G, and Eexd IIC; unless otherwise noted.

4. Transmitter:

a. Features: 4-line by 20-character LCD, keypad programmable.

b. Nonvolatile memory.

c. Signal Interface:

1) Outputs:

a) Analog: Two isolated 4 mA to 20 mA dc for maximum 600 ohm load, unless otherwise noted.

b) Discrete:

(1) Two independently adjustable 10 amps at 115V ac or 24V dc.

(2) Configurable as high or low flow or process temperature.

2) Communication:

a) RS-232C serial port enables remote adjustment and reading of process values and set points.

b) Protocols: If and as noted.

d. Power:

1) Selectable: 115V ac, 230V ac, 24V dc.

e. Electrical Connection: 1-inch FNPT.

f. Transmitter Enclosure:

1) Type: Fiberglass NEMA 4X, unless otherwise noted.

2) Mounting: Remote from sensor.

g. Single factory calibration, unless otherwise noted.

5. Cables:

a. Length: As required.

b. Cable Jacket: PVC rated for 220 degrees F, unless otherwise noted.

6. Manufacturer and Product: Fluid Components International; Model GF90.

F. L5 Level Element and Transmitter, Ultrasonic:

1. General:

a. Function: Continuous, noncontacting level measurement.

b. Type: Ultrasonic.

c. Parts: Element, transmitter, interconnecting cable, and accessories as noted.

2. Service:

a. Application: If and as noted.

b. Vapor Space Pressure: Atmospheric, unless otherwise noted.

c. Operating Temperature Range:

1) Element: Minus 4 degrees F to plus 149 degrees F.

2) Transmitter: Minus 4 degrees F to 113 degrees F.

3. Performance:

a. Range: As noted.

b. Zero Reference: As noted.

c. Accuracy: Plus or minus 0.25 percent of maximum range or 6 mm, whichever is greater.

d. Resolution: 0.1 percent of range or 2 mm, whichever is greater.

e. Blanking Distance: Sensor dependent, typically 1 foot.

4. Element:

a. NEMA 6P waterproof.

b. Housing: PVDF, unless otherwise noted.

1) Other materials subject to Engineer approval.

c. Facing: None, unless otherwise noted.

d. Integral Flange: If noted.

1) Face: PTFE, unless otherwise noted.

2) Size: As noted.

e. Process Connection:

1) 1-inch NPT, unless otherwise noted.

2) Top mounted.

f. Electrically Hazardous Rating:

1) Class I, Div 1, Groups A, B, C, and D: If noted.

2) Class II, Div 1, Groups E, F, and G: If noted.

3) Other Ratings: As noted.

g. Beam Angle: 12 degrees or less.

h. Integral temperature compensation.

5. Transmitter:

a. Display.

b. Integral keypad or nonintrusive external programming.

c. Enclosure: NEMA 4X polycarbonate, unless otherwise noted.

d. Power Supply: 115 volts, 50/60-Hz, unless otherwise noted.

e. Isolated Analog Output:

1) One Minimum: 4 mA to 20 mA dc for load impedance of 0 to 750 ohms.

f. Digital Communication: As noted.

g. Discrete Outputs:

1) Minimum, two relay (SPDT) rated for 2 amps continuous at 230V ac.

2) Assignable and as noted.

6. Interconnecting Cable: Weatherproof, UV protected, length as required, and type as recommended by manufacturer.

7. Accessories:

a. Submergence Shield: If noted.

b. Remote Programming Software: If noted.

1) Allows remote programming via computer and echo traces for troubleshooting.

2) One per lot of units furnished.

c. Others: As noted.

d. If no integral keypad, furnish one handheld programmer per lot of units furnished.

8. Manufacturers and Products:

a. Siemens; SITRANS L, Model HydroRanger 200 and Sensor.

b. Pulsar; Blackbox Series 13X and Sensor.

c. Endress & Hauser; Model FMU90 and Sensor.

G. L8A Level Switch, Tilting Float:

1. Tilting float actuated level switches shall be of the standard size designed to operate in WASTEWATER applications in harsh Raw-Sewage and Sludge Holding Basins. The tilting float actuated level switches shall be used to initiate level alarms and level activated control action.

2. Tilting float level switches shall use the tilting movement of a float whose specific weight is less than that of the process media, to actuate switches as the level changes. The switch shall be integrally mounted in the float and connected to a junction box which shall be provided with the switch for termination of the cable and wiring. The junction box for each group of floats and/or single float shall be NEMA-4X rated Type 304-Stainless Steel junction box equipped with hinged doors complete with 1/4 (quarter) turn door latches as manufactured by

Hoffman Concept Series, or approved equal. The float switches shall not contain mercury.

3. A movable weight shall be installed on the cable for level adjustment. The float switch, however, is to have a minimum "SET-RESET" level differential angle of 85-degrees (plus or minus 5 degrees).

4. Float switches shall be set/mounted in the field based on owner furnished/selected switch make/break set points.

5. Switch contacts shall be single-pole-single-throw (SPST), rated 15 amps (inductive load) at 120 VAC. Contacts shall be Mechanically Activated. Float Switches shall not contain mercury.

6. The entire float switch assembly to be U.L. listed and shall be for use with Intrinsically Safe Circuits. The entire float switch assembly shall be furnished with two-year limited factory warranty.

7. Switch cable shall be flexible 14 gauge, 2-conductor SJOW-A (U.L. certified and listed), water-resistant. Minimum cable length shall be 100-feet. Coordinate cable length with the PLANS.

8. Mounting: Float switch assembly, cable weight, junction box, and all other required accessories shall be mounted per the requirements of the application.

9. The entire float switch assembly, cable weights, junction boxes, tags and all other accessories described above shall be furnished by the same manufacturer. Float switches shall be as manufactured by SJ Electro Systems, Inc. Series SJE Pump Master Plus with S.J. Electro Systems, Inc. liquid-Tight round cable connectors (one per float) and S.J. Electro Systems completeCable Weight Assembly and the additional specified accessories, or approved equal.

H. L42WW Level Element/Transmitter, Submersible, Wastewater:

1. General:

a. Submersible Pressure Transducers/Transmitters shall be designed to operate in WASTEWATER applications in harsh Raw-Sewage Basins. The Submersible Pressure Transducers/Transmitter shall be used to initiate level alarms and level activated control action.

b. The Submersible Pressure Transducer/Transmitter shall be of the intelligent type and shall convert the pressure applied to one diaphragm, with the low side open to atmospheric pressure, to a 4-20 mAdc electrical output that is linear with the applied pressure.

c. The Submersible Pressure Transducer/Transmitter shall be of the intelligent type for measuring head Pressure and transmitting a 4 to 20mAdc output signal that is proportional to the measured Pressure (two wire dc supply voltage system).

2. Service:

a. Fluid: Wastewater, unless otherwise noted.

3. Features:

a. Two-wire 4-20mAdc (loop powered) proportional to head Pressure.

b. Pressure range of 0 - 30 psig.

c. Accuracy of the indicator/transmitter shall be 0.3 percent of calibrated span, and repeatability shall be 0.2 percent of span. The transmitter shall meet the specified performance under ambient temperature range of +32 degrees Fahrenheit to +158 degrees Fahrenheit, process temperature limits of +32 degrees Fahrenheit to +158 degrees Fahrenheit, DC loop supply voltage range of 12 to 42 VDC, and output load of 200 to 1,400 ohms.

d. The Submersible Pressure Transducer/Transmitter shall be equipped with local indicator which is calibrated in "feet and tenths of a foot" and to the range of the transmitter. The indicator shall be of the digital type with liquid crystal display (LCD), driven by the loop power (4-20mA at 24 VDC), and have an accuracy within 0.3 percent of full scale. The local indicator shall be the 3.5 digit type with 0.5 inch high digits.

e. The Submersible Pressure Transducer housing shall be Type 316-Stainless Steel. The Submersible Pressure Transducer diaphragm in contact with the Section 17380 Field Instrumentation and Sensing Devices process stream shall be of heavy-duty molded Teflon and shall be of 2-3/4 inch diameter, minimum.

f. The Submersible Pressure Transmitter electronics shall be equipped with operators on the face of the unit for configuration and calibration functions. External and/or internal source/devices shall not be required for calibration, additionally handheld programmer shall not be required for unit configuration and calibration functions.

g. The space between the Submersible Pressure Transducer's diaphragms shall be filled with Silicone.

h. The Submersible Pressure Transducer shall be furnished with a cable suspension mounting pipe two (2) feet in length of Type 316 Stainless Steel construction with necessary Type 316 Stainless Steel hardware to connect the cable suspension mounting pipe to the Submersible Pressure Transducer housing.

4. The Submersible Pressure Transmitter and local indicator shall be enclosed in a NEMA-4X rated Type 304-Stainless Steel enclosure with a hinged door. The door hinge shall extend the full height of the door/enclosure. The local indicator shall be visible through the front door of the enclosure via a weatherproof clear polycarbonate window.

5. The Submersible Pressure Transducer shall be set/mounted in the field based on OWNER furnished setpoint.

6. Submersible Pressure Transducer/Transmitter interconnect cable shall be flexible and contain one (1) 16 gauge, 3-conductor (U.L. certified and listed) signal cable and one (1) 1/8 inch diameter flexible tubing dedicated for Submersible Pressure Transducer atmospheric pressure compensation. The Submersible Pressure Transducer/Transmitter interconnect cable shall be water-resistant. Minimum cable length shall be 100-feet. Coordinate cable length with the PLANS.

7. Mounting: Submersible Pressure Transducer assembly, Submersible Pressure Transmitter (with local indicator) enclosure, and all other required accessories shall be mounted in the locations on the PLANS. Provide 1/8 inch diameter Type 316 Stainless Steel transducer support cable and necessary related Type 3 I 6 stainless steel hardware for suspension of transducer. Coordinate cable length with the PLANS.

8. The Submersible Pressure Transducer/Transmitter, transmitter/indicator enclosure, tags and all other accessories described above shall be furnished by the same manufacturer. Submersible Pressure Transducer/Transmitters shall be as manufactured by U. S. Filter, Inc., Series AIOOO, with U. S. Filter, Inc; or Mercoid Series PBLT as manufactured by Dwyer Instruments; complete Cable Suspension Mounting Kit Assembly (and the additional specified accessories; or approved equal.

I. P9 Pressure Transmitter:

1. General:

   a. Function: Measure pressure and transmit signal proportional to pressure.

   b. Type:

      1) Electronic variable capacitance or silicon strain gauge.

      2) Two-wire transmitter; “smart electronics”.

   c. Parts: Transmitter and accessories.

2. Performance:

   a. Range: As noted.

      1) Select transmitter’s factory upper range limit (URL) such that upper boundary of noted range is as close as possible to 80 percent of factory URL, but does not exceed it.

   b. Accuracy: Plus or minus 0.075 percent of span, unless otherwise noted.

   c. Ambient Operating Temperature: Minus 40 degrees F to plus 175 degrees F, with integral meter.

   d. Process Operating Temperature: Minus 40 degrees F to plus 250 degrees F.

   e. Humidity: 0 to 100 percent relative humidity.

   f. Hazardous Location Certifications: If and as noted.

3. Features:

   a. Type: Gauge pressure, unless otherwise noted.

   b. Adjustable damping.

   c. LCD indicator, unless otherwise noted.

      1) Display in either percent or engineering units, field configurable.

   d. Wetted Metallic Parts: Type 316 stainless steel, unless otherwise noted.

1) Includes drain/vent valves; process flanges and adapters, and process isolating diaphragm.

e. Wetted O-Rings: Glass filled TFE, graphite filled PTFE, or Viton, unless otherwise noted.

f. Bolts and Nuts (if required): Type 316 stainless steel, unless otherwise noted.

g. Fill Fluid: Silicone, unless otherwise noted.

4. Process Connections:

a. Line Size: 1/2 inch.

b. Connection Type: FNPT.

c. Direct/remote Diaphragm Seal: If and as noted.

5. Signal Interface:

a. 4mA to 20 mA dc output with digital signal based on HART protocol, unless otherwise noted below.

1) Nominal Maximum Loop Resistance with External 24V dc Power Supply: 550 ohms.

b. FOUNDATION fieldbus protocol: If noted.

c. Profibus: If noted.

6. Enclosure:

a. Type: NEMA 4X.

b. Materials: Coated aluminum, unless otherwise noted.

c. Mounting bracket, unless otherwise noted.

1) Bracket and Accessories: Stainless steel; suitable for mounting transmitter to panel or 2-inch pipe.

7. Accessories:

a. Two-valve (isolate and vent) Stainless Steel Manifold: If noted.

8. Manufacturers and Products:

a. Gauge Pressure Units:

1) Foxboro; Model IGP20.

2) Rosemount; Model 3051 TG.

3) SMAR; LD30XM Series.

b. Absolute Pressure Units:

1) Foxboro; Model IAP20.

2) Rosemount; Model 3051 TA.

3) SMAR; LD30XA Series.

J. Y40 Uninterruptible Power Supply System:

1. General:

   a. Function: Provides isolated, regulated uninterrupted ac output power during a complete or partial interruption of incoming line power.

   b. Major Parts: Inverter, battery charger, sealed battery.

2. Performance:

   a. Capacity: As noted.

   b. Input Power:

      1) 120V ac single-phase, 60-Hz, unless otherwise noted.

      2) Connections: Manufacturer's standard, unless otherwise noted.

   c. Output Power:

      1) 120V ac single-phase, 60-Hz, unless otherwise noted.

      2) Connections: Manufacturer's standard, unless otherwise noted.

   d. On-line Efficiency: 85 percent minimum, unless otherwise noted.

   e. Backup Runtime:

      1) Full Load: 9 minutes minimum, unless otherwise noted.

      2) Half Load: 20 minutes minimum, unless otherwise noted.

   f. Continuous no-break power with no measurable transfer time.

   g. Sine-Wave Output Voltage Total Harmonic Distortion (THD): Plus or minus 6 percent or less.

   h. Input Voltage Range: Plus 15 percent, minus 20 percent.

   i. Output Voltage Regulation: Plus or minus 3 percent nominal.

   j. Operating Temperature: 0 degree to 40 degrees C (32 degrees to 104 degrees F) or per Environmental requirements as specified in herein.

   k. Operating Relative Humidity: 5 percent to 95 percent without condensation.

   l. Lightning and Surge Protection:

      1) Pass lightning standard IEEE C62.41 Categories A and B tests.

      2) 2000 to 1 attenuation of input spike.

3. Features:

   a. Bypass Switches: As noted.

   b. Provide with relay card that allows monitoring of:

      1) UPS Fail alarm.
      2) Battery Fail alarm.

   c. Enclosure:

      1) Tower, unless otherwise noted.

2) If rack-mount noted, unit to be suitable for mounting in a 19-inch rack.

4. Manufacturers and Products:

a. Powerware; FERRUPS FE/Rackmount Uninterruptible Power System.

b. Controlled Power Company.

K. Y50 Programmable Logic Controller System, Larger Applications:

1. General:

a. PLC system shall be Schneider Electric, Modicon Quantum Platform, as specified below. No substitutions allowed.

b. All PLC components shall include conformal coating option as offered by Modicon.

2. Control Processor:

a. PLC Communications:

1) One Modbus communication ports.

2) One USB port.

3) One Ethernet Modbus TCP/IP port.

4) Baud rates supported 1200, 2400, 9600, 19200. 9600 Baud rate default.

b. Flash EPROM Memory Card, 4MB. Modicon Model TSXMFPP004M, suitable for harsh environments.

c. Units shall be Modicon Quantum, Model 140 CPU 652 60C.

3. Power Supply: Units shall be Modicon Quantum Platform, Model 140 CPS 114 20C.

4. PLC Backplane: Units shall be Modicon Quantum Platform, Model 140 XBP 016 00C.

5. Backplane Expander: Units shall be Modicon Quantum Platform, Model 140 XBE 100 00C with Backplane Expander cable Model 140XCA71706 (two meter length).

6. Discrete Input Modules: Units shall be Modicon Quantum Platform, Model 140 DAI 540 00C.

7. Isolated Discrete Output (Relay) Modules: Units shall be Modicon Quantum Platform, Model 140 DRC 830 00C.

8. Analog Input Modules: Units shall be Modicon Quantum Platform, Model 140 ACI 030 00C.

9. Analog Output Modules: Units shall be Modicon Quantum Platform, Model 140 ACO 020 00C.

10. Communication Network:

a. Peer-To-Peer: Modbus for peer to peer PLC communication; support data block transfers of up to 255 16-bit registers per transaction.

b. Network Interface: Communication to computer subsystem computers via Ethernet TCP/IP interface and protocol.

c. Manufacturers: Modicon - Quantum Platform, Model 140 NOE 771 01C.

11. Identification:

a. Nameplates installed above/below each PLC component (CPU, I/O rack, power supply.).

b. Label configured I/O points as they have been configured (addressed) in the system, as approved by the Engineer.

12. Programming Computer:

a. Only one Programming Computer shall be required for all PLCs provided under this contract. The PICS Contractor shall be responsible for providing this computer per the following requirements.

b. Hardware:

1) Type: Portable, 64-bit, IBM compatible personal computer.

2) Processor: Intel i7 quad-core.

3) Clock Speed: 2.8 G Hz, minimum.

4) RAM: 8 Gbyte, minimum, expandable to 16 Gbytes, minimum.

5) NVIDIA Quatro 3000M w/ 2 GB GDDR5

6) 16X CD/DVD writer (DVD+/_RW Drive).

7) Hard Drive: 750 Gbyte, minimum. Partitioned with NTFS.

8) Ports: 4-USB, VGA port and HDMI.

9) Built in Bluetooth.

10) Wireless switch to disable wireless LAN communications

11) Integrated 10/100/1000 network card through RJ-45 connection.

12) High Definition Display: Suitable for use in low light situations (1080i resolution). 15.6” Ultra Sharp FHD (1920 x 1080) Wide View. Anti-glare LED backlit.

13) Battery pack and charger.

14) Carrying case with shoulder strap, storage pockets and space for battery, charger, power cords, and communications cable.

15) Provide with 5 year manufacturer’s warranty on parts and labor with next day business day on site support as well as ProSupprt and 5 year Complete Care Accidental Damage Protection.

16) Manufacturer: Dell, Latitude Series.

c. Standard Software:

1) All software shall be installed and activated.

2) All software shall be registered in the OWNER's name.

3) Number of Copies: One.

4) Microsoft Windows 7 Professional 32 bit operating System, latest release.

5) Microsoft Office 2010 Professional software.

6) PLC Program Software:

a) The PLC shall be programmed by the AES Provider to provide the overall system functions as described in Section 13401, Supplement 2 Control Narratives. Software shall be the latest version of the PLC Manufacturer's programming package.

b) General requirements:

(1) Windows Based.

(2) Be able to monitor and modify the PLC online.

(3) Contain an equation editor for complex algorithms.

(4) Be compliant with IEC-61131 Ladder Logic, Function Block, Structured Text, and Sequential Function Chart program formats.

(5) Have on-line Help Menus.

c) The Contractor shall register PLC programming software licensed with Schneider Electric Software Support Program for the entire construction period plus one year after final acceptance. The support shall include 24/7 technical support (email and phone), software upgrades and patches at no extra cost. Software support renewal, as applicable, shall be the sole responsibility of the contractor.

d) In an attempt to address possible version compatibility problems, the version of each software package to be provided shall be reviewed prior to PLC Equipment submittal.

e) The PLC Programming Software shall be the full version of the package provided by the Manufacturer. I t shall include all the latest service packs provided for the programming package by the Manufacturer with discs, manuals, certificates in the original packaging.

f) The Contractor shall provide one copy of the fully licensed versions of Unity Pro XL PLC programming package as provided by Schneider Electric.

g) The PLC Programming Software shall be licensed in the name of the City of Austin.

13. Programming Cables: Contractor shall furnish one serial or USB programming cable for each type of PLC/RTU to be programmed.

14. Equipment Groups:

    a. Equipment Group 1:

        1) Components:

            a) Programming computer.

            b) PLC system software.

            c) PLC programming system software and manuals (system software loaded on programming computer by Contractor prior to delivery).

        2) Location: Staging area or Owners Representative's location.

        3) Prerequisite: PLC hardware, software, and I/O database Submittals.

    b. Equipment Group 2:

        1) Components:

            a) CPU: 1.

            b) PLC Power Supply: 2.

            c) Analog and Discrete I/O Modules: 1 of each type.

            d) Interconnecting Data and Programming Cables: As required for components shipped.

            e) Power Cable: As required for components shipped.

            f) 24V dc Power Supply: 1.

            g) Transmitter Simulator: 1.

        2) Location: Staging area.

        3) Prerequisite: PLC hardware, software, and I/O database Submittals.

15. Spares (Per requirements listed above):

    a. CPU: 1.

    b. Flash EPROM Memory card, size = 4 MB: 1.

    c. Spare I/O Cards Installed in I/O racks: For each type of I/O card, quantity = 20 percent of each type and size used, minimum 1 each.

    d. Spare I/O Cards Provided Loose (Shelf Spares): For each type of I/O card, quantity = 20 percent of each type and size used, minimum 1 each.

    e. Power supply: 1.

    f. Cables: 1 of each type and length used, minimum 1 each..

g. Communication Module: 1.

h. I/O Rack: 1.

L. Y50A Programmable Logic Controller System, Smaller Applications:

1. General:

a. Applications included for this PLC system are those where all I/O and communications module requirements can be accommodated with no more than two backplanes.

b. PLC components listed in this Component Specification shall require protection against harsh environments thus requiring Conformal Coating.

c. PLC system shall be Schneider Electric, Modicon M340 Platform, as specified below. No substitutions allowed

2. Control Processor:

a. PLC Communications:

1) One Modbus RS-232 Serial port.

2) One USB port.

3) One Ethernet Modbus TCP/IP port.

4) Baud rates supported 1200, 2400, 9600, 19200. 9600 Baud rate default.

b. SD Flash Memory Card, 8MB. Modicon Model BMX RMS 008 MPF.

c. Units shall be Modicon M340, Model BMX XP34 2020H.

3. Power Supply: Units shall be Modicon M340 Platform, Model BMX CPS 3500H.

4. PLC Backplane (12 slot): Units shall be Modicon M340 Platform, Model BMX XBP 1200H

5. Discrete Input Modules: Units shall be Modicon M340 Platform, Model BMX DAI 1604H.

6. Isolated Discrete Output (Relay) Modules: Units shall be Modicon M340 Platform, Model BMX DRA 0805H.

7. Analog Input Modules: Units shall be Modicon M340 Platform, Model BMX AMI 0410H.

8. Analog Output Modules: Units shall be Modicon M340 Platform, Model BMX AMO 0210H.

9. Communication Network:

a. Peer-To-Peer: Modbus for peer to peer PLC communication; support data block transfers of up to 255 16-bit registers per transaction.

b. Network Interface: Communication to computer subsystem computers via Ethernet TCP/IP interface and protocol.

c. Manufacturers: Modicon – M340 Platform, Model BMX NOE 0100H.

10. Unused Slot Protective Covers: Units shall be Modicon M340 Platform, Model BMX XEM 010.

11. Shielding Connection Kit (12 slot): Units shall be Modicon M340 Platform, Model BMX XSP 1200, suitable for harsh environment.

12. Identification:

    a. Nameplates installed above/below each PLC component (CPU, I/O rack, power supply.).

    b. Label configured I/O points as they have been configured (addressed) in the system, as approved by the Engineer.

13. Programming Cables: Contractor shall furnish USB Grounded programming cable (4.5 meters). Cable shall be Modicon M340 Platform, Model BMXXACUSB045.

14. Spares (Per requirements listed above):

    a. CPU: 1.

    b. SD Flash Memory card, size = 8 MB: 1.

    c. Spare I/O Cards Installed in I/O racks: For each type of I/O card, quantity = 20 percent of each type and size used, minimum 1 each.

    d. Spare I/O Cards Provided Loose (Shelf Spares): For each type of I/O card, quantity = 20 percent of each type and size used, minimum 1 each.

    e. Power supply: 1.

    f. Cables: 1 of each type and length used, minimum 1 each..

    g. Communication Module: 1.

    h. I/O Rack: 1.

M. Y182A Operator Interface Unit (OIU):

1. General:
    a. Function: Allows operator to monitor and control at Local Control Panel level via PLC interface.
    b. Type: Backlite color TFT LCD.
    c. Parts: Screen, cabling, accessories.
2. Environmental:
    a. Operator Temperature: 0 to 50 degrees C.
    b. Relative Humidity: 10 to 90 percent relative humidity, noncondensing.
3. Features:
    a. Installation: Front mount.
    b. Power requirements: 24 Vdc
    c. Display Type: Backlit color TFT LCD.
    d. Display Resolution: 1024 by 768 pixels XGA.
    e. Colors: 65636 colors.
    f. Display Size: 15 inch diagonal, nominal.
    g. Dimensions: 15.55W by 11.57H by 3.54D, inches, nominal.
    h. Touch Panel Type: Analogue, TFT.
4. Communication Ports:

a. (2) USB type A.
b. Ethernet TCP/IP,10BASE-T100BASE-TX, RJ45.
c. COM1 = serial male 9-pin RS232C/RS422/RS485.
d. COM2 = serial link RJ45 RS485.

5. Accessories:
   a. Configuration Software and Ancillaries:
      1) Configuration Software: Vijeo Designer.
      2) Full documentation.
      3) Download cable.
      4) Power cords.
6. Manufacturer and Product: Schneider Electric, Magelis Advanced Touch Screen Panel, Model XBTGT7340.

END OF SECTION

SECTION 13580 - LOCAL AREA NETWORK (LAN) COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Related sections include the following:

1. Section 01010, Summary of Work.
2. Division 16, Electrical.
3. Section 13401, Instrumentation and Control for Process Systems.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. Institute of Electrical & Electronic Engineers, Inc. (IEEE): 802.3, Telecommunication and Information Exchange Between Systems.
2. International Organization for Standardization (ISO).
3. National Electrical Code (NEC).
4. Telecommunications Industry Association (TIA); Electronics Industry Association (EIA):
   a. 492, Specifications for Optical Waveguide Fibers.
   b. 526-7, OFSTP-7, Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
   c. 568, Commercial Building Telecommunications Cabling Standard.
   d. 569, Commercial Building Standards for Telecommunications Pathways and Spaces.
   e. 607, Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3 ABBREVIATIONS

A. ATM: Asynchronous Transfer Mode.

B. AUI: Attachment Unit Interface.

C. dB: Decibel.

D. EMB: Effective Modal Bandwidth.

E. ETL: Electrical Test Laboratories.

F. FDDI: Fiber Distributed Data Interface.

G. Flux Budget: Difference between transmitter output power and receiver input power required for signal discrimination when both are expressed in dBm.

H. FOCS: Fiber Optic Communication Subsystem.

I. Fusion Splice: Connecting ends of two fibers together by aligning fiber ends and applying electric arc to fuse ends together.

J. Hybrid Cable: Cable containing more than one type of fiber.

K. MHz: Megahertz, one million cycles per second.

L. Mbps: Megabits per second.

M. Mechanical Splice: Connecting ends of two fibers together by means other than fusion.

N. OFN: Nonconductive Optical Fiber Cable.

O. OFNR: Nonconductive Optical Fiber Riser Cable.

P. OLTS: Optical Loss Test Sets.

Q. OTDR: Optical Time-Domain Reflectometer.

R. TDR: Time-Domain Reflectometer.

S. UPS: Uninterruptible Power Supply.

1.4 SYSTEM DESCRIPTION

A. This Section covers requirements for Local Area Network (LAN) and Fiber Optic Communication Subsystem (FOCS) and is in addition to Section 13401, Instrumentation and Control for Process Systems. PIC Subcontractor shall be responsible to provide both subsystems as a complete and functioning network. PIC Subcontractor shall coordinate efforts of LAN Subcontractor and/or FOCS Subcontractor. This could be one subcontractor for LAN and FOCS.

B. The LAN Communication Subsystem includes Operator Workstation, network switches, telephone modems, fiber optic cables, twisted pair cables, patch panels, converters, connectors, and accessories for the following plant wide networks as shown on Drawings:

1. Plant Control System Architecture Network Drawing.

1.5 SUBMITTALS

A. Action Submittals:

1. Purchase Quotation: Listing of LAN system components and accessories to be provided. Include applicable tag numbers and functional names of components.
2. Order Confirmation Summary: Final listing of LAN system components and accessories to be provided.
3. LAN System Components Data Sheets:

a. Neat and legible markups of the LAN system components data sheets provided in this Section.

b. Markup the LAN system components data sheets to include complete product information and corrections to reflect all items in the purchase quotation.

c. Component Data:

1. Manufacturer and model number.

2. General data and description.

3. Engineering specifications and data sheet.

4. Scaled drawings and mounting arrangements.

4. Cable Schedule Showing:

a. Cable identification.

b. Fiber counts for each cable and identification of used fiber pairs.

c. Cable length and attenuation, with two connector pairs and no splices, based on TIA/EIA 568, Annex H.

B. Informational Submittals:

1. Manufacturer's statement that installer is certified to perform installation Work.

2. Subcontractor Qualifications:

a. LAN and FOCS Subcontractor: Minimum of 5 years' experience providing, integrating, installing, and commissioning of similar systems.

b. Engineer's acceptance of LAN and/or FOCS Subcontractor does not exempt LAN Subcontractor, FOCS Subcontractor or PIC Subcontractor from meeting Contract Document requirements nor does it give prior acceptance of subsystems, equipment, materials, or services.

1. LAN and FOCS Subcontractor Statement of Experience: List of at least five Ethernet network systems and three fiber optic data communications systems comparable to system specified which have been furnished and placed into operation by prospective LAN and FOCS Subcontractor. For each system, provide following information:

a. Owner's name, address, telephone number, and name of current operations supervisor or other contact.

b. Description of system hardware configuration, including major equipment items, number of nodes, and communication standards implemented.

c. System block diagram.

d. Dates when contract was signed, equipment was delivered, and system was accepted by Owner. Also, include originally scheduled completion date and if different from actual date, explain why.

e. Approximate value of listed LAN/FOCS provided in dollars.

2. Qualification of Personnel:

a. Network certifications from nationally recognized vendor or training agency, showing individuals are knowledgeable LAN installers. Certifications may be similar to Certified Network Cabling Installer Professional (CNCIPro).

b. Resumes giving management and technical qualifications of supervisory, local service representative, and key personnel.

c. For each maintenance organization, identify location of base of service and how required coverage will be achieved.

c. Fiber Test Results: Documentation covering fiber facility testing, not later than 2 days after testing, showing:

1. Manufacturer's tag of attenuation per fiber as recorded from OTDR reading before shipment.

2. Attenuation of each fiber upon delivery to Site.

3. Attenuation of each fiber plus connector after installation as recorded from OTDR with tracing.

d. LAN Test Results: Documentation covering CAT 6 cable, showing:

1. Manufacturer's tag of attenuation per cable as recorded from TDR reading at factory.

2. As-installed TDR testing to determine cable integrity.

3. Manufacturer's Certificate of Compliance.

4. Manufacturer's suggested installation practice.

5. Testing related submittals, including the following as a minimum:

a. Fiber optic cable preinstallation (OTDR) testing.

b. Fiber optic cable post-installation (OTDR) testing.

c. Copper network cabling (CAT 6) preinstallation or factory testing.

d. Copper network cabling (CAT 6) post-installation testing (including transmission and TDR testing).

6. Operation and Maintenance Data: As specified in Section 01 00 01, General Requirements.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Optical Fiber Cable and Cable Splice Centers:

1. Outside, Underground/Submerged: Minus 20 to 40 degrees C.

2. Outside, Aboveground in Conduit: Minus 40 to 80 degrees C.

3. Inside: 0 to 40 degrees C.

B. Equipment:

1. Outside, Aboveground: Minus 40 to 80 degrees C.
2. Control Rooms, Equipment Rooms and Telecommunications Closets: 30 to 55 percent relative humidity, 18 to 24 degrees C.
3. Other Interior Areas: 0 to 100 percent relative humidity, 5 to 35 degrees C.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Cable:
   a. ISO 9001 or QF TL 9000 registered, whichever applies to material.
   b. Minimum of 20 years in manufacturing optical fiber cable in order to demonstrate reliable field performance.
2. Housing: ISO 9001 and QF TL 9000 registered.
3. Connector:
   a. ISO 9001 or QF TL 9000 registered.
   b. Minimum 10-year history of manufacturing and supporting connector technology that does not require epoxy or polishing in field.
4. Jumper Cable: ISO 9001 and QF TL 9000 registered.

B. Fiber Optic Installer Qualifications:

1. Individuals with at least 3 years of experience with projects utilizing fiber optic cable in compliance with TIA 568-C.3.
2. Certified by fiber cable manufacturer.

C. Fiber Optic Tester Qualifications: Individuals with at least 3 years of experience with projects utilizing fiber optic cable in compliance with TIA 568-C.3.

1. Technician: Successfully attended training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof. Certificate may have been issued by the following organizations or an equivalent organization:
   a. Manufacturer of fiber optic cable and fiber optic connectors.
   b. Manufacturer of test equipment used for field certification.
   c. Other independent training organizations acceptable to Owner.

D. Provide connectors/coupling, mounting hardware, and miscellaneous accessories for fibers by same manufacturer.

PART 2 - PRODUCTS

2.1 NETWORKING

A. As shown on the System Architecture on Drawings.

B. The Process Control System (PCS) LAN allows the PLCs at the various facilities to communicate with one another and with the main plant PLC without concerns about network contention from other sources. Provide managed Gigabit Ethernet switches on the PCS LAN.

2.2 NETWORK INTERFACE PANELS

A. General: Network switches and fiber optic cable management shall be included Local Control Panels, as shown on Drawings, at the following locations:

Panels provided under Section 13401, Instrumentation and Control for Process Systems:

1. Operation Building Control Room: TL-CP-01-1.

Panels provided under Division 11, Mechanical and Division 16, Electrical:

1. Lift Station Control Panel: TL-LS-01-1.
2. Screenings Equipment Package Local Control Panel: TL-LCP-104-1.
3. RAS Pump Package Local Control Panel: TL-LCP-111-1.
4. Filter Package Local Control Panel: TL-LCP-112-1.
5. Hypochlorite Generation Package Local Control Panel: TL-LCP-113-1.
6. Non Potable Water Package Local Control Panel: TL-LCP-116-1

B. Plant Control Panels shall house the following (at a minimum):

1. Fiber optic network distribution patch panels.
2. Fiber management system.
3. Twisted pair patch panels.
4. Network switches.

2.3 NETWORK EQUIPMENT

A. Fiber Patch Panel:

1. Panel shall come complete with a fiber patch panel, fiber management, and bend radius control. Unit shall be wall mountable.
   a. Provide patch panel in every panel enclosure.
   b. Provide with appropriate CCN connector panels.
2. Manufacturer and Product: Corning; Model SPH-01P (or approved equal).

B. Ethernet Switches:

1. Type 1 Ethernet Switch – Layer 3, Managed

a. Installation: Controlled environment.
b. Manufacturer and model: Cisco, Model 3750, 24 TC w/ 2 SFP modules.

2. Type 2 Ethernet Switch – Industrial, Layer 2, Managed
   a. Installation: Local Control Panels.
   b. Manufacturer and model: Cisco, Model IE3000, 8 TC w/ 2 SFP modules.

3. Type 3 Ethernet Switch – Industrial, unmanaged.
   a. Installation: Local Control Panels.
   b. Manufacturer and model: N-Tron, Model 104TX (or larger if required).

C. Telephone Modem:

1. Modem shall be an industrial grade communications modem.
   a. Communications rate: Up to 14.4 Kbps.
   b. Power Requirements: 120VAC, 60 Hz.
2. Manufacturer and model: Telenetics, Model MIU14.4 (or approved equal).

D. Operator Workstation:

1. Processor:
   a. Dual Core 3.3 GHz, 3 MB , with HD4000 Graphics.
2. Processor Speed: 3.3 GHz, minimum.
3. Memory: 8 GB, minimum.
4. Hard Disk Drive: 250 GB , 3.5 SATA, no RAID.
5. 16X CD/DVD writer (DVD+/_RW Drive).
6. Network Interface: 10/100/1000 BaseT.
7. Video: Multi Head SVGA Video Card – 1 GB RAM, minimum.
   a. HDMI output for LED monitor.
8. Monitor: Dell 21.5 inch Ultra Sharp U2212H, with VGA/DVI/DP.
9. Keyboard and mouse.
10. Operating System: Microsoft Windows 7 Professional, latest release.
11. Standard Software: Microsoft Office 2010 Professional, latest version.
12. Provide with 5 year manufacturer's warranty on parts and labor with next day business day on site support.
13. Manufacturer and Product: Dell Computers; OptiPlex 9010 Desktop computer with Dell Ultrasharp monitor.

E. SCADA Application Software:

1. Intellution iFIX, latest version, coordinate with Owner. Contractor shall provide iFIX Plus SCADA Pak Unlimited Developer license to be registered in Owner's name.

2.4 FIBER OPTIC CABLING

A. Single-Mode: 8.3/250-micron Class IVa dispersion-unshifted optical fibers for use in backbone distribution subsystem shall meet or exceed requirements of TIA 568-C.3, including the following specifications:

1. Chromatic Dispersion:
   a. Zero-Dispersion Wavelength: Between 1,302 nm and 1,322 nm.
   b. Maximum value of dispersion slope at zero dispersion wavelength shall be no greater than 0.093 ps per km-nm^2.
2. Mode Field Diameter: Nominal 8.7 microns to 10 microns, with a tolerance of plus or minus 0.5 micron at 1,300 nm.
3. Maximum Attenuation:
   a. Outside and Indoor-Outdoor Optical Fiber Cable:
      1. 0.5 dB per km at 1,310 nm.
      2. 0.5 dB per km at 1,550 nm.
   b. Inside Optical Fiber Cable:
      1. 1 dB per km at 1,310 nm.
      2. 1 dB per km at 1,550 nm.
4. Cutoff Wavelength of Cabled Fiber: Less than 1,260 nm.
5. TIA 492 CAAA (OS1) compliant.
6. Distance Capacity per IEEE 802.3:
   a. 1 Gbit Ethernet, 1,300 nm Laser Minimum Distance: 5000 m.
   b. 10 Gbit Ethernet: 10 km at 850 nm and 40 km at 1,310 nm

B. Single-Mode: Type 8.3/250, Backbone for Underground Conduit Installation:

1. Individual Fibers: 8.3/125/250 microns.
2. Fiber Type: OS2.
3. Fiber Count: 24 fibers.
4. Assembly:
   a. Nonmetallic, gel-free, dry water blocked, loose-tube fiber core with dielectric strength member enclosed by nonmetallic cross-ply sheath; requires buffer tubing.
   b. Cable: Comply with ICEA S-87-640 and RDUP 7 CFR 1755.902 for backbone, feeder and distribution cables.
5. NEC/UL Listing: None; not approved for general use within building, except when installed in metallic conduit.

6. Protective Covering: Black, antifungus, UV-resistant, polyethylene jacket with rip-cord.

7. Minimum Short Term Pull Strength: 600 lbf.

8. Manufacturers and Products:

   a. Corning Cabling Systems; ALTOS loose-tube dielectric cable.

   b. Mohawk; Outdoor loose-tube cable.

C. Single-Mode: Type 8.3/250, Backbone for Underground Conduit and Building Riser Installation:

1. Individual Fibers: 8.3/125/250 microns.

2. Fiber Type: OS2.

3. Fiber Count: 24 fibers.

4. Assembly:

   a. Nonmetallic, gel-free, dry water blocked, loose-tube fiber core with dielectric strength member enclosed by nonmetallic cross-ply sheath; requires buffer tubing.

   b. Cable: Comply with ICEA S-104-696.

5. NEC/UL Listing: OFNR.

6. Protective Covering: Black, flame and UV-resistant, thermoplastic jacket with rip-cord.

7. Minimum Short Term Pull Strength: 600 lbf.

8. Manufacturers and Products:

   a. Corning Cabling Systems; FREEDM cable.

   b. Mohawk; RiserLite loose-tube cable.

D. Conduit and Innerduct: As specified in Division 16, Electrical.

E. Fiber Connectors:

1. Features:

   a. In accordance with requirements of TIA/EIA 568, Section 12.4.3 or Annex F.

   b. SC connectors with 12.7 millimeter spacing between ferrules.

   c. Pull Strength: 0.2 N minimum.

   d. Durability: Sustain minimum 500 mating cycles without violating other requirements.

      1. Ferrules: Free-floating low loss ceramic.

      2. Polarizing key on duplex connector systems.

2. Attenuation:

   a. In accordance with requirements of TIA/EIA 568, Section 12.4.4.

b. Maximum of 0.75 dB per connector pair.

3. Manufacturer: AMP.

F. Jumper Cables:

1. In accordance with requirements of TIA/EIA 568, Section 12.5.

2. Function: To connect from fiber centers to network nodes, such as computer workstations.

3. Fiber Characteristics: In accordance with requirements for fiber optic cable.

4. Cable Configuration:

a. Individual tight-buffer thermoplastic, fibers single-mode, to match fibers being jumpered on.

b. Protected with kevlar strength members and enclosed in thermoplastic jacket.

5. Length: Standard, to meet requirements shown, plus minimum 3 meters at workstations.

6. Connectors:

a. SC-style connectors.

b. On-Axial Pull Strength: 33 N.

c. Normal-to-Axial Pull Strength: 22 N.

2.5 TWISTED PAIR ETHERNET CABLING

A. For communication between programmable logic controllers, operator workstation and network equipment.

B. Unshielded Twisted Pair (UTP) Telephone and Data Cable, 300 Volts:

1. Category 6 UTP, UL listed, and third party verified to comply with TIA/EIA 568-C Category 6 requirements. Must comply with IEEE 802.3ab standard for CAT 6.

2. Suitable for high speed network applications, including gigabit Ethernet and video. Cable shall be interoperable with other standards compliant products and shall be backward compatible with Category 5 and 5e.

a. Proven capability of 1,000 Mb/sec (1,000 baseTX standard).

3. Must be bonded cable to ensure cable integrity and eliminate any “untwisting” of UTP cable.

4. All CAT 6 cable to be provided by one vendor, to ensure similarity and consistency in cable manufacturing, such as twists per inch. This includes both long-run cables and patch cables.

5. Provide four each individually twisted pair, 23 AWG conductors, with FEP insulation and blue PVC jacket.

6. NFPA 70 Plenum (CMP) rated; comply with flammability plenum requirements of NFPA 70 and NFPA 262.

7. Cable shall withstand a bend radius of 1-inch minimum at a temperature of minus 20 degrees C maximum without jacket or insulation cracking.

8. All jumper cables shall be prefabricated (by manufacturer) with stranded cable. Longer runs should use plenum-rated solid core, and can be connectorized by installer.

9. Manufacturer:

   a. Belden or Approved equal.

C. Cable Physical Preparation:

1. No splicing allowed.

2. No staples.

3. Loose – no tight wrap.

D. Installation Methods:

1. Installation by manufacturer's certified installer.

2. Install cables in accordance with manufacturer's requirements.

3. Install cable directly from shipping reels. Ensure that cable is:

   a. Not dented, nicked, or kinked.

   b. Not subjected to pull stress greater than manufacturer's specification.

   c. Not bent to a radius below manufacturer's minimum bend radius.

   d. Not subjected to treatment that may damage cable during installation.

4. Max pull force 25 lbf.

5. Support cables evenly every 5 feet.

PART 3 - EXECUTION

3.1 PREPARATION/INSTALLATION

A. Conduits and Innerduct are provided under Division 26, Electrical.

B. Fiber Optic Cable:

1. Specified fiber counts, routing, origination, and terminating points are indicated on Drawings.
2. Installation by manufacturer's certified installer.
3. Install cables in accordance with manufacturer's requirements.
4. Install cable directly from shipping reels. Ensure that cable is:
   a. Not dented, nicked, or kinked.
   b. Not subjected to pull stress greater than manufacturer's specification.
   c. Not bent to a radius below manufacturer's minimum bend radius.
   d. Not subjected to treatment that may damage fiber strands during installation.
5. Cables per Conduit or Innerduct: In accordance with NFPA 70 NEC conduit fill limitations.
6. If calculation indicates cable will attenuate signals more than 8 dB, reroute may be allowed if approved by ENGINEER.
7. Splices:
   a. Install fiber optic cables in unspliced lengths from fiber centers to switches.
   b. If splicing is required, splice fibers using apparatus applicable to type and size of fiber being spliced. Insert loss of splicing unit shall not exceed 0.2 dB on single-mode fibers.
8. Connector: Insertion loss on single-mode connections exceeding 0.4 dB connections not permitted.
9. Identification:
   a. Identify cable on both ends, in access holes, and pull points.
   b. In accordance with TIA 606.
10. Arrange cable, equipment, and hardware to provide neat appearance and accessibility for servicing.
11. Access Holes:
   a. Provide supports for cables in access and handholes as shown on Drawings.
   b. While maintaining minimum bend radius, lace cables neatly to supports to keep them out of way of personnel.

C. Fiber Center, Fiber Distribution Frame, Housing, Panel, Splice Tray: Install securely in field panels or enclosures as shown on Drawings.

D. Cable Terminations:

1. Terminate cables in accordance with TIA/EIA 568.

2. Fan out fiber cable to allow direct connectorization of connectors. Sleeve over individual fibers with transparent furcation tubes. At point of convergence of furcation tubes, provide strain relief with metal or high density plastic fan-out collar.

3. Break-Out Kits:

   a. Terminate cables using manufacturer-supplied break-out kits.

   b. Terminate in accordance with manufacturer's recommendations.

4. Connectors:

   a. Terminate 100 percent of fibers in each cable to specified connectors.

   b. Connect into fiber management system.

3.2 FIELD QUALITY CONTROL

A. Test components of installation in accordance with standards and specifications.

B. Provide equipment, instrumentation, supplies and skilled staff necessary to perform testing.

C. Advise ENGINEER at least 24 hours in advance of each test. ENGINEER shall have option to witness and participate actively in tests.

D. CAT 6 Cable Installation:

1. After termination, test all cables to each end device to determine losses in the cable.

2. Use TDR tester to determine cable integrity and identify any degradation of signal between each end device. Ensure cable complies with TIA/EIA standards for CAT 6, including bandwidth requirement of 1,000 Mbps.

   a. Manufacturer: Fluke Networks.

3. PIC Subcontractor to coordinate IP address assignment with OWNER. LAN network installer to configure end devices and switches with interim IP addresses to conduct testing of communication between points on the network. Verify that end devices can communicate to all points on the network.

E. Fiber Optic Test Equipment:

1. Field test instruments shall have latest software and firmware installed.

2. Optical Fiber Cable Testers:

   a. Field test instrument shall be within calibration period recommended by manufacturer.

   b. Optical Loss Test Set (OLTS):

      1. Single-mode Optical Fiber Light Source:

         a. Provide dual laser light sources with central wavelengths of 1,310 nm (plus or minus 20 nm) and 1,550 nm (plus or minus 20 nm).

b. Output Power: Minus 10 dBm, minimum.

c. Manufacturer: Fluke Networks.

d. Manufacturer: Fluke Networks.

2. Power Meter:

a. Provide 850 nm, 1,300/1,310 nm, and 1,550 nm wavelength test capability.

b. Power Measurement Uncertainty: Plus or minus 0.25 dB.

c. Store reference power measurement.

d. Save at least 100 results in internal memory.

e. PC interface (serial or USB).

f. Manufacturer: Fluke Networks.

3. Optional Length Measurement: Capable of measuring optical length of fiber using time-of-flight techniques.

3. Optical Time Domain Reflectometer (OTDR):

a. Bright, color transmissive LCD display with backlight.

b. Rechargeable for 8 hours of normal operation.

c. Weight with battery and module of not more than 4.5 pounds and volume of not more 200 cubic inches.

d. Internal nonvolatile memory and removable memory device with at least 16 MB capacity for results storage.

e. Serial and USB ports to transfer data to PC.

f. Single-mode OTDR:

1. Wavelengths: 1,310 nm (plus or minus 20 nm) and 1,550 nm (plus or minus 20 nm).

2. Event Dead Zone: 2 meters maximum at 1,310 nm and 2 meters maximum at 1,550 nm.

3. Attenuation Dead Zone: 15 meters maximum at 1,310 nm and 15 meters maximum at 1,550 nm.

4. Distance Range: Minimum 10,000 meters.

5. Dynamic Range: Minimum 10 dB at 1,310 nm and 1,550 nm.

g. Manufacturer: Fluke Networks.

4. Fiber Microscope:

a. Magnification: 250X or 400X for end-face inspection.

b. Manufacturer: Fluke Networks.

5. Integrated OLTS, OTDR, and Fiber Microscope:

a. Test equipment that combines into one instrument such as OLTS, OTDR, and fiber microscope may be used.

b. Manufacturer: Fluke Networks.

F. Fiber Optic Cable Testing:

1. Test procedures and field test instruments shall comply with applicable requirements of:

a. LIA Z136.2.

b. TIA/EIA 455-78.

c. TIA/EAI 455-133.

d. TIA 526-7.

e. TIA 526-14.

f. TIA 568-C.1.

g. TIA 568-C.3.

h. TIA TSB 140.

2. Test attenuation and polarity of installed cable plant with OLTS and installed condition of cabling system and its components with OTDR.

3. Verify condition of fiber end face.

4. Perform on each cabling link (connector to connector).

5. Perform on each cabling channel (equipment to equipment).

6. Do not include active devices or passive devices within link or channel other than cable, connectors, and splices. For example, link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

7. Document Tests:

a. OLTS dual wavelength attenuation measurements for single-mode links and channels.

b. OTDR traces and event tables for single-mode links and channels.

G. Fiber Testing Parameters: Each cabling link shall be in compliance with the following test limits:

1. Optical Loss Testing:

a. Backbone (single-mode) Link:

1. Calculate link attenuation by the formulas specified in TIA 568-C.1.

2. Values for Attenuation Coefficient (dB/km) are listed in the table below:

Attenuation Coefficient				
Type of Optical Fiber	**Wavelength (nm)**	**Attenuation Coefficient (dB/km)**	**Wavelength (nm)**	**Attenuation Coefficient (dB/km)**

Attenuation Coefficient				
Type of Optical Fiber	**Wavelength (nm)**	**Attenuation Coefficient (dB/km)**	**Wavelength (nm)**	**Attenuation Coefficient (dB/km)**
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

2. OTDR Testing:
   a. Reflective Events: Maximum 0.75 dB.
   b. Nonreflective Events: Maximum 0.3 dB.
3. Magnified Endface Inspection:
   a. Visually inspect fiber connections for end-face quality.
   b. Scratched, pitted, or dirty connectors shall be diagnosed and corrected.

H. Diagnosis and Correction:

1. Installed cabling links and channels shall be field tested and pass test requirements and analysis as described herein.
2. Link or channel that fails these requirements shall be diagnosed and corrected.
3. Document corrective action and follow with new test to prove corrected link or channel meets performance requirements.
4. Provide final and passing result of tests for links and channels.

I. Acceptance: Acceptance of test results shall be given in writing after Project is tested and completed in accordance with Contract Documents and satisfaction of Owner.

J. Test Execution:

1. Optical Fiber Cable Testing:
   a. Tests performed that use laser or LED in test set shall be carried out with safety precautions in accordance with LIA Z136.2.
   b. Link and channel test results from OLTS and OTDR shall be recorded in test instrument upon completion of each test for subsequent uploading to a PC in which administrative documentation may be generated.
      1. Record end-face images in memory of test instrument for subsequent uploading to a PC and reporting.
   c. Perform Testing:
      1. On each cabling segment (connector to connector).
      2. On each cabling channel (equipment to equipment).
      3. Using high-quality test cords of same fiber type as cabling under test.

a. Test cords for OLTS testing shall be between 1 meter and 5 meters in length.

b. Test cords for OTDR testing shall be approximately 100 meter for launch cable and at least 25 meters for receive cable.

2. Optical Loss Testing (OLTS):

a. Backbone Link:

1. Test single-mode at 1,310 nm and 1,550 nm in accordance with TIA 526-7, Method A.1, One Reference Jumper or equivalent method.

2. Perform tests in both directions.

3. OTDR Testing:

a. Test backbone, horizontal, and centralized links at appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.

1. Single-mode: 1,310 nm and 1,550 nm.

b. Test each fiber link and channel in one direction.

c. Install launch cable between OTDR and first link connection.

d. Install receive cable after last link connection.

4. Length Measurement:

a. Record length of each fiber.

b. Measure optical length using OLTS or OTDR.

5. Polarity Testing:

a. Test paired duplex fibers in multifiber cables to verify polarity in accordance with subclause 10.3 of TIA/EIA 568-C.1.

b. Verify polarity of paired duplex fibers using OLTS.

6. Test Results Documentation:

a. Test results saved within field-test instrument shall be transferred into Windows-based database utility that allows for maintenance, inspection, and archiving of test records. These test records shall be uploaded to the PC unaltered. For example, “as saved in the field-test instrument.” The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.

b. Available for inspection by Owner or Owner’s representative during installation period. Submit within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling.

c. Database for Project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD-ROM prior to Owner acceptance of building. CD-ROM shall include software tools required to view, inspect, and print test reports.

d. Circuit IDs reported by test instrument shall match specified label identification.

e. Provide in electronic database for each tested optical fiber with the following information:

1. Identification of Site.
2. Name of test limit selected to execute stored test results.
3. Name of personnel performing test.
4. Date and time test results were saved in memory of tester.
5. Manufacturer, model, and serial number of field test instrument.
6. Version of test software and version of test limit database held within test instrument.
7. Fiber identification number.
8. Length for Each Optical Fiber: Optionally the index of refraction used for length calculation when using a length capable OLTS.
9. Test results to include OLTS attenuation link and channel measurements at appropriate wavelength and margin; difference between measured attenuation and test limit value.
10. Test results to include OTDR link and channel traces, and event tables at appropriate wavelength.
11. Length for each optical fiber as calculated by the OTDR.
12. Overall pass/fail evaluation of link-under-test for OLTS and OTDR measurements.

K. Drawings:

1. Record Copy: Provide at end of Project on CD-ROM.

a. Editable CAD format and include notations reflecting as-built conditions of additions and variations from Drawings provided, such as to cable path and termination point.

b. CAD drawings are to incorporate test data imported from test instruments.

2. As-built Drawings:

a. Include, but not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts, and frame installation details.

b. Include field changes made up to construction completion:

1. Field directed changes to pull schedule.
2. Field directed changes to cross connect and patching schedule.
3. Horizontal cable routing changes.
4. Backbone cable routing or location changes.
5. Associated detail drawings.

3.3 TESTS AND INSPECTION

A. Cable Testing:

1. Fiber Optic Cables:

a. TIA/EIA 568: Demonstrate that 100 percent of the fibers in each cable meet requirements of TIA/EIA 568, Annex H, as modified here:

1. Maximum attenuation as specified in Article Field Quality Control.

2. Measure attenuation in both directions, not in one direction only.

b. Replace and retest cables that do not have specified number of fibers that meet attenuation standards.

2. CAT 6 Cables:

a. TIA/EIA 568: Demonstrate that 100 percent of the cables installed meet CAT 6 cable standards, including bandwidth requirement of 1,000 Mbps.

B. Performance Testing:

1. Validate that LAN network performance for the following:

a. Simulated Fail and Measure Restoration Times:

1. Test time to restore network less than 250 ms.

b. Simulate Constant Loading of Network: 10 to 20 percent of design bandwidth for critical components on the network.

1. Verify no CRC errors.

2. Verify no packet losses.

3.4 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.

1. As-Built Fiber Optic Cable Installation Form.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surge protective devices for low-voltage (120 – 600V) power distribution and control equipment.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. VPR: Voltage Protection Rating.

C. SPD: Surge Protective Device

D. I-nominal: Nominal discharge current.

E. SCCR: Short-circuit current rating.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.

B. Submittals shall include UL 1449 Listing documentation verifying:
1. Short Circuit Current Rating (SCCR)
2. Voltage Protection Ratings (VPRs) for all modes
3. Maximum Continuous Operating Voltage rating (MCOV)
4. I-nominal rating (I-n)
5. Type 1 Device Listing

(NOTE: VPR, MCOV, I-n, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCRs are posted in manufacturer's UL docs.)

UL data and visual inspection takes precedence over manufacturer's published documentation.

C. Qualification Data: For testing agency.

D. Field quality-control test reports, including the following:
1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

E. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain surge protective devices and accessories for each category through one source from a single manufacturer.

B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with IEEE C62.41-2002, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45-2002, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage (1000 Volts or less) AC Power Circuits."

E. SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
3. Humidity: 0 to 85 percent, non-condensing.
4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.7 COORDINATION

A. Coordinate location of field-mounted surge protective devices to allow adequate clearances for maintenance.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of any surge suppressor that fails due to materials or

workmanship within ten year from date of Project Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. General Electric Company.
2. Innovative Technology, Inc.
3. Square D/ Schneider Electric.
4. Eaton/Cutler Hammer.
5. Advanced Protection Technologies, Inc.

2.2 480V SWITCHBOARD AND 480V MCC SUPPRESSORS

A. Surge Protective Devices with the following features and accessories:
1. SPD shall be UL Labeled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of the SPD, per NEC 285.6.
2. SPD shall be UL labeled with 20 kA I nominal (I-n), for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
3. Fabrication using bolted compression lugs for internal wiring.
4. Integral disconnect switch, if no breaker position available.
5. Redundant suppression circuits.
6. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
8. LED indicator lights monitoring each individual MOV, including N-G. Units indicating "power is on" does not meet the intent of this specification.
9. Audible alarm, with silencing switch, to indicate when protection has failed.
10. One set of dry contacts rated at 5 A and 250Vac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
11. Surge-event operations counter with a means of saving totals in the event of power interruption.

B. SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental overcurrent controls.

C. Peak Single-Impulse Surge Current Rating: 300kA/phase.

D. Connection Means: Permanently wired.

E. Protection modes and UL 1449 Third Edition VPRs for grounded wye circuits with voltages of 480Y/277, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 1200V
2. Line to Ground: 1200V

3. Neutral to Ground: 1200V

F. Protection modes and UL 1449 Third Edition VPRs for voltages of 480, 3-phase, 3-wire, delta circuits shall be as follows:
   1. Line to Line: 1800V
   2. Line to Ground: 1800V

2.3 PANELBOARD SUPPRESSORS

A. Surge Protective Device with the following features and accessories:
   1. SPD shall be UL Labeled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of the SPD, per NEC 285.6.
   2. SPD shall be UL labeled with 20 kA I nominal (I-n), for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
   3. Fabrication using bolted compression lugs for internal wiring.
   4. Integral disconnect switch, if no breaker position available.
   5. Redundant suppression circuits.
   6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
   7. LED indicator lights monitoring each individual MOV, including N-G. Units indicating "power is on" does not meet the intent of this specification. .
   8. Audible alarm, with silencing switch, to indicate when protection has failed.
   9. One set of dry contacts rated at 5 A and 250Vac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
   10. Surge-event counter with a means of saving totals in the event of power interruption.

B. Peak Single-Impulse Surge Current Rating: 150 kA / phase

C. Protection modes and UL 1449 Third Edition VPRs for grounded wye circuits with voltages of 480Y/277, 3-phase, 4-wire circuits shall be as follows:
   1. Line to Neutral: 1200V for 480Y/277.
   2. Line to Ground: 1200V for 480Y/277.
   3. Neutral to Ground: 1200V for 480Y/277.

D. Protection modes and UL 1449 Third Edition VPRs for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
   1. Line to Neutral: 700V for 208Y/120.
   2. Line to Ground: 700V for 208Y/120.
   3. Neutral to Ground: 700V for 208Y/120.

2.4 ENCLOSURES

A. Internal surge protective devices are to be installed in the same cabinet as the MCC and 480V and 120/208V panelboards.

B. External surge protective devices shall have the following enclosures:
   1. Indoor Enclosures: NEMA 250 Type 1.
   2. Outdoor Enclosures: NEMA 250 Type 4X

PART 3 EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Internal surge protective devices shall be installed by the MCC and panelboard manufacturer at the factory.

B. External surge protective devices shall be installed adhering to the following requirements:
   1. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing if a 60 A breaker is not available.
   2. At Distribution, MCC and Branch, SPD shall have an independent means of servicing disconnect such that the protected panel remains energized. A 30 A breaker (or larger) may serve this function.
   3. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
   4. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.
   5. SPD shall be installed on the load side of the main service disconnect.
   6. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

3.2 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect service entrance equipment, panelboards, control terminals, data terminals to their sources until surge protection devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.3 FIELD QUALITY CONTROL

A. Remove and replace malfunctioning units and retest.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices.

END OF SECTION