100% PROJECT MANUAL

COMMERCE 2.0 MGD GROVE CREEK WPCP

COMMERCE, GEORGIA

for

CITY OF COMMERCE

BID DOCUMENTS

March 2025

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CERTIFICATE OF AUTHORIZATION

GEORGIA
REGISTERED
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03.19.2025
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COMMERCE 2.0 MGD GROVE CREEK
WATER POLLUTION CONTROL PLANT

FOR

CITY OF COMMERCE

COMMERCE, GEORGIA

GMC PROJECT NO. CATL230033

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Labels.
5. Lockout devices.

B. Related Requirements:

1. Section 09 96 00 – High-Performance Coatings: Execution requirements for painting specified by this Section.

1.2 SUBMITTALS

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

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for equipment identification and schedule, including equipment number, location, function, and manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

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

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved black letters on light, contrasting background color.

2.2 TAGS

A. Metal Tags:

a. Stainless steel construction; stamped letters.
b. Minimum Tag Size and Configuration: 1 inch x 2-inch (minimum) with finished edges.

2.3 STENCILS

A. Description:

1. Clean-cut symbols.
2. Letter Height**:** 1-3/4 inch.

B. Stencil Paint: As specified in Section 09 96 00 – High-Performance Coatings; semi-gloss enamel.

2.4 LABELS

A. Description:

1. Laminated Mylar construction.
2. Minimum Size: 1.9 by 0.75 inch.
3. Adhesive backed, with printed identification.

2.5 LOCKOUT DEVICES

A. Lockout Hasps:

a. Anodized aluminum construction.
b. Furnish hasp with erasable label surface.
c. Minimum Size: 7-1/4 by 3 inches.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Prepare surfaces as specified in Section 09 96 00 – High-Performance Coating for stencil painting.

3.2 INSTALLATION

A. Identify equipment with nameplates.

B. Identify inline pumps and other small devices with tags.

C. Identify control panels and major control components outside panels with plastic nameplates.

D. Apply stencil painting as specified in Section 09 96 00 – High-Performance Coatings.

E. Install identifying devices after completion of coverings and painting.

F. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.

G. Labels:

1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
2. For unfinished covering, apply paint primer before applying labels.

H. Install tags using corrosion-resistant chain.

END OF SECTION 46 05 53

SECTION 46 21 15 – ROTARY DRUM SCREEN

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes all screening equipment at proposed headworks.

1. Two (2) totally self-contained, factory assembled, internally-fed rotary drum screens.
2. One (1) Fine Screening Conveyor
3. One (1) Shaftless Spiral Compactors

B. Related Requirements:

1. Section 03 20 00 – Anchorage in Concrete.
2. Section 05 50 00 – Metal Fabrications: Fasteners, brackets, and other miscellaneous metal fabrications as required by this Section.
3. Section 09 96 00 – High-Performance Coatings: Product and execution requirements for painting as required by this Section.
4. Section 46 05 53 – Identification for Water and Wastewater Equipment.

1.2 SUBMITTALS

A. Shop drawings shall be submitted in accordance with the requirements of Section 01 33 00 - Submittal Procedures. The equipment manufacturer shall include descriptive literature, dimensional prints of all components described herein, and performance data in sufficient detail to fully describe the equipment being installed.

B. Operation and maintenance manuals shall be submitted in accordance with the requirements of Section 01 33 00 - Submittal Procedures.

1.3 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Requirements for scheduling.

B. The Contractor shall review design and layout drawings to ensure that installation arrangements are suitable for the specified equipment. Any potential conflicts or recommended modifications shall be coordinated with the Engineer and noted on the shop drawings or by a pre-submittal request for information, if appropriate.

C. Coordinate installation and startup of Work of this Section with Owner and Engineer.

1.4 SCHEDULING

A. Section 01 31 00 – Project Management and Coordination: Requirements for scheduling.

B. Schedule Work of this Section to install equipment prior to connecting piping Work.

1.5 DELIVERY, STORAGE AND HANDLING

A. All equipment shall be suitably packaged to facilitate handling and protect against damage during transit and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.

B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces, which are damaged prior to acceptance of equipment, shall be repaired to the satisfaction of the engineer.

C. Grease and lubrication oil shall be applied to all bearings and similar items.

D. Each item of equipment shall be tagged or marked as identified on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

E. Motors, electrical equipment, and other equipment with bearings shall be stored and maintained. Electrical equipment, controls, and insulation shall be protected against moisture and water damage. All space heaters furnished in electrical equipment shall be connected and operated continuously.

F. Screen, conveyor, compactor and accessories shall be delivered, stored and protected in accordance with the manufacturer's recommendations and the requirements of Section 01 60 00 – Product Requirements.

1.6 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.7 QUALITY ASSURANCE

A. The manufacturer shall provide the Engineer with written certification that all equipment furnished complies with all applicable requirements of Specifications.

B. The manufacturer shall have at least five (5) years of experience in the design and construction of the rotary drum screens, screening conveyor and washing compactor described herein, with at least ten (10) similar equipment installations.

1.8 TOOLS AND SPARE PARTS

A. Spare parts shall be prepared for long term storage, sufficiently labeled, and shipped in separate containers.

1. Furnish one (1) set of manufacturer's recommended spare parts for the screen and conveyor.
2. Furnish a complete list of manufacturer's recommended spare parts.

B. Tools: Furnish special tools and other devices required for Owner to maintain, disassemble and repair screens, conveyors, and washing compactors.

1.9 WARRANTY

A. The Manufacturer and Contractor shall furnish a warranty extending twelve (12) months after substantial completion date of the project in its entirety.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The equipment shall be manufactured by:

1. CleanTek Water Solutions/Lackeby Products.
2. Parkson
3. JWC
4. Or pre-approved equal
    a. Specifications and equipment arrangements for the equipment referenced are based on CleanTek Water Solutions/Lackeby Products. Changes to the arrangement indicated in the specifications and in the plan set shall be at the expense of the installing Contractor. No change orders will be issued to the contractor for modifications to the laying length, footprint, concrete layout, electrical, mechanical, etc.

2.2 EQUIPMENT

A. Schedule:

1. Rotary Drum Screen No.1 (SCR1110)
2. Rotary Drum Screen No.2 (SCR1120)
3. Rotary Drum Screen No.3 – Future (SCR1130)
4. Screening Conveyor No.1 (SCY1111)
5. Screening Washing Compactor (SWC1112)

B. Description:

1. Rotary drum screen shall be fully automatic, internally-fed, perforated plate media, cylindrical drum screen designed to receive a pumped flow of raw wastewater.
2. Conveyor shall be designed with a shaftless screw to receive raw wastewater screenings form multiple rotary drum screens and transport to downstream washing compactor.
3. Washing compactor shall be designed to receive screenings from conveyor, wash out the organic materials, dewater, and compact raw wastewater screenings, inert solids, and

general trash without binding, clogging, or obstruction in the compactor mechanism. Compacted screening shall be discharged to a dumpster for final disposal.

C. Rotary Drum Screen:

1. Design Requirements:

a.	No. of Units currently installed:	2
b.	No. of Units for future:	1
c.	Design Flow:	6.55 MGD
d.	Influent Total Suspended Solids:	320 mg/L
e.	Screen Opening:	3 mm
f.	Inlet Capacity:	140 ft^3/hr of wet screenings with no less than 8% dry solids
g.	Motor Size:	1.5 HP
h.	Wash Water Requirement:	14 gpm @ 60 psi

D. Screw Conveyor:

1. Design Requirements:

a.	No. of Units:	1
b.	Capacity:	125 ft^3/hr
c.	Screw Diameter:	10 in
d.	Through Thickness:	10 gauge
e.	Length:	18 ft
f.	Angle of Incline:	0 – 5°
g.	Number of Inlets:	4
h.	Number of Outlets:	1
i.	Screw Speed:	22 rpm max
j.	Horsepower:	2 HP
k.	Power Supply:	460 V, 3 phase, 60 Hz

E. Washing Compactor:

1. Design Requirements:

a.	No. of Units:	1
b.	Capacity:	140 ft^3/hr
c.	Inlet Solids Concentration:	8% - 10%
d.	Screw Diameter:	8 7/8 in/min
e.	Length:	9 ft
f.	Angle of Incline:	15°
g.	Motor Horsepower:	3 HP
h.	Volume Reduction:	60 %/min
i.	Compacted Solids Percent:	40 %/min

2. Spray Flush System:

a.	Solenoid Valve Diameter:	1/2 inch
b.	Flush Water Requirement:	12 gpm @ 60 psi
c.	Flush Water Connection Size:	1/2 inch

2.3 DESIGN REQUIREMENTS

A. Each screen shall be capable of treating a peak flow of at least 6.55 MGD of wastewater at a maximum total suspended solids concentration of 320 mg/l and FOG concentration less than 40 mg/l.

B. Each compactor shall have a capacity of at least 140 ft^3/hr of screenings at a solids concentration of 8% to 10%.

2.4 ROTARY DRUM SCREEN

A. Screen Assembly:

1. The screening element shall be a perforated cylinder constructed of a minimum of 22-gauge type 316L stainless steel. Each end of the screen elements shall be fitted with a type 316L stainless steel end ring welded to the screen element substructure throughout the circumference. Rings shall be a minimum thickness of 0.135-inch and have stiffening flanges welded around their circumference. One end ring shall be at the discharge end and designed with an extended bell mouth to provide effective discharge of dewatered solids away from the base of the unit. Each end ring shall also include a steel track area specifically designed to be supported by the carbon fiber belt drive system. The drum shall be a minimum 50 inches in diameter and a minimum 113 inches in length.
2. The screening element perforations shall be 3mm in diameter.
3. The screen element shall be equipped with type 316L stainless steel flights arranged in a continuous helical pattern throughout the length of the drum causing solids to continually move towards the discharge end. The diverter height shall be a minimum of 4-inches. The flights shall be designed to structurally strengthen the perforated cylinder and make it suitable for the intended duty. Screens without continuous helical flights that are at least 4 inches in height shall not be allowed.

B. Base Frame and Lower Collection Pan:

1. The base frame shall be constructed of type 304L stainless steel sections and shall be accurately fabricated to provide a mounting surface for the screen assembly. The frame shall be designed to withstand all loads imposed by the screen components, plus wastewater passing through the unit. The base shall also be designed in such a way to allow for four-pin support without the linear deflection exceeding 0.04-inch. Four (4) 304SS anchor bolt holes shall be incorporated into the base.
2. The lower collection pan shall be fabricated of type 316L stainless steel and shall be integral to the screen assembly. Pan shall be sloped towards the outlet pipe to prevent ponding of water in collection pan. Screen filtered effluent shall be gravity discharged from the inclined collection pan through a 316L stainless steel minimum 24-inch diameter plain end discharge pipe. Drum screens that require field assembly of the lower collection pan or do not include a sloped lower collection pan shall not be allowed.

C. Inlet Pipe, Headbox, and Overflow Assembly:

1. All components of the piped inlet and headbox assembly shall be fabricated of a minimum of 14-gauge type 316L stainless steel. The inlet connection to the headbox assembly shall be a maximum 20-inch diameter flanged connection.

2. An inlet pipe of special hydraulic design to accommodate a maximum of 4600 gpm inflow shall be furnished. It shall be supported from the feed end of the screen frame. Flow entering the inlet shall be baffled to reduce forward velocity and provide momentary flow equalization. Flow shall be controlled to provide smooth, uniform distribution over the side weir surface parallel to the drum axis.
3. An integral overflow bypass system, with alarm detection device, shall be provided to ensure that unscreened flow is bypassed when flow exceeds the design flow, or if the screen should be inoperative for any reason during flow to the screen. Bypass flow shall be directed to a separate 16-inch diameter, 316L stainless steel, flanged connection for discharge into the plant sewer system. Drum screens without an integral overflow detection, alarm, and bypass system will not be allowed.

D. Splash Guards:

1. The screen shall be equipped with external splash guards constructed of a minimum of 14-gauge type 316L stainless steel. These guards shall be located on each side of the screening element and attached to the base. The guards shall also be designed to contain and direct the entire flow through the screen base discharge opening.
2. The splash guards shall have internal guided flow vanes and be self-supporting throughout their entire length. Additionally, the guards shall also support the weight of the inspection cover hoods.

E. Inspection Cover Hoods:

1. Inspection cover hood assemblies shall be provided for each screen. Each cover hood will be sized to facilitate handling by the operator or maintenance personnel. Each section shall be sufficiently durable to withstand visual damage from 1-inch hailstones and designed for a live load of 40 psf on horizontal projection plus 30 psf wind loads.
2. Each inspection hood section on the cover hood assembly shall be capable of being opened and removed by one operator. Each side of the cover hood shall consist of two (2) inspection panels, plus support members, and cover hood assembly. All inspection panels shall be secured by a keyed lock.
3. Cover inspection panels shall be UV resistant, reinforced fiberglass with 0.125" minimum thickness. All resin shall be chemical-resistant and shall contain light stabilizers such as UV-9, or equal. Resin shall be suitable for service in temperatures ranging from 300F to 1400F. Fiberglass reinforcement shall consist of a combination of shopped strand mat and woven roving, shall be equal to PPG 526, and shall be treated with a finish compatible to the resin being used. Panels shall be formed on a suitable mold to insure constant and accurate dimensions of the finished units. Mold shall be designed so the panel can be cast in one (1) piece without joining members by bonding or bolting. All layers shall contain pigment to produce a translucent panel. Handles shall be provided to allow the panel to be lifted by one operator. Cover hood assemblies shall fasten to and be supported by the splash guards below.

F. Screen Cleaning System:

1. Each screen shall be provided with an external spray system and two (2) counter rotating horizontal cleaner roller brushes. As available, potable or treated plant water shall be supplied to the spray system at the required volume and pressure.
2. The removable external spray system shall consist of a type 316 stainless steel spray header and 316SS spray nozzles. The external spray header shall be parallel to the screen

axis with the spray nozzles positioned to clean the entire screen surface. Maximum flow shall be 14 gpm at 60 psi. Inlet connection to the spray header shall be 1-inch NPT.

3. The counter rotating cleaner roller brushes shall consist of a rotary nylon brush bristle mounted on a type 316 stainless steel shaft with sealed bearings at each end. The brushes are located above the perforated cylinder and rotates in contact with the cylinder as it turns. The angular contact generated by the unique shape of the brush cleans the perforations. The joint cleaning action of the brush and intermittent wash water sprays effectively maintains the open area of the screen cylinder and prevents blinding. Drum screens that do not include a cleaner brush will not be allowed.

G. Solids Discharge Chute and Screen End Cover:

1. Each screen shall be provided with a heavy-duty type 316L stainless steel solids discharge chute. The lower part of the chute shall fit closely beneath the screen discharge, so that all solids are captured. The hopper shall extend downward. The chute shall converge to a nominal 34-inch x 10-inch discharge opening and the converging sides shall be not less than 60 degrees from horizontal.
2. The discharge end of the screen shall be enclosed by a removable cover, which when opened shall provide access to the screen interior. Screen end cover shall be secured by a keyed lock when the screen is operating. The cover shall be fiberglass with 0.125" minimum thickness. All resin shall be chemical-resistant and shall contain light stabilizers such as UV-9, or equal. Resin shall be suitable for service in temperatures ranging from 300F to 1400F. Fiberglass reinforcement shall consist of a combination of shopped strand mat and woven roving, shall be equal to PPG 526, and shall be treated with a finish compatible to the resin being used. Cover shall be formed on a suitable mold to insure constant and accurate dimensions of the finished units. Mold shall be designed so the end cover can be cast in one (1) piece without joining members by bonding or bolting. All layers shall contain pigment to produce a translucent panel. Handles shall be provided to allow the cover to be lifted by one operator.
3. The discharge end of the enclosure shall be provided with a 316L stainless steel, 6-inch, plain end pipe odor control outlet.

H. Drive and Motor:

1. The screen shall have a drive system consisting of an electric motor, two type 316 stainless steel pinion gears, and two carbon fiber belts mounted onto both ends of the screen cylinder. The drive end pinion gear will drive the carbon fiber belt which in turn will directly drive and support the drum. Drum drive assemblies which include steel chains, trunnion wheels, or stabilizer wheels will not be accepted.
2. The cylinder drive system shall consist of a NORD Gear electric motor coupled to a NORD Gear helical gear reducer. Motor shall have the following characteristics, along with those specified in the design requirements:
   a. 460V/3ph/60 Hz
   b. Maximum 1.5 Horsepower
   c. Inverter Duty
   d. TEFC
   e. Continuous Duty
   f. Minimum 1.15 service factor
3. The motor will be directly coupled to a flange mounted, parallel helical, double reduction gear. The reducer shaft shall be keyed to a type 316 stainless steel driving shaft. The

drive assembly shall be externally mounted onto the inlet end of the 316L stainless steel screen frame. The assembly shall provide vibration free operation with minimum wear. The reducer shall be sized to maintain a minimum 1.1 service factor.

I. Electrical Devices:

1. In addition to the drive motor, the following electrical devices will be supplied with each unit. Proper wiring from the devices to the control panel will be the responsibility of the Contractor.

   a. One (1) spray water solenoid valve shall be shipped loose and provided for control of the spray wash system on the unit. Solenoid valves will be activated on a signal from the drum screen control panel at preset intervals. The valves shall be NEMA 4x, explosion-proof, normally closed, pilot operated, bronze body.
   b. A conductive probe shall be installed in the overflow box to detect any overflow condition. The probe shall provide a local and remote alarm and initiate a continuous cleaning cycle in the event of an overflow condition due to screen blinding. The probe shall be supplied by screen Manufacturer.
   c. One (1) NEMA 4x 304SS remote emergency stop pushbutton station will be included with each screen. Station to be mounted in the field by contractor near each screen unit depending on project requirements/needs.

2.5 SCREW CONVEYOR

A. Spiral Flight:

1. Spiral flight for the shaftless screw conveyor shall be designed to convey material without a center shaft.
2. The spiral flight shall be designed with the stability to prevent distortion and jumping in the trough.
3. Spiral flighting shall have full penetration welds at all splice connections. The flights shall be fabricated and welded on a jib to assure true alignment and shall be assembled according to the manufacturer's recommendations. The spiral flights shall be coupled to the end shafts by a pipe to shaft connection of sufficient strength to transmit thrust and/or torsion applicable to meet performance criteria.

B. Drive and Shaft Connections:

1. Spiral flights shall be connected to the drive end shaft using an end flange and a pipe sleeve to effectively transmit torque from the drive shaft to the spiral flight. The plate flange shall be a minimum of 8 mm thick.
2. The flange and pipe sleeve shall be welded to the spiral flights, with welded gusset plates used for additional reinforcing. The end shaft shall extend through the pipe sleeve and be secured using stainless steel bolts penetrating the pipe sleeve and the end shaft. Bushings may be used between the pipe sleeve and the end shaft if necessary.

C. Trough:

1. The trough assembly shall consist of a U-trough, wear liner, inlet flanges, and trough cover.

2. The U-trough shall be constructed from material 304 stainless steel.
3. The U-trough shall have a 1/4-inch-thick replaceable wear liner of material specified above. The liner is held in place by clips along the length of the conveyor.
4. Hold-down angles from 304 stainless steel shall be provided on both sides of the trough assembly to control excessive vertical movement of the spiral flights. Hold-downs shall not interrupt material transportation.
5. Four (4) flanged inlets to the conveyor trough from rotary drum screens.
6. The trough will be supplied with covers. Trough covers, constructed at a minimum of 14 gage thick, will be provided with neoprene gaskets and bolted to the flanges of the U-trough.

D. Chutes:

1. The conveyor shall include four (4) inlet chutes – three (3) for immediate use and one for a future screen. Each trough shall be equipped with filling and/or discharge chutes for transferring material to or from another conveyor. The chutes shall be fabricated from a minimum 12-gauge plate. Equal level transfers shall be permitted. Each chute shall be sized to fit the screening discharge chutes of the drum screens.

E. Trough Covers:

1. The specified cover shall cover the portion of each trough that is not covered by the filling chute.

F. Conveyor Supports:

1. Each conveyor shall be furnished complete with supports suitable for mounting. The legs shall be securely bolted to the concrete surface.
2. The supports shall be shop fabricated from rectangular structural steel shapes and plates. All shop welding shall conform to the latest standard of the American Welding Society.
3. Structural Design:
    a. The ration of the unbraced length to least radius of gyration (slenderness ratio) shall not exceed 120 for a compression member (of angles 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 1/3 when subject to loading of twice the running torque of the drive motor.
    b. Supports shall be provided near the drive units (1 to 2 feet) and at locations 12 feet apart along the conveyor.
    c. Support loads shall be based on a completely filled trough plus dead weight of the equipment.
    d. Support legs shall be securely bolted to the concrete surface.

G. Drive Unit:

1. The screw conveyor drive shall consist of a speed reducer, electric motor, and trough end seal. Drives shall be mounted as show on the trough end. The drive system shall be designed for starting the conveyor fully loaded. Drive size shall be as recommended by the manufacturer. All electric motors shall be totally enclosed and fan cooled. The design of all drive components shall be such that jamming of any components shall not cause damage to the equipment. Trough end seal shall be a compression-type Packing Gland. Provisions shall be installed as required to protect the equipment.

H. Gear Reducer:

1. All gear reducers shall be commercially built, minimum AGMA Class I, single, double, or triple reduction, helical gear units with high-capacity roller bearings. Bearings shall be designed for the thrust loads from the spiral flights and shall have a B-10 live of 30,000 hours. The reducers shall be standard air-cooled units with no auxiliary cooling allowed.

I. Motor:

1. All electrical motors shall be fan cooled, severe duty, totally enclosed, and shall be rated as specified in the design requirements, except where noted otherwise.

J. Hold Down Provisions:

1. Hold down provision shall be installed on shaftless screw conveyors if required by the manufacturer's design or if excessive vertical movement of the spiral flights occurs during the first year of operation.
2. Evidence of excessive vertical movement shall include wear on the trough cover plates. Hold-down provisions shall be of welded steel construction supported by the conveyor trough and be designed to minimize material flow interruption. The manufacturer shall design the hold-down provisions.

K. Wear Liner:

1. Trough replaceable wear liner of 5/8 inch thickness shall be held in place by clips along the length of the conveyor.

L. Overload:

1. Overload protection shall be provided, if required to protect the drive components and shaftless screw from torsion loadings exceeding the torque rating of the shaftless auger.

2.6 SHAFTLESS SPIRAL SCREW COMPACTOR

A. Materials

1. The materials used in the fabrication of the spiral compactor furnished under this section shall conform to the following:

a.	Steel plate and shapes:	316L stainless steel
b.	Spiral:	High Strength Alloy Carbon Steel
c.	Wear Lining:	5/16" thick Hardox Wear Bars
d.	Dewatering Zone:	316L Stainless Steel Cylinder with 2mm perforated slots
e.	Inlet & Discharge Chutes:	316L stainless steel

B. Trough and Spiral

1. The trough shall be U-shaped. Filling and discharge chutes for transferring material from the screens to the dumpster, shall be provided as shown on the Plans.

a. Compactor shall have one (1) inlet(s) sized to accept screenings from one (1) screen conveyor.

2. The inlet chutes shall be fabricated from a minimum 14-gauge 316L stainless steel plate. Each chute shall welded to the compactor trough.
3. The trough shall be complete with at least three (3) 5/16" thick Hardox wear bars.
4. Each portion of the compactor trough not covered by the inlet chutes shall have covers of a material identical to the trough. The covers shall be held in place by stainless steel bolts with sufficient number to firmly hold the covers in position under all design operating conditions while still allowing the operator access to the trough and spiral for cleaning and maintenance. The covers shall be manufactured in maximum 4 ft. length sections.
5. Spiral shall be constructed of high strength carbon steel - Type S355JO
   a. Two concentric flights will be formed from bar stock and shall be welded together. Spirals with single flights will not be permitted. The outer spiral shall have a nominal thickness of 5/8 inch and the inner spiral flight shall have a nominal thickness of 1/2 inch.
   b. The spiral shall be fitted with a nylon brush to clean the perforated drain section that conforms to the trough radius on the low end of the trough.

C. Compaction Zone

1. At the discharge end of the unit will be the compaction zone.
2. The compaction / dewatering zone shall consist of a 316LSS cylinder with 2mm perforated slots.
3. The spiral screw applies pressure within the compaction zone which is enclosed in a perforated cylinder basket. Material is dewatered/compacted through the pressure generated in the perforated cylinder basket with back pressure provided by a weighted door. Amount of back pressure will be adjustable through addition or removal of included weights on door.
4. The spray wash assembly shall be designed for flushing away wastewater sewage debris and grease without obstruction of or plugging of the 3" drain.
5. The spray wash flushing system shall consist of a 316 stainless steel spray bar, solenoid valve, manual ball valve, and wye strainer. The system shall have a maximum output of 12 gpm at 60 psig. Spray connection shall be 3/4-inch NPT. Flush system shall be compatible with non-potable water supply.
6. A 3" 316L stainless steel perforated drain that conforms to the trough radius shall be attached to the drive end of the compactor trough to drain away free water. Perforated plate shall be kept clear via a nylon brush attached to the spiral.
7. The 316L stainless steel cover door over the compaction zone is hinged to allow inspection and clearing.

D. Compactor Supports

1. The compactor shall be furnished complete with supports suitable for anchoring to the concrete base or building as required by the compactor press configuration shown on the plans. The supports shall be shop-fabricated from 316L stainless steel structural steel shapes and plates. The supports shall be designed to avoid interference with other equipment or equipment supports. The supports shall be designed to prevent excessive vibration of any portion of the compactor unit under all loading conditions.

E. Motor

1. The spiral compactor shall be driven at a maximum speed of 22 rpm by an electric motor directly connected to a gear reducer. Motor shall have the following characteristics:

    a. 1. 230/460V, 3ph, 60 Hz
    b. 2. Maximum 3 Horsepower
    c. 3. Inverter Duty
    d. 4. TEFC
    e. 5. Continuous Duty
    f. 6. Minimum 1.15 service factor

F. Gear Reducer

1. The gear reducer shall be direct –coupled to the compactor drive shaft at the head end. Gear reducers shall be NORD helical gear units. Bearings shall be designed for the thrust loads from the spiral flights, suitable rated to accommodate the axial load. The reducers shall be standard air-cooled units with no auxiliary cooling required.
2. The applied torque of the drive unit and gear reducer shall be adequate to start the spiral compactor when fully loaded.

G. Drive Shaft

1. The drive shaft shall be heat-treated alloy steel AISI 4150. The shaft shall be accurately ground and fitted with key seats, as required.

H. Covers

1. A protective cover fabricated of minimum 14-gauge 316L stainless steel shall be provided for the exposed length of the compactor, as shown on the Plans. The cover shall be sectioned to allow removal in pieces.

I. Electrical Devices

1. In addition to the drive motor, the following electrical devices will be supplied with each unit. Proper wiring from the devices to the control panel will be the responsibility of the Contractor.

    a. One (1) bronze body spray water solenoid valve shall be provided for control of the spray wash system on the unit. Solenoid valves will be activated on a signal from the compactor control panel at preset intervals. The valve shall be NEMA 4x, explosion-proof, normally closed, pilot operated.
    b. One (1) NEMA 4x 304SS remote emergency stop pushbutton station will be included with each compactor. Station to be mounted in the field by contractor near each compactor unit depending on project requirements/needs.

2.7 CONTROLS

A. One (1) factory control panel shall be supplied to control all equipment: two (2) screens, one (1) conveyor, and one (1) washing compactor. Space for one (1) future screen shall be included in the panel.

B. Factory control panel shall be furnished by the rotary drum screen Manufacturer. The panel shall be NEMA 4X, type 304 stainless steel enclosure.

C. The panel shall contain one (1) soft start motor starter for each screen, each conveyor, and one (1) IEC-rated non-reversible motor starter for each screenings compactor. It shall also include a transformer for 120 VAC control power.

D. The panel shall be furnished with the following door front mounted devices:
1. H-O-A switch for operation of each screen and compactor.
2. O-C-A switch for wash water system of each screen and compactor.
3. ELAPSED TIME METER for each screen and compactor.
4. CONTROL POWER ON indicating light.
5. RUN indicating light for each screen and compactor.
6. OVERFLOW indicating light for each screen
7. OVERLOAD indicating light for each screen and compactor
8. WASH VALVE ENERGIZED indicating light for each screen and compactor.
9. EMERGENCY STOP pushbutton

E. Remote System Interface: The panel shall be provided with 120 VAC, 10 amp, Form C dry contacts for remote status. It shall accept 120 VAC dry contacts for remote control. The remote system shall include the following points:

1. Panel outputs – Discrete
   a. RUN status to Plant Control System for each screen and compactor.
   b. Common FAULT status to Plant Control System for each screen and compactor.
   c. OVERFLOW status to Plant Control System for each screen

2. Panel inputs - Discrete
   a. Screen CALL-TO-RUN from the Plant Control System.
   b. Emergency stop from each field mounted Emergency Stop device.
   c. Overflow switch from each screen

F. Panel shall be provided with powered 120 VAC outputs for wash water solenoid valves on each screen and compactor.

G. Repeat cycle timer for each screen and compactor wash water solenoid.

H. Off delay timer for each screen.

I. The compactor shall be interlocked with the drum screen(s) for automatic operation. A normally opened relay contact will be brought to the control panel from the screen(s), and the compactor shall start when the contact(s) close. The compactor shall continue to run after the contacts open again for an adjustable time to clear the inlet hopper(s). Spray water shall be automatically controlled during the compactor operation when the spray wash selector switch is in the AUTO position.

J. Two normally open isolated relay contacts, rated 3 amperes minimum at 120 volts AC shall be provided for remote indication. One shall close whenever the compactor is running (RUN), and the other shall close when the compactor stops for motor overload or emergency stop (FAULT).

K. Control Functions:

1. Screen & Compactor Operation HOA Switch:
   a. When HAND mode is selected, the screen or compactor shall run continuously.
   b. When the OFF mode is selected, the screen or compactor shall stop.
   c. When the AUTO mode is selected, screen shall receive a run command from the Plant Control System.

2. Spray System OCA Switch (each screen and compactor):
   a. When OPEN mode is selected, the spray shall be continuous.
   b. When the CLOSED mode is selected, the spray shall stop.
   c. When the AUTO mode is selected, the spray shall cycle per the settings on the internal repeat cycle timer whenever the screen is running.

2.8 SURFACE FINISH

A. All stainless steel sub-assemblies will be acid passivated after welding for corrosion resistance and to provide a superior surface finish. This will be done by full dipping of weldments; or by using an acid passivation paste in the weld and heat effected areas and spray-on acid solutions elsewhere. After passivation, the weldments will be thoroughly rinsed with clean water and allowed to air dry. Sandblasting, bead blasting, or grit blasting of stainless steel surfaces will not be allowed in lieu of acid passivation.

B. Motors and gear reducers will remain the manufacturer’s standard finish for severe environment. All plastic parts will remain unfinished, supplied as the manufacturer’s standard.

2.9 ANCHOR BOLTS

A. Contractor shall provide type 304 stainless steel anchor bolts and support stands as required for installation of the equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that facility is ready to receive rotary drum screens, conveyer and washing compactor.

3.2 INSTALLATION

A. All equipment specified herein shall be installed in accordance with reviewed shop drawings and the manufacturer's instructions and recommendations.

B. To minimize the risk of galling, anti-seize thread lubricant shall be liberally applied to male threads of all stainless steel anchor bolts and other stainless steel fasteners immediately prior to assembly and tightening.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Manufacturer Services:

1. Start-up:

a. Furnish the services of a factory representative, having complete knowledge of proper operation, start up procedure and maintenance requirements, for one (1), eight (8) hour day, to inspect the final installation and supervise a test run of the screens, conveyor, and compactor.

2. Training:

a. Furnish the services of a factory representative, having complete knowledge of the operational and maintenance requirements of the system to instruct the Owner's personnel in the proper operation of the equipment. Training for proper operation and maintenance of the equipment shall be scheduled for one (1), eight (8) hour day and will be concurrent with trip to site required for purposes of start-up.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace system components that fail to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 ASSEMBLY, INSPECTION AND TESTING

A. Following installation, operating tests will be performed to demonstrate to the Engineer that each mechanism and the system as a whole will function in a satisfactory manner. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or adjustments required to ensure satisfactory operation.

B. Conveyors shorter than 15 feet shall be totally assembled with gear drive and shop tested for at least one hour before shipment. Larger deliveries shall be shipped in sections of a maximum of 40 feet.

3.5 FIELD PAINTING

A. All shop primed surfaces shall be cleaned and painted as specified in Section 09 96 00 – High-Performance Coatings.

B. Electric motors, speed reducers, and other standard components shall be supplied with the manufacturer’s standard finish.

3.6 CLEANING

A. Prior to acceptance of the work of this Section, thoroughly clean all installed materials, equipment, and related areas in accordance with Section 01 70 00 – Execution and Closeout Requirements.

3.7 DEMONSTRATION

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

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 46 21 15

SECTION 46 23 23 - GRIT REMOVAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

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. Related Requirements:

1. Section 05 50 00 - Metal Fabrications: Fasteners, brackets, and other miscellaneous metal fabrications as required by this Section.
2. Section 09 96 00 – High-Performance Coatings: Product and execution requirements for painting as required by this Section.
3. Section 46 05 53 - Identification for Water and Wastewater Equipment: Nameplates for equipment specified in this Section.

1.2 SUBMITTALS

A. Manufacturer shall provide, at a minimum, the following information in accordance with Section 01 33 00 – Submittals.

1. Product Data/Information: Descriptive literature, bulletins and/or catalogs of the equipment.
2. Certified general arrangement drawings showing all important details including materials of construction, dimensions, loads on supporting structures, and anchor bolt locations.
3. Complete data on motors and gear reducers.
4. Maintenance Instructions
5. Installation Instructions
6. Wiring diagrams and electrical schematics for all control equipment to be furnished.
7. Parts List
8. Sample Warranty

1.3 COORDINATION

A. The Contractor shall review design and layout drawings to ensure that installation arrangements are suitable for the specified equipment. Any potential conflicts or recommended modifications shall be coordinated with the Engineer and noted on the shop drawings or by a pre-submittal request for information, if appropriate.

B. Coordinate installation and startup of Work of this Section with Plant Operations.

1.4 SCHEDULING

A. Section 01 31 00 – Project Management and Coordination: Requirements for scheduling.

1.5 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of installed grit removal equipment.

C. Operation and Maintenance Data: Submit instructions for equipment and accessories.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

1.7 QUALITY ASSURANCE

A. The unit offered must meet the following requirements:

1. The equipment shall be manufactured in North America.

2. The equipment supplier shall provide, on request, proof of experience in manufacturing this type of equipment, in the form of a reference list.

3. The manufacturer shall be certified ISO 9001-2015.

4. Equipment of other dimensions shall be unacceptable if their use requires architectural, structural, mechanical or electrical design changes.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver materials in manufacturer's packaging, including application instructions.

C. Inspection: Accept materials on-Site in original packaging. Inspect for damage.

D. Store materials according to manufacturer's instructions.

1.9 WARRANTY

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

B. The Contractor shall furnish a warranty extending twelve (12) months after substantial completion date of the project in its entirety.

C. During the warranty period, the Supplier shall include remote quarterly reviews of operating data (extracted from Cloud), with issuance of summary reports and a conference call by an application engineer (if necessary), noting key observations and recommendations.

D. During the warranty period, the Supplier shall allow for ten (10) hours per year of remote support conducted via phone, email, and/or video conferencing for assistance in further optimization, troubleshooting, training or other needs of the Owner. The Supplier shall also include the use of app-based augmented reality tools where such tools would be beneficial, at no additional charge (minimum of 1 hour charged per call).

E. The warranty coverage plan shall include a dedicated application, equipment and automation hotline accessible weekdays (8:00AM EST to 8:00PM EST).

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The entire Grit Removal System shall be manufactured by VEOLIA Water Technologies Canada Inc.

B. Or Pre-Approved Equal

1. Specifications and equipment arrangements for the equipment referenced are based on VEOLIA Water Technologies. Changes to the arrangement indicated in the specifications and in the plan set shall be at the expense of the installing Contractor. No change orders will be issued to the contractor for modifications to the laying length, footprint, concrete layout, electrical, mechanical, etc.

2.2 OPERATING CONDITIONS (PER UNIT)

A. Vortex Grit Chamber

1. Design peak flow	6.55 MGD
2. Downstream water level at design peak flow	16 in
3. Head loss across the grit chamber (peak flow)	3 in
4. Tank diameter	⌀120 in
5. Influent channel width	30 in
6. Influent channel depth	44 in
7. Inlet tunnel slope	15 degrees
8. Effluent channel width	30 in
9. Effluent channel depth	44 in

B. Grit Dewatering Screw

1. Grit Dewatering Screw Inlet capacity (with cyclone)	175 GPM

2. Grit Dewatering Screw Hydraulic capacity (hopper)	165 GPM
3. Grit Dewatering Screw Solids handling capacity (screw)	60 ft³/ h
4. Classification	Class I, Division I, Group D

2.3 EQUIPMENT SPECIFICATIONS

A. Vortex Grit Chamber

Model number	JMDV/3-30SXH
Quantity	One (1)

1. Agitator (drive tube)

a.	Rotating speed	19 RPM

2. Drive unit

a.	Main Power Supply	460 V, 3 Ph, 60 Hz
b.	Drive Motor	0.75 HP, Standard efficiency
c.	Enclosure	TEFC, Explosion-proof Class B design, Class F insulation
d.	Motor Service Factor	1.15 minimum
e.	Reducer Service Factor	2.0 minimum

3. Fluidization system

a.	Wash water quality	Treated effluent or Potable
b.	Fluidization flow	45 GPM @ 55 PSI
c.	Connections	⌀1.0 in
d.	Valves size	⌀1.5 in
e.	Solenoid valve enclosure	NEMA-7

4. Grit extraction pump

a.	Quantity	One (1)
b.	Capacity	175 GPM
c.	Total dynamic head	35 ft
d.	Maximum re-priming lift	8 ft
e.	Main Power Supply	460 V, 3 Ph, 60 Hz
f.	Drive Motor	7.5 HP Premium efficiency
g.	Enclosure	TEFC, Explosion-proof Class B design, Class F insulation
h.	Motor Service Factor	1.15 minimum

5. Materials

a.	Gear case	Carbon Steel*
b.	Drive tube	304 stainless steel
c.	Paddle assembly (blade, arm,)	304 stainless steel
d.	Inlet & outlet separator baffle	304 stainless steel

e.	Grit extraction pipe	304 stainless steel
f.	Water fluidization nozzle(s)	304 stainless steel
g.	Water interconnecting lines	Clear PVC Flexible tubing reinforced with Nylon braid (125 PSI)
h.	Fluidization pipe	304 stainless steel
i.	Solenoid valve(s) body	Brass
j.	Manual ball valve(s) body	Brass
k.	Fasteners & Hardware	316 stainless steel

* All submerged or partially submerged parts shall be hot dip galvanized prior to assembly. All parts designed for use above the maximum water level and subject to corrosion shall be provided with an epoxy paint coating (Sand blasting: SP-6; Paint: two coats of 5 mils FDT, Macropoxy 646 NSF, grey).

B. Grit Dewatering Screw

Model number	GDSC/9-10-25XA
Quantity	One (1)

1. Inlet hopper

a.	Thickness	0.1875 in
b.	Covers thickness	18 Ga.
c.	Overflow diameter connection	⌀6.0 in

2. Trough

a.	Length	10’
b.	Thickness	0.25 in
c.	Drain pipe connection	⌀2.0 in
d.	Drain pan connection	⌀0.75 in

3. Screw

a.	Diameter	9 in
b.	Pitch	Full

4. Support

a.	Thickness	0.25 in

5. Drive unit

a.	Main Power Supply	460 V, 3 Ph, 60 Hz
b.	Drive Motor	1.0 HP Premium efficiency
c.	Enclosure	TEFC Class B design, Class F insulation
d.	Motor Service Factor	1.15 minimum
e.	Reducer Service Factor	1.4 minimum

6. Cyclone

a.	Quantity	One (1)
b.	Diameter	⌀10.0 in
c.	Estimated pressure drop	8 PSI
d.	Inlet diameter connection	⌀4.0 in
e.	Outlet diameter connection	⌀6.0 in

7. Materials

a.	Trough	304 stainless steel
b.	Inlet hopper	304 stainless steel
c.	Screw shaft	Carbon Steel*
d.	Screw flights	Abrasion Resistant Steel (CHT series 400) with HOBART type FABTUF 960 hard facing
e.	Structural components	304 stainless steel
f.	Cyclone support	304 stainless steel
g.	Cyclone flanges	ASTM A-36 Carbon Steel*
h.	Fasteners & Hardware	316 stainless steel

* These parts shall be provided sand blasted per SP-6 and painted with two coats of Macropoxy paint.

2.4 PADDLES DRIVE MECHANISM

The unit drive mechanism shall include a gear case coupled to the paddles by a drive tube. A gear reducer with a motor mounted on top of the gear case shall power it.

A. Gear Case

The gear case shall be fabricated from a heavy bearing support plate and structural members. It shall be designed so that the gears and bearings are easily grease lubricated. The lower portion of the case shall be closed with an anti-splash plate.

1. The gear case shall include a pinion mounted directly on the gear motor's output shaft and ride on a ⌀19.5 in pitch diameter slewing ring having external gearing. The slewing ring shall have a minimum service factor of 5 and a 20 year life expectancy. The slewing ring and pinion shall have a pressure angle of 20° and the contact between the pinion and the slewing ring shall be grease lubricated. The slewing bearing and pinion shall be sufficiently wear resistant to withstand 24 hours per day continuous service.

2. A built-in removable ⌀4.0 in diameter sight glass shall be supplied as part of the gear case to allow for proper verification of lubrication.

3. The pinion shall be manufactured of quenched steel, and machined on all surfaces. Its minimum hardness shall be of 200 BHN.

4. The slewing bearing shall have precision-ground, deep induction-hardened raceways. Internal and external rings shall be hot rolled. The ball bearings shall be chrome alloy

steel. They shall be separated by spacers, grease lubricated and protected by reliable seals. The gear on the external ring shall have a hardness of at least 200 BHN and shall be grease lubricated.

5. The gear case shall be firmly anchored to the operating floor. Anchors shall be supplied and installed by the contractor.

B. Agitator

For maximum grit removal efficiency, an agitator rotating at the previously stated speed shall maintain the rotational water flow regime within the grit chamber.

1. The agitator shall consist of adjustable paddles fastened on a ⌀10.0 in nominal diameter drive torque tube.

2. The torque tube shall be bolted to the slewing bearing.

3. The agitator shall be designed to keep organic matter in suspension without affecting the desired grit removal efficiency.

4. A flexible range of adjustment of the paddles shall allow for pitch variations as well as upward or downward and radial positioning in order to meet the requirements.

C. Gear Motor

A speed-reducing gearbox and motor mounted vertically on the gear case shall power the grit removal mechanism. The motor shall not be overloaded under normal operating conditions and shall be designed for heavy duty 24 hours per day service duty.

1. The motor shall be of the normal starting torque and low starting current type. The motor shall have an external protection to meet the local environmental conditions.

2. The gear reducer shall be of the parallel-helical type. It shall include anti-friction bearings with high overhang load properties, and double lip temperature oil seals riding on a precision ground shafts. Gears shall be made of hardened, heat treated forged steel as per AGMA standards. The gearing shall be oil lubricated. The gear reducers shall have an internal and external protection to meet the local environmental conditions (corro-protected).

2.5 INLET / OUTLET SEPARATOR BAFFLE

The unit shall include a circular sloped baffle dividing the unit top chamber in two distinct zones.

A. The separator baffle shall provide a physical barrier for the ascending flow patterns of the vortex unit. This configuration shall enhance the unit grit capture, while providing effective 360 degrees arrangement.

B. The lower part of the chamber will be connected to the inlet channel by means of the sloped inlet tunnel and will effectively remove the bulk of the grit.

C. The top portion, designed to refine the removal, will be directly connected with the outlet channel of the structure.

D. The baffle shall be anchored to the periphery of the grit removal basin. Anchors shall be supplied and installed by the contractor.

2.6 FLUIDIZATION SYSTEM

Water shall be provided at the bottom of the grit well. This incoming water shall ensure a proper fluidization of the accumulated grit before its extraction.

A. The fluidization shall start before an extraction cycle for a pre-set time.

B. The following equipment shall be supplied, per unit, to control the fluidization water:

1. One (1) manual ball valve
2. One (1) solenoid valve

2.7 GRIT PUMP EXTRACTION SYSTEM

Gorman-Rupp non clog impeller type grit pump shall be supplied for each grit chamber. The grit extraction shall be top suction type with a self-priming type grit pump and a central suction pipe with ⌀4.0 in diameter.

A. Performance requirements

1. Pump must have the necessary characteristics and be properly selected to perform under the operating conditions as previously stated.

2. Consideration shall be given to the service anticipated, in which occasionally debris will lodge between the pump suction check valve and seat, resulting not only in the loss of liquid in the suction leg, but also in the siphoning of liquid from the pump casing to the approximate centerline of the impeller. Such occurrence shall be considered normal with proper installation of an air release line free to the atmosphere.

3. In consideration of such occurrence and of the unattended operation intended, each pump shall be so designed as to retain adequate liquid in the pump casing to insure unattended automatic re-priming while operating at its rated speed in a completely open system without suction check valves and with a dry suction leg.

B. Pump Construction

1. The pump shall be horizontal, self-priming centrifugal sewage pump designed for pumping raw, unscreened, domestic sanitary sewerage. The assembly shall have a motor over pump in line configuration. Pumps shall have ⌀4.0 in suction and discharge ASA connections (Compatible with ASME B16.1 class 125 and 150 Flanges).

2. Materials shall be as follows:

a. Pump casing, removable cover plate, bearing housing, flanges: gray iron N°30.
b. Impeller, seal plate and wear plate: austempered ductile iron hardened to 400 Brinell.
c. Impeller shaft: stainless steel.
d. Shaft seal:

1) Rotating and stationary faces: silicon carbide.
2) Elastomers: Viton.
3) Cage and spring: stainless steel No. 18-8.

e. Valve flap: Neoprene.
f. O-rings: Viton and/or Buna-N.
g. Gaskets: Compressed synthetic fibers; red rubber; Teflon.

C. Internal Passages

1. All openings, internal passages, impeller vanes and internal re-circulation ports shall be large enough to permit the passage of a ⌀3.0 in sphere, and any trash or stringy material which may pass through the average house collection system.

2. Screens, smaller internal passages or any internal devices that create a maintenance nuisance or interfere with priming and performance of the pump shall not be permitted.

3. Certified dimensional drawings indicating size and locations of the priming re-circulation port or ports shall be submitted to the engineer prior to shipment.

D. Re-prime lift

1. Each pump must be capable of a re-prime lift as stated above. Re-prime lift is defined as the static height of pump suction centerline above liquid that the pump will prime; and delivery within five minutes on liquid remaining in the pump casing after a delivering pump is shut down with the suction check valve removed.

a. No restrictions shall be present in pump or suction piping, which could serve to restrict the rate of siphon drop of the suction leg. The pump shall be designed to re-prime with a suction pipe configuration that incorporates a minimum horizontal run of 4.5 ft and one 90° elbow.
b. Impeller shall be set at the clearances recommended by the manufacturer in the pump service manual.
c. Re-prime lift repeatability shall be demonstrated by five sequential re-prime cycles.
d. Re-prime lift stated above shall be based on the use of clear water.

2. Each pump shall be supplied with:

a. Vacuum gauge.
b. Low vacuum cut out switch.

E. Special Tools

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

F. Cover Plate

The pump must be equipped with a removable cover plate which includes a removable light-weight (12 lbs) inspection cover, allowing access for service and repairs without removing suction or discharge piping. An easy-grip handle shall be mounted on the face of the inspection cover.

G. Aggressive self-cleaning Wear plate and rotating assembly

1. The pump shall be fitted with a replaceable wear plate in Hardened Alloy Steel ASTM#A514 / 360-440 BHN material. Wear plate shall be self-cleaning design ensuring that debris is cleared away and does not collect on the impeller vanes.

2. The aggressive self-cleaning wear plate shall have integral laser cut notches and grooves in combination with a "tooth" designed to disturb and dislodge any solids which might otherwise remain on the impeller in dynamic operation. Wear plate is designed to constantly and effectively clear the eye of the impeller without the use of blades or cutters.

3. Replacement of the wear plate, impeller, seal, and suction check valve shall be accomplished through the removable cover plate.

4. The entire rotating assembly, which includes bearings, shaft, seal, and impeller, shall be removable as a unit without removing the pump volute or piping.

H. Impeller

1. The impeller shall be two-vane, semi-open, non-clog, cast in ductile iron with integral pump out vanes on the back shroud.

2. Impeller shall thread onto the pump shaft and be secured with a lock screw and a conical washer.

3. Impeller shaft shall be of sleeveless design.

I. Impeller clearance adjustment

1. Means shall be provided for external adjustment of the clearance between the impeller and the wear plate.

2. Impeller clearance adjustment shall be accomplished by moving the entire rotating assembly towards the wear plate, to compensate for wear.

3. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the cover plate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment.

4. Clearance adjustment by means of positioning the shaft only toward the wear plate, thereby reducing pressure on the seal, shall not be acceptable.

J. Suction check valve

1. Each pump shall incorporate a suction valve that can be removed or installed through the removable cover plate opening, without disturbing the suction piping.
2. Function of the check valve shall be to eliminate re-priming with each cycle.
3. Pumps requiring suction check valves to prime or re-prime will not be acceptable.

K. Seal

1. The pump shaft shall be sealed against leakage by a mechanical seal.
2. Both the stationary sealing member and mated rotating member shall be of silicon carbide. Each of the mated surfaces shall be lapped to a flatness of three light bands (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating so that faces will not lose alignment during periods of mechanical or hydraulic shock loads that will cause deflection, vibration, and axial/radial movement of the pump shaft.
3. The seal shall be lubricated with oil from a separate, oil-filled reservoir. The same oil shall not be used to lubricate both the shaft seal and the shaft bearings.

L. Shaft bearings

1. The pump shaft bearings shall be anti-friction ball or tapered roller bearings, of ample size and proper design to withstand all radial and thrust loads which can reasonably be expected during normal operation. Bearing design shall exceed L10 bearing life of 100,000 hours when operating anywhere within the published performance curve.
2. Bearings shall be lubricated from a separate reservoir.
3. Pump designs in which the same oil lubricates both the shaft bearings and the shaft seal shall not be acceptable.
4. Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

M. Pump suction spool

1. Pump shall be equipped with a one-piece, cast iron suction spool, flanged on each end.
2. Each spool shall have one ⌀0.75 in NPT and one ⌀0.25 in NPT tapped hole with pipe plugs for mounting gauges or other instrumentation.

N. Motor

1. The motor shall have a horizontal solid shaft and shall be of the normal starting torque and low starting current type suitable for continuous operation.
2. Non-overloading over the entire pump curve.
3. Provide heavy lifting eyes capable of supporting the entire weight of pump and motor.
4. Power shall be transferred from the motor to the pump with a safety factor of 1.5 by a number of V-belts depending on the starting and output RPM.

2.8 GRIT DEWATERING SCREW - INLET HOPPER

The inlet hopper made of plate shall be welded on top of the trough to form an integral unit. The slope of the hopper's sides shall be inclined at least 60° from the horizontal to prevent grit build up.

A. An overflow weir integral to the hopper shall be used to maintain a constant water volume and to control the discharge of the degritted water. An overflow pipe of appropriate diameter shall be installed to return the degritted water to the grit chamber influent channel.

B. The top of the hopper shall be closed by means of removable covers.

C. Stainless steel parallel lamellar plates shall be incorporated in the hopper to increase settling efficiency of the system.

2.9 GRIT DEWATERING SCREW - TROUGH

The unit shall include a transport trough with a U shape section. One side of the bottom section shall have a right angle to allow water drainage.

A. The upper end of the trough shall have an end plate to receive the screw conveyor drive. The drive shall support the upper end of the screw top shaft.

B. The lower end of the trough shall have an end plate with a watertight lower bushing assembly. This assembly shall support the lower end of the screw shaft.

C. The trough shall have a drain connection at the lower end.

D. The discharge outlet, located at the upper end of the trough, shall be round with a plain end.

2.10 GRIT DEWATERING SCREW - SCREW

The screw shall consist of flights of 0.25 in thick plates with hard facing on the leading edge and the outer 1.0 in of the face. These flights shall be welded onto a shaft of appropriate diameter.

2.11 GRIT DEWATERING SCREW - SUPPORT STRUCTURE

The integral support structure shall be made of structural angles and channels. It shall be firmly anchored to the operating floor and be designed to support and maintain the grit dewatering screw at an angle of 25° from the horizontal. Anchors shall be supplied and installed by the contractor.

2.12 GRIT DEWATERING SCREW - DRIVE UNIT

The main drive shaft shall be driven by means of speed-reducing gearbox and motor. The motor shall not be overloaded under normal operating conditions and shall be designed for heavy duty 24 hours per day service duty.

A. The motor shall also be of the normal starting torque and low starting current type. The motor shall have an external protection to meet the local environmental conditions.

B. The gear reducer shall be of the parallel-helical type. It shall include anti-friction bearings with high overhang load properties, and double lip temperature oil seals riding on a precision ground shafts. Gears shall be made of hardened, heat treated forged steel as per AGMA standards. The gearing shall be oil lubricated. The gear reducer shall have an internal and external protection to meet the local environmental conditions (corro-protected).

2.13 GRIT DEWATERING SCREW - CYCLONE GRIT CONCENTRATOR

A. Each grit concentrator shall operate by vortex principle. The design shall be such that a small amount of water will discharge at the bottom with a concentrated volume of grit. The larger volume of water pumped to the concentrator shall flow out the top and be returned ahead of the grit chamber. Each unit shall be capable of intermittent operation and maintain removal efficiency.

B. Each unit shall be able to accommodate the flow capacity of feed slurry having a grit concentration of approximately 2% to 4% at a pressure drop as previously stated. Each cyclone will incorporate one replaceable vortex finder and one replaceable apex.

C. Under the above operating conditions, each cyclone will recover a minimum of 95% of the particles greater than or equal to that retained on a 150 Mesh screen, with a specific gravity of 2.65 or greater. The underflow volume will be approximately 5% to 10% of the feed volume. The largest spherical solids size flowing through the cyclone, at any time, shall not exceed ⌀0.5 in (1/3 of the apex diameter size).

D. Manufacturing materials

1. Each cyclone shall have carbon steel involute type feed entry (cyclone head) and A36 carbon steel housings (cyclone cylinder and cone). The apex housing shall be aluminum. Each section of the cyclone shall be independently lined with replaceable liners to protect them from the wearing effect of high velocity grit. The inlet and overflow connections shall be supplied with Victaulic grooved connections. The vortex finder shall be made of unlined nihard material having an approximate hardness of 500 Brinell.
2. A quick connection clamp shall be provided between the apex and lower cone section to allow removal of material which may clog the apex, without disconnecting any piping or the cyclone itself. A pressure gauge and diaphragm with a ⌀1.25 in connection shall also be provided.

E. Special fittings included

1. Inlet flanged adapter (Victaulic grooved);
2. Overflow flanged adapter - Victaulic grooved (Note: 125 PSI minimum flange rating;

3. Vortex finder, Nihard (unlined);
4. Apex quick connection device;
5. Top cover plate liner*;
6. Inlet head liner*;
7. Cylinder liner*;
8. Cone liner*;
9. Apex valve liner*;
10. Fasteners, AISI-SAE 304 SS;

* : Pure Gum Rubber
The grit concentrator and Victaulic couplings will be provided with a paint coating as per their respective manufacturer's standards.

2.14 GRIT DEWATERING SCREW - SAFETY PULL SWITCH

A safety switch mounted on the side of the hopper shall have a NEMA-7 enclosure suitable for hazardous locations c/w a reset lever and stainless steel trip cable and fasteners. It shall stop the motor when tripped.

2.15 GRIT DEWATERING SCREW - WEATHER PROTECTION SYSTEM

The unit shall be equipped with a weather protection system which shall inhibit freezing of the protected surfaces exposed to outdoor conditions.

A. The weatherproof heat tracing shall be installed on the conveyor trough, and shall be covered by weather resistant insulation and metallic cladding.

B. The heat tracing shall provide 8-watts/foot of heating at 40°F and shall be self-regulating. The conductors shall be protected by a braided-metal sheathing and waterproof outer jacket. The heat tracing shall be rated for a Class 1, Division 2 area.

C. The heating cable shall be insulated from the environment using thermal insulation covered with a weatherproof metallic cladding.

D. The heating cable shall be insulated from the environment using a 1 in thick closed-cell elastomeric thermal insulation covered with a factory-applied heavy-duty 26-ga thick weatherproof laminated aluminium cladding.

E. By means of an ambient temperature sensor, the system shall be automatically energized when the ambient temperature is below 40°F and shall be automatically de-energized when the ambient temperature is above 40°F. (thermostat)

F. The ambient temperature sensor needs to be installed in a non-classified area and all field interconnections will be done by the electrical contractor. Electrical connections shall be provided and installed by the contractor as defined by the National Electric Code.

2.16 CONTROL SYSTEM

A. The JOHN MEUNIER MECTAN®V Grit Removal System and the SAM® Grit Dewatering Screw control system shall be supplied by the same manufacturer. It shall provide total automatic machine operation with protection against overload conditions, which might damage the equipment.

B. The control system shall be automatically operated by a Programmable Logic Controller (PLC). An operator interface display (HMI) shall also be provided. The required start/stop signals, timers and logic shall be included to control the equipment based on its sequence of operation.

C. The control system shall be rated for the following classifications:

1.	Main control cabinet	NEMA-4/12 painted enclosure For indoor installation in Non-hazardous area
2.	Local control station	NEMA-7 enclosure For installation in Class I, Division I, Group D area

D. Provided as part of the Headworks control system, all required hardware and software programming shall be integrated in the control panel for providing cloud-based monitoring and support assistance. The control system shall include an access device for remote internet support capability and extraction of PLC data for Key Process Indicator (KPI) monitoring. Internet connection shall be available through local network (Ethernet or WiFi) or cellular connection.

E. The cloud-based monitoring portal shall be accessible 24/7, to Owner's team and Supplier's experts (as supporting data for troubleshooting or optimization) from any desktop, laptop computer or tablet with a web browser and an active internet connection. The system shall include a user-configurable dashboard with graphical display of equipment KPIs, as well as access to an electronic library with O&M manuals, commissioning reports and supporting training material.

2.17 SEQUENCE OF OPERATION

1. Automatic mode

   a. The agitator motor shall run continuously.

   b. The automatic grit removal cycles shall be controlled by an adjustable 24 h timer. At the signal of the 24 h timer, the water fluidization valve shall open. The water fluidization period preceding the grit extraction shall be adjustable (from 0.1 to 1.0 h). At the end of this period, the grit pump and the grit dewatering screw shall start. The water fluidization shall continue for an additional adjustable period (from 0.1 to 1.0 h), then the valve shall close. The grit extraction sequence duration shall also be adjustable (from 0.1 to 1.0 h). At the end of the grit extraction period, the grit pump shall stop.

   c. The grit dewatering screw shall continue to run for an additional period of time, controlled by another timer adjustable (from 0.1 to 1.0 h). After the pre-set duration, the grit dewatering screw shall shut off.

2. External Start

Connecting terminals shall allow for reception of an external signal to start the pre-set grit extraction sequence. If the external signal is related to a plant flow monitoring or a predetermined high water level, the grit extraction will be continuous until the external signal is off (flow monitoring device or water level sensor are not part of the scope of supply).

3. Manual Mode

The equipment components can be operated manually using the control panel operators, the interface and from the local control station installed at direct proximity of the equipment.

4. Thermal Protection

a. The overload protection circuit shall cut the power off to the motor and to the control circuit of the motor starter, should the following conditions occur:
   1) Overheat of the motor
   2) Short circuiting
   3) Loss of phase

b. The overload protection shall be sized according to the motor nameplate full load rating. Upon detection of an over load, the dedicated motor shall stop and the "Motor Fault" alarm indicator light shall be activated. The protection circuit shall be reset manually inside the control panel. The control system shall be reset manually by a push button.

2.18 MAIN CONTROL SYSTEM

The following basic components shall be assembled in the system main control panel enclosure and pre-wired to identified terminal blocks. This enclosure shall provide upfront panel door operation. Panel hook up shall be made on site by the contractor.

1. Programmable Logic Controller (PLC) shall be Allen-Bradley Micro800 with a 7" color-touch operator interface display (HMI), both shall allow for Ethernet communication;

2. Remote internet access device with proven built-in firewall including fully encrypted data transfer (one-way only) using most recent TLS protocols and SSL certificates;

3. Main fusible type disconnect switch sized for the application shall be front panel mounted c/w NEMA-4X operating handle and interlock;

4. Full voltage non-reversible motor starters (IEC rated) sized for the application with manual starter, circuit and adequate magnetic overload protection;

5. I/O connections shall be available for external status and alarm feedback;

6. Safety barrier for digital signal (float switch);

7. Operator devices shall be 22/30 mm diameter, type NEMA-4X:

   a. General: Power ON (white light), General E-Stop (mushroom button), General Alarm (red light), General Reset (black push-button).

   b. Equipment Status: Paddles Motor Running (green light), Paddles Motor Fault (red light) Fluidization Solenoid Valve Opened (green light), Pump Motor Running (green light), Pump Motor Fault (red light),

   c. Equipment manual controls: Paddles Motor Off / Auto (selector switch), Pump Motor Manual / Off / Auto (selector switch).

2.19 LOCAL CONTROL STATION

A. Each grit chamber shall be supplied with a local control station located near the unit. The following components shall be assembled and pre-wired to identified terminal blocks.

   1. “EMERGENCY STOP” Push button, pad-lockable

   2. Paddles “OFF / AUTO” selector switch

B. Each grit pump shall be supplied with a local control station located near the unit. The following components shall be assembled and pre-wired to identified terminal blocks.

   1. “EMERGENCY STOP” Push button, pad-lockable

   2. Grit extraction “OFF / REMOTE / MAN.TEST” selector switch c/w spring loaded return from "MAN.TEST" to “REMOTE”

C. Each Grit Dewatering Screw unit shall be supplied with a local control station located near the unit. The following components shall be assembled and pre-wired to identified terminal blocks.

   1. “EMERGENCY STOP” Push button, pad-lockable

   2. “OFF / REMOTE / MAN.TEST” selector switch c/w spring loaded return from "MAN.TEST" to “REMOTE”

D. When manually operated in LOCAL mode, all automatic operations of the equipment are de-activated. Manual operation of the equipment requires an operator at direct proximity of the equipment at all times.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

A. Install the grit removal equipment according to manufacturer's instructions.

3.3 START-UP, TRAINING AND MANUFACTURER'S SERVICES

A. Remote Installation check and pre-start-up assistance: Installation and pre-start-up checklists shall be filled out prior to any intervention. A remote support session of three (3) hours with video and audio support for equipment and automation verifications shall be provided to ensure equipment readiness, prior to site intervention.

B. Start-up and training (per system): one (1) trip of three (3) days on site for mechanical equipment and instrumentation commissioning assistance, and one (1) trip of three (3) days on site for control system commissioning assistance.

3.4 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.

3.5 MANUFACTURER'S CERTIFICATE(S)

A. Provide MANUFACTURER'S certificate of installation and commissioning following functional testing and startup.

B. Provide MANUFACTURER'S OEM Software Licensing Agreement following and final payment.

END OF SECTION 46 23 23

SECTION 46 33 41 - LIQUID CHEMICAL FEED SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Skid- Mounted Sodium Hydroxide Feed Pumps
2. Skid- Mounted Liquid Alum Feed Pumps.
3. Control panels.
4. Installation requirements.

B. Related Requirements:

1. Section 40 42 13 - Process Piping Insulation: Insulation requirements for piping and appurtenances.

1.2 REFERENCE STANDARDS

A. Instrument Society of America:

1. ISA 5.1 - Instrumentation Symbols and Identification.
2. ISA 20 - Specification Forms for Process Measurement and Control Instruments Primary Elements and Control Valves.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Integrate instrumentation and control devices provided under other Sections.

C. Resolve signal, power, or functional incompatibilities among interfacing devices.

1.4 SUBMITTALS

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

B. Product Data: Submit manufacturer's information with each instrument data sheet.

C. Shop Drawings:

1. Symbology and Nomenclature: Comply with ISA 5.1.
2. Indicate interfaces between instruments, motor starters, control valves, variable-speed drives, flow meters, and chemical feeders.

D. Data Sheets:

1. Comply with ISA 20.
2. Submit following:

a. Manufacturer's model number or designation.
b. Component system or loop.
c. Installation location.
d. Input and output characteristics.
e. Scale, range and units.
f. Requirements for electric and plant water requirements.
g. Materials of component parts in contact with process chemicals.
h. Special requirements or features.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

H. Qualifications Statements:

1. Submit qualifications for system integrator.

1.5 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Complete loop and schematic diagrams including field and panel wiring, piping and tubing runs, routing, mounting details, and point-to-point diagrams with cable, wire, tube, and termination numbers.

1.6 QUALITY ASSURANCE

A. Instruments Using Common Measurement Principle:

1. Furnish by single manufacturer.
2. Furnish same type, model, or class.

B. System Integrator: Company specializing in integrating chemical feed products specified in this Section with minimum three years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 PERFORMANCE AND DESIGN REQUIREMENTS

A. Sodium Hydroxide Feed System:

1. Chemical Characteristics:

a. Physical state: Clear liquid
b. Concentration by weight: 25-50 percent
c. Specific gravity: 1.54 to 1.68 @ 60 degrees F
d. Viscosity: 35 to 60 cPs
e. Minimum temperature: 55 degrees F
f. Maximum temperature: 95 degrees F

2. The equipment to be provided shall include, but is not necessarily limited to, the following:

a. One (1) skid mounted Quadplex peristaltic metering pumps (CP8110, CP8120, CP8130 & CP8140) with integral controls.

1) Feed Rate (GPH): 0.1 min-10 max
2) Back Pressure: 22 psig

b. Sodium Hydroxide system control to be complete with the following:

1) Integral Drive suitable for 100-240VAC, single phase with an internal switch-mode power supply.
2) Color LCD touch screen Operations Interface Terminal (OIT)
3) All necessary conduit, wire, boxes, etc., required for complete system interconnection

3. All necessary valves, instrumentation and ancillary equipment necessary to make the system completely operational.

B. Polyaluminum Chloride Feed System:

1. Chemical Characteristics:

a. Physical state: Clear liquid
b. Maximum concentration by weight: 50 percent

c. Specific gravity: 1.19 @ 68 degrees F
d. Viscosity: 3 to 19 cPs
e. Minimum temperature: 40 degrees F
f. Maximum temperature: 90 degrees F

2. The equipment to be provided shall include, but is not necessarily limited to, the following:

a. Two (2) skid mounted Quadplex peristaltic metering pumps (CP8210, CP8220, CP8230 & CP8240, CP8250, CP8260, CP8270 & CP8280) with integral controls.

1) Feed Rate (GPH): 0.2 min-20 max
2) Back Pressure: 22 psig

b. Liquid Alum system control to be compelte with the following:

1) Integral Drive suitable for 100-240VAC, single phase with an internal switch-mode power supply.
2) Color LCD touch screen Operations Interface Terminal (OIT)
3) All necessary conduit, wire, boxes, etc., required for complete system interconnection

c. All necessary valves, instrumentation and ancillary equipment necessary to make the system completely operational.

1.9 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Panels and Enclosures: Suitable for operation in locations as indicated on Drawings.

C. Temperature Range: 32 degrees F to 104 degrees F.

D. Relative Humidity: 20 to 90 percent, noncondensing.

E. Instrumentation in Hazardous Areas: Suitable for use in particular hazardous or classified location.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.11 MAINTENANCE MATERIALS

A. Provide spare parts under provisions of Section 01 70 00, Contract Closeout

1. Peristaltic pumps:

    a. 4 pumpheads per for each model of pump
    b. Provide a 1 year supply of all greases and lubricants required for each pump

1.12 WARRANTY

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

B. Furnish five-year manufacturer's warranty for liquid feed equipment systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Liquid Chemical Feed Systems:

1. Watson Marlow Qdos 60 Universal 60+
2. Lutz-JESCO Amnerican Corp
3. Approved Equal

2.2 MATERIALS

A. Sodium Hydroxide feed pumps:

1. Pump housing: corrosion resistant and high impact resistant glass filled PPS or PPE/PS.
2. Pumphead: ReNu cartridge style peristaltic pumphead supplied as a single replaceable component. All chemicals shall be contained inside the pumphead during changeout after tube failure to protect operator safety and eliminate possible chemical exposure.
3. Max Rating: 15.85 GPH at 125 RPM and 100 psi discharge pressure
4. Leak Detection: non-contacting optical sensor with alarm to shut down pump in the event of tube failure

B. Alum feed pumps:

1. Pump housing: corrosion resistant and high impact resistant glass filled PPS or PPE/PS.
2. Pumphead: ReNu cartridge style peristaltic pumphead supplied as a single replaceable component. All chemicals shall be contained inside the pumphead during changeout after tube failure to protect operator safety and eliminate possible chemical exposure.
3. Max Rating: 5 GPH at 125 RPM and 100 psi discharge pressure
4. Leak Detection: non-contacting optical sensor with alarm to shut down pump in the event of tube failure

2.3 ACCESSORIES

A. Calibration columns:

1. Capacity to match chemical feed pumps
2. Clear glass construction, 500 ml
3. Embossed graduations in standard divisions for rating gph capacity based on a one minute draw down and in 5 mL increments
4. Calibration column must be integral to equipment skid and rigidly mounted to skid with pipe clamps. Mounting calibration column to plumbing alone shall not be acceptable.

B. Pressure relief valves in addition to the internal relief valves in the pumps:

1. 5-100 psi adjustable relief setting
2. Materials:

    a. Lower body, seat, ball guide, ball: As appropriate for chemical resistance
    b. Diaphragm, seat gasket: Teflon—verify with chemical resistance

C. Pressure Gauge: Stainless steel, 2-1/2 inch dial, glycerin filled with diaphragm seals for chemical isolation

2.4 FABRICATION AND MANUFACTURE

A. Frame/skid:

1. All structural members – co-polymer polypropylene
2. Mounting panels - co-polymer polypropylene
3. Gussetted members longer than 36 inch shall be tubing
4. Provide mounting holes for installation on concrete floor pad
5. Suitable for lifting by fork-lift
6. Designed to straddle containment for day tank as shown

2.5 CONTROLS

A. Integral controls and all devices in accordance with Division 16 requirements. Provide and tag terminal blocks as required for power and motor leads, remote control inputs, status and alarm outputs, sensors, alarms, and protective devices.

B. Enclosures: NEMA 4

C. Control Wiring:

1. Material: Copper.
2. Minimum Size: No. 16 AWG.
3. Tagging:

    a. Tag control wiring at both ends with legible permanent-coded wire-marking sleeve.
    b. Mark with white PVC tubing sleeves with machine-printed black marking.
    c. Mark according to wire numbers as indicated on control wiring diagrams and terminal strip numbers.

D. Pilot lights: On (green), Off (red)

E. Power supply per unit: 120V, single phase, 60 Hz. Provide complete with nine-foot length main power cord with standard 115VAC three-prong plug. Minimum operator controls and monitoring per unit (provide separate control panel as required):

1. Circuit breaker protected main power ON-OFF with indicator light
2. Terminal blocks sized for 12 ga. wire, numbered and with legend
3. LOCAL-OFF-REMOTE hand switch with contacts to receive remote start/stop for each pump and 4-20mA metering pump signal in REMOTE mode for each pump
4. Potentiometer for manual stroke frequency adjustment or speed control on each pump
5. Alarms:

    a. Loss of flow: Local alarm and light upon loss of flow
    b. High Level Alarm in Storage Tank
    c. Low Level Alarm in Storage Tank

6. Alarm reset pushbutton (integral to LOCAL-OFF-REMOTE switch)
7. Common alarm and run status signals to plant computer for monitoring
8. Black “Fault Reset” Pushbutton
9. Contacts to allow drive operational status to be remotely monitored
10. System Fault, NO closes under fault condition
11. System Running, NO closes when running
12. Accept input for remote start-stop when in Auto mode
13. Accept input from remote low storage tank level switch to stop drive in both Auto and Manual modes and indicate common alarm

F. Chemical pump operation:

1. Each pump on a skid shall be capable of operating as independent systems.

G. System operation:

1. The chemical feed pumps will be started and stopped based on flow rate from the associated treatment unit control panels when in REMOTE operating mode
2. Adjustment of metering pump stroke frequency or speed will be done by 4-20mA signal for remote adjustment, and manually for local adjustment
3. The transfer pump shall be automatically started on Day Tank low level and stopped with Day Tank High level cutoff. Interlock anti-siphon valve control with pump operation

H. Power Supplies:

1. Operation:

    a. 115 V, plus or minus 10 percent.
    b. 60 Hz, plus or minus 2 Hz.

2. Furnish power supplies for two-wire transmitters, loops for monitoring discrete inputs, and outputs.
3. Design: Minimum 130 percent of maximum simultaneous current draw.

4. Furnish power ON-OFF switch or air circuit breaker for each item requiring electrical power.
5. Mount power supplies in enclosures in field panel.

2.6 CORROSION PROTECTION

A. Electrically isolate dissimilar metals or connectors in direct contact.

B. Use corrosion resistant materials and color code all piping, equipment and coat ferrous materials with epoxy paint system under provisions of Section 09 96 00, High Performance Coatings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pump skids per manufacturer's instructions

B. Mount skids where shown on Drawings

C. Fit and align connecting piping to eliminate all stresses

D. Install combination backpressure and anti-siphon valve, pressure relief valve and pulsation dampener on the discharge of each chemical feed as close to the pumps as possible

3.2 START-UP AND PERFORMANCE WARRANTY TESTS

A. Make equipment adjustments required to place system in proper operating condition.

B. Test each feed system for proper operation in the presence of the Owner. All testing costs are the Contractors.

C. Furnish all testing equipment, special instruments and devices required for performance testing.

D. Modify and/or replace defective equipment until it meets specified requirements. Re-test system to verify satisfactory operation.

E. Demonstrate the accuracy of each metering pump using job supplied calibration column.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Calibration:

1. Calibrate each instrument at 40, 60 and 100 percent of its span using test instruments to simulate inputs.

2. Field-calibrate instruments that were not bench-calibrated.
3. Tags: Attach calibration and testing tag to each device, signed and dated by device manufacturer's representative after calibration has been completed.

C. After installation, inspect and test for proper operation.

D. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 2 days, (16 hours) on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

E. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 DEMONSTRATION

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

B. Demonstrate system startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

END OF SECTION 46 33 41

SECTION 46 33 83 - LIQUID CHEMICAL FEED ACCESSORIES AND SAFETY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Personal protective equipment.
2. Emergency showers.
3. Emergency eye and face washers.
4. Emergency combination showers with eye and face washers.
5. Drum Handling Equipment
6. Equipment supports.

B. Related Requirements:

1. Section 03 30 00 - Cast-in-Place Concrete: Equipment foundation pads.
2. Section 09 96 00 - Painting and Coating: Painting as specified by this Section.
3. Section 40 05 07 - Hangers and Supports for Process Piping: Piping supports, anchors, and guides.
4. Section 40 05 53 - Identification for Process Piping: Labeling and other identification methods for process piping, valves, and accessories
5. Section 43 41 45 – Polyethylene Tanks and Accessories: Storage Tanks for Chemical Feed Systems
6. Section 40 42 13 - Process Piping Insulation: Piping insulation.
7. Section 46 05 53 - Identification for Water and Wastewater Equipment: Nameplates, labeling, and identification methods for water and wastewater process equipment and accessories.

1.2 REFERENCE STANDARDS

A. American National Standards Institute:

1. ANSI Z87.1 - American National Standard for Occupational and Educational Personal Eye and Face Protection Devices.
2. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment.

B. ASME International:

1. ASME B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay).

C. National Electrical Manufacturers Association:

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

D. UL:

1. UL 508 - Industrial Control Equipment.

1.3 SUBMITTALS

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

B. Product Data:

1. Submit manufacturer information for drive assemblies, pumps, tanks, mixers, panels, and other system components.
2. Submit schematics, diagrams, panel layouts, ladder diagrams, and sequence of operation.

C. Shop Drawings:

1. Indicate assembly, foundation, and installation with location.
2. Indicate critical dimensions, sizes, and support locations.

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

E. Manufacturer Instructions: Submit special procedures and assembly of components.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.6 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.7 WARRANTY

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

B. Furnish five year manufacturer's warranty for equipment furnished under this section.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Corrosion Resistance: Furnish materials resistant to corrosive attacks from process chemicals being handled.

2.2 PIPING CONNECTIONS

A. Provide supports, anchors, and guides as specified in Section 40 05 07 - Hangers and Supports for Process Piping.

B. Flexible Connections:

1. Provide flexible connectors in piping connections to vibrating equipment.
2. Harness or anchor flexible connectors as necessary.

2.3 SAFETY EQUIPMENT

A. Personal Protective Equipment:

1. Gloves:

a. Type: As recommended by manufacturer of chemical being handled.
b. Furnish leather or metal mesh gloves for personnel handling glass products or materials that may cause a cut.
c. Disposable Gloves for Handling Small Quantities of Chemicals: Non-reusable type, made of latex rubber, nitrile rubber or neoprene.

2. Safety Glasses:

a. Comply with ANSI Z87.1.
b. Furnish side shields.

3. Safety Goggles:

    a. Comply with ANSI Z87.1.
    b. Frames: Soft vinyl material, conforming to every size face, and able to fit over prescription glasses.
    c. Lens: Coated polycarbonate material to resist fogging, scratching, and damage from dust and UV rays.
    d. Furnish heavy-duty carrying case.

4. Equipment Cabinets:

    a. Adequate for storage of personal protective equipment, as indicated on Drawings, and clearly labeled as **SAFETY EQUIPMENT**.
    b. Number and Locations: As directed by Engineer.

B. Emergency Combination Showers with Eye and Face Washers:

1. Shower:

    a. Comply with ANSI Z358.1.
    b. Mounting: Freestanding.
    c. Description: Self-cleaning and non-clogging.
    d. Shower Head:

        1) Type: Deluge.
        2) Material: Stainless steel.
        3) Diameter: 8 inches.

    e. Furnish instant-action stay-open valve actuated by rigid stainless-steel pull rod.

2. Eyewash:

    a. Comply with ANSI Z358.1.
    b. Bowl: Stainless steel, with elbow.
    c. Pedestal:

        1) Material: Stainless-steel pipe.
        2) Diameter: 1-1/4 inches.
        3) Furnish floor flange of same material as pedestal.

    d. Valve:

        1) Type: Instant action, stay open.
        2) Actuation: Push flag or foot pedal.

    e. Furnish twin spray heads**,** dust cover assembly**,** tailpiece, and chrome-plated brass P-trap.

3. Furnish emergency signage as recommended by manufacturer.
4. Finish: Corrosion-resistant coating.

2.4 DRUM HANDLING EQUIPMENT

A. Provide 2 Wesco Industrial Products, Inc. Model 272404 Portable Drum Carrier/Dispensers, or approved equal equipment for use by the operators to maneuver and position polymer drums.

2.5 EQUIPMENT SUPPORTS

A. Support and anchor chemical feed equipment and piping on concrete pads as specified in Section 03 30 00 - Cast-in-Place Concrete.

B. Fabricated Metal Supports Exposed to Chemical Spillage:

1. Type 316 stainless steel or enameled steel.
2. Anchor Bolts, Nuts, and Washers: Type 316 stainless steel.

2.6 INSULATION

A. Piping Insulation: As specified in Section 40 42 13 - Process Piping Insulation.

2.7 FINISHES

A. Machine Finish: Comply with ASME B46.1.

B. Coat equipment as specified in Section 09 96 00 – High Performance Coatings.

2.8 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Control Panel:

1. Perform factory test of completed control panel by demonstrating operation of control functions, and provide certified test results.
2. Factory assemble and test each control and alarm function.
3. Test sequence of operation.

C. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that designated areas, clearances, structural requirements, piping, utility connections, and electronic signals are ready to receive equipment.

3.2 PREPARATION

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

B. Disconnect electrical systems scheduled for removal.

C. Provide temporary wiring and connections to maintain existing systems in service during construction.

D. Remove, relocate, and extend existing installations as necessary to accommodate new construction.

3.3 INSTALLATION

A. According to manufacturer instructions.

1. Provide rigid anchors for pipes after vibration isolation components are installed.

B. Install insulation as indicated on as specified in Sections 40 42 13 - Process Piping Insulation.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Inspect for proper alignment.

C. Testing:

1. Demonstrate operation without undue noise, vibration, or overheating.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.5 DEMONSTRATION

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

B. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

END OF SECTION 46 33 83

SECTION 46 41 26 - FLOATING MECHANICAL AERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Floating mechanical aerators.

B. Related Requirements:

1. Section 09 96 00: High Performance Coatings: Surface preparation and coating requirements.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

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

1.3 SUBMITTALS

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

B. Product Data:

1. Submit manufacturer's product information for system materials and component equipment.
2. Submit electrical characteristics and connection requirements.
3. Submit installation requirements and other details.

C. Shop Drawings:

1. Indicate size and configuration of aerator assembly, mountings, weights, and accessory connections.
2. Indicate system materials and component equipment.

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

1. Certify that installation is completed according to manufacturer's instructions.

E. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Source Quality-Control Submittals: Provide certified wet & dry testing of the complete unit at the manufacturer’s facility.

1. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

H. Manufacturer Reports:

1. Certify that equipment has been installed according to manufacturer's instructions.
2. Indicate activities on Site, adverse findings, and recommendations.

1.4 COORDINATION

A. Coordinate Work of this Section with Work of other Sections.

1.5 SCHEDULING

A. Section 01 31 00 – Project Management and Coordination: Requirements for scheduling.

B. Schedule Work of this Section to install equipment prior to connecting piping Work.

1.6 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of installed aerators and components.

1.7 MAINTENANCE MATERIAL SUBMITTALS

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

B. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer's instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer's instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

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

B. The Manufacturer and Contractor shall furnish a warranty extending twelve (12) months after substantial completion date of the project in its entirety.

PART 2 - PRODUCTS

2.1 FLOATING MECHANICAL AERATORS

A. Manufacturers:

1. Aqua-Aerobic® (Model FSS Endura® Series Aqua-Jet® Aerator)
2. Or Approved Equal

B. Schedule:

1. SA2110
2. SA2120
3. SA2130

C. Performance and Design Criteria:

1. Motor size: 20 hp
2. Speed: 1200 rpm

D. Diffusion Head

1. Material: 304 SS
2. The design of the diffusion head shall be such that the liquid spray shall discharge at an angle of 90 degrees to the motor shaft over a 360 pattern in the horizontal plane and shall be a monolithic casting.
3. The diffusion head casting shall act as a base for the aerator motor and alignment of the motor to this base shall be controlled by machined index fittings that engage the P-base of the motor. Diffusion head designs that employ studs and spacers or shoulder bolts are not allowed.
4. The diffusion head shall have load bearing flange-to-flange connections.
5. The diffusion head shall contain an anti-deflection journal insert to limit the radial deflection of the motor shaft. This anti-deflection journal insert shall be located in the lower extremity of the diffusion head approximately one-half the distance between the motor base

and the lower end of the shaft. The journal insert shall be machined from Delrin or molded from moly-filled urethane and shall be a minimum of 0.060 inch diameter or larger through the bore than the diameter of the motor shaft. There shall be a fluid deflector located on the motor shaft immediately below the anti-deflection journal, which shall cover completely the anti-deflection journal insert and the lower portion of the diffusion head. This fluid deflector shall be molded from black neoprene and shall be press fit onto the motor shaft.

E. Float:

1. The aerator shall have sufficient reserve buoyancy to ensure stability and to provide support flotation required during aerator servicing.
2. Fill:
   a. Material: Closed-cell polyurethane foam with minimum density of 2.0 lbs/ft^3.
   b. Injection applied.
3. Float shall be completely sealed to prevent the foam from being in contact with the external environment.
4. All floats shall have six mooring points, spaced 3 or 4-point mooring around the outer circumference. Spaced. All mooring connections shall be stainless steel.

F. Propeller:

1. Two-blade, left handed, self-cleaning, marine type
2. Material: 316 or 15/5 SS
3. Dynamically- and hydraulically-balanced.
4. Self-cleaning
5. Propeller shall be attached to the motor shaft with a hardened stainless steel pin and set screw.

G. Volute

1. Material: 304 stainless steel
2. Minimum diameter: 15 inches
3. The volute shall have a minimum of 3/16-inch wall thickness and a minimum of four full-length stainless steel gussets shall be welded on 90° spacing around the circumference of the volute between the top and bottom flanges.
4. Volute shall be round and true so that propeller blade tip clearance is uniform within the volute as it rotates.

H. Intake Cone

1. Material: 304 stainless steel
2. The intake cone shall be fabricated having a gradually expanding opening outward to the intake end. The length and inlet diameter shall be sufficient to provide uniform inlet hydraulics so that no increase in vibration is caused due to its shape or size.
3. The intake cone shall be designed so that the suction lift from the aerator propeller is vertical from the liquid depth below the aerator

I. Balancing

1. The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced within 2.0 mils peak-to-peak horizontal displacement measured at the upper and lower motor bearing. Measurements shall be taken at a frequency equivalent to the motor RPM. Measurements shall be taken with the motor in a vertical, shaft down position with the entire power section mounted on resilient pads.

J. Mooring

1. Type: Restrained Mooring
2. Material: stainless steel
3. The mooring frame shall be fastened to the bottom of the aerator float and consist of 304 stainless steel mooring arms to which are attached removable U-bolts which shall fit around 304 stainless steel 4" diameter mooring posts, which shall permit the unit to rise and fall with the varying water levels.
4. Three (3) mooring posts shall to be provided by the Contractor per unit and shall extend a minimum of two feet above the high water level, and filled with concrete after installation.

K. Cable Floats

1. The manufacturer shall provide a minimum of 8 vinyl electrical cable floats, complete with Nylon cable ties for supporting the electrical power cable. The Nylon cable ties are to be heavy duty type, black in color and UV stable. Contractor shall be responsible for field attaching the electrical cable floats in accordance with the manufacturer's recommendations.

L. Electrical Service Cable

1. Electrical service cable shall be provided and shall be a continuous length (non-spliced). The cable shall have three power conductors and a ground conductor.
2. Conductors shall be flexible type annealed copper stranded. Each conductor, including the ground conductor, shall be insulated. Cables containing an uninsulated ground conductor will not be acceptable.
3. The insulated conductors shall be assembled together with a non-hygroscopic filler material.
4. Outer jacket shall be high quality CPE, PVC, TPE or equal, and shall be rated at a conductor operating temperature of not less than 90°C.
5. The cable shall be rated for hard usage outdoor service and shall be resistant to oil, sunlight, ozone, grease, acids, water, abrasion and impact.
6. The electrical service cable shall be factory assembled to the motor conduit box with cord grip and strain relief grip. The cord grip shall include a Neoprene bushing providing a liquid tight seal. The strain relief grip shall be a 304 stainless steel wire mesh strain relief grip for the electrical cable at the motor to prevent the cable from pulling out of the conduit box.
7. Spiral Wrap Electrical Cable Protection: A polyethylene expandable spiral wrap abrasion protection sleeve shall be provided for wrapping around the electrical cable at the unit. The spiral wrap shall be weather resistant for a temperature range from -40 degrees F to one hundred and 22 degrees F, and protect the electrical cable from rubbing on the edge of the float.

M. Operation:

1. Electrical Characteristics:

    a. 460 V, 3 phase, 60 Hz.

2. Motor:

    a. Type: Totally enclosed, fan cooled (TEFC).
    b. Rating: Severe chemical duty.
    c. Motor windings shall be nonhygroscopic, and insulation shall equal or exceed NEMA Class "F".
    d. Base: Vertical
    e. Shaft: 17-4 PH stainless steel
    f. Bearings shall be regreasable and be of the radial and axial thrust type.
    g. Hardware, Condensate Drains, and Grease Fittings shall be Cadmium-plated.

2.2 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that facilities are ready to receive floating mechanical aerators.

3.2 INSTALLATION

A. Install according to manufacturer's instructions.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Wet Startup: Run equipment with wastewater and verify proper alignment and operation.

C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than one day (8 hrs) on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in maintenance of equipment.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 DEMONSTRATION

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

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 46 41 26

SECTION 46 43 21 - CIRCULAR CLARIFIER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Full diameter access bridge and walkway.
   a. Center platform
   b. Grating
   c. Hand-railing
   d. Toe Plates
2. Clarifier drive mechanism.
   a. Gearmotor reduction unit
   b. Micro-switch torque overload devices
   c. Shear pin
3. Unitube sludge removal mechanism.
   a. Header
   b. Manifold
   c. Seals
   d. Clamp Kit
   e. Supports
4. Center cage.
   a. Cage
   b. Truss arm
   c. Tie-chord A-frame
   d. Clevis assembly
5. Surface skimmer assembly.
   a. Scum blade
   b. Hinged skimmer assembly
   c. Raceway skimmer
   d. Ramp
6. Scum trough with flushing device
7. Influent peripheral feed channel.
   a. Oriface tubes
   b. Overflow tubes
   c. Skirt baffle
   d. Target baffle
8. All associated hardware and anchor bolts

B. Related Requirements:

1. Section 06 60 00 – FRP Weir Plates, Scum Baffles and Brackets: Weirs and Baffles furnished under this section
2. Section 46 05 53 - Identification for Water and Wastewater Equipment: Nameplates for equipment specified in this Section.

1.2 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.3 REFERENCE STANDARDS

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. American Gear Manufacturers Association:

1. AGMA 201.02 - Tooth Proportions for Coarse-Pitch Involute Spur Gears.
2. AGMA 390.03a - Handbook - Gear Classification, Materials and Measuring Methods for Bevel, Hypoid, Fine Pitch Wormgearing and Racks Only as Unassembled Gears.
3. AGMA 908 - Information Sheet - Geometry Factors for Determining the Pitting Resistance and Bending Strength of Spur, Helical and Herringbone Gear Teeth.
4. AGMA 2000 - Gear Classification and Inspection Handbook - Tolerances and Measuring Methods for Unassembled Spur and Helical Gears (Including Metric Equivalents)
5. AGMA 2001 - Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
6. AGMA 2004 - Gear Materials and Heat Treatment Manual.
7. AGMA 6001 - Design and Selection of Components for Enclosed Gear Drives.
8. AGMA 6013 - Standard for Industrial Enclosed Gear Drives.
9. AGMA 6019 - Standard for Gearmotors Using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears.
10. AGMA 6022 - Design Manual for Cylindrical Wormgearing.
11. AGMA 6034 - Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors.
12. AGMA 6113 - Standard for Industrial Enclosed Gear Drives (Metric Edition).
13. AGMA 9005 - Industrial Gear Lubrication

C. American Society of Mechanical Engineers:

1. ASME B17.1 - Keys and Keyseats.
2. ASME B17.2 - Woodruff Keys and Keyseats.
3. ASME B29.100 - Double-Pitch Roller Chains, Attachments, and Sprockets.

D. ASTM International:

1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. American Society for Testing and Materials (ASTM):

1. A36/A36M – Standard Specifications for Structural Steel
2. A48 – Standard Specification for Gray Iron Castings

3. A148/A148M – Standard Specification for Steel Castings, High Strength, for Structural Purposes
4. A276 – Standard Specification for Stainless Steel Bars and Shapes
5. A325 – Standard Specification for High-Strength Bolts for Structural Steel Joints
6. A536 – Standard Specification for Ductile Iron Castings

F. American Welding Society:

1. D 1.1 – Structural Welding Code for Steel

G. American Institute of Steel Construction (AISC):

1. Specification for Structural Steel Buildings
2. Code of Standard Practice for Steel Bridges and Buildings

1.4 SUBMITTALS

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

B. Product Data: Submit manufacturer's Product Data for system materials and component equipment, including electrical characteristics.

C. Shop Drawings:

1. Indicate system materials and component equipment.
2. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.

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

1. Certify that installation is completed according to manufacturer's instructions.

E. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Manufacturer Reports: Indicate that equipment has been installed according to manufacturer's instructions.

H. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of installed clarifiers and components.

C. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

B. Spare Parts:

1. Furnish one set of manufacturer's recommended spare parts.

C. Tools: Furnish special tools and other devices required for Owner to maintain and calibrate equipment.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on-Site and inspect for damage.

C. Store materials according to manufacturer's instructions.

1.9 WARRANTY

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

B. Furnish five-year manufacturer's warranty for circular clarifier equipment and accessories.

PART 2 - PRODUCTS

2.1 CIRCULAR CLARIFIER EQUIPMENT

A. Manufacturers:

1. Evoqua Water Technologies Corp.

2. Westech

3. Ovivo

4. Approved Equal

   a. Specifications and equipment arrangements for the circular clarifier equipment are based on Evoqua. Changes to the arrangement indicated in the specifications and in the plan set shall be at the expense often installing contractor. No change orders will be issued to the contractor for modifications to the laying length, footprint, concrete layout, electrical, mechanical, etc.

B. Description:
   1. Furnish and deliver suction type sludge collectors for installation in two (2) concrete settling tanks.
      a. Tank inside diameter of 65 feet with inboard effluent launder
      b. Tank side water depth of 14 feet
      c. Tank freeboard of 2 feet
      d. Floor slope of 1/16 in per foot

C. Performance and Design Criteria:

   1. Clarifier Mechanism:

      a. Provide a center pier supported, peripheral feed design with peripheral overflow.
      b. Provide a center drive mechanism that supports a walkway, maintenance platform, and rotating structural steel cage.
      c. The cage shall support the Unitube header, manifold, and truss arm.
      d. (1) surface skimmer assembly which includes scum blade, hinged skimmer assembly, raceway skimmer, and ramp.
      e. Fabricated steel structures shall be shipped in the largest sub-assemblies permitted by carrier regulations, properly match-marked and identified for ease of field erection.
   2. Design Criteria - Equipment

Internal Diameter (feet)	65
Side-water Depth (feet)	14
Minimum Freeboard (feet)	2
Floor Slope	1/16:12
Center Pier Minimum Inside Diameter (in)	 24
Skimmer and Scum Trough Number of skimmer arms Trough width (feet)	 1 6

   3. Design Criteria – Drive Mechanism

Ball Race Diameter (in)	30

Torque Requirements	
AGMA Rated Torque (ft-lbs)	12,100
Motor Shut-Off Torque (ft-lbs)	14,520
Momentary Peak Torque (ft-lbs)	24,200
Service Factor	1.25
Drive Output Speed (RPM)	0.04

4. Hydraulic Design Criteria (per Clarifier)

	MIN.	AVE.	PEAK
Effluent Flow (MGD)	0.625	1.0	2.25
Return Flow (MGD)	0.625	1.0	1.0
Mixed Liquor Flow (MGD)	1.25	2.0	3.25

D. Materials:

1. Drive housing: Cast iron
2. Non-submerged steel: A36 carbon steel
3. Submerged steel: A36 carbon steel
4. Grating: 1 ¼-inch aluminum grating
5. Handrails: Aluminum
6. Anchor bolts and hardware: Type 316 SS
7. Structural steel components: Minimum thickness of ¼-inch unless otherwise specified
8. Sharp corners or sheared edges ground to provide a smooth edge
9. Panel lengths and member sizes shall be selected such that slenderness ratios do not exceed 200 for compression and 240 for tension
10. Maximum deflection in a span under combined live and dead loads shall not exceed L/360

E. Drive Mechanism

1. General:

a. Drive mechanism consisting of primary helical gear reduction, intermediate worm gear reduction unit and enclosed final reduction unit consisting of internal spur gear and pinion in a turntable base is to be completely assembled and finish painted in the Manufacturer's shop.
b. All gearing shall be enclosed in gray cast iron ASTM A-48 Class 40B housings. Fabricated steel housings, exposed gearing and submerged bearings will not be acceptable.
c. The drive shall be designed to allow removal and replacement of internal gear, balls and strip liners without raising the walkway.
d. All components of the drive mechanism shall be designed in accordance with AGMA Standard 6034-B92 "Practice for Enclosed Cylindrical Worm Gear Speed Reducers and Gearmotors", and Standard 2001-D04 "Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth"; for 24-hour continuous, uniform load duty and 20-year design gear life at the specified output speed. The AGMA rated torque of the drive shall be the lowest value computed for worm gear set, spur gear and pinion for strength and durability.
e. Select conservative values for bending strength and pitting resistance life factors Kl and Cl based on a minimum of 420,000 cycles of the main gear. The drive

AGMA torque rating shall be as specified above with a minimum 1.25 service factor.

f. All bearings shall be designed for a minimum B-10 life of 200,000 hours.

2. Primary Reduction Unit:

a. Provide commercially available helical gear reducer or gearmotor in a cast housing.
b. All bearings shall be anti-friction type running in oil.
c. Motor shall be totally enclosed, ball bearing type, of ample power for starting and continuously operating the drive mechanism without overloading.
d. Motor to conform to NEMA standards and be suitable for operation on 230/460 volt, 3 phase, 60 Hertz current.
e. Primary reduction unit shall drive the intermediate reduction through a chain and sprocket arrangement with #80L self-lubricating chain and non-corrosive OSHA approved removable chain guard.
f. Provide proper chain tension by an adjustable steel base mounted on the intermediate reduction unit.

3. Intermediate Reduction Unit:

a. Provide worm gear speed reduction with grease and oil lubricated anti-friction type bearings in cast iron housing securely bolted on the machined top face of the final reduction unit. Worm and shaft shall be a two-piece assembly for ease of maintenance. Cycloidal and planetary gearing will not be acceptable.
b. Align and maintain accurate centers with the final reduction gearing. Swivel base mounting of the intermediate unit will not be acceptable.
c. Mount an electro-mechanical overload device on the thrust end of the worm shaft consisting of plate spring assembly, plunger, indicator dial two (2) micro-switches (one N.O. and one N.C.) and a terminal block, all enclosed in a weather tight, gray cast iron housing. Amperage metering devices will not be considered equal to the overload device specified.
d. Micro-switches shall be factory set to: (1) sound an alarm when the load on the mechanism reaches 100% of the AGMA torque; and (2) stop the motor when the load reaches 120% of the AGMA torque.
e. Provide a shear pin device mounted on the drive end of the worm shaft.

4. Final Reduction:

a. Provide internal, full depth involute tooth design, ductile iron spur gear driven by a heat treated steel pinion from the slow speed shaft of the intermediate reduction unit. Stub tooth design will not be acceptable.
b. Provide bearings at top and bottom of pinion to ensure complete tooth contact between mating surfaces. Pinion and pinion shaft shall be furnished as a two-piece assembly for ease of maintenance.
c. Provide cast iron turntable base with annular raceway to contain balls upon which the internal gear rotates. The ball race shall ensure low unit ball load, long life and stability without the use of submerged guide shoes, bumpers or steady bearings.
d. Provide (4) 3/8" thick x 3/4" wide renewable special hardened (38-42 Rockwell C) steel liner strips force fitted (pins and cap screws not permitted) into the turntable base and internal gear for balls to bear on vertically and horizontally.

e. Provide an internal gear of split design with precision mating surfaces for ease of removal of gear, balls and liner strips without raising bridge. Drives without this feature are not acceptable.
f. Internal gear, pinion and balls to run in an oil bath and be protected by a felt seal and vertical neoprene dust shield.
g. Provide oil filling and level pipe along with a drain plug and sight gauge.
h. Turntable base shall be bolted to the center column and be designed to support the bridge, internal gear and rotating mechanism.

F. Influent/Effluent Channels:

1. Contractor to construct channels of concrete at periphery of tank.
2. Influent flow to be in one direction only.
3. Decrease influent channel width uniformly to maintain constant flow velocities.
4. Increase effluent channel width uniformly with decrease in influent channel width to maintain concentric weir wall.

G. Orifices:

1. Manufacturer to size and space inlet orifices in floor of influent channel to provide uniform flow distribution around periphery of the tank.
2. Provide each orifice with a deflection baffle and anchors to reduce jetting action and diffuse the flow.
3. Orifice length shall not be greater than floor thickness.
4. Spacing shall not exceed 6 feet.
5. Provide 3/16" steel plate orifice baffles allowing no restriction less than the orifice diameter and no greater than the diameter plus one inch.

H. Influent Skirt Baffle:

1. Provide influent skirt baffle constructed of 3/16" thick steel sheets and extending 5' beneath the water surface or a minimum 1' below bottom of influent channel, whichever is greater.
2. Fabricate skirt baffle in approximately 20' sections supported from bottom of influent channel floor.
3. Provide sufficient clearance beneath skirt to permit operation of sludge collector mechanism.
4. Maximum velocity beneath skirt baffle not to exceed 5 FPM at maximum flow.

I. Center Pier:

1. A cylindrical 1/4" thick steel plate center pier shall support the drive, collector mechanism and access bridge.
2. Top of pier to have a drive mounting plate set plumb with the centerline.
3. Drive to be positioned, leveled and grouted in place on top of pier with a non-shrink grout.
4. Manufacturer to provide minimum eight (8) 1" diameter anchor bolts and steel template/grout shield to accurately locate anchors.

J. Sludge Collection Header:

1. The header shall be parallel to the tank floor and have a series of inlet orifices such that the entire tank bottom is swept clean in a single revolution.
2. The header shall be designed to uniformly remove sludge in proportion to the area swept with the removal of a larger volume of sludge at greater distances from the tank center.
3. Sludge shall be transported through the header to the center manifold, with removal being accomplished by hydrostatic pressure.
4. Provide a fully tapered, rectangular-shaped Unitube header varying in cross section from a maximum near the tank center to a minimum at the outer wall.
5. Fabricate header from 1/4" thick steel plate.
6. Provide steel plate counterweights not exceeding 50# each as necessary for proper equipment balance. Field welding of galvanized header or supports will not be allowed.
7. Longitudinal cross sectional axis to be mounted at an angle of 45 degrees to tank bottom to trap sludge.
8. Provide a 2" fluidizing vane as an integral part of header. Attach neoprene squeegee to fluidizing vane provided with 1" vertical adjustment.
9. Manufacturer to size and space header inlet orifices at regular intervals not exceeding 30".
10. Orifice design to be proportionate to the volume of sludge withdrawn from the entire tank floor at all flows.
11. Provide header flange with silicone seal for bolted connection to center manifold. Tie bar shall provide header support.
12. Alternate Manufacturers shall submit header verification field data in accordance with the Substitute Equipment Section of this specification.
13. Sludge withdrawal by means of individual riser pipes or stepped header construction will not be acceptable.

K. Center Cage, Truss Arm, and Manifold:

1. Center cage to be of an all-welded box truss construction made up of structural steel members having a minimum thickness of 1/4".
2. Truss arm shall be furnished with a triangular three-point contact design for ease of installation and alignment. Truss shall be constructed with 1/4" minimum thick members. Truss shall be pinned at the base for vertical adjustment and connected to the center cage through strut and adjustable clevis assembly. Tie-rod and turnbuckle designs that do not provide lateral support will not be acceptable.
3. Provide a cylindrical manifold with (2) seals for bolted connection to the sludge collection header and bottom of cage. A bottom seal plate shall be furnished by the equipment Manufacturer securely anchored to the floor and grouted in place after final adjustment.

L. Surface Skimmer:

1. Provide (1) skimmer assembly consisting of scum blade and hinged wiper assembly.

    a. The scum blade shall span the full length between the center pier and scum trough. Scum blade shall have a height of 5-in rigidly attached to vertical pipe supports and structural A-frame. The A-frame shall be bolted to the truss arm at maximum of 15’ spacing.
    b. Mount a hinged wiper assembly on the end of the scum blade to form a pocket for trapping scum. The wiper assembly shall maintain continual contact and proper alignment between scum blade, outer scum baffle and scum trough. The wiper

blade shall have a wearing strip on its outer end which contacts the scum baffle and neoprene strip on its inner and lower edges which contact the scum trough.

c. All springs, pivot points and threaded fasteners shall be constructed of 302 stainless steel. The hinged wiper assembly shall be hot dipped galvanized. The wiper blade shall be neoprene with Durometer range 50-60. The wiper assembly shall be the same dimension of the scum trough.

d. Provide a manual lockout mechanism on hinged skimmer assembly to allow for flexible independent operation for surface ice. Lockout mechanism shall raise hinged skimmer assembly above water surface without removal.

2. Provide (1) scum trough 6'-0" wide with inclined beach of 1/4" thick plate, supported from the tank wall.

   a. Scum trough shall have an overall length of 4'-9" along the scum baffle consisting of beach plate, inner radius baffle, hopper and 6" discharge pipe. Manufacturer shall provide a loose plate flange for contractor to field weld and connect to scum drain piping.

3. Provide mechanical flushing device made from 304 stainless steel and activated by the main tank skimmer arm. The flushing device shall pivot on a fabricated hinge that uses a ¾" diameter minimum stainless steel pin/bolt. The flushing device will provide a counterweight action which in conjunction with a neoprene seal will assure a positive closure. The flushing device shall be held open to allow 15 to 25 gallons of flushing water per trip.

M. Raceway Scum Removal:

1. Contractor to provide an adjustable inverted slide gate for removal of influent channel scum to a pit located outside the clarifier wall as shown on the contract drawings.
2. Extend a channel sweep arm with blade from the main tank skimmer.

N. Access Bridge:

1. Provide a bridge of wide flange beam construction extending from the tank wall to the stationary drive base.
2. Provide a bridge extension to provide full-diameter access.
3. Bridge to be designed for the dead load and a live load of 60#/sq. ft., with a deflection not exceeding L/360 of the span.
4. Provide a 3' wide walkway of 1 1/4-inch aluminum grating extending over the entire bridge length.
5. Provide a 2-rail handrail consisting of 1-1/2" diameter, Sch. 40 mechanically fastened Aluminum pipe for rails and Sch. 80 posts. Post spacing not to exceed 5'. Omit handrail only where truss bridge members at 21" and 42" above the walkway provide the same function.
6. Provide a 4" high aluminum toe plate along both sides of bridge and bridge extension.
7. Provide a minimum 8'-0" x 10'-0", rectangular platform to provide a 2' working clearance around the drive.

O. Effluent Weirs and Scum Baffles **(to be provided by installing contractor)**

1. Fabricate weirs from 3/16" thick x 9" FRP.

2. Weir shall have 90 degree, 2.5 inch deep "V" notches spaced 6" on centers.
3. Fabricate scum baffle from 1/4" thick x 12" FRP

P. Anchor Bolts:

1. All equipment anchor bolts shall be Type 316 stainless steel.
2. Equipment Manufacturer shall furnish steel template and grout shield to accurately locate center pier anchors and allow for grouting beneath the pier and manifold seal plate after final plumbing.

2.2 SURFACE PREPARATION AND FINISHING

A. The center drive mechanism shall be shipped, assembled and finish painted with manufacturer's standard paint system.

B. Fabricate header from 1/4" thick steel plate hot-dip galvanized after fabrication per ASTM-A123.

C. Submerged components will be prepared by blasting to SSPC-SP10 and prime painted with (1) shop coat. Finish coats are to be applied in the field by the Contractor.

D. Non-submerged components will be prepared by blasting to SSPC-SP10 and prime painted with (1) shop coat. Finish coats are to be applied in the field by the Contractor.

E. Galvanized and stainless-steel components will be shipped unpainted.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that clarifier basin is installed and ready to receive circular clarifier equipment.

3.2 INSTALLATION

A. Install circular clarifier equipment according to manufacturer's instructions.

B. Weir Plates: Mount weir plates against double bead of the sealant.

3.3 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Dry Startup: Run equipment without liquid in basins and inspect for:

1. Alignment of sprockets, chain, flights, and wearing surfaces.
2. Binding and excessive heat buildup in drive units.

C. Wet Startup: Run equipment with wastewater in basins and verify proper operation.

D. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than two trips of two days each on-Site for installation, inspection, field testing, and instructing Owner's personnel in maintenance of equipment.

E. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified, and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

F. Furnish installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for startup and testing.

3.4 ADJUSTING

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

B. Check control module functions and adjust as necessary.

3.5 DEMONSTRATION

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

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 46 43 21

SECTION 46 51 15 – ORBAL AERATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all labor, material and equipment to furnish and install the Orbal Aeration Equipment as specified herein.

B. This specification covers the general requirements for the design, fabrication and installation of one (1) Orbal aeration basins.

C. Related Requirements:

1. Section 05 50 00 - Metal Fabrications: Miscellaneous metalwork and fasteners as required by this Section.
2. Section 09 96 00 – High Performance Coatings for touchup and finish painting of installed equipment.
3. Section 40 05 57 – Actuators for Process Valves and Gates

1.2 REFERENCE STANDARDS

A. American Society of Civil Engineers:

1. ASCE 2 - Measurement of Oxygen Transfer in Clean Water.

B. National Electrical Manufacturers Association:

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

C. American Gear Manufacturers' Associates

1. AGMA 2001-C95 Fundamental Rating Factors and Calculations
2. AGMC 2002-B88 Tooth Thick Specification

D. American Bearing Manufacturers Associates

1. ABMA 11 Load Ratings and Fatigue Life for Roller Bearings

E. American Society for Testing and Materials

1. ASTM A36 – Carbon Structural Steel
2. ASTM A48 – Gray Iron Castings

1.3 SUBMITTALS

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

B. Product Data: Submit manufacturer information describing materials of construction, fabrication, and protective coatings.

C. Shop Drawings: Indicate materials and equipment, including wiring and control diagrams, performance charts and curves, installation and anchoring requirements, fasteners, and other details.

D. Spare Parts List: Complete list of spare parts supplied with equipment.

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

F. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

G. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

H. Field Quality-Control Submittals: Indicate results of Contractor- or Vendor-furnished tests and inspections.

I. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

J. Qualifications Statements:

1. Submit qualifications for manufacturer as follows:

a. The Manufacturer shall have at least fifteen (15) successful installations of the specified process in state of GA.
b. The Engineer may require evidence, in the form of operating records, from these installations to substantiate any claims concerning the ability of the equipment to perform as required.

1.4 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations and final orientation of equipment.

1.5 QUALITY ASSURANCE

A. All the equipment specified under this Section shall be furnished by a single Manufacturer fully experienced, reputable, and qualified in the manufacture of the equipment specified. The basin has been designed to accommodate equipment supplied by the following manufacturers:

1. Evoqua Water Technologies LLC, of Waukesha, WI
2. or pre-qualified equal which meet or exceed the following requirements

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. 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.

C. Store gear reducers and motors in buildings or trailers which have a concrete or wooden floor, a roof and fully enclosed walls on all sides. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.

D. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations and shall be properly match-marked for ease of field erection. The units shall be erected and lubricated in strict accordance with the instructions of the Manufacturer's field engineer.

1.7 WARRANTY

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

B. Furnish two-year manufacturer's warranty for equipment furnished under this section.

PART 2 - PRODUCTS

2.1 GENERAL

A. There shall be provided, as shown on the plans, one (1) complete Orbal aeration wastewater treatment systems.

B. The principal structure shall consist of three (3) endless aeration channels arranged in a concentric manner with common intermediate walls. Raw wastewater, after entering the system, shall pass progressively through the aerated channels and then to the final clarifier(s). The raw wastewater may be introduced into any one of the channels depending upon the operating conditions. Recycled sludge shall be returned to any one of the channels depending upon the operating conditions. The flow from one aeration channel to another shall be by displacement of the mixed liquor circulating in each channel through submerged ports interconnecting each adjacent aeration channel. The displaced flow shall be equal to the volume of raw waste and recycled sludge introduced into the aeration system.

C. The effluent from the final aeration channel shall be controlled by means of a submerged adjustable orifice gate and overflow weir provided by the contractor and shall be, designed to allow a liquid level variation of 12 inches in the aeration channels with variations in the flow of waste water and recycled sludge.

2.2 EQUIPMENT

A. General

1. The aeration equipment for Orbal system shall be as described herein and as shown per general arrangement drawings.

2. The aeration equipment shall consist of three (3) complete rotary aerator assemblies designed for operation at controlled disc submergence of 12 to 24 inches and at max 52 rpm, so that the oxygen transfer rate and power requirements can be varied with the flow and treatment requirements.

3. A process control system shall be provided to monitor and control dissolved oxygen levels and ORP in the Orbal system based on process objectives.

B. Design Criteria

1. The rotary aerator assemblies to be furnished and installed shall be capable of delivering a SOR of 680 lb. O_2/hr. The oxygen values are measured at Standard Operating Requirements of 68^{o}F (20^{o}C) and 30" Hg.

C. Disc Aeration Equipment

1. Total of three (3) 30 HP and three (3) 60 HP complete disc rotary aerator assemblies as shown per the general arrangement drawings.

2. There shall be a provided total of one-hundred forty-four (144) circular aeration discs, located as determined by the Manufacturer in order to provide the required oxygen requirements. The disc shall be 66” in diameter. 54” nominal diameter discs shall not be considered an alternate.

3. The discs shall be US manufactured. The disc shall be fabricated of 1/2" thick molded polystyrene structural foam, resistant to corrosive action of the mixed liquor being aerated. Each disc shall have a compound for ultra-violet stabilization. A multiplicity of cavities and raised protrusions shall be provided in the disc to cause entrained air to be dispersed in the mixed liquor. The raise protrusions shall be of cup shape with a trailing tail.

4. The aeration discs shall be firmly attached to the shafting by means of a shaft locating collar. This shaft locating collar shall be an integral part of the aeration discs. To enable the individual discs to be attached, adjusted, or removed from the shafting without disassembling the shafting, discs shall be split into half sections held in position by bolts at the shaft. All bolts, washers and nuts shall be 304 stainless steel.

5. The disc manufacture/seller shall submit a certificate verifying manufacture location of the discs and ownership of the disc molds. If validation of owner ship is not of the manufacture/seller this shall be grounds for rejection.

6. Contractor shall be required to field install discs, and set disc location along the shaft as required meeting the specifications and the treatment process as determined by the Manufacturer and the Engineer.

D. Aerator Shafting

1. Aerator shafts shall be made from solid, 6" diameter, SAE 1045 machine steel bar stock, turned and polished. Shaft ends shall be true concentric.

2. The shafting shall be capable of withstanding all dead, live, and radial loads imposed on it. Maximum allowable deflection shall be 0.15 inch per 10 ft. length of shaft.

3. Shafts to be blast cleaned per SSPC-SP10-63. Shafts shall have two (2) coats of Sherwin Williams, Dura-Plate 235 B67A235 Haze Gray. Shafts shall be supplied with Manufacturer's standard paint to ensure proper fit-up between the aeration discs.

E. Bearings

1. Each aerator shaft shall be supported by self-aligning, grease lubricated, roller bearings with cast iron pillow block housings. Housings shall be coated for corrosion protection according to this proposal. Each bearings shall have double row spherical roller bearings with locking collars to secure the bearing to the shaft. Heavy duty contact seals shall be provided to insure positive sealing against contaminants. The seals shall be designed for operation in a moisture laden environment.

2. Minimum B-10 bearing life shall be 200,000 hours.

F. Bearing Base Plates

1. Base plates shall be provided for setting the pillow block bearings. Base plates must be set and grouted level by the contractor in accordance with approved general arrangement drawings. Bearing base plates shall be fabricated from commercial quality steel, and coated for corrosion protection according to the specification specified herein. Stainless steel hardware shall be provided for securing the bearings to the base plates.

G. Remote Bearing and Automatic Lubrication System

1. A remote lubrication system will be provided for each bearing assembly. The system will provide convenient access for bearing lubrication by the plant operator.

2. The remote lubrication system will consist of tubing and an installation kit. Fit-up and installation is to be by the contractor.

3. A Memolub or equal automatic lubricator shall be installed which will deliver small, metered amount of grease over a period of time.

4. It is factory pre-lubricated with Mobilth 460.

Specification	
Operation:	Electro-Mechanical, positive displacement pump
Lubricant cartridge capacity:	240cc, 1 pt or 480cc , 2 pt (Replaceable)
Connection thread:	¼" NPT Male
Max operating pressure:	350psi (25 bar)
Temperature Range:	5°F to 120°F (-15°C to 50°C)
Output timing settings:	52 Adjustable settings

Power supply:	4.5VDC Alkaline battery pack
External On/Off Control	No
Remote Installation:	Up to 30 feet, single point
Reusable:	Yes
Multi-Point:	2pt for a double bearing and 1pt for single bearing

H. Rotor shaft flexible coupling

1. The couplings employ a molded, non-lubricated elastomeric flexing member loaded in shear that is bonded to steel clamp rings. The flexible member is compounded of natural rubber and is available with an optional proprietary coating that adds additional protection in specific environments.

2. The standard compound of natural rubber and the optional proprietary coating shall be suitable for operation in ambient temperatures from -45°F to 220°F (-42°C to 104°C). Both have an initial hardness of 55-70 Shore durometer A.

3. The flexible element is attached radially to axially separated hubs with exposed SAE grade 8 or ISO Class 10.9 flanged head cap screws. The coupling assemblies have optional methods of attachment to the shaft including, but not limited to: clearance fit, transitional fit, interference fit, TAPER-LOCK bushings, or QD bushings. Clearance fits and transitional fits are supplied with two set screws, one over the key and one at 65°.

4. Spacer couplings consist of two hubs and a pre-assembled, or customer assembled, center assembly. The center assemblies are available in half spacer or full spacer versions.

I. Direct Drive

1. The drive mechanism for each aerator assembly shall consist of a single speed motor and a shaft mounted AGMA Class II helical gear reducer sized for 24 hour continuous operation with allowance for moderate shock loads. The motor and reducer shall be fully suitable for outdoor service and exposure to the atmosphere encountered, and shall be coated for corrosion protection according to the manufacturer's standards.

2. An adjustable torque arm shall be provided to secure the reducer in position. The reducer shall be attached to the motor using a cast iron adapter. Each drive shall produce a maximum aerator speed of 52 rpm.

3. Motors shall be 30 HP or 60 HP, TEFC, 1800 RPM, 460 volt, 3 phase, 60 Hz, induction type, NEMA Design A or B, with Class F insulation and a 1.15 service factor. All motors shall be compatible with variable frequency drive (VFD) controller (inverter ready), and shall be premium efficiency design. Each motor shall be C-faced mounted to the drive

4. Direct drives shall be equipped with vibration and temperature sensors. The sensors shall be data secure, wireless, intrinsically safe, include up to 2 years of battery life and have a non-rechargeable and non-replaceable battery. The sensors shall be directly positively attached to the monitored equipment and be commissionable with hand-held Wi-Fi or cellular tablet or phone. The data shall be stored in a secure cloud accessible by customer created secure credential or via a customer created secure API key.

J. Splash Shields

1. Splash shields shall be provided to prevent the wetting of bearings, and drive units from disc spray. Shields shall be constructed of galvanized steel.

2. Mounting brackets for the splash shields shall be fabricated from commercial quality steel and hot dip galvanized for corrosion protection. Components for the splash shields shall be shipped loose for field assembly and installation by the contractor in accordance with Manufacturer's instructions, and approved general arrangement drawings.

3. Neoprene seals shall be attached to the splash shields where the shaft passes through the plate.

K. Anchors and Hardware

1. All anchor bolts shall be 304 stainless steel and furnished by the Manufacturer and set with proper projection by the Contractor in accordance with approved, certified drawings furnished by the Manufacturer.

2. All hardware shall be 304 stainless steel.

L. Painting

1. Bearing base plates shall be blast cleaned followed by one (1) coat of Tnemec Series N140F primer. Finish painting shall be done in the field by the installing contractor after equipment installation and alignment.

2. Exposed machined surfaces - solvent wiped followed by one (1) coat of shop preservative.

3. Non ferrous materials stainless steel, aluminum, and galvanized surfaces unpainted.

4. Reducers, motors, base plates, guards and other related drive components shall be coated per the manufacturer's standards.

5. Bearings and couplings – Manufacturer's standard coating.

M. Smart BNR® Lite Process Controls

1. The Smart BNR Lite control system shall contain all interlocks, alarm functions and aerator control as required for operation of the Orbal system. It shall be furnished by Evoqua or pre-qualified and approved Equal.

2. System Function

a. The Orbal system shall be designed to monitor oxidation reduction potential (ORP) in outer channel and dissolved oxygen (DO) in the inner channel, and control oxygen delivery based on the ORP, DO and process objectives.

b. Plant flow shall be monitored and the point of application of the influent shall be adjusted during high flow events to enter the Stormflow mode of operation and prevent solids loss in the clarifiers.

c. All of these functions shall be incorporated in a single package from the same Manufacturer of the Orbal system.

3. Control Panel – A control panel shall be supplied and will include the following:

a. Design and construction shall conform to the latest edition of the NEC. There shall be a main power on/off switch for the control system rated for the voltage and current required. Individual branch circuit breakers shall be provided as required. Power on indicating light will be provided. Control panel will operate on 120Vac, single phase, 60Hz, electrical service.

b. Control panel equipment shall be mounted in a NEMA 12 painted steel wall-mounted enclosure located indoors in the electrical room. Enclosure shall be Hoffman or equal.

c. Surge suppression will be provided inside the panel for the electrical service to protect control panel components, surge suppressors shall be Phoenix Contact SFP, EDCO or equal.

d. Corrosion inhibitors will be provided, Hoffman AHCI10E or equal.

e. The panel shall incorporate a Programmable Logic Controller (PLC) for accomplishing the control logic. The PLC shall be capable of online program editing without stopping the process control system. The system shall not require a battery for program memory and include removable SecureDigital (SD) card for program backup. The PLC processor shall be a Allen-Bradley CompactLogix 5370 L2 Series with Ethernet communications protocol and will utilize 1769 Series I/O modules.

f. The PLC shall contain input/output points for the following equipment and instruments. Analog inputs and outputs shall be of the 4-20 mA type.

Equipment	**Qty.**
Aerator VFD	6
DO Probe	1
ORP Probe	1
Influent Flow rate	1
Influent Gates	3

g. An Operator Interface shall be provided for displaying process and entering selected functions and operating variables. The operator interface shall be a Siemens TP700 Color Touch Panel. The minimum screen size shall be 7”. The panel shall use Siemens Simatic WinCC HMI software.

h. Control panel shall include all required power supplies for DC circuits. Power supplies shall be Phoenix Contact, Sola or equal.

i. Surge Arrestors shall be provided for any analog circuits that originate from outside of the control panel building, surge arrestors shall be Phoenix Contact TT, EDCO PC series or equal.

j. Where used, operator indicating lights, selector switches and pushbuttons shall be industrial duty, rated NEMA 4X, and be 30.5mm nominal size with required nameplates. Pilot lights shall be of the LED push to test type, color as required. Operator devices shall be Siemens Class 52 Series, Allen Bradley, Square D or equal.

k. Relays supplied shall be industrial plug-in type, minimum DPDT, with contacts rated for 10 amps. Relays shall be Phoenix Contact, IDEC, Potter Brumfield or equal.

l. Timers shall be multi-range, multi-function, industrial plug-in type. Timers shall be IDEC RTE, Siemens or equal.

m. All wiring in the control panel shall be in wire-ways or suitably tie-wrapped to provide for neat appearance. Internal wiring shall be color coded. All wires which connect outside the panel shall terminate on NEMA rated terminal blocks. Terminal Blocks shall be Phoenix Contact UT, WAGO or equal.

n. Provide in control panel a Phoenix Contact or N-TRON 4 port (RJ45, 10/100) network switch for interface to the plant SCADA system provided by others.

4. Instruments

a. Manufacturer shall supply one (1) Dissolved Oxygen (DO) probe and one (1) Oxidation Reduction Potential (ORP) probe and a mounting kit for each probe. The probe handrail mounting kit shall be constructed of stainless steel (as shown in general arrangement drawings). The DO probes shall be YSI FDO model 700 H. The ORP probes shall be YSI SensoLyt H (rated for hazardous locations). One (1) YSI 284 Controller(s) shall be supplied. The transmitter(s) shall have 4-20 mA outputs for transmission of the signal to the PLC.

5. Control Programming

a. The aeration program shall control using a system approach. Oxygen delivery to the entire process shall be determined using all sensor inputs rather than each sensor control aerators in discrete reactors.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify layout, type, and orientation of connections.

3.2 INSTALLATION

A. The Contractor shall install the Orbal Aeration System as shown on the drawings.

B. Equipment shall be installed in accordance with GENERAL MECHANICAL REQUIREMENTS, and in accordance with the Manufacturer's recommendations to provide a complete installation.

C. The Contractor shall level, align shafting, grout beneath bearing base plates, install drives, aeration discs and accessories in accordance with the Manufacturer's drawings and installation manual.

3.3 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Manufacturer's Field Service for Equipment Installation

1. The Manufacturer's field service technician shall check the installation of the equipment, assist in the start-up, and provide training on the maintenance of the equipment. A minimum of two (2) trips, and a total of four (4) days at site shall be provided.

B. Process training

1. The Manufacturer's process engineer shall provide process training. The training is conducted 4 to 6 weeks after the plant has begun receiving wastewater. At that time, a review of the plant analytical and operational data shall be reviewed and training provided. Prior to the actual field visit, the manufacturer's process engineer shall be in contact with the plant operators to discuss operational issues including the actual process start-up. The total service shall not be less than one (1) trip and one (1) day at site.

END OF SECTION 46 51 15

SECTION 46 51 16 - SUBMERSIBLE ASPIRATING AERATOR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Submersible propeller Aspirating Aerator and accessories.

B. Related Requirements:

1. Section 05 50 00 - Metal Fabrications: Miscellaneous metalwork and fasteners as required by this Section.
2. Section 46 05 53 - Identification for Water and Wastewater Equipment: Nameplates for equipment specified in this Section.

1.2 REFERENCE STANDARDS

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. National Electrical Manufacturers Association:

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

C. National Sanitation Foundation:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

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

B. Product Data:

1. Submit manufacturer's Product Data for system materials and component equipment, including performance characteristics.

C. Shop Drawings:

1. Indicate system materials and component equipment.
2. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.

D. Manufacturer's Certificate:

1. Certify that Aspirating Aerator meet or exceed specified requirements.
2. Certify installation is completed according to manufacturer's instructions and that Aspirating Aerator have been properly installed and tested and are ready for operation.

E. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statements:

1. Submit qualifications for manufacturer and licensed professional.

1.4 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations and final orientation of Aspirating Aerator.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

B. Spare Parts:

1. Furnish one (1) set of manufacturer’s recommended spare parts for Aspirating Aerator.
2. Furnish a complete list of manufacturer’s recommended spare parts.

C. Tools: Furnish any special tools and devices required for Owner to maintain, service, repair, and disassembly the submersible Aspirating Aerator.

1.6 QUALITY ASSURANCE

A. The mixing equipment shall be certified according to ISO 9001 (quality): ISO 14001 (environmental) and OHSAS 18001 (occupational health and safety) standards.

1.7 QUALIFICATIONS

A. The mixer specified herein shall be the design and fabrication of a single manufacturer which shall have sole source responsibility for all equipment included in this specification.

B. The manufacturer shall have mixing equipment of comparable capacity in successful operation in the field for a minimum period of ten (10) years.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver materials in manufacturer's packaging including application instructions.

C. Inspection: Accept Aspirating Aerator on-Site in original packaging and inspect for damage.

D. Store Aspirating Aerator according to manufacturer's instructions.

E. Protect Aspirating Aerator from water and wet weather.

1.9 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 of substantial completion, or eighteen (18) months from shipment of equipment, whichever first shall occur.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Tsurumi Pump

2.2 SCHEDULE

A. Reaeration Basin: SMA6110-6150 (5 total) 7.5 HP 50TRN45.5-62

2.3 SCOPE OF SUPPLY

A. Furnish and install TSURUMI Model Submersible Self Aspirating aerator(s). Each unit shall be capable of delivering 1 lbs. of Oxygen per horsepower in clean water at an operating depth of 8 ft. submergence, when installed in accordance with manufacturer’s directions. The aerator(s) shall be designed to operate in waste water, sewage or effluent containing solids while entraining aspirated air on a continuous operation basis without damage during operation or de-rating. The aerator(s) shall be capable of operation at a minimum liquid depth of 6 feet and a maximum liquid depth of up to 13.1 feet. The unit(s) shall be designed so that the shaft output power of 7.5 HP shall not be exceeded. Sound pressure levels at a distance of 15 meter shall be less than 46.5 dB A per ISO 9614-2 or equivalent testing standards. Each unit shall include manufacturer’s installation instructions, operation instructions, maintenance information and replacement and spare parts information.

2.4 MATERIALS OF CONSTRUCTION

A. Construction of major parts of the aeration unit(s) including oil casing and guide vane shall be manufactured from gray cast iron, ASTM A48 CLASS 35. Internal and external surfaces coming into contact with the pumpage shall be protected by a fused polymer coating. All exposed fasteners shall be stainless steel. Impellers shall be of the semi-open, solids handling design equipped with back pump out vanes and shall be slip fit to the shaft and key driven.

2.5 MECHANICAL SEAL

A. All units shall be furnished with a dual inside mechanical shaft seal located completely out of the pumpage, running in a separate oil filled chamber and further protected by an exclusionary air seal to prevent excessive pressure on the mechanical seal during operation. Unit shall be fitted with a device that shall provide positive lubrication of top mechanical seal, (down to one third of the standard oil level). The device shall not consume any additional electrical power. Mechanical seals shall be rated to preclude the incursion of water up to 42.6 PSI. (98.4 Ft.). Units shall have silicon carbide mechanical seal faces. Mechanical seal hardware shall be stainless steel. Units designed to exceed 42.6 PSI at shut off head shall incorporate seal pressure relief ports.

2.6 MOTOR

A. The pump motor(s) shall be 7.5 HP, 460 V., 60 Hz, 3 Phase and shall be NEMA MG-1, Design Type B equivalent. Motor(s) shall be rated at full load amps. Motor(s) shall have a 1.15 service factor and shall be rated for 20 starts per hour. Motor(s) shall be air filled, copper wound, class F insulated with built in thermal protection for each winding. Motor shaft shall be 420 or 403 stainless steel and shall be supported by two permanently lubricated, high temperature ball bearings, with a B-10 life rating at best efficiency point of 60,000 hours. On units up to 10 Hp. (7.5 kW), the bottom bearing shall be single row, double shielded, C3, deep groove type ball bearings. On units 15 Hp. (11 kW) and above, the bottom bearing shall be two row, double shielded, C3, deep groove type ball bearings. The top bearing on all units shall be single row, double shielded, C3, deep groove type ball bearings. Motor housing and bearing housing shall be gray cast iron, ASTM A48 CLASS 30. Motors shall be D.O.L. or Star-delta start (15 Hp. and above), and shall be suitable for across the line start or variable speed applications, utilizing a properly sized variable frequency drive.

2.7 POWER CABLE AND CABLE ENTRANCE

A. The pump power cable shall be suitable for submersible applications. Units up to 5 HP shall be supplied with a cable entrance that incorporates built in strain relief, a one piece, three way mechanical compression seal with a fatigue reducing cable boot. On units 7.5 HP and above, the cable entrance shall incorporate built in strain relief, and combination three way mechanical compression sealing with a fatigue reducing/thermal expansion rubber boot. The cable entrance assembly on all units shall contain an anti-wicking block to eliminate water incursion into the motor due to capillary wicking should the power cable be accidentally damaged.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify layout, type, and orientation of piping connections.

C. Verify that tank configuration will accommodate pump, piping, and accessories.

D. Include inlet pipe and filter as indicated on drawings

3.2 INSTALLATION

A. Install equipment according to manufacturer's instructions.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Manufacturer Services:

1. The manufacturer or their representative is to verify proper installation and positioning of the mixer upon start-up, and provide operators with training on how to operate and maintain the mixer(s).
2. Training for proper operation and maintenance of the equipment shall be scheduled for one (1) eight (8) hour day and shall be concurrent with trip to site required for start-up.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified, and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

END OF SECTION 46 51 16

SECTION 46 51 23 – FIXED HEADER COARSE-BUBBLE AERATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes all materials and equipment for the fixed header aeration systems in the aerobic digester tanks.

1.2 REFERENCE STANDARDS

A. American Society of Civil Engineers:

1. ASCE 2 - Measurement of Oxygen Transfer in Clean Water.

1.3 SUBMITTALS

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

B. Product Data: Submit manufacturer's information for system materials and component equipment.

C. Shop Drawings:

1. Indicate system materials and component equipment.
2. Indicate connections and other installation details.

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

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

I. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.4 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations and final orientation of equipment.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

B. Spare Parts:

1. Furnish one (1) set of spare parts as recommended by Manufacturer.
2. Furnish a complete list of spart parts as recommended by Manufacturer.

C. Tools: Furnish special tools and other devices required for Owner to service, maintain, adjust, and disassemble the diffusers.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three (3) years' documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging; include application instructions.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store diffusers according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 WARRANTY

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

B. Furnish one (1) year manufacturer's warranty for coarse bubble diffusers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Xylem Sanitaire – Brown Deer, Wisconsin.

B. Approved equal.

1. Experience in design, manufacture, supply, and commissioning of coarse bubble fixed header aeration equipment of the type specified is required for this project. Submit references for a minimum of five (5) installations of similar size and design as specified, having been in successful operation for a period of no less than five (5) years.

2.2 SYSTEM DESIGN AND PERFORMANCE

A. Tank Configuration:

1. Number of Tanks: 2
2. Shape: Semi Circular
3. Diameter: 80’
4. Wall Height: 20’
5. Side Water Depth: 18.5’

B. Diffuser Design Requirements:

1. Air Flow Rate (SCFM/tank): 1,650
2. Available Operating Pressure at Drop Leg (psig): 9.5
3. Diffuser Submergence (ft): 17.5

2.3 MATERIALS, FABRICATION AND FINISHING

A. Stainless Steel:

1. Fabricate all welded parts and assemblies from sheets and plates of 304L stainless steel with a 2D finish conforming to ASTM A240.

2. Fabricate non-welded parts and pieces from sheets, plates or bars of 304 stainless steel conforming to ASTM A240 or ASTM A276.

3. Provide drop legs, manifolds and headers of the diameter shown on the drawings with dimensional tolerances conforming to ASTM A554 and fabrication procedures in accordance to ASTM A774 & A778.

4. Furnish air distribution headers with the following minimum nominal wall thicknesses.

a. For gusset-reinforced diffuser connectors and header systems as specified in Section 2.4.E.

Header Diameter (Inches)	Wall Thickness (Inches)
4 Thru 18	0.109

b. For diffuser connectors and headers that are not gusset reinforced as specified in Section 2.4.E, the minimum allowable header wall thickness is 0.25 inches to minimize potential for connector failure.

5. Furnish diffuser connector from cast 316L Stainless Steel.

6. Furnish all flanges from stainless steel per paragraph 2.3.A.2.

7. Furnish all nuts, bolts and washers including anchor bolts in 18-8 series stainless steel.

8. Furnish 304L stainless steel diffusers conforming to the material as listed in paragraph 2.3.A. 1,2, and 3 with a cast 304L Schedule 80 threaded inlet nozzle.

9. Welds & Welding Procedure:

   a. Weld in the factory with ER 316L filler wire using MIG, TIG or plasma-arc welding inert gas processes. Provide a cross section equal to or greater than the parent metal.
   b. Provide full penetration butt welds to the interior surface with gas shielding to interior and exterior of joint.
   c. Provide smooth, even distribution interior weld beads with an interior projection not exceeding 1/16 inch beyond the I.D. of the air header or fittings.
   d. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.
   e. Field welding is generally NOT permitted unless pre-approved by Engineer.

10. Corrosion Protection and Finishing: Clean all welded stainless steel surfaces and welds after fabrication by using the following procedure:

    a. Pre-clean all outside weld areas to remove weld splatter with the use of stainless steel brushes and/or deburring and finish grinding wheels.
    b. Finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits, oxide film and contaminants to regenerate a uniform, corrosion resistant chromium oxide film.

       1) Completely immerse all stainless steel assemblies and components in an acid solution as described in Section 6.2.11 of ASTM A380. Use nitric-hydrofluoric acid solution as defined in Table A.2.1 of Annex A2 of ASTM A380.
       2) Provide a final thorough rinse using ordinary industrial or potable water and dry in conformance per Section 8.3 of ASTM A380.

    c. Corrosion protection techniques not utilizing full immersion methods are unacceptable and will be cause for rejection of the equipment.
    d. Engineer/Owner at their option may choose to observe the equipment cleaning procedure by notifying the Manufacturer of their intent to visit thirty (30) day prior to the date. Cost of the travel and expenses are by the Owner.

B. Neoprene:

1. furnish all gaskets of fiber reinforced neoprene – 45 to 50 durometer (Shore A).

2.4 FIXED AERATION HEADERS, MANIFOLD AND DROPLEGS

A. Provide a drop leg from the air main connection or air control valve to the aeration system as shown on the drawings.

1. Provide a Van Stone style flange design with a 150-pound drill pattern for the top connection.
2. Provide a band clamp coupling with gasket for the lower dropleg to header connection for ease of installation and alignment.

B. Fabricate manifold and air distribution headers in sections up to 41 feet in length.

1. Provide eccentric reducers for changes in diameter for constant invert elevation.
2. Provide 8-inch diameter and smaller headers with removable end caps and 10 inch diameter and larger headers with welded end caps.

C. Join sections of manifold or air distribution headers with flanged joints or expansion joints. Design individual header sections for rotation independent of adjacent sections for alignment purposes during installation.

1. Provide flanged joints consisting of face rings, rotating ring flanges, bolts and gaskets.
2. Provide expansion joints consisting of a welded flanged expansion barrel, “O” ring gasket, “O” ring locking flange and hardware to accommodate + 2 inch of movement.

D. Furnish expansion/contraction system for all headers designed for temperature range of 125 °F consisting of simple and fixed supports and expansion joints.

1. Lengths of header can extend up to 80 feet from restraining point without an expansion joint.
2. Limit maximum distance between restraining points on a continuous length of header to 120 feet maximum.
3. Provide an expansion joint on continuous lengths of header between two restraining points.
4. Provide simple supports to restrain header from buoyant uplift forces in compliance with Section 2.5.
5. Provide fixed supports in compliance with Section 2.5.

    a. Limit movement to prevent expansion joint blow apart and transmit expansion forces from the header to the fixed support stand.

        1) Provide a mechanical link to connect the header and fixed support stand.
        2) Reinforce the header at the attachment point of the mechanical link.

E. Duplex Diffuser Connectors:

1. Factory weld to the invert centerline of the air header.
2. Design diffuser connectors for two diffusers.

3. Furnish PVC plugs for all unused diffuser connectors.
4. Provide connectors of length appropriate to the header diameter and positioned so that air exiting the diffusers clears the header.
5. Design header and diffuser connectors as follows:

    a. Reinforce the connector header weld joint by providing gussets continuously welded between the vertical side wall of the header and the connector ends to limit long term flexure failure. Minimum gusset thickness is 0.125 inch.
    b. Weld connector to the header with a full penetration butt weld to minimize potential for crevice corrosion between header and connector. Use of fillet welds at the connection between the diffuser connector and header shall NOT be permitted.
    c. Resist a vertical dead load applied to the threaded end of the connector that results in a bending moment of 1000 inch-lbs without exceeding 24,000 psi design stress in any part of the header wall or connector.
    d. Header wall thickness for unreinforced connectors must comply with Section 2.3 A.4.b.

2.5 SUPPORTS AND ANCHOR BOLTS

A. Provide each section of air header with a minimum of two (2) supports with the maximum spacing between supports not to exceed 17.5 ft.

B. Limit header or manifold cantilever to no more than 4 ft.

C. Provide header supports with a vertically adjustable header hold down locking mechanism mounted on a stainless steel support structure.

2.6 AIR DIFFUSERS

A. Provide diffusers fabricated of stainless steel material. Refer to Section 2.3 Materials, Fabrication and Finishing.

B. Design diffuser for operating range of 8 to 40 SCFM.

C. Design diffusers with cast schedule 80 – 3/4-inch NPT threaded nozzle and acetyl orifice insert if required, an inverted air reservoir, air exit ports and a full-length deflector.

1. Design diffusers to provide full wide band aeration with a minimum air release perimeter of 48 inches per diffuser. Release air uniformly along a minimum two-foot band beyond each side of the header.
2. Locate exit ports discharging air into liquid on horizontal planes at two levels.

D. Diffuser Deflector:

1. Provide deflector below each diffuser for its full length and width.
2. Design deflector to direct the liquid being aerated along the diffuser reservoir walls so that the air exits through the ports and is sheared into small bubbles and distributed into the liquid.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

A. According to manufacturer instructions.

3.3 INSTALLATION/START UP SERVICES

A. Provide services of a factory representative for 1 day(s) to verify the proper installation of the equipment.

B. Provide services of a factory representative for 1 day(s) to instruct owner's personnel on operation and maintenance.

3.4 WARRANTY

A. Warrant all parts to be free from defects in materials and workmanship for a period of one (1) year after substantial completion or 18 months after delivery, whichever occurs first.

B. Furnish replacement parts to the Owner for any items found to be defective within the one-year warranty period.

3.5 SOURCE QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements for testing, inspections, and analysis.

B. Provide shop inspection and testing of completed assembly.

C. Certificate of Compliance:

1. Submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

3.6 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing:

1. Test for proper operation.
2. Energize system equipment and test operation under supervision of manufacturer's representative and in presence of Engineer.

C. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

D. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.7 DEMONSTRATION

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

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 46 51 23

SECTION 46 61 23 - DISC CLOTH TERTIARY FILTRATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Disc cloth filters

B. Related Requirements:

1. Section 26 29 23 - Variable-Frequency Motor Controllers: Drive unit for filter shaft.

1.2 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

1.3 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

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

1.4 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with Work of other Sections.

1.5 SCHEDULING

A. Section 01 31 00 – Project Management and Coordination: Requirements for scheduling.

1.6 SUBMITTALS

A. Manufacturer shall provide, at a minimum, the following information in accordance with Section 01 33 00 Submittals.

1. Product Data/Information
2. Calculations verifying the effective filtration surface area.

3. Hydraulic profile through the filter showing influent and effluent weir lengths, elevations, and nappe at design and peak flow.
4. Shop Drawings
5. Maintenance Instructions
6. Installation Instructions
7. Wiring Diagrams
8. Parts List
9. Qualification Data
10. Sample Warranty

B. Manufacturer shall provide Operations and Maintenance Data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

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

B. Spare Parts:

1. Two (2) frame and cloth assemblies

2. One (1) backwash/solids waste valve and actuator

3. One (1) Viton V-ring effluent port/centertube seal

C. Tools: Furnish special tools and other devices required for Owner to maintain equipment.

1.8 QUALITY ASSURANCE

A. The Contractor shall assign full responsibility for the functional operation of all components of the cloth media filtration and biological process to a Single Source Supplier. This Supplier shall be responsible for all engineering necessary in order to select, furnish, inspect the installing Contractor’s equipment installation and connections, calibrate, and place into operation the aforementioned systems along with all other equipment and accessories as specified herein.

B. The Manufacturer shall have experience in the design and manufacture of cloth media filters for a minimum of ten (10) years and shall be able to demonstrate a minimum of fifty (50) installations within the United States in municipal wastewater applications with cloth media.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store and protect materials according to manufacturer instructions.

1.10 WARRANTY

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

B. 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.

C. The Contractor shall furnish a warranty extending twelve (12) months after substantial completion date of the project in its entirety.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Aqua-Aerobic – Model ADFSC-54 x 10E-PC
2. Approved Alternate - Specifications and equipment arrangements for the Disc Cloth Filters are based on Aqua-Aerobic. Changes to the arrangement indicated in the specifications and in the plan set shall be at the expense of the installing contractor. No change orders will be issued to the contractor for modifications to the laying length, footprint, concrete layout, electrical, mechanical, etc.

2.2 SCHEDULE

A. DF-5110
B. DF-5210

2.3 GENERAL

A. Each filtration unit shall include:

1. Basin Mounting Brackets and Hardware
2. Sun Cover
3. Drive Assembly
4. Centertube Assembly with Cloth Media Disks
5. Backwash System
6. Backwash/Waste Pump Assembly
7. Valves
8. Influent Weir
9. Pressure Transducer Assembly
10. Float Switch
11. Vacuum Transmitter
12. Electrical Controls with Internal Components

B. Design Criteria

1. Flow: 2.0 MGD average design, 4.5 MGD peak design
2. Filter influent total suspended solids (TSS) concentration shall be 10 mg/l daily average and 15 mg/l maximum at average daily flow rate.
3. Filter effluent total suspended solids concentration shall not be greater than 5 mg/l based on a monthly average.
4. Filter influent total phosphorus (TP) concentration shall be 0.8 mg/l.
5. The filtration system shall be able to treat 100% of the maximum design flow to meet the above design conditions with one unit offline.
6. With the growing concern of microplastic pollution, manufacturer shall provide certified third-party testing or peer reviewed journal article demonstrating the ability of the filtration technology to remove greater than 90% of microplastics.

C. 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.

D. Filter Disk Basin

1. Each filter shall be installed in a concrete basin.
2. Each filter shall be provided with a 3" manually operated butterfly drain. Valve shall be provided with ductile iron body, aluminum bronze disk, stainless steel shaft and EPDM seat. Valve shall be Nibco or approved equal.

E. Basin Mounting Brackets and Hardware

1. Each 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 basin wall with 304 stainless steel wedge anchors and hardware.
2. Through the wall spool piping and all external filter piping shall be provided by the Installing Contractor.

F. Drive Assembly

1. Each filter 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 3/4 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.
2. To reduce energy demand, the drive assembly shall rotate the disks only during backwash. Systems requiring constantly rotating disks during filtration will not be acceptable. Belt drive systems or systems with multiple drive units per filter will not be acceptable.
3. If motors and gearboxes require routine maintenance, and are not accessible from the outside tank side walls, the equipment manufacturer shall provide an internal access platform between the tank side walls and motors and gearboxes.

G. Centertube Assembly

1. Each 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. Each centertube assembly shall also include a Viton

v-ring effluent port seal which provides superior chlorine resistance. Materials other than Viton are not acceptable for seal materials. Systems with swivel joints requiring routine lubrication are not acceptable. The driven sprocket shall be multi segment made of UHMW polyethylene. All fasteners shall be stainless steel.

H. Cloth Frame

1. Each cloth disk assembly shall be comprised of six (6) individual segments, each consisting of a cloth media sock supported by an injection molded glass filled polypropylene frame with corrosion resistant assembly hardware. The cloth / frame assembly must be installed in direct contact with the centertube without adaptors. Cloth/frame assemblies shall be constructed such that each segment is easily removable from the centertube, without special tools, to allow for removal and replacement of the cloth at the point of installation. Systems requiring special tools and/or the return of media segments to the factory for replacement will not be considered. Disks shall be spaced a minimum of 8 inches from center to center and have a minimum 5 inches of open space between adjacent disks.

I. Filter Media

1. Each cloth disk assembly shall have a minimum of 53.8 square feet of effective submerged filtration area. Each disk shall be divided into no more than six (6) segments and shall be easily removable for service.
2. If the wet weight of the filter disk segment is greater than 50 pounds, a lifting mechanism shall be provided.
3. Each basin shall include ten cloth disk assemblies.
4. Each filter unit shall have a total of: 538 square feet of minimum effective submerged filtration area.
5. Cloths shall be of microfiber pile construction having a nominal filtration rating of 5 microns. Granular media and screens having structured identical openings shall not be allowed. The pile cloth shall be free chlorine resistant cloth.
6. Cloth filter media must have obtained conditional acceptance under California Title 22 regulations. The approval letter associated with this acceptance must be included with submittals.
7. 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. Woven mesh or microscreen type media with no filtration depth are not acceptable.
8. Individual pile fibers shall be held in place by a support backing integral to the media. To facilitate proper flow of backwash water through the cloth, the medium's back side shall be of open construction consisting of 10% open area at least 50 times larger than the nominal filtration media in any direction. Media that uses sewn in support structures, which have the potential to prevent free flow through the media, shall not be allowed.
9. Cloth strength is critical to ensure long term performance of the media. Cloth media breaking strength and elongation shall be tested in accordance with ASTM Standard D5035 2R-E method by an ISO certified laboratory specializing in textile testing. Breaking strength shall be in excess of 200 lbf (890 N) in the warp and the weft direction. Elongation shall be less than 10% at 60 lbf (270 N) in the warp and the weft direction. Test reports shall be provided with submittals to demonstrate compliance with this requirement.

10. To avoid excessive media movement, deformation and folding during backwash, the maximum distance between cloth restraints must not exceed 36 inches.

J. Filter Hydraulics

1. During filtration, the filter unit 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 cloth frame to the inside. Systems with flow paths from the inside to the outside of the cloth frame that collect filtered solids and plastic debris on the interior surfaces of the cloth frame will not be acceptable.
2. Only media area below the effluent weir elevation will be considered in the filtration area calculation since this is the only area that is submerged and available for filtration 100% of the time.
3. Submittal information shall include calculations that verify the effective filtration surface area. Media surface fused directly to support structure such that water cannot pass through the media shall not be included in these calculations
4. 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.
5. Because of the frequency of the backwash and misting associated with spray systems, designs that utilize high pressure spray or a moving vacuum head as the sole means of solids removal will not be acceptable.

K. Backwash and Solids Removal System

1. 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 disk 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.
2. The backwash shoe shall be in direct contact with the cloth to ensure effective media cleaning. Systems utilizing media cleaning mechanisms that do not contact the filter media will not be acceptable.
3. 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.
4. The cloth media filter shall be fitted with backwash shoes with a grooved surface on the trailing side to leave a textured surface on the filter media providing additional area for surface filtration mechanisms.
5. The backwash system shall include 304 stainless steel backwash shoe supports with UHMW backwash shoes, 316 stainless steel springs reinforced PVC flexible hose with stainless steel hose clamps, 304 stainless steel backwash manifolds, and PVC sludge collection manifold.

L. Backwash/Waste Pump Assemblies

1. Each backwash/waste pump assembly shall include two backwash/waste pump(s), valves and gauges external to the basin. System utilizing internal backwash pumps shall not be permitted. In the external piping shall be backwash and solids waste valves, 3" recirculation ball valve(s), 3" manually operated flow control gate valve) for each pump, vacuum gauge(s), and pressure gauge(s).
2. The backwash/waste pump(s) shall be shipped loose for field installation by the installing contractor. Backwash piping between the filter basin and pump(s) as well as piping following the pump(s) shall be supplied by the installing contractor. Installing contractor shall supply unions or flanges for service, and interconnecting wiring.
3. The backwash/waste pump(s) 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 23.2 ft TDH with 12.2 ft allowable discharge head after losses in internal filter piping have been accounted for. Motor shall be Baldor, Teco, Weg or approved equal. Backwashing shall be initiated by tank 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. Backwash pumps using a belt drive shall not be acceptable due to routine tensioning and other maintenance requirements.
4. Each pump shall be provided with a painted 304 stainless steel support stand with wedge anchors.
5. Pump manually operated 3" 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.
6. The 3 inch threaded ball valves shall be a two-piece, full port, with a brass body. Valves and shall be Nibco or approved equal.
7. The vacuum gauge(s) 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.
8. The pressure gauge(s) 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.
9. Filtering shall not be interrupted during normal backwashing and solids waste discharge.

M. Valves

1. Each filter shall include five 2" backwash valve(s). Valve(s) 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.
2. Because of fouling that can be caused by stringy material, non full port valves such as butterfly valves or plastic valves shall not be acceptable.
3. Each filter shall include one 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.

4. Each filter 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. Filters that are designed without a solids waste removal system will not be acceptable.

N. Individual Filter Isolation

1. Each filter shall include isolation upstream provided by the installing contractor.

O. Pressure Transducer

1. A submersible pressure transducer shall be supplied for each filter basin. The pressure transducer shall have stainless steel wetted parts and provide a 4-20 mA signal over a range of 0 psi to 5 psi. Units shall monitor the water level in the filter basin. Pressure transducer shall be provided with a mounting bracket and stainless steel anchors. A bellows providing vented gage atmospheric reference shall be supplied for contractor installation in junction box. The installing contractor shall provide junction box, bellows mounting and interconnecting wiring. Transducers shall be Keller Levelgage series or approved equal.

P. Float Switch

1. 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 and a PVC #18 AWG three conductor cable. Switch rating shall be minimum 4.5 amps non-inductive at 120 VAC.

Q. Vacuum Transmitter

1. The vacuum transmitter shall have stainless steel wetted parts and provide a 4-20 mA signal over a compound range of -14.5 to 14.5 psi. Transmitter shall be an IFM Effector PA series or approved equal.

R. Control System

1. The automatic and manual controls for operation of the Aqua Disk® Filter system shall be furnished fully assembled, wired and pre-programmed in a UL 508A Certified Industrial Control Panel. Controls shall be provided to control or monitor equipment as described in the contract drawings. The control program shall be written in-house by the filter manufacturer. The control system shall include the following control components and practices:

S. 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 maximum.

2. All control panel single conductor wire shall be 16 AWG multi-strand machine tool wire (MTW) minimum, with PVC insulation.

3. Wire colors are as follows:

a.	208 VAC or higher	Black
b.	120 VAC control power	Red
c.	Neutral	White
d.	Ground	Green with Yellow Stripe
e.	Power from remote source	Orange
f.	Neutral from remote source	White with Orange Stripe
g.	24 VDC (+)	Blue
h.	24 VDC (-)	White with Blue Stripe
i.	Intrinsically Safe	Light Blue

4. All wires shall be clearly marked with an identification number consistent with the wiring schematic drawing. Wire markers shall be a thermal transfer printable type. The material shall be a self-laminating vinyl. Labels shall be Brady THT-9-427-10 or approved equal.

5. 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.

6. Control components mounted internal and external to the enclosure shall be mounted with stainless steel hardware and clearly labeled with a plastic identification nametag. The tag shall be white with black lettering.

T. Control Panel Quality Assurance

1. All Control panels shall be UL certified. Testing by manufacturer's electrical engineering prior to releasing for shipment shall be completed. Testing shall consist of the following:
2. Point to point testing of all wiring prior to application of power
3. Intended supply voltage shall be applied to the enclosure
4. All components shall be tested for proper operation and calibration
5. The PLC and operator interface program shall be loaded and functionally checked
6. All components shall be checked to confirm proper mounting specifications have been followed
7. Enclosure shall be inspected for defects and repaired if necessary
8. All labeling of wires and devices are correct, properly installed and clean
9. The manufacturer shall finalize the factory checkout by completing a control panel checklist to document all testing completed above.
10. 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.

U. Control Enclosure

1. The automatic controls shall be provided in a UL listed, NEMA Type 4X 304 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.

V. Enclosure Sun Shield

1. A 304 10 gauge stainless steel sun shield shall be included. A sunshield shall over hang the front of the panel a minimum of 10".
2. The control enclosure shall be mounted remotely.

W. 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.

X. 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.

Y. 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/HDL, JDL, LDL, MDL, PDL or approved equal.

Z. Motor Starter

1. A full voltage non-reversing Integrated Motor Starter-Controller shall be provided for motor applications up to 15 kW. Each starter shall provide control, protection and

monitoring functions for the motor. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a 42kA @ 480 VAC rated breaking capacity on short circuit. The starter shall have a mechanical durability of 15 million operations. The starter shall provide short circuit trip, thermal overload trip with selectable tripping class, under current trip and phase imbalance trip.

2. A full voltage non-reversing IEC Style motor starter shall be provided for motor applications over 15 kW. Each starter shall consist of a circuit breaker, contactor and overload relay. The starter shall be IEC rated and shall have certifications according to UL and CSA standards and shall bear the CE marking. The starter shall have a maximum rated operational voltage of 690V and provide a minimum 18 kA @ 480VAC and 25 kA @ 240 VAC interrupt rating on short circuit when used in combination with a PowerPact circuit breaker. The starter shall have a mechanical durability of 15 million operations. The solid state overload relay shall have class 10 tripping characteristics with trip current adjustment, phase loss and unbalance protection.

AA. 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.

BB. 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.

CC. 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.

DD. Fuse

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.

EE. 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 Square D 9001 or approved equal.

FF. 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 120VAC operating at 50/60 Hz. The unit shall provide surge capacity of 25,000 amps and provide transient protection in all modes (Line to neutral, line to ground and neutral to ground). The noise filter shall be a SolaHD STFV or approved equal.

GG. 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.

HH. 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.

II. Control Relay

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 be Allen Bradley 700-HK, Square D, or approved equal.

JJ. 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 Allen-Bradley 1492-J4 (35A max) and 1492-J16 (85A max) or approved equal.

KK. Programmable Logic Controller

1. Automatic operation of the Filter shall be controlled through a programmable logic controller (PLC) mounted inside the main control panel. The PLC components shall consist of a power supply, CPU, discrete input and output modules and analog input and output modules. The processor unit shall include built-in USB and two (2) Ethernet IP communication ports. All input and output points supplied (including unused) shall be wired to terminal blocks. Processor design characteristics shall include: 1.0MB user memory size, real-time clock and calendar, battery backed RAM and an operating temperature range between 32 °F and 140°F. The PLC processor shall be an Allen-Bradley CompactLogix 1769-L30ER or approved equal.

2. Modular equipment shall be provided to complete the PLC system. These Allen-Bradley components include: 1769-PA4 – Power Supply, 1769-IA16 – Discrete input (16 point) modules, 1769-OW16 – Discrete output (16 point) modules and 1769-IF8 – Analog input (8 point) modules, 1769-OF4CI – Analog output (4 point) modules.

LL. PLC Power Supply

1. Input voltage range of 85-265 / 170-265 VAC, 47-63 Hz, maximum inrush current of 30 amps, backplane output current of 4 amps @ 5V or 2 amps @ 24V, internal fuse protection, ambient operating temperature of 32°F to 140°F, Class I, Division 2 hazardous location certified, UL Listed.

MM. Discrete Input Module

1. Operating voltage of 79 to 132 VAC at 47 to 63 Hz, backplane current draw at 5VDC = 115mA , off-state current 2.5mA maximum, maximum inrush current 250mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

NN. Discrete Output Module

1. Operating voltage of 5 to 265 VAC at 47 to 63 Hz / 5 to 125 VDC, backplane current draw at 5 VDC = 205mA , at 24VDC = 180mA, off-state current leakage is 1.0mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

OO. Analog Input Module

1. Backplane current draw at 5 VDC = 120mA, at 24VDC = 70mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

PP. Analog Output Module

1. Backplane current draw at 5 VDC = 120mA, at 24VDC = 170mA, LED status indication of each point, ambient operating temperature of 32°F to 140°F, UL Listed.

QQ. Ethernet Switch

1. An unmanaged Ethernet switch shall be provided inside the control enclosure to provide connectivity between the PLC, operator interface and plant networking. The switch shall support both 10 and 100 Mbit/s operation. The switch shall have five (5) 10/100Base-T ports with RJ-45 sockets and shall support auto-crossing, auto-negotiation and auto-polarity. Maximum distance between devices shall be 100m.

2. The unit shall be DIN rail mounted and require 24VDC power. Diagnostic LEDs for power and connection status shall be included. The Ethernet switch shall be UL listed and manufactured by Allen-Bradley Stratix 2000 1783-US5T, or approved equal.

RR. Human Machine Interface Overview

1. The control system shall be equipped with a UL listed 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:
3. Backwash interval, Backwash duration, Solids Waste interval, Solids Waste duration, Number of Backwashes between Solids Waste interval.
4. 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:
5. Water level in the filter, Time since last Backwash, Time since last Solids Waste withdrawal, Elapsed time on the Drive Motor, Elapsed time on the Backwash/Waste Pump(s), Total Backwash time and cycles, Total Solids Waste withdrawal time and cycles.
6. The operator interface shall allow the Operator to:
7. Initiate Backwash
8. Control all electric actuated valves
9. 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.
10. The interface shall also display current alarms, including the date, time and a description of the alarm.
11. As a diagnostic aid to the Operator, the interface shall display the time between Backwashes for the most recent 40 Backwashes.

SS. Human Machine Interface

1. The operator interface shall be a NEMA Type 12, 13, 4X rated, 6.5” diagonal, color touchscreen display with Ethernet and serial communications. The interface shall be a liquid crystal display (LCD). The display type shall be color active matrix thin-film transistor (TFT) with 640 x 480 pixel resolution. The rated operating temperature shall be 32° to 131° F (0° to 55° C). The operator interface shall be an Allen Bradley PanelView Plus 7 Performance 7”.

TT. Human Machine Interface Sun Shield

1. 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 EXAMINATION

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

B. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

A. Install according to manufacturer instructions.

3.3 FIELD SERVICE

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. The equipment manufacturer shall furnish the services of a factory trained representative for a maximum of 3 trips and 11 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. The equipment manufacturer shall furnish the services of a factory trained representative for 1 trip and 3 eight hour days at the jobsite for performance testing.

C. 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.

D. The selected manufacturer shall have a free troubleshooting help line available 24 hours a day, 365 days per year for the life of the plant.

3.4 DEMONSTRATION

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

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 46 61 23

SECTION 46 66 16 – NON-CONTACT ULTRAVIOLET DISINFECTION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: a complete “In-Pipe” flange connected, low pressure high intensity (LPHO) Ultraviolet (UV) Non-Contact disinfection system to provide required disinfection of plant effluent waters prior to ultimate plant discharge.

B. The system shall be complete with power enclosures, power distribution and system controls shown on the contract drawings and specified herein.

C. Related Requirements:

1. Section 46 05 53 - Identification for Water and Wastewater Equipment: Nameplates for equipment specified in this Section.
2. Division 40 – Process Interconnections.

1.2 REFERENCE STANDARDS

A. American National Standards Institute:

1. ANSI C82.4 - American National Standard for Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type).

B. Federal Communications Commission (FCC):

1. 47 CFR 15 - Radio Frequency Devices.

C. National Electrical Manufacturers Association:

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

1.3 SUBMITTALS

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

B. The Manufacturer shall furnish electronic submittals consisting of the following information:

1. Detailed scope of supply
2. Mechanical/ assembly drawings.
3. Hydraulic calculations
4. Summary UV dose calculations based on Bioassay Validation Report.
5. Power/Control wiring single line diagrams.
6. Manufacturer's catalog information consisting of descriptive literature, specifications and materials of construction for all components

C. After successful startup, Manufacturer shall provide certification that the ultraviolet disinfection system is commissioned and is ready for service.

D. Manufacturer shall furnish the OWNER with hard copy and electronic copies of maintenance data on all machinery and equipment furnished for the system. The manuals shall include the following:

1. Equipment operating and maintenance instructions
2. Parts lists
3. Assembly and disassembly instructions
4. Equipment specifications and guaranteed performance data
5. Recommendations for preventive maintenance
6. Step-by-step operating and start-up procedures
7. Lists of spare parts, tools, and supplies
8. Wiring diagrams of all control circuits
9. Software programming as updated after final acceptance
10. Troubleshooting instructions

1.4 QUALITY ASSURANCE:

A. The equipment manufacturer shall be regularly involved in the manufacture and supply of low-pressure high output UV Disinfection systems for a minimum period of fifteen (15) years, and with a history of at least one hundred (100) successful Municipal Wastewater installations of non-contact UV systems.

B. The UV Manufacturer shall submit a Bioassay Validation Certificate confirming the Validation for the proposed reactor conducted and certified by an independent third party. The bioassay protocol, testing, QAQC, data analysis, and report shall be in accordance with the NWRI Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (May 2012). The bioassay shall have been conducted on an identical UV reactor to the proposed UV reactor, with identical UV lamps, reactor lamp symmetry, and configuration. The UV manufacturer shall demonstrate that the scale up factor from the UV reactor used for bioassay testing to the proposed reactor is less than the maximum allowable scaling ratio. The bioassay report testing shall clearly indicate the proposed reactor(s) ability to meet the specified dose with the number of total UV lamps.

C. The bioassay report shall include evaluations of the reactor performance over varying range of flow per AFP tube, the range of UVT % tested, and the MS-2 Reduction Equivalent Doses calculated per NWRI 2012. The bioassay validation testing must include comprehensively the range of flow, UVT %, and UV MS-2 RED specified for this project. Extrapolations of flow rates, UV Transmittance values, or UV doses outside the range actually tested shall not be permitted for design of the proposed UV system(s).

1.5 CLOSEOUT SUBMITTALS

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

B. Section 01 78 39 - Project Record Documents: Record actual locations, layout, and orientation of installed UV disinfection equipment and accessories.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

B. Manufacturer recommended spare parts:

1.	Spare Lamp Racks (populated with lamps and ballasts)	2
2.	Spare UV Lamps	24
3.	Spare Ballasts	12
4.	Operator's safety kit includes UV resistant Gloves, and Face Shields that block UV light wavelengths between 200 and 400 nm.	2
5.	AFP Tube Cleaning Kit- Teflon Brush and extension kit with adaptable poles.	2

C. Furnish a complete list of spare parts as recommended by Manufacturer.

D. Tools: Furnish special tools and other devices required for Owner to maintain equipment.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

E. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

F. PERFORMANCE WARRANTY

1. The manufacturer shall guarantee that the proposed UV disinfection system shall produce an effluent that meets or exceeds the requirements of this specification. The effluent quality exiting the UV system must be equal to or better than the specification requirements, as long as the wastewater flow and quality remains in the range(s) specified in the Design Criteria, and the UV reactors are operated in accordance with the UVSS O& M Manual.

G. EQUIPMENT WARRANTY:

1. The equipment furnished in the scope of supply (excluding lamps, ballasts) shall be warranted to be free of defects in material and workmanship, including damages that may be incurred during shipping for the lessor of a period of 12 months from substantial completion of the installed UV system or 18 months from receipt of all equipment supplied by the contractor and received in good condition by owner.

2. UV LAMPS: UV lamps shall be warranted for a minimum of 15,000 hours operating time under the conditions specified herein prorated after 12,000 hours. In the event of premature UV lamp failure, the UV system supplier shall offer the following:
3. Lamp failure before 12,000 hours – send a replacement lamp free of charge
4. Lamp failure after 12,000 hours – issue a credit proportional to the hours not used.
5. BALLASTS: Electronic ballasts are fully warranted for 3 years, extended to 5 years with first purchase of (1:1) replacement lamps from ENAQUA lamps within three years of installation.
6. AFP TUBES: AFP tubes shall be warranted for twenty years as long as the wastewater flow and quality remain in the range(s) specified in the Design Criteria, and the UV system is operated in accordance with the O&M manual

PART 2 - PRODUCTS

2.1 Manufacturers:

A. Enaqua - Vista, CA

B. Or Pre-Approved Equal
1. Specifications and equipment arrangements for the UV Disinfection System are based on Enaqua. Changes to the arrangement indicated in the specifications and in the plan set shall be at the expense of the installing contractor. No change orders will be issued to the contractor for modifications to the laying length, footprint, concrete layout, electrical mechanical, etc.

2.2 Design Criteria:

A. The UV equipment to be supplied and installed shall meet the performance requirement as stated below:

Peak Design Flow Rate (Peak Disinfection Flow Rate)	4.5/3,125	MGD/GPM
UV Transmittance	65.0	% UVT (Minimum)
Total Suspended Solids	< 5.0	mg/l (7-day average)
Total BOD	< 5.0	mg/l (7-day average)
Indicator Organism	E. coli	
Permit Criteria	126.0	CFU/100 mL, single sample maximum
Validated MS-2 RED	45.0	Minimum validated MS-2 UV RED of 45.0 mJ/cm^2. UV Dose per Independent Third-Party Bioassay conducted in accordance with NWRI 2012- after applying certified Lamp End of Lamp Life (EOLL) and Fouling Factors.
End of Lamp Life (EOLL) Factor	.87	Validated by independent third party
AFP Tube Sleeve Fouling (FF) Factor	.89	Validated by independent third party
Particle Size*	30.0	Microns

Total Iron*	0.3	mg/l
Effluent Turbidity*	5.0	NTU
Operating Pressure	< 20.0	PSIG
Equipment Redundancy	Two UV trains in parallel, each capable of disinfecting 100% of the peak flow rate.	

*Note: standard water quality parameters used.

B. UV Design Dose:

1. The UV disinfection system shall be designed to deliver a MS-2 Reduction Equivalent Dose of 45.0 mJ/cm^2 under flow and design conditions, after adjusting for lamp End of Lamp Life (EOLL) and Sleeve Fouling factor (FF). The RED must be verified by the third-party validation bioassay.
2. The UV dose shall be adjusted using an EOLL factor of 0.5 to compensate for lamp output reduction over the time corresponding to the manufacturer's lamp warranty. A higher EOLL factor shall be allowed only if manufacturer can provide third party verified Microbial testing (testing for EOLL using MS-2) data that has been collected and analyzed in accordance with protocols described in NWRI Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse.
3. The UV dose shall be adjusted using a FF of .5 for contact systems (using quartz sleeves) and non-contact systems. A higher FF shall be considered if manufacturer can provide third party certified report that supports a fouling factor greater than .5, up to a maximum of .9; use of fouling factor greater than .9 shall not be allowed.

C. Head Loss

1. Flange to Flange Head loss through the reactor shall be as follows:
   a. Head loss through UV reactor < 12.5" per reactor at 4.5 MGD.

D. Operating Conditions:

1. The system shall be designed for indoor or outdoor covered installation, with ambient temperatures ranging between 20°F to 110.0°F, with effluent temperatures ranging between 1° C to 30°C.

E. Components:

1. Reactor Model No: C8t.10082 (x2)
   a. Number of reactors: 2

2. Each reactor shall consist of the following:
   a. Number of Banks per Reactor 2
   b. Number of AFP Tubes per Bank 80
   c. Number of Lamp Racks per Bank 9
   d. Number of Lamps per Lamp Rack 12
   e. Number of Lamps per Bank 108
   f. Number of Lamps per Reactor 216
   g. Number of Ballasts per Reactor 215
   h. Total Number of lamps (system) 432

3. Reactor thermal control mechanism shall consist of the following:

a.	Air/Water Heat Exchangers	4 per UV bank
b.	Cooling pumps	2 per reactor (One duty, one stand-by)

4. The UV system shall include the following controls/monitoring:

a.	Radar Level Sensor	2 (1 per UV reactor)
b.	UV Intensity Monitor:	4 (1 per UV bank)
c.	ADR:	4 (1 per UV bank)
d.	EDC:	2 (1 per UV reactor)
e.	UV Control Panel:	1 common
f.	Power Disconnect Panels:	4 (1 per UV bank)
g.	Pump Disconnect Panels:	2 (1 per UV reactor)

5. Spare parts consisting of the following:

a.	Spare Lamp Racks (populated with lamps and ballasts)	2
b.	Spare UV Lamps	24
c.	Spare Ballasts	12
d.	Operator's safety kit includes UV resistant Gloves, and Face Shields that block UV light wavelengths between 200 and 400 nm.	2
e.	AFP Tube Cleaning Kit- Teflon Brush and extension kit with adaptable poles.	2

6. Effluent level control mechanism shall consisting of the following:

a.	Rectangular contracted/V-Notch Weir plate	2

2.3 DESIGN, CONSTRUCTION AND MATERIALS

A. General

1. All module welded metal components in contact with effluent shall be Type 304 stainless steel.
2. All non-wetted metal components shall be Type 304 stainless steel with the exception of the Lamp Rack Assembly, which shall be constructed of aluminum and be capable of sustaining intermittent pedestrian traffic on the lamp racks.
3. All wiring exposed to UV light within the UV reactor, or electrical ballast enclosure shall be Teflon™ coated.
4. All wires connecting the lamps to the ballasts shall be enclosed inside the frame of lamp rack and not exposed to the effluent.
5. The effluent water shall be conveyed through the UV reactor via AFP_{840}™ tubes – there shall be no contact with effluent and quartz sleeves at any time during normal operation.
6. All wetted components in the UV reactor shall be: AFP_{840}™, 304 SS, PVC, ABS or other non-reactive, non-corrosive material.
7. The UV system (ballasts, lamps, and controls) shall be capable of 24 on/off cycles per 24-hour day for the full specified warranty life of the lamps and ballasts.

B. Lamp Array Configuration:

1. The lamp array configuration shall be the uniform array with all lamps parallel to each other and to the flow.
2. The UV reactor shall be designed to avoid any immersion of UV lamps in the Effluent.

3. The UV lamps shall be arranged around the outside of the AFP_{840}™ tubes in such a way that each AFP_{840}™ tube shall have no less than 6 lamps irradiating it at all times.
4. Reflectors optimized to reflect UVC wavelength of 253.7 nm, and improve UVC energy density within the UV reactor shall be arranged in between the UV lamps in the lamp racks such that each AFP_{840}™ tube reactor has a minimum of six (6) UV lamps and four (4) reflectors surrounding it.

C. Inlet/Outlet Flow Distribution:

1. Each UV reactor shall have an inlet and outlet tank. Plant effluent piping shall connect to each of the tanks to convey effluent through the UV reactor.
2. Connection to inlet and outlet tanks of UV reactor:
3. Diameter: 16.00” Diameter (ASME/ANSI B16.5, CL 150 Flange)
4. Each UV reactor shall have a flow distribution sheet, so as to distribute wastewater efficiently through the AFP_{840}™ tubes.
5. The tanks and inlet flow distribution sheet shall be made of 304SS material. All material which comes in contact with the wastewater shall be non-corrosive.

D. Effluent Level Control Mechanism:

1. Each UV reactor shall have effluent level control mechanism (a rectangular contracted/V-Notch) installed in the effluent tank, provided by manufacturer. The weir geometry shall be designed such that the weir will flood varying # of AFP tubes based on flow thus achieving the required minimum submergence of the calculated # of AFP tubes and providing the minimum specified UV dose at varying flow conditions.
2. The effluent level control shall be a removable weir plate, and a weir frame installed in the effluent tank of the UV reactor. The weir plate and all mounting hardware shall be of 304 SS, to be supplied and installed by manufacturer.

E. AFP_{840}™ Tube Ultraviolet reactor:

1. Within the ultraviolet reactor, AFP_{840}™ UV transmitting tubes are arranged in a horizontal and vertical array. These AFP_{840}™ tubes are in a parallel mode and are attached at one end to the inlet flow distributor sheet and to the outlet flow distributor sheet with appropriate leak proof fittings. The AFP_{840}™ tubes shall be adequately supported.
2. In between and around the AFP_{840}™ tubes, lamp rack assemblies shall be placed in such a fashion so as to provide uniform and adequate ultraviolet light intensity. The lamp racks slide in and out between and around a row of AFP_{840}™ tube array.
3. Within the AFP_{840}™ UV reactor, all UV sensitive materials shall be protected from the UV light.
4. The flow path through the AFP_{840}™ tubes shall achieve optimized plug flow regime. The flow of wastewater should be in sufficient turbulent mode; therefore, the Reynold's number in each UV reactor would be greater than 50,000 at peak flow. A turbulent flow shall be in such a way that it scours the inner walls of the AFP_{840}™ tube to help prevent scaling or fouling.
5. The UV reactor shall be covered from five sides with either coated aluminum or stainless panels. The sixth side (top) shall have access door(s). The lamp racks shall be accessible through these doors.
6. The air temperature inside the AFP_{840}™ UV reactor shall be maintained between 90-120 deg. F by means of an air-air heat exchanger to minimize the potential for increase in the

temperature of the disinfected effluent. The control of the reactor temperature shall ensure optimum UV light emissions from the UV lamp.

7. A temperature sensor shall be installed within the UV reactor for protection against heat build-up under no or low flow conditions.

F. UV Reactor Thermal Control Mechanism:

1. Heat Exchangers
   a. Cooling within the UV reactor shall utilize a series of air to water heat exchangers. Cooling water shall consist of disinfected effluent obtained downstream of the UV reactor via a centrifugal pump (one duty, one standby).
   b. The UV equipment manufacturer shall supply the centrifugal cooling pumps and associated controls.
   c. Control between the cooling water pump shall be done via a flow-switch located on the downstream end of the reactor.

2. Cooling Pump
   a. The centrifugal cooling pump shall be AMT 1.5" centrifugal pump Model 282D-95, with a .75 HP rated for operation at 115 VAC 1P. The design point of the pump shall be 20 gpm at 60 feet TDH.

G. UV Lamps: The UV lamps shall have the following characteristics:

1. A low pressure, high output (LPHO) non-amalgam mercury vapor lamp of the hot cathode type.
2. The filament shall be of the clamped design, significantly rugged to withstand shock and vibration.
3. Each lamp will produce at least 90% emissions at the germicidal frequency of 253.7 (254nm) nanometers.
4. The power consumption shall be a maximum of 138 input watts per lamp, total including ballasts losses shall not exceed 145 watts including ballast losses.
5. The rated UV output at 253.7 nanometers (nm) shall be a nominal 57 UVC Watts at 100 hours of operation.
6. The lamp shall have a minimum UV intensity of >400 microwatts/cm2 at 1 meter.
7. Each lamp shall have a rated life of 12,000 hours.
8. Each lamp shall be single ended. Each lamp shall have a nominal arc length of 1400 millimeters.
9. Each lamp has a minimum length of 1554 mm.
10. Each lamp shall produce no measurable amount of ozone.
11. Each lamp envelope is made of fused quartz and is capable of transmitting at 90% of UV light at 253.7 nm.
12. Electrical connections shall be at one end of the lamp and have six (6) pins, dielectrically tested for 2,500 volts. Lamps that have 2-4 pins (instant start) may be considered. However, to be considered as an alternate, instant start lamp systems shall supply replacement spare lamps equal to 20% of the total number of lamps in the system.
13. Each UV lamp shall have a smart lamp Module (an integral unique lamp identification chip) embedded in the lamp pin connector that enables the lamp position in the UV reactor to be altered independent of a lamp holder. The smart lamp module shall be capable of measuring and storing at a minimum the following data for each UV lamp in a reactor:
    a. Part and Serial number (unique identification) of each individual UV lamp
    b. Total accrued run time hours

c. Lamp ON/OFF cycles

H. UV Lamp Racks

1. The UV lamp racks shall be placed between rows of the AFP_{840}™ tubes.
2. The lamp racks shall typically slide in and out within a track that shall be attached to the main frame of the UV reactor.
3. The use of cranes, hoists or other mechanical lifting devices shall not be required.
4. The lamp rack assemblies shall be made from aluminum.
5. Electrical mounting sockets shall be attached to one end of the lamp rack.
6. The other end of the rack shall have slotted holes to slide lamps in and out during installation and removal of lamps.
7. Reflectors optimized to reflect UVC wavelength of 253.7 nm, and improve UVC energy density within the UV reactor shall be arranged in between the UV lamps in the lamp racks such that each AFP_{840}™ tube reactor has a minimum of six (6) UV lamps and four (4) reflectors surrounding it.
8. Quick power disconnects allow quick disconnect of the lamp rack assembly to the main power at the UV reactor chassis.
9. Each lamp rack shall be equipped with its own on/off switch and fuse.
10. Each lamp rack shall be equipped with an LED indicator to identify the operating condition of each lamp on the lamp rack.
11. Lamp Racks shall be removable for service during UV operation without impacting Hydraulic flow and still maintaining plug flow regime in the reactor.
12. Each lamp shall be controlled by an individual ballast. Systems that have one ballast controlling multiple lamps shall not be considered.
13. There shall be no quartz sleeves, O rings, seals, glands or retainers required to be around the lamps when installed in the lamp racks.

I. Electronic Ballasts:

1. The ballast used to energize the UV lamps shall be high frequency electronic ballasts. The ballasts shall be housed in the lamp rack assembly as an integral part of the lamp rack.
2. The electronic ballasts shall be rated at 120-277 V +/- 10% without discernible change of characteristics.
3. The electronics ballast shall have the following features:
   a. Power factor greater than or equal to 0.95.
   b. Electrical conversion efficiency greater than or equal to 90%.
   c. Ballast shall have high frequency phase returns from the UV lamps.
   d. The ballast operating frequency shall be between 40 and 150 K Hz.
   e. The ballast shall have a thermal overload protector to protect against overheating when ballast skin temperature reaches 75 deg. C.

J. UV Intensity Monitors

1. The UV reactor shall have a minimum of one UV intensity sensor per bank which responds to the germicidal portion of light generated. The sensor shall not degrade after prolonged exposure to the UV light or effluent.
2. The sensor shall measure only the germicidal portion of the light emitted by the UV lamps as measured at 254 nm. It shall have sensitivity at 254 nm of greater than 95%. Sensors whose sensitivity to other wavelengths amounts to more than 5% of the total sensitivity shall not be allowed.

K. Radar Level Sensor

1. 1. The inlet tank of each UV reactor shall include a radar level sensor and transmitter provided by Manufacturer of the non-contact UV disinfection equipment, which will monitor the water level in the inlet box and transmit a signal to the EDC for activation and de-activation of UV lamps based on the level in the influent tanks.
2. The radar level sensor/transmitter shall conform to the following requirements:

a.	Range:	Rod & coaxial: 9.8’ (3m) Cable: 18’ (5.5m)
b.	Accuracy:	± 3mm
c.	Dead band:	Top: 4” (10cm) Bottom: 2” (5cm)
d.	Repeatability:	< 2mm
e.	Resolution:	< 2mm
f.	Configuration:	WebCal® PC Windows® USB 2.0
g.	Supply voltage:	10-30 VDC
h.	Max. consumption:	< 50mA @ 24 VDC
i.	Signal output:	4-20mA, 3-wire
j.	Signal fail-safe:	4mA, 20mA, 21mA, 22mA or hold last
k.	Dielectric:	> 1.8
l.	Process temp.:	F: -40º to 302º C: -40º to 150º
m.	Ambient temp.:	F: -40º to 185º C: -40º to 85º
n.	Pressure:	-14.5 to 250 PSI (-1 to 17 bar)
o.	Enclosure rating:	NEMA 4
p.	Encl. material:	Aluminum
q.	Feed through mat.:	316L SS & PEEK
r.	Conduit entrance:	(1) 1/2” NPT connector
s.	Probe material:	Rod: 316L SS Coaxial: 316L SS or galvanized Cable: 316 SS
t.	Process mount:	3/4” NPT (3/4” G)
u.	Classification:	General purpose
v.	Certification:	cCSAus, NRTL
w.	Compliance:	CE, CRN, RoHS

3. The radar level sensor/transmitters shall be Flowline EchoWave® LG10-11 Guided Wave Radar Level Transmitter or approved equal.
4. The radar level sensor/transmitter(s) shall be mounted atop the removeable lid of the inlet tank and extending to within one inch (1”) of the bottom of the inlet tank.

L. Electrical:

1. The UV reactor shall be powered from its own incoming power supply (to be supplied by others).
2. All cabling, conduit runs and wiring from the plant power supply to the UV reactor shall be as shown on the construction drawings.
3. The CONTRACTOR shall be responsible for bringing main and control power to the UV reactor through a Branch Circuit protections device (disconnect) as shown on the drawings.
4. Electrical power required shall consist of the following:

a. Main power to reactor banks(s): 480VAC, 3 phase, 4 Wire plus ground
b. Power to cooling pumps: 480VAC, 3 phase, 3 Wire plus ground
c. Control power to reactor(s): 120VAC, 1 phase, 2 wire plus ground
d. Power to UV Control Panel: 120VAC, 1 phase, 2 wire plus ground

M. Power Panels:

1. The power panel(s) for the UV banks shall consist of a UL 508-A NEMA 4X rated electrical enclosures. The power panels shall house the following:
   a. All contactors, disconnects, terminations and fuses required to power the appropriate bank.
   b. Electrical safety lock-out.

2.4 CONTROL

A. Analog Input Output Modules (AIO)

1. If required One (1) AIO module shall be supplied in the UV control panel. AIO module provides for Precision and Isolated Analog Input and Output. The analog signals are in the form of a 4-20mA current loop. The Inputs can be signals from Flow and/or Level Sensors.
2. Features of AIO modules:
   a. 2 RJ 45 Ethernet ports for network integration with EDC module
   b. Daisy Change up to 2 AIOs
   c. 2 Precision Analog Inputs – 4~20 mA, Isolated
   d. 1 Precision Analog Output – 4~20 mA, Isolated

B. Port Input Output Modules (PIO)

1. Two (2) PIO modules shall be supplied in the UV control panel. PIO modules provide for one Analog Input (4-20 mA) and Switch Inputs and Relay Outputs. Switch Inputs may be remote start signals from a PLC or HOA (Hand-Off-Auto) switch. Relay Outputs can be programmed to provide an Alarm signal, System Operating and/or Cooling Control.
2. Features of PIO modules:
   a. 2 RJ 45 Ethernet ports for network integration with EDC module
   b. Daisy Change up to 2 PIO's
   c. One Simple Analog Inputs – 4~20mA
   d. 4 Switch Inputs – Dry Contact
   e. 4 Relay Outputs – Switch 120VAC @ 6A
   f. 2 Temperature Probe Inputs

C. Electronic Data Center (EDC)

1. Each UV reactor shall be equipped with a supervisory microcontroller called Electronic Data Center (EDC). The EDC shall collect all the data from individual UV lamps, UV and other sensors in the system and shall display it at the HMI and remotely to the plant operation console. The Local display panel (HMI) shall show at a minimum the following data:
   a. On/Off status of lamps.
   b. Error Status of lamps and sensors.
   c. Lamp Hours

d. An advanced signal for lamp service or replacement.
e. UV intensity per UV Bank.
f. The type and location of the alarm.
g. The frequency of alarms shall be counted and stored.
h. Alarms and historical operating data shall be stored in a removable storage device in comma delineated format.

2. Communication between each bank of UV rector and the EDC's shall be via CAT5 or CAT 6 Ethernet cable.

D. UV Control Panel (HMI Panel)

1. The HMI for Enaqua's EDC's shall be installed and mounted in a UL 508-A NEMA 4X type 304 SS rated electrical enclosure to provide graphic interface for monitoring and control.
2. The HMI interface shall be 19" NEMA 4X Touchscreen Industrial Display (Hope Industries Model HIS-ML19 (Rev. G)) with VIA Technologies Windows 10 PC (AMOS-3005-1Q12A2), and shall display all system operational data, system operational history and shall allow access via remote internet connection for troubleshooting and system upgrades.
3. The UV Control System enclosure shall house the following:
   a. 19-inch color touchscreen display
   b. Windows 10 Industrial PC
   c. Ethernet Switch, 8 port 10/100BaseT(X) (RJ45 connector. Weidmuller Model IE-SW-BL08-8TX
   d. Electronic Data Center (EDC) EDC GEN 2- Part # 62.010037
   e. PIO (Enaqua Port I/O Modules). Part # 062.01003600
   f. AIO (Enaqua Analog IO Module)
   g. 24 V DC Power Supply. IDEC Slim Line Model PS5R-SB24
   h. 1000VA UPS. Phoenix Contact MODEL 2320270

E. ALARMING AND CONTROLS:

1. Minor alarms shall be communicated to the plant's SCADA system by the Enaqua EDC via either MODBUS TCP, or dry contacts to indicate to plant operators that maintenance attention is required. Minor alarms shall include:
   a. Low UV Intensity shall be pre-set at the factory for 70% of the intensity after 100 hours. Alarm set point shall be field adjustable.
   b. Single Lamp Out per UV Bank
   c. Lamp Life approaching EOLL

2. Major alarms shall be communicated to the plant's SCADA by the Enaqua EDC via either MODBUS TCP, or dry contact to indicate an extreme alarm condition in which the disinfection performance may be jeopardized. Major alarms shall include:
   a. Low UV Transmittance alarm, default at 65.5% UVT
   b. Low UV Intensity Alarm. This alarm shall be pre-set at the factory for 50% of the intensity after 100 hours burn-in of the lamps. The alarm set point shall be field adjustable. A low intensity alarm shall not cause any bank to turn off.
   c. Contiguous lamp failure alarm
   d. UV Bank Over Temperature Alarm.

F. Remote Monitoring and Control

1. The Run command for the UV reactor shall be via hard wired connections from the Plant SCADA PLC to Enaqua PIO (port input output) for each UV reactor in the UV control panel. The UV reactors can be turned ON or OFF by the Main Plant's PLC/SCADA system via an enable bit or by opening or closing dry contacts.
2. The UV reactor shall have the capability of providing basic remote monitoring/control via the plant's main console (or another designated computer). The plant shall provide either an Internet IP address specific to the UV system or allow access through its network and via a secure website.
3. Communications between the Enaqua EDC and the plant's SCADA system and integration of the UV system controls with the plant's SCADA system shall be provided by others. Connection/integration to the main console (or customer SCADA system) shall be MODBUS TCP protocol.
4. The following status IO's are provided both over network (MODBUS TCP) and as discrete outputs to Plant SCADA PLC, one per UV Bank, 12 total outputs.
   a. UV Bank (1.1, 1.2, 2.1, 2.2,) ON
   b. UV Bank (1.1, 1.2, 2.1, 2.2,)- Minor Alarm
   c. UV Bank (1.1, 1.2, 2.1, 2.2,)- Major Alarm
5. The following IO's are provided as discrete outputs to Plant SCADA PLC, one per UV Bank, 4 total outputs.
   a. UV Bank 1.1- Over Temp Alarm.
   b. UV Bank 1.2- Over Temp Alarm.
   c. UV Bank 2.1- Over Temp Alarm.
   d. UV Bank 2.2- Over Temp Alarm.

G. Control Philosophy for the UV System.

1. At any given time, one UV reactor shall be designated as LEAD and the other reactor shall be designated as LAG.
2. The inlet and discharge isolation valves for each UV reactor shall be maintained in the proper (OPEN/CLOSE) positions by the operators, and the HOA selector switches for the required UV reactor banks shall be placed in their respective positions. For UV reactor banks to be utilized the HOA selector switches shall be in AUTO position. For UV reactor banks in Stand-by the HOA selectors shall be in OFF position.
3. Level Pacing (UV Dose Pacing):
   a. The effluent weir plate shall control the level of water in the UV system based on flow. The Weir geometry shall be designed to ensure that the minimum # of AFP tube required to be flooded downstream of the UV reactor at varying rows to deliver the minimum MS-2 UV of 45.00 mJ/cm2 at the minimum UVT of 65.0% are flooded.
   b. This function is called controlled Level Pacing, wherein only the # of AFP tubes necessary to provide the minimum specified MS-2 RED based on flow and the specified minimum UVT% are flooded by the geometry and weir crest of the effluent weir. The associated UV lamps in each lamp rack of each UV bank, based on level of water in the influent tanks, are active, and the rest of the UV lamps are OFF. Level pacing of the UV lamps in the lamp racks of each UV bank is controlled by the EDC.
   c. Depending on the water level in the inlet tank, the turndown range (ratio of lamps in lamp rack to lamps used based on liquid level) shall be from as low as 33.3 % to 100.00 %. Determining water level shall be provided via an integral level sensor using a 4-20 mA signal terminated at the HMI panel.
4. The UV control system design shall allow operation of the UV system in either manual or automatic modes.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that facilities are ready to receive floating mechanical mixers.

3.2 INSTALLATION

A. Equipment shall be installed by CONTRACTOR in accordance with the manufacturer's recommendations, drawings and specifications to provide a complete installation.

B. Installation Responsibilities of the CONTRACTOR
1. Provide the Manufacturer with at least two (2) week notice prior to any changes in the installation date previously agreed upon by the OWNER and Manufacturer.
2. Sufficient space for moving into place and placement of all equipment supplied by Manufacturer.
3. Equipment anchoring and grouting including anchor bolts.
4. All required permits.
5. Structural work such as concrete pads, mezzanines for elevating equipment items, etc.
6. Interconnecting electrical outside of the UV Skid limits.
7. Connection and sealing of al flanges, fittings and connections to the adjacent plan processes.
8. All flanges, reducers, elbows, valves and other plumbing appurtenances not specified within these specifications shall be by the CONTRACTOR.
9. All electrical outside the skid limits including, transformers and disconnect switches. Equipment electrical supply shall be detailed on the shop drawings.
10. Protecting the UV reactor from damage between the time of delivery and installation.
11. Analytical testing.
12. Equipment unloading, moving and rigging into position.

C. Installation Responsibilities of Manufacturer
1. Equipment packaging for transportation from Manufacturer Factory to the job site.
2. All labor to complete the tasks listed as Manufacturer’s responsibility shall be performed as straight time rates by employees of Manufacturer is a non-union company, or our designated subcontractors.
3. Any deviations from this assumption shall require approval of a Change Order.

D. Startup Responsibilities of the CONTRACTOR
1. Provide the Manufacturer with a two (2) week notice prior to any changes in the start-up date previously agreed upon.
2. Availability of all required utilities.
3. Availability of typical feed water quality and quantity.

E. Joint Responsibility of Manufacturer and CONTRACTOR

1. Final assembly of and loading of the UV lamps supplied by Manufacturer.

F. Startup Responsibilities of Manufacturer

1. Startup Services:

a. The manufacturer's representative for the equipment specified herein shall be present at the jobsite for a minimum amount of workdays for services listed below. Excluded from these time requirements shall be travel time spent, time spent during shipping of equipment, time spent at the jobsite correcting any fabrication or manufacturing errors, and time spent preparing and operating the equipment to meet performance requirements including all performance testing. The Bid shall include all associated expenses incurred by the technical representative during the jobsite visits. The following services shall be provided in one trip:

b. One trip (two technicians), and three eight-hour workdays each included for IO Checkout, electrical testing, Start-up, performance testing, commissioning, and operator training.

3.3 ELECTRICAL CONNECTIONS AND CONTROLS

A. Wiring and conduits for electrical power, controls, and instrumentation shall be provided by the CONTRACTOR.

END OF SECTION 46 66 16

SECTION 46 73 22 – DECANTER ASSEMBLY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install two (2) decant lines for drawing off fluid from two (2) sludge digester tanks at any point between the maximum tank water level and the invert of the draw-off pipe as specified herein and shown in the Drawings

B. The decant line shall be provided complete with all accessories, anchor bolts and other appurtenances as specified and as may be required for a complete and operating installation

1.2 REFERENCES

A. American Gear Manufacturers Association (AGMA)

B. National Electrical Manufacturers Association (NEMA)

C. American Federation of Bearing Manufacturers Association (AFBMA)

D. American Society for Testing and Materials (ASTM)

E. American Welding Society (AWS)

F. Steel Structures Painting Council, American National Standards Institute (SSPC)

G. Underwriters Laboratory (UL)

1.3 SUBMITTALS

A. Shop Drawing Submittals shall be submitted in accordance with Section 01 33 00, and contain the following minimum content:

1. Shop Drawings and erection drawings showing details of construction, dimensions, anchor bolt locations, and field connections

2. Descriptive literature, bulletins, and catalogs of the equipment, including details of the hand winch and any lubrication points

3. Installation, operation, and maintenance procedures

4. Total weight of the equipment

1.4 OPERATION AND MAINTENANCE MANUALS

A. Submit operations and maintenance manuals for the equipment in compliance with Section 01 33 00. Manuals shall include:
   1. Contact name, address, and telephone number of the equipment manufacturer's Service Department and Parts Department
   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. Operation and maintenance information
   4. Complete maintenance parts list
   5. Complete connection, interconnecting and assembly diagrams
   6. Approved Shop Drawings

1.5 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 fluid decanting 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. The design is based on a model as produced by Vulcan Industries, Inc. of Missouri Valley, Iowa. Acceptable manufacturers include Jim Myers & Sons, Waste-Tech, Inc., and Online Engineering. Substitute, alternate, and "or-equal" manufacturers are not acceptable

1.6 DESIGN REQUIREMENTS

Number of Units:	Two (2)
Maximum Water Surface Elev:	528.16
Decanter Intake Elev:	528.25
Invert Elev. of Draw-off Pipe (Swivel Joint):	519.00
Decant Pipe Size:	6-inch

1.7 STORAGE AND HANDLING OF EQUIPMENT

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. 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.

PART 2 - PRODUCTS

2.1 GENERAL

A. The decant line furnished shall be capable of decanting fluid from a storage tank at any point between the maximum fluid level and the invert of the draw-off pipe. The decant line shall be installed as shown on the Contract Drawings

2.2 DECANT TUBE

A. The decant tube(s) shall be fabricated of a minimum 12-gauge, 304 stainless steel. The unit shall be of single swivel joint design and shall be of proper length as shown on the Contract Drawings

B. The decant tube shall have a flanged elbow that shall be bolted to the contractor supplied draw-off piping. Contractor shall coordinate actual laying lengths with installation of piping

C. A swivel joint shall be furnished to allow the decant tube to travel between the high water level and the invert of the draw-off pipe as shown on the Contract Drawings. Swivel joint shall have replaceable seal gaskets

D. The decant tube shall be weighted with a properly sized weld-on weight to prevent flotation of the pipe

2.3 WINCH

A. A 1000-pound capacity, 304 stainless steel spur gear hand operated ratchet winch shall be furnished for each decant assembly. Winches shall have a suitable length of 3/16-inch diameter stainless steel cable and a hook with safety latch to attach the cable to the decant tube

2.4 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 the hand winch. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly

2.5 PROTECTIVE COATINGS

A. Stainless steel and plastic components shall not be painted. The stainless steel structural components and enclosure panels shall be 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

PART 3 - EXECUTION

3.1 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 one (1) year from date of Substantial Completion on the project

3.2 START-UP

A. Manufacturer shall provide the services of manufacturer's technician to check out the equipment with ½ day and certify the installation before the start-up

END OF SECTION 46 73 22

SECTION 46 76 21 - BELT FILTER PRESSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Belt filter presses and accessories.

B. Related Requirements:

1. Division 26 – Electrical.
2. Division 43 – Process Gas and Liquid Handling

1.2 DEFINITIONS

A. HDPE: High-density polyethylene.

B. TSS: Total suspended solids.

C. UHMWPE: Ultra-high-molecular-weight polyethylene.

1.3 REFERENCE STANDARDS

A. American Bearing Manufacturers Association:

1. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. American Gear Manufacturers Association:

1. AGMA 2001 - Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.

C. ASTM International:

1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. National Electrical Manufacturers Association:

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

1.4 SUBMITTALS

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

B. Product Data: Submit manufacturer's information for system materials and component equipment, including electrical characteristics.

C. Shop Drawings:

1. Indicate system materials and component equipment.
2. Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.

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

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

I. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.5 CLOSEOUT SUBMITTALS

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

B. Project Record Documents: Record actual locations of installed belt filter press equipment.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

B. Spare Parts:

1. Furnish one set of belts.
2. Furnish one of each size and type of roller bearings.
3. Furnish two sets of doctor blades.
4. Furnish two complete sets of rubber seals for gravity and wedge zones.
5. Furnish two complete sets of belt wash box seals.

C. Tools: Furnish special wrenches and other devices required for Owner to maintain and calibrate equipment.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with a minimum three years of documented experience.

B. Installer: Company specializing in performing Work of this Section with a minimum three years of experience and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

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

B. Furnish five-year manufacturer's warranty for belt filter press equipment and accessories.

C. Furnish five-year manufacturer's warranty for roller bearings.

PART 2 - PRODUCTS

2.1 MANUFACTURES

1. Charter Machine Company.
2. Approved Equal

2.2 SCHEDULE

A. BFP 7150

2.3 DESIGN CRITERIA

Model No.	Belt Width Minimum	Width Overall	Length Overall	Height Overall
TP 22.44S	2.2m	10'- 6"	21'- 3"	8'- 3"

2.4 TOWER BELT FILTER PRESS MAIN FRAME

A. Main frame design is crucial as it is the support structure of the entire machine. The main frame shall be a box frame of welded and bolted MC channels conforming to ASTM Specification A36 and designed to accommodate all operating and static loads without significant deflection, deformation or vibration. Maximum operational loading shall be defined as the sum of the belt tension load based on a belt tension of 75 pli; friction loads; roller, equipment and sludge loads; any loads induced by the belts; and any loads induced by the torque of the drive. The pressure zone main beams shall have a moment of inertia of at least 60 inches to the fourth power. The frame safety factor shall be greater than 7.1.

B. Main frame coating is crucial to the protection of the press main frame. All frame members shall be prepared and coated according to ASTM A123, hot dip galvanized to a minimum 5 mil thickness. All frame members shall be drilled and machined, and all bolted connections shall be disassembled prior to galvanizing.

2.5 FLOCCULATOR

A. The belt filter press shall be furnished with an upstream sludge-conditioning device consisting of an inline adjustable orifice venturi type mixer complete with polymer injection device. The mixer shall be designed to condition the sludge with polymer to result in a degree of flocculation that will produce the greatest amount of dewatering while maintaining the highest quality filtrate.

B. Location of the flocculation device will vary with the application. Several locations may be specified with the unused locations plumbed with spool pieces.

2.6 GRAVITY DEWATERING ZONE

A. The gravity-dewatering zone shall consist of an extending horizontal belt with neoprene sealed sidewalls. Sludge shall be distributed on the horizontal belt through a stainless steel head-box. A series of eleven (11) rows of plows shall be arranged along the sludge path to achieve maximum drainage of free water from the sludge. The eighty-three (83) individual sludge plows shall be constructed of polyethylene. Belt press manufacturers' whose gravity deck height exceeds 72" (as measured from the base plane of the press frame to the top of the plow assembly), shall supply an elevated walkway with safety handrails and access stairs along three (3) sides of the press.

B. The complete sludge plow assembly can be raised away from the filter belt for cleaning purposes by operating a 4-way pneumatic hand valve. The free-floating, individual plows shall ride on the belt. Each individual plow shall be replaceable without disassembly and removal of the plow grid, and without the use of hand tools in under 2 seconds.

C. Sludge from the upper gravity area shall be distributed onto the lower horizontal belt by a baffled type 304 stainless steel chute.

D. Midway through the lower gravity area, an adjustable stainless steel sludge leveling bar shall evenly apply the sludge across the full belt width.

E. The gravity belts shall be supported by rollers and a grid of high-density polyethylene wear bars.

F. The minimum effective dewatering area of the upper and lower gravity dewatering zones shall be, 107.72 square feet as measured along a single belt.

2.7 WEDGE ZONE

A. The wedge zone shall be provided in order to gently apply and gradually increase the pressure on the thickened sludge. The wedge zone shall consist of a wedge-shaped roller and adjustable grid formation in which the two belts gradually converge to form the cloth/cake sandwich. Support for the filter belt shall be by rollers and a grid of high-density polyethylene wear bars. The minimum effective dewatering area of the wedge zone shall be, 67.53 square feet as measured along the lower belt.

2.8 HIGH PRESSURE/SHEAR ZONE

A. The high pressure/shear zone shall consist of a minimum of eight (8) rollers. The first shall be a 1/4" thick perforated drum of 26" diameter with a special design that allows for a minimum 89% open area. Any manufacturer with a dandy/perforated roller with less than 89% open area will not be considered acceptable. The succeeding rollers shall be solid faced decreasing in diameter from 20" to 14" to 11" and arranged in a vertical configuration with belt to roller contact exceeding 205 degrees. The total high pressure dewatering area shall be a minimum of; 135.9 square feet as measured along the length of a single belt in contact with the pressure rolls.

2.9 CAKE DISCHARGE ZONE

A. Adjustable pneumatically loaded doctor blades shall be mounted at the discharge rollers for removing sludge cake from both belts. The doctor blades shall be power retractable and can be held away from the filter belts for cleaning and maintenance. The amount of pressure the doctor blades exert equally against both belts can be varied while the machine is operating. The adjustment of the doctor blades can be regulated from a pneumatic control panel located on the press.

B. The doctor blades shall be made from UHMW polyethylene. The blades shall be rigidly reinforced to provide even gentle pressure on the belts with a minimal amount of abrasiveness and shall be capable of providing passage clearance for the belt seam without injuring the seam.

C. A 14-gauge type 304 stainless steel chute shall be provided for directing the sludge to the next destination.

2.10 ROLLERS

A. All rollers shall be designed for a maximum deflection of 0.05" at mid span under maximum loading conditions. Maximum loading shall be defined as the sum of the belt tension load at 50 pli; friction loads; equipment and sludge loads; any loads induced by the elasticity of the belts; and any loads induced by the torque of the drive. Minimum roll safety factor shall be 4.

B. The perforated drum shall be of through shaft design with internal bulkhead and matched deflection of shaft and end plates. All other rollers shall be of stub shaft design with each stub secured by an end plate and an internal bulkhead. Assembly of rollers, shafts, end plates, and bulkheads shall be of machined concentricity and by means of continuous weld.

C. Drive rollers shall be coated with a minimum 3/8" thick synthetic rubber of 60 durometer to provide the friction required for efficient belt drive and tracking. All other solid rollers shall be coated to the point of insertion of the bearing with Rilsan Nylon II to a thickness of 25 mil by the Electro Static, Fusion Bonded Rilsan Powder Dispersion Process.

D. The perforated drum shall be hot dip galvanized to a minimum thickness of 5 mil and shall be totally free of projections that may shorten belt life.

E. The pressure rollers shall be arranged vertically on alternating sides of the main pressure channel. The diameters of the rollers starting with the perforated roll shall decrease in size up through the vertical stack to the first of five 10 ¾" diameter rolls, with each roller separately pan drained to prevent rewetting of the sludge on the preceding rollers.

2.11 ROLLER BEARINGS AND SEALS

A. Roller bearings shall have an L-10 rating greater than 400,000 Hours per AFBMA test procedure under maximum loading conditions as the sum of the belt tension load at 50 pli and calculated at a belt speed of 5 meters per minute. All bearings shall be greasable with all grease fittings located for servicing from the machine exterior. All roller bearings shall be double row spherical roller type. All bearings shall have quadruple lip contact seals.

B. All bearing housings shall be class 30 cast iron one-piece pillow block type with bolted end cap as manufactured by Charter Machine Company. Bearing housings shall be coated by a two part epoxy base coat primer of four (4) mil dry film thickness and two (2) finish coats of two part epoxy at four (4) mil per coat dry film thickness.

C. All Tower Press roller bearings shall be guaranteed for five (5) years.

2.12 BELT TENSIONING

A. Belt tensioning shall be maintained hydraulically and controlled from the press mounted hydraulic control center.

B. Each filter belt shall be tensioned by a pair of noncorrosive cylinders attached to a rigid tensioning assembly. The tensioning assembly shall be attached to each tensioning cylinder in such a way as to assure parallel movement of the tensioning roller.

C. Each belt shall be tensioned individually, with capability of changes with the machine operating. Tensioning pressure shall be gauged at the control center. Tensioning cylinders shall be power retractable for belt replacement and emergency detensioning.

D. The tensioning arrangement shall accommodate a minimum of ±2% increase in belt length throughout the anticipated belt life.

2.13 BELT TRACKING

A. Belt tracking shall be totally hydraulic and shall function as a continuous automatic belt guidance system. Each belt shall be tracked individually by a type 304 stainless steel paddle arm and analog system sensor which monitors one edge of the belt and hydraulically signals a noncorrosive cylinder for corrective positioning when required. That corrective motion shall be smooth, minimal, and adjustable.

B. Each belt tracking assembly shall be center pivoting complete with bearings to minimize dewatering belt stretch and wear.

2.14 HYDRAULIC CONTROL SYSTEM

A. Each belt filter press system shall be provided with a dedicated hydraulic power system to provide pressurized oil for the steering, tensioning and doctor blades. The unit shall consist of a maximum ten-gallon reservoir; variable-displacement pressure compensated hydraulic oil pump and drive motor, hydraulic oil filter (reusable), pressure gauges, piping, valves and cylinders to make a complete operational system and shall be mounted directly to the belt press frame to minimize excess piping runs, fittings and hoses.

B. Hydraulic Lines:

1. All hydraulic lines shall be properly sized for the pressure and flow of the unit.
2. Pressurized hydraulic lines shall be 316ss tubing and shall be rigidly supported on the structural frame of the press.
3. Flexible lines to cylinders, low-pressure connections to the reservoir, etc. shall be hose of the material and construction appropriate to the application.

C. The 10 gallon hydraulic reservoir shall be made of 304 ss and have a visual inspection of the oil level.

D. The pump motor shall be a 1 hp and shall not exceed a noise level of 70 DbA. The motor shall be a cast iron TEFC 1,200 rpm, NEMA B design with a “C” face mounting for the hydraulic pump adapter. Maximum system pressure shall be set equal to the highest pressure required to obtain the desired operating belt tension. The maximum system operating pressure is 500 psi.

E. Hydraulic system controls shall be grouped for easy access and ease of operation. There shall be means provided to retract the belt tension cylinders for service. The valves, fittings, manifold

and associated parts shall be of non-corroding materials such as FRP, glass filled Nylon and stainless steel.

F. Pressure Gauges and Switches:

1. The oil pressure gauge(s), one for each pair of belt tension cylinders (upper & lower belt) shall indicate oil pressure in PSI and the belt tension in PLI.
2. Normal operating limits shall be indicated on the face of each gauge.
3. Low-pressure switches shall be provided to sense the absence of belt tension pressure.

G. Hydraulic cylinders shall have a non-corrosive body and 316 stainless hardware and cylinder rod. The cylinder rod shall be solid stainless with a hardened polished seal contact surface. Chrome or nickel plated rods are not acceptable.

2.15 BELT WASH STATIONS

A. Each filter belt shall be equipped with a belt wash station for constant belt washing. Each station shall include a manifold with removable stainless steel nozzles, internal hand wheel operated brush, hand wheel operated flush valve, and stainless steel neoprene skirted enclosure for containing spray mist. Belt spray water and flush water shall be collected in stainless steel pans and plumbed to the base sump to prevent rewetting of sludge process. Spray nozzles shall be suitable for use with non-potable plant effluent water.

B. A washwater booster pump shall be provided and neatly installed near the belt press. The pump shall be centrifugal type with replaceable wear rings and shall be plumbed into the belt wash system by the Contractor.

2.16 FILTER BELTS

A. Filter belts shall be of polyester monofilament wovenware with minimum tensile strength of 890 pounds per lineal inch. Edges shall be chamfered and belt seams shall be type 316 stainless steel clipper type. Mesh shall be selected for optimal pressure dewatering of the pertinent sludge. Belts shall be self-threading under power for replacement.

B. Replacement of filter belts shall be accomplished without any disassembly of any part of the belt filter press except the belt joints.

2.17 DRIVE MOTOR

A. The belt drive shall be variable speed, shaft mounted on one drive roller shaft. Drive shall transfer to the second drive roller by means of a gear combination. The gears shall be enclosed by a solid, stainless steel enclosure. The drive motor shall be severe duty TEFC of ample power for starting and operating under normal conditions without exceeding the nameplate horsepower and shall have a service factor of 1.15.

B. The drive shall be Variable Frequency Drive using AC motor and quadruple gear speed reducer. Speed control of the drive shall be in the belt press control panel. The inverter, start/stop and speed control of the drive shall be in the belt press control panel.

2.18 FACTORY WIRING

A. All equipment and components shall be factory wired using non-metallic, flexible liquid-tight conduit and fittings wired to numbered terminal blocks in a frame mounted NEMA 4X junction box. All conduit shall be run and secured inside the MC channel frame wherever possible.

2.19 SAFETY FEATURES

A. Each belt filter press shall be equipped with a lanyard type safety switch with cable encircling three sides of the press at an easily accessible height.

B. Each belt tensioning system shall have a limit switch that shall shut down the system in the event of total belt failure.

C. The belt tracking system shall have a limit switch on each side of the press that shall shut down the system in the event of belt tracking failure.

D. Each pneumatic control center shall have a pressure switch that shall shut down the system in the event of low air pressure.

E. Each gear drive shall have a solid stainless steel enclosure.

2.20 ELECTRICAL CONTROL PANEL

A. General Requirements: Each belt filter press shall be provided with a control panel that will contain the necessary control devices and equipment for controlling the dewatering process as described herein. The control panel shall meet the following general requirements:

1. The control panel shall accept a 460 volts, 60 hertz, 3-phase ac power input. A main disconnect circuit breaker and operator mechanism shall be included. When the disconnect is in the open position, all power shall be removed from the control system.

2. IEC rated motor starters shall be provided for the air compressor, belt wash water booster pump, cross conveyor, and the discharge conveyor.

3. Variable frequency drive (VFD) shall be provided for the belt drive and sludge feed pump.

4. Short circuit protection for each motor shall be accomplished utilizing fuses. Individual thermal overload protection shall be provided (except for the belt drive and sludge feed pump).

5. A control power transformer shall be included that will provide 120 volts, ac control power to the system.

6. An industrial programmable logic controller (PLC) located in the control panel shall perform all logic functions for the system.

7. A CONTROL POWER ON/OFF switch shall be located on the front of the control panel. When in the ON position, the CONTROL POWER ON pilot light will be illuminated and control power shall be distributed to the control system. When in the OFF position, the control system shall be held de-energized.

8. An EMERGENCY STOP pushbutton shall be located on the control panel. It shall be a mushroom head style pushbutton that when depressed shall immediately de-energize all moving equipment in the system.

9. An alarm horn shall be included with the control panel for audible alarm annunciation along with a horn silencing button in the front of the panel.

B. Control and Pilot Devices: As a minimum, the following control and pilot devices shall be located on the front of the control panel with nameplates as worded below in UPPERCASE LETTERS:

1. Pushbuttons:

   a. AUTO START
   b. AUTO STOP
   c. SYSTEM RESET
   d. ALARM SILENCE
   e. AIR COMPRESSOR START
   f. AIR COMPRESSOR STOP
   g. WASHWATER PUMP START
   h. WASHWATER PUMP STOP
   i. BELT DRIVE START
   j. BELT DRIVE STOP
   k. SLUDGE PUMP START
   l. SLUDGE PUMP STOP
   m. POLYMER SYSTEM START
   n. POLYMER SYSTEM STOP
   o. CROSS CONVEYOR START
   p. CROSS CONVEYOR STOP
   q. DISCHARGE CONVEYOR START
   r. DISCHARGE CONVEYOR STOP

2. Selector Switches:

   a. PRESS HAND/OFF/AUTO MODE
   b. CONTROL POWER ON/OFF

3. Indicator Lights:

   a. PREWET CYCLE ON
   b. POSTWASH CYCLE ON
   c. AIR COMPRESSOR RUNNING
   d. WASHWATER PUMP RUNNING
   e. BELT DRIVE RUNNING
   f. SLUDGE PUMP RUNNING
   g. POLYMER SYSTEM RUNNING

h. CROSS CONVEYOR RUNNING
i. DISCHARGE CONVEYOR RUNNING
j. LOW AIR PRESSURE
k. BELT OVERTRAVEL
l. BELT BROKEN
m. LOW POLYMER

4. Speed Potentiometers:

a. SLUDGE PUMP SPEED
b. BELT DRIVE SPEED

C. Signal Input and Output Devices:

1. Discrete Input Signals: The control panel shall receive the following discrete input signals from normally open dry contacts in external devices (contacts close when the equipment runs or a fault occurs):

a. POLYMER SYSTEM RUNNING
b. POLYMER SYSTEM FAIL

2. Discrete Output Signals: The control panel shall provide the following discrete signals for transmission using normally open dry contacts (contacts close when the equipment is called to run or a fault occurs):

a. PRESS RUNNING
b. PRESS FAULT

D. Sequence of Operation:

1. Automatic Mode of Operation:

a. The press may be operated in the automatic mode by placing the HAND/OFF/AUTO selector switch in the AUTO position. The operator will next press the AIR COMPRESSOR START pushbutton and allow the pressure to reach normal operating level.
b. After the air pressure has reached operating level, the operator will press the AUTO START pushbutton, this will energize the washwater pump and belt drive, illuminate the PREWET CYCLE ON pilot light and start the pre-wet time delay. After the pre-wet timer times out, the sludge pump, polymer system, cross conveyor and the discharge conveyor will be energized.
c. Pressing the AUTO STOP pushbutton will de-energize the sludge pump and polymer system, illuminate the WASHDOWN CYCLE ON pilot light and start a washdown time delay. After the washdown timer has timed out, the belt drive, washwater pump, cross conveyor and discharge conveyor will be de-energized.

2. Manual Mode of Operation

a. To operate the press in the manual mode, the operator will place the HAND/OFF/AUTO selector switch in the HAND position. The operator will next start the air compressor by pressing the AIR COMPRESSOR START pushbutton.

After the air pressure has reached operating level, start the washwater pump by pressing the WASHWATER PUMP START pushbutton.

b. The operator will not proceed until the belts are allowed to be fully tensioned. No interlock shall be provided to prevent the operator from starting the belt drive in the manual mode. Pressing the BELT DRIVE START pushbutton will energize the belt drive. At this time, the operator will start the cross conveyor by pressing the CROSS CONVEYOR START pushbutton, the discharge conveyor by pressing the DISCHARGE CONVEYOR START pushbutton, the sludge pump by pressing the SLUDGE PUMP START pushbutton and the polymer pump by pressing the POLYMER SYSTEM START pushbutton.

c. The system will be stopped by pressing the respective STOP pushbutton in the reverse order stated above.

E. Faults:

1. When any of the following fault conditions occur, in automatic or manual mode, the appropriate fault indicator will be illuminated, the alarm horn will sound and the belt filter press and associated equipment will be de-energized:

   a. LOW AIR PRESSURE (amber light)
   b. BELT OVERTRAVEL (amber light)
   c. BELT BROKEN (amber light)
   d. LOW POLYMER (amber light)
   e. BOOSTER PUMP FAULT (flashing run light)
   f. BELT DRIVE FAULT (flashing run light)
   g. SLUDGE PUMP FAULT (flashing run light)
   h. CROSS CONVEYOR FAULT (flashing run light)
   i. DISCHARGE CONVEYOR FAULT (flashing run light)

F. Components:

1. Enclosures: Control panel enclosures shall be free-standing, fabricated of type 304 stainless steel and shall be suitable for NEMA 4X service. Enclosures shall be manufactured by Saginaw Manufacturing.
2. Wiring: All power and control wiring shall be 600 volt, type SIS insulation stranded copper and shall be sized for the required load, 14 AWG minimum.
3. Circuit Breakers: Circuit breakers for the main disconnect shall be thermal magnetic molded case units. Circuit breakers shall be Square D, Class 650, Type FAL.
4. Motor Starters: Motor starters shall be full voltage, nonreversing, IEC style across-the-line units. Coils shall be 120 volts ac. Siemens type Sirius 3RT10.
5. Selector Switches: All selector switches shall be heavy duty, corrosion resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10-ampere continuous service. Selector switches shall be Idec Series TWTD.
6. Pushbuttons: All pushbuttons shall be heavy duty, corrosion resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10-ampere continuous service. Pushbuttons shall be Idec Series TWTD.
7. Pilot Lights: Pilot lights shall be heavy duty, corrosion resistant units rated for NEMA 4X service. Units shall be 120 VAC full voltage incandescent type. Pilot lights shall be Idec Series TWTD.
8. Terminal Blocks: Terminal blocks shall be high density, solderless box lug style, with 600-volt rating. Terminal blocks shall be Allen Bradley type 1492.

9. Control Relays: Control relays shall be general purpose type with a 10 amp contact rating, miniature square base and internal on status pilot light. Relays shall be Allen Bradley Type 700-HF Series.
10. Programmable Logic Controller (PLC): The PLC shall be a modular type with discrete and analog capabilities. The CPU shall have 6K minimum RAM for user instructions. The unit shall have battery backed RAM and EEPROM backup. The PLC shall be an Allen Bradley Micrologix Type.
11. Variable Frequency Drive (VFD): The VFD shall be UL listed and shall be manufactured by Omron.

2.21 UTILITY REQUIREMENTS

A. Electrical - 460 volt, 3 phase, 60 Hz

B. Power (HP)

1.	Belt Drive	- 5.0
2.	Hydraulic Motor	- 1.5
3.	Wash Water Booster Pump	- 7.5

C. Belt Wash Water

1.	Water @ 85 psi (min.)	- 55 gpm

2.22 SUMMARY OF CONSTRUCTION MATERIALS

A.	Main Frame	Box frame of welded and bolted MC channels conforming to ASTM A36, then hot dip galvanized according to ASTM A123.
B.	Flocculator	Type 304 stainless steel and UHMW polyethylene.
C.	Perforated Roller	Carbon steel, hot dip galvanized according to ASTM A123.
D.	Sludge Plows	Polyethylene
E.	Drive Rollers	Carbon steel coated with 3/8" thick synthetic rubber, 60 durometer.
F.	Tracking Rollers	Carbon steel coated with 3/8" thick synthetic rubber, 60 durometer.
G.	Other Rollers	Carbon steel coated with 25 mil Rilsan II Nylon.
H.	Bearings	Double row spherical roller type.
I.	Bearing Seals	Quadruple lip contact seals with gasketed cast iron end caps.
J.	Hydraulic Cylinders	200 psi rating, anodized aluminum tube with stainless steel tie rods, teflon seals, graphite bearing, lubrication not required.
K.	Belt Tracking	Fully hydraulic analog.
L.	Belt Tensioning	Fully hydraulic.

M.	Belt Wash Stations	Hand wheel operated internal brush type with stainless steel manifold, valve, nozzles, brush, aluminum handwheel and type 304 stainless steel enclosure with neoprene seals.
N.	Belts	Monofilament polyester weave selected for function and particular sludge. Seams are 316 stainless steel clipper type.
O.	Filtrate Pans	Type 304 stainless steel.
P.	Sludge Chutes	Type 304 stainless steel.
Q.	Cake Discharge Chute	Type 304 stainless steel.
R.	Water Plumbing	PVC, schedule 80.
S.	Hydraulic Plumbing	SS braided hydraulic tubing, 1,000 psi burst.
T.	Doctor Blades	UHMW polyethylene
U.	Junction Box	NEMA 4X type 304 stainless steel
V.	Pneumatics Station	NEMA 4X type 304 stainless steel
W.	Assembly Hardware	Type 304 stainless steel

2.23 ADDITIONAL ITEMS

A. Polymer System Skid System. The L-2 Polymer system shall be mounted on a carbon steel hot dip galvanized skid per the drawings. Charter Machine Company; Model L-2.20 Polymer System

1. Water Control

a. Make up water flow shall be variable and measurable by means of a control valve and a sight glass rotometer.
b. Make up water flow capacity shall be 2-20 gpm provided at 30 psi minimum.
c. The inlet stream shall have an electronic flow sensor with immersed in-line element capable of transmitting a signal for a low/no flow alarm. Element shall be removable without plumbing disassembly.
d. Unit shall have an electric solenoid valve for on/off control of dilution water flow.
e. The pressure of the incoming water stream and the outgoing polymer solution stream shall be monitored by a 2” stainless steel liquid filled gauge.

2. Polymer Make-up (Pump – 0.2-8.0 GPH)

a. A neat polymer metering pump shall be integrated in the system. The pump shall be a positive displacement progressive cavity type.
b. A 0.5 HP, TEFC 230/460VAC motor shall drive the pump. The motor shall be controlled by a VFD mounted on the unit.
c. A calibration column read in gpm and milliliters shall be supplied.

d. A sensor shall be placed in the neat polymer feed line to sense a "no-flow" condition.
e. A check valve shall be placed in the neat polymer feed line to isolate neat polymer from the dilution water.

3. Multi-zone Mixing Chamber (High Energy)

a. Polymer shall be injected in the water stream by the feed pump to a kinetic mixing chamber to create a thorough mixing energy. The design shall include a motor driven impeller to create a high impact energy and low fluid shear. Solution shall undergo a tapered mixing intensity slope as it passes through a second recovery zone. Polymer activation efficiency shall be consistent over the entire dilution water range.
b. A portion of the mixed polymer is then re-circulated through the mixing chamber ensuring optimum mixing has occurred.
c. A transparent section after the mixing chamber shall be provided to observe the solution consistency.

4. Multi-Zone Acrylic Polymer Blending Chamber (Low Energy)

a. The mixed polymer solution is then transferred to an exclusive acrylic blending chamber allowing the pre-mixed polymer solution to be gently mixed and provide additional retention time to achieve the highest performance.

5. Post Dilution System

a. Dilution water shall be split into two streams. Primary water flow shall supply the mixing chamber. Secondary water flow shall be used to post dilute the activated polymer stream. These two streams shall be completely blended by a static mixer prior to exiting the unit.

1) The post dilution water flow shall be variable and measurable by means of a control valve and a 2-20 gpm sight glass rotometer.
2) Unit shall have an electric solenoid valve for on/off control of post dilution water flow.

6. Assembly and Frame Work

a. All components and parts shall be of corrosion resistant construction.
b. All sheet metal work and frame assemblies shall be of type 304 stainless steel.

7. Controls

a. A local-off-remote switch for the mixing chamber shall be provided.
b. A hand-off-auto switch for the polymer injection pump shall be provided.
c. The system shall be provided with positive flow logic to signal an alarm in the event of low dilution water flow. This alarm will disable the polymer injection pump from operating when the injection pump is run in the automatic mode.
d. The polymer preparation system shall be capable of remote start/stop operation.
e. Speed control for the neat polymer make-up pump speed rate shall be provided.

f. All controls are to be mounted in a NEMA 4X FRP enclosure and wired directly to its components. A common power feed cord with a standard male plug for a 120V, 20-amp receptacle shall be furnished. (Receptacle by others)

B. Normal Set of Spare Parts:

1. one (1) complete set of dewatering belts,
2. one (1) complete set of doctor blades
3. one (1) complete set of containment seals.

2.24 Shafted Screw Conveyors:

Supply one Charter Machine Co shaftless carbon steel screw with 304 SS trough 20' Long, 10" internal diameter cake inclined screw conveyor with support structures per the drawings. Supply one Charter Machine Co horizontal reversing loading conveyor with shaftless carbon steel screw with 304 SS trough 25' Long, 10" internal diameter with ceiling hanger brackets. The conveyor shall have 2 electrically controlled slide gates.

A. Trough:

1. The trough shall be a formed flanged type, minimum 14 gauge thick 304 SS. Trough shall be manufactured in standard 10' lengths. Each trough shall have an end flange, which shall mate with the next trough to form a straight conveyor.

B. Screw:

1. The auger shall be a 10" diameter single piece shaftless design.

C. Hopper:

1. The inlet hopper will be fabricated of 14 gauge stainless steel. The unit will be flanged to mate with the inlet flange of the trough. The hopper will be designed with maximum slope and angle to help induce material flow.

D. Trough ends:

1. The trough ends will be ¼" thick 304 SS construction. The units will be designed to accept a 1 1/2" 4-bolt flanged bearing at both ends.

E. Covers:

1. Covers will be 14 GA. stainless steel.

F. Bolts:

1. All coupling bolts will be standard, grade 5 screw conveyor bolts. All assembly bolts will be stainless steel, except drive mount bolts.

G. Drive:

1. Drive will be a 3 HP motor and drive to run the unit at 25 RPM. The motor will be a washdown motor (or approved equal), 1750 RPM, 240/480 V. The motor will have a 1.15 SF, TEFC.

H. Supports:

1. The manufacturer will provide all necessary structural supports for the conveyor, with all necessary clearances. Supports will be designed to support the conveyor with minimal deflection. The support will provide clearance for the sludge hopper, as shown on the drawings. The support will act as a support only and not for access or maintenance.

2.25 Boerger Rotary Lobe Pumps

A. GENERAL

1. The equipment covered by these Specifications shall be of standard units of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed as shown on the Drawings.
2. All equipment shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating, without cavitation, and without excessive vibration or strain.
3. The pumping units required under this section shall be complete. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs and adjustment shall be provided.
4. Stainless steel nameplates giving the name of the MANUFACTURER, the pump serial number and material code and all other pertinent data shall be attached to each pump, motor, and control panel.
5. All working parts of the pumps and motors, such as bearings, wearing rings, shaft, sleeves, etc., shall be standard dimensions built to limit gauges or formed to templates, such that parts will be interchangeable between like units and such that the OWNER may, at any time in the future, obtain replacement and repair parts for those furnished in the original machines.
6. The nameplate ratings of the motors shall not be exceeded, nor shall the design service factor be reduced when the pump is operating at any point on its characteristic curve at maximum speed.
7. Mechanical equipment, including drives and electric motors shall be supplied and installed in accordance with applicable OSHA regulations. The noise level of motors, unless otherwise noted, shall not exceed 85 dBA measured 3 meters from the unit under free field conditions while operating on utility power.
8. All lubrication fitting shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards.
9. Warranty: Rotary Lobe Pumps supplied under this section shall be warranted to be free from defects in workmanship, design and materials for a period of two (2) years from shipment. If any part of the equipment should prove to be defective during the warranty period, the MANUFACTURER at no expense to the OWNER shall replace the part.

B. PUMPS

1. General

a. The Rotary Lobe Pumps shall be designed to be abrasion resistant for applications in wastewater treatment plants. The pump shall have a minimum displacement of 71 gal / 100 rev. (PL 300)
b. The ratio of the axial length of the lobe as compared to the lobe diameter (length/diameter) shall not exceed 1.0.
c. The pumps shall be of the positive displacement, rotary lobe type, designed to pump primary and secondary wastewater sludge as manufactured by Boerger.
d. All fluid-wetted parts including the mechanical seal shall be replaceable through the quick release front cover without disassembly of coupling, drive unit or the pipe system.
e. The pumps shall be designed to temporarily run dry and to operate in either direction. Oil-quench for protection of the mechanical seal is mandatory. Seal water flush systems are not acceptable.
f. The pumps shall be constructed with an oil-filled intermediate chamber between the pump casing and the gearbox with the following functions:

1) Oil-Quench (Lubrication and cooling) of the mechanical seals
2) Detection of seal failures
3) Buffer zone to the sealed timing gear

g. Oil drain of gearbox and intermediate chamber shall be easily accessible with side mounted drain screw. Oil drain under the pump is not acceptable.
h. The rotor/shaft connection shall be oil-lubricated fed by an intermediate chamber and shall not come in contact with the pumped fluid.

2. System and Fluid Conditions

Fluid Name	Sludge
Solids Content	-
Capacity	250 gpm
Discharge Pressure	20 psi
Suction Condition	Flooded
Temperature	Ambient
pH Value	Neutral
Specific Gravity	1.0
Duty	Continuous

3. Pump Unit

Model	PL300
Drive Type	Geared motor with flexible coupling
Drive Configuration	Inline
Motor Power	5 hp
Pump Speed	233 rpm
Suction Flange	6” ANSI 150-lb
Discharge Flange	6” ANSI 150-lb

4. Pump Construction

   a. The pump casing shall be manufactured in a single block construction (Cast iron ASTM A48 grade 40, Brinell hardness 264 Brinell). Multiple Piece Design Pump Casings held together by screw connections are not acceptable.
   b. The rear of the pump casing and the front cover shall be protected with replaceable wear plates with a hardness of 550 Brinell. The front cover protection plate shall be reversible. The pump casing shall be equipped with radial pump casing protection plates, which are less expensive and will eliminate the pump casing as a spare part for reduction of the Life Cycle Costs of the pump unit. Pump casings without radial liners are not acceptable.
   c. The quick release cover shall be held in place by four eye nuts. The stationary threaded studs shall keep the front cover on the same level as the pump casing in the process of opening the pump for easy handling.
   d. PL Series Rotors shall be tri-lobe screw rotor design and shall consist of a non-sludge-wetted cast iron core entirely coated with abrasion-resistant Buna-N. Stacking of lobes is not acceptable. Rotors shall be keyed to the shaft and secured with one central screw to a cylindrical thread inside the shaft. The cast iron core of the rotor shall be equipped with a female thread to enable the removal of the rotor from the shaft with ease. Rotor/shaft designs with a cover disc and/or spring washers are not acceptable.
   e. The shafts shall be non-sludge-wetted. The rotor/shaft connection shall be lubricated with quench fluid of the intermediate chamber. The shafts shall be timed in their rotation by straight cut timing gears running in a separate oil chamber, which also contains the ball and roller bearings for each shaft. Sludge wetted rotor/shaft connections are not acceptable. The shafts shall be constructed from AISI 4140 carbon steel.
   f. The pumps shall be fitted with maintenance free, quenched mechanical seals with duronit seal faces. The seals shall be operating in a common oil-filled intermediate chamber (Quench for lubrication and cooling). Purge systems for the seals are not acceptable. The rotating holding bush shall be locked in a fixed radial position by a keyway that also holds the rotor in place. Seal designs that open during rotor replacement are not acceptable. No sleeves shall be necessary for the mechanical seal set up. Design of the pump shall allow removal and replacement of the seal via the front cover.
   g. Bearings and timing gear shall be located in a common oil-filled cast iron gearbox, fitted with a built in sight glass to monitor oil level. The timing gear shall maintain non-contact between the rotors. Bearing life to be designed for L-10 bearing life rating of 100,000 hours at design conditions.
   h. Suction and discharge connections from galvanized steel shall be ANSI 150-lb flanges.
   i. Pump and drive fitted on common base, made from galvanized steel.

C. Spare Parts
   1. One (1) set of mechanical seals and o-rings for each pump model
   2. One (1) set of lobes and o-rings for each pump model
   3. One (1) set of axial protection plates for each pump model
   4. One (1) set of radial liners (if provided) for each pump model
   5. One (1) set of special tools for each pump model

D. Motors

1. Each unit shall consist of a pump with a gear reducer and 1800 rpm electric motor.
2. The motor shall be 3-phase, 60 Hz, 460 V with 1.15 SF and Class F Insulation.
3. All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA standards where applicable.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Verify that facility, piping, and electrical Work are ready to receive belt filter press.

3.2 INSTALLATION

A. According to manufacturer instructions.

B. Level unit to ensure that belts are level and true.

3.3 FIELD SERVICE

A. The manufacturer shall include the services of a factory trained field engineer for the purposes of installation inspection, equipment start-up, polymer selection, performance testing and training of plant personnel regarding proper operation and maintenance of the equipment.

3.4 CLEANING

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

B. Blow systems clear of moisture and foreign matter.

3.5 DEMONSTRATION

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

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

C. A manufacturer’s representative shall complete all of the above sessions in a total of two trips to the jobsite. Additional time for training can be negotiated between the owner a manufacturer’s representative.

END OF SECTION 46 76 21