

SECTION 11226

CLARIFIER EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

- A. The CONTRACTOR shall furnish, install and place in satisfactory operating condition the number of center feed, peripheral take-off circular clarifier mechanisms with scraper type collectors and launder covers in two (2) existing concrete secondary settling tanks as shown on the Drawings and described in the Specifications.
- B. The unit shall include all manufacturer's motors, starters/electrical work necessary for connecting conduit, wiring controls, control panels within requirements of Division 16.
- C. Coordinate all work with this equipment and any other associated equipment, installed and specified under other sections of these specifications.

1.02 RELATED SECTIONS

- A. Section 05500 – Metal Fabrications
- B. Section 05505 – Aluminum Railings and Grating
- C. Section 09900 – Painting: Exposed metals and equipment.
- D. Division 16 - Electrical work.

1.03 REFERENCES

- A. ASTM - American Society for Testing and Materials
- B. AWS – American Welding Society
- C. ANSI – American National Standards Institute
- D. AISC – American Institute for Steel Contractors.
- E. AGMA – American Gear Manufacturers Association.
- F. NEMA - National Electrical Manufacturers Association

G. AISI - American Iron and Steel Institute

1.04 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. No separate payment will be made. Include cost of this item in the Alternate section of the bid.

1.05 SYSTEM DESCRIPTION

- A. Contractor shall purchase and install two (2) 30 foot diameter steel Circular Collectors. It is the Contractor's obligation to properly erect and install the clarifier, baffle walls, equipment, weirs and piping etc. with all associated accessory items necessary for proper installation and operation of the equipment.

B. Sludge Collector Mechanism

1. Bridge supported, side feed type with peripheral overflow. Existing bridges, access, and handrail are to be reused. Refer to Section 00300 for information regarding the existing equipment. New piping into the clarifier mixer sized for operation of a single clarifier will be provided and installed. Grating is to be replaced. Provide a 4" high aluminum toe plate along both sides of bridge and bridge extension with expansion joint.
2. Provide a center drive mechanism that supports and rotates a torque tube to which two (2) structural steel type scraper arms are attached.
3. The existing structural steel bridge shall span the tank diameter and shall support the entire collector mechanism.
4. 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.

- C. Weir plates, scum baffles, current velocity baffles and effluent launder covers shall be fiberglass reinforced plastic (FRP), furnished with FRP washers or cover plate which will prevent short circuiting through the adjustment slot, and stainless steel fasteners.

- D. Scum trough, scum collector arms, hangers and supports shall all be fabricated from steel.

- E. Fasteners and anchor bolts for steel parts that can be coated shall be zinc coated steel and non-coated parts shall be stainless steel, minimum 316.

1.06 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.

- B. Product Data: Provide physical dimensions and locations.
- C. Shop Drawings: Indicate equipment location, rough-in and anchor placement dimensions and tolerances, clearances required and elevation.
- D. The manufacturer shall provide a copy of the written clarifier drive warranty with shop drawing submittals and shall include a copy in the installation-operation-maintenance manuals. Indicate installation procedures and interface required with adjacent work.
- E. Maintenance and Operating Instructions
 - 1. Three (3) copies of each Manufacturer's maintenance and operating instructions manual shall be provided with the equipment at the time of delivery.

1.07 QUALITY ASSURANCE

- A. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single manufacturer.
- B. No equipment shall be supplied by a manufacturer not regularly engaged in the manufacturing and production of peripheral feed center take-off clarifier equipment designed for use in wastewater treatment. The manufacturer must have installed and had in satisfactory use for a period of not less than ten (10) years a minimum of thirty (30) installations of similar size (30 ft and larger) and type comparable to the units specified.
- C. The clarifier equipment shall be warranted from defects for a period five (5) years from date of substantial completion and shall include the following items:
 - 1. Motor
 - 2. Primary Gear Reducer
 - 3. Secondary Gear Reducer
 - 4. Electromechanical Overload Devices
 - 5. Torque Tube and Scraper Arms
 - 6. Shear Pin Hub
 - 7. Influent Feedwell
 - 8. Control Panel
 - 9. Discharge weir trough
 - 10. Scum assembly

The manufacturer shall repair or replace, but not be required to install, the items noted above that are found to be defective within the warranty period.

- D. The Contract Documents represent the minimum acceptable standards for the clarifier equipment for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the drawings and specifications. Equipment which is a "standard product" with the manufacturer shall be modified, redesigned from the standard mode, and shall be furnished with special features, accessories, materials of construction or finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the specification.

PART 2 PRODUCTS

2.01 CIRCULAR COLLECTOR

A. Manufacturers:

1. Evoqua Water Technologies
2. Walker Process Equipment
3. Amwell, Inc.
4. Envirodyne Systems
5. Or Engineer-approved equal.

- B. The steel circular collector shall be 30 foot diameter by sixteen (16) foot side water depth. It shall include the center torque tube, electrical drive system, scraper arm and scraper, scum arm and box, toe plate for existing handrail and associated piping and fittings as required. Any additional piping and fittings necessary for proper installation shall also be furnished and installed.

C. Equipment Requirements:

<u>Description</u>	<u>Secondary Clarifier</u>
Quantity	2
Diameter	30'
Bottom Slope	1" in 12"
Sidewater depth	15' 10"
Normal running torque, ft.-lbs.	1000
Stall torque, ft.-lbs.	2000
Inf. Pipe to Unit	12" Side feed
Drive Support	Bridge
Influent well diameter (min)	6'-4 3/16"
Influent well depth, below water	4'

level (min)	
Ave. & Max. Flow/Unit*	0.40, 0.80 mgd* & 1.0, 1.4 mgd*
Tip Speed	5 – 7 fpm
*Includes return sludge	

2.02 MATERIALS

A. Structural Steel:

1. Shall conform to the requirements of "Standard Specifications for Structural Steel," ASTM A-36.
2. Except where specifically indicated otherwise, all plates and structural members designated for submerged service shall have a minimum thickness of 1/4 inch.
3. All welding to conform to American Welding Society Standard AWS D1.1. Structural support members shall be shop welded for bolted field assembly. A minimal amount of field welding shall be required
4. Design components so that stresses developed do not exceed allowable stresses, as defined by current AISC standards when designed for the AGMA rated torque.
5. Panel lengths and member sizes shall be selected such that slenderness ratios do not exceed 200 for compression and 240 for tension. For strength, the controlling member force shall be used to determine member size.
6. Maximum deflection in a span under combined live and dead loads shall not exceed L/360.

B. Grating:

1. Serrated aluminum, conforming to Section 05530, with not less than 1 1/2 inch by three-sixteenths inch bars on one inch centers.

C. Anchor Bolts:

1. Anchor bolts, nuts, washers shall be 316 stainless steel, furnished by equipment manufacturer.

D. Steel and steel fasteners shall be in accordance with Section 05500, hot galvanized after fabrication.

E. FRP shall be approximately 30% fiberglass, 70% polyester resin and have all surfaces smooth, resin rich, free of voids and porosity, without dry spots, crazes, or unreinforced areas.

F. Minimum properties required for FRP are:

		<u>Test Method</u>
Tensile Strength	14,000 psi	ASTM D-638
Flexural Strength	25,000 psi	ASTM D-790
Average Coefficient of thermal expansion – inch per inch, per degree F.	900,000 psi	ASTM D-790
Water Absorption, % 24 hours	0.20	ASTM D-570

2.03 EQUIPMENT

A. Drive Mechanism

1. General

- a. Drive mechanism shall be completely factory assembled consisting of primary helical gear and a final worm gear reduction unit.
- 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. All components of the drive mechanism shall be designed in accordance with AGMA Standard 6034-B92 (February 1992) Practice for Enclosed Cylindrical Worm Gear Speed Reducers and Gearmotors, for 24-hour continuous, uniform load duty, 20-year life at the specified output speed. The AGMA rated torque of the drive shall be the rating of the worm gear set.
- d. The drive AGMA rated torque shall be as specified above with a minimum 1.25 service factor.
- e. All bearings shall be designed for a minimum B-10 life of 200,000 hours.

2. Primary Reduction Unit

- a. Provide commercially available heavy duty 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 240/480 volt, 3 phase, 60-Hertz current.
- e. Primary reduction unit shall drive the final reduction unit 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. Final Reduction Unit

- a. Provide final reduction, cut-tooth casting, worm gear mounted on an anti-friction ball bearing assembly. Bearing balls shall be of the finest quality, high carbon, alloy steel, running on hardened steel

ances.

- b. The bearings shall be mounted in a high strength cast iron housing.
- c. A steel torque tube shall be bolted to the gear that supports the scraper mechanism.
- d. The final reduction gear and the anti-friction ball bearings shall run in an oil bath within the final gear reduction housing. A ready accessible oil filling and level pipe with sight gauge shall be furnished.
- e. Mount an electro-mechanical overload device on the thrust end of the worm shaft consisting of plate spring assembly, plunger, indicator dial two (2) microswitches (one N.O. and one N.C.) and a terminal block, all enclosed in a weather tight, gray cast iron housing. The end thrust of the worm shaft against the plate spring shall actuate the plunger, which in turn shall move the indicator dial. Amperage metering devices will not be considered equal to the overload device specified.
- f. Microswitches 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.
- g. Provide a shear pin device, set for 130% of the AGMA torque mounted on the drive end of the worm shaft.

B. Torque Tube and Scraper Arms

- 1. The steel torque tube shall be bolted to the final reduction gear and shall support two (2) structural steel rake arms.
- 2. Each circular sedimentation tank mechanism arm shall be equipped with two (2) rigidly braced, three dimensional, fabricated structural steel ASTM A36 steel scraper arms suspended from the torque tube with a series of blades on each side of the arms. Contractor shall confirm the slope of the tank floor, which original design called out as 1:12, the height from the center of each tank to the existing bridge and the exact location of the sludge hopper. Scrapers shall be spaced to rapidly move settled sludge from the outer areas of the tank bottom to a sludge hopper located near the center of the basin. The collecting arms shall be attached to and rotated by the torque tube. The scraper arm assembly shall be able to be adjusted vertically and horizontally using threaded rods with turnbuckles attached to the torque tube. Segmented steel flights for blades shall be furnished with adjustable brass or stainless steel squeegee blades to allow for sufficient movement of sludge to the center collection pit.
- 3. Fabricate the collecting arms of structural steel with a minimum thickness of 1/4" and adequately brace with struts.
- 4. Space blades so that the entire tank bottom is scraped twice for each revolution of the mechanism.
- 5. Provide adjustable spring brass squeegees, for the blades, that project

1-1/2" below the bottom of the blade.

6. Collector Mechanism – As an option to providing a spiral collector, a sludge collector mechanism with a minimum of two rigidly braced, three dimensional, fabricated structural ASTM A36 steel arms suspended from the torque tube with segmented scraper arms as shown on the Drawings shall be acceptable. The scraper arm assembly shall be able to be adjusted vertically and horizontally using threaded rods with turnbuckles attached to the torque tube. Segmented steel flights for blades shall be furnished with adjustable brass or stainless steel squeegee blades to allow for sufficient movement of sludge to the center collection pit.

C. Influent Feedwell

1. The influent well shall be fabricated from 3/16" steel plate.
2. Ports shall be cut into the influent well to permit entrapped scum to escape.
3. Ports shall be baffled to prevent short circuiting to the weirs.
4. Provide a flanged pipe fitting for connection to the influent pipe furnished by the General Contractor.
5. Support the influent well on two (2) structural steel beams spanning the tank which shall hold the well in alignment in both a horizontal and vertical plane. The beams shall be anchored to the tank walls.

D. Surface Skimmer

1. Provide One (1) full-radius skimmer consisting of scum blade, hinged wiper assembly, scum trough, scum trough and counter weight arm.
2. Support the scum blade and counter weight arm from the torque tube.
3. Mount the hinged wiper assembly on the outer end of the scum blade to form a pocket for trapping scum. Provide structural steel counterweight arm, 180 degrees apart from skimmer, for proper equipment balance.
4. The wiper assembly shall maintain continual contact and proper alignment between scum blade, inner scum baffle and scum trough.
5. 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.
6. The scum shall be trapped as the wiper blade meets the skimmer blade ramp and is raised up the beach to be dumped into the scum trough.
7. All springs, pivot points and threaded fasteners shall be constructed of 316 stainless steel.
8. Skimmers which rely on support from the scum baffle will not be acceptable.
9. The scum trough and beach shall be fabricated of 1/4" thick steel

- plate, supported from the tank wall.
10. Scum trough shall be 4'-0" wide with an overall length of 4'-9" along the scum baffle consisting of beach plate, inner radius baffle, hopper and 6" discharge pipe stub.
 11. Beach plate to slope at a nominal incline of 1-3/4" per foot to a point 5" below the maximum water elevation.

E. Effluent Weirs and Scum Baffles

1. Fabricate weirs from FRP per specifications and as noted on drawings.
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" carbon steel.

F. Anchor Bolts

1. All equipment anchor bolts shall be type 316 stainless steel and provided by the clarifier equipment manufacturer.
2. Anchors shall be set by the General Contractor in accordance with the Manufacturer's instructions.

G. Launder Covers

1. The effluent launders shall be covered by hinged FRP covers that can be lifted from the outside edge to observe the launder at all points around the launder. The covers shall prevent passage of light when closed.
2. Materials, equipment and components in this section shall be the products of NEFCO, Incorporated, 4362 Northlake Boulevard, Palm Beach Gardens, FL 33420-0493 or equal.
3. Design: The Launder Cover shall consist of a system of molded fiberglass panels that are attached together to form a continuous cover over the launder trough, weir and scum baffle within the treatment tank. The Cover shall be designed and manufactured to inhibit incident sunlight from striking the surfaces of the launder and weir. Each Cover section shall be molded of UV-protected fiberglass and shall be opaque to sunlight. Individual sections shall be a minimum of four feet in length and curved to follow the curvature of the tank. The Cover shall extend over the trough and weir as far as possible and may extend to a point immediately inside the scum baffle so long as the Cover does not interfere with the sweep arm. The Cover shall be designed such that adjacent panels fit together properly and the completed Cover, when installed, forms a rigid structure and has a well-engineered and professional appearance.
4. The Cover shall be designed to open away from the operator and toward the center of the tank. Each Cover segment shall consist of two

sections, a fixed Mounting Section and a hinged Cover Section connected by a continuous stainless steel hinge. The Mounting Section shall provide a rigid mount for the Cover and is fastened to the weir wall with stainless steel brackets as shown in the contract drawings. The Mounting Section extends inward to a point just inboard the scum baffle. The hinged Cover Section extends outward toward the tank wall and swings open to allow inspection and maintenance of the launder and weir. In the closed position, the Cover Section rests on an FRP support flange attached to the inner wall of the tank.

5. Provision shall be made to lock the Cover in the closed position for safety and security. This shall be accomplished by means of an easily operated latch mechanism that secures the hinged Cover Section to the support flange. Handles or lift rings may also be required for some panels. A means of limiting the travel of the hinged Cover section, in the form of a restraint corrosion resistant cable or tether, may also be provided to protect against damage.
6. The hinged Cover sections shall also be designed such that alternating sections have integral tabs at each side which rest on the adjacent section, insuring that the seams between panels are covered and enabling the alternate panels to open independent of every other panel.
7. Provision shall be made to support the Cover in such a manner that the panels are held securely in place, with the panels hinged to provide access to the launder and weir for inspection and maintenance. Neither the Cover nor the means used to support it shall interfere with effluent flow over the weir or within the trough. Cover supports shall not impede personnel from entering and traversing the launder.
8. Where the circumference of the trough is interrupted by a bridge-support or another obstacle, a fixed panel(s) shall be installed over the trough beneath the support such that the surface of the Cover is continuous around the entire tank. Alternatively, vertical panels may be installed on both sides of the bridge supports to block out sunlight.
9. The Cover system shall be designed to withstand common wind and snow loads but shall not be intended as a "walk-on" Cover designed to support the weight of plant personnel. Adequate stiffeners shall be integral to each panel, but panels reinforced with balsa or foam cores are not acceptable.
10. Materials:
 - a. Each Cover panel shall be molded of fiberglass, reinforced plastics. The resins and fiberglass reinforcing materials shall be consistent with the environmental conditions and structural requirements of the application.
 - b. Fasteners, handles, hinge and latches shall be stainless steel. The weir wall mounting brackets shall be Stainless Steel, FRP or a combination of the two.

- c. The latch/handle shall be a spring-loaded mechanism with a positive detent positioned to indicate the closed/locked position of the handle. The latch is activated by pressing down on the spring-loaded handle and turning it. A corrosion resistant operating rod shall be provided to easily operate the latch/handle and shall be designed for convenient use given the elevations provided in the drawings.
- d. The tether or restraint cable shall consist of a length of stainless steel cable secured to the tank wall and the hinged Cover Section by means of stainless steel eyebolts. The length of the cable is selected to limit the travel of the Cover.

11. Installation:

- a. The Cover sections shall be mounted to the weir wall on stainless steel or FRP brackets. The free end of each Cover panel shall be supported at the outer tank wall by an FRP support flange that attaches to the entire periphery of the tank.
- b. The installation contractor shall install the Cover in accordance with the contract drawings, manufacturing drawings and manufacturer's recommendations. Field cutting of panels shall be allowed to complete the structure and accommodate in-tank obstructions. All cut ends shall be dressed as per the manufacturer's recommendations.
- c. All of the fasteners and brackets required for the installation shall be Stainless Steel and shall be supplied by the Cover manufacturer. The support flange and weir wall brackets are installed using 3/8" x 3-3/4" expansion anchors with flat washers, lock washers and hex nuts.

H. FRP Current Density Baffle

- 1. Materials, equipment and components in this section shall be the products of NEFCO, Incorporated, 4362 Northlake Boulevard, Palm Beach Gardens, FL 33420-0493 or equal.
- 2. The Stamford Density Current Baffle shall consist of a series of baffle panels that are attached to the wall of the clarifier to form an inclined, shelf-like surface around the entire inner periphery of the tank. Each panel shall be molded of corrosion-resistant, UV-treated fiberglass. The panel shall be a maximum of 8 feet in length and shall be curved to follow the curvature of the clarifier tank. The width, inclination angle and mounting location of the baffle shall be determined based upon the clarifier configuration in order to provide optimum baffle performance. The panels shall be designed such that adjacent panels fit together without overlapping or cutting, and the completed baffle when installed, has a well-engineered and professional appearance.

3. The inclination angle of the baffle shall be 30 degrees as measured from the horizontal and the horizontal projection of the baffle shall be defined by the following equation:

$$\text{Horizontal Projection (in)} = 24 \text{ in} + 0.4 \text{ in/ft} \times (\text{tank dia. (ft)} - 30)$$

4. Provision shall be made to attach the panels to the clarifier wall and support them at the proper angle using a triangular panel bracket. The panel and bracket shall be molded as an integral part of each panel, forming a baffle module, or separate panels and brackets may be supplied. If the panel and bracket are molded as an integral unit with adequate stiffeners, only one bracket is required per panel. A specially formed "free-end" bracket shall be provided to support the free end of the last panel where the run of panels is interrupted by an obstruction. Panels may be cut as required to fit around obstructions.
5. In tanks with inboard launders, the baffle shall be designed to fasten to the trough face at the lower inboard corner of the trough. In this case the baffle bracket will extend beneath the trough and fasten to the underside of the trough. The width of the Horizontal Projection of the baffle shall include the width of the launder trough, but the length of the density current baffle attached to the launder shall not be less than 24 inches.
6. If separate panels and brackets are supplied, the panels shall be molded of fiberglass and shall meet the specifications of this section. The brackets shall be fabricated of 3" x 3" x 1/4" stainless steel angle and shall be triangular in shape, with the corners welded. Brackets shall be installed at a maximum spacing of four (4) feet. The panels shall be fastened to the brackets with stainless steel nuts, bolts and lock washers every 8 inches.
7. A method of interconnecting adjacent panels shall be provided such that the entire assembly forms a rigid structure capable of supporting its own weight plus snow and wind loads in the event the tank is out of service. The baffle shall also be designed to withstand a buoyant force load equal to the weight of the water displaced from the volume beneath the baffle. The angled working surface of each baffle shall be sufficient in pitch and width to divert the flow and to create a self-cleaning action of the baffle itself. Provision shall also be made to vent gases which may form beneath the baffle through 3" diameter half-round openings molded into the panel at its highest point.
8. Materials:
 - a. Each baffle panel shall be molded of fiberglass-reinforced plastic. The resins and fiberglass reinforcing material shall be consistent with the environmental conditions and structural requirements.
 - b. The resin shall be an isophthalic polyester resin with corrosion-resistant properties, Corezyn COR75-AQ-010 or equivalent, suitable for use in submerged waste treatment applications. The

resin shall not contain fillers except as required for viscosity control. For viscosity control, a thixotropic agent up to 5% by weight may be added to the resin. The resin shall be treated to provide UV suppression.

- c. Glass reinforcement shall consist of chemically bonded surfacing mat and chopped strand roving. Surfacing mat shall be Type C veil. The glass reinforcement shall be 357-211 PLN CTC chopped strand roving or equivalent. The glass content of the finished laminate shall not be less than 30% by weight. The nominal thickness of each baffle panel shall be 1/4" \pm 1/16 inch thick with resin rich surfaces and edges to prevent migration of moisture and fiber "blooming." The baffle shall be black in color.
 - d. The upper surface of each panel shall be mold smooth and no glass fibers shall be exposed. Laminations shall be dense and free of voids, dry spots, cracks or crazes. The upper surface of the baffle shall be reinforced with one layer of surfacing veil followed by 2 ounces or more of chopped strand roving. In addition, the vertical mounting flange (return flange on launder mount applications) shall be reinforced with one layer of 24 oz woven roving.
 - e. No other glass product is permitted between these layers. All factory-trimmed edges shall be "hot coated" with resin to prevent wicking.
9. Installation
- a. The installation contractor shall field verify existing dimensions and install the baffle in accordance with the contract drawings, approved shop drawings and manufacturer's recommendations. Mounting holes shall be factory drilled. Field cutting of baffle panels will be allowed to complete the structure and accommodate in-tank obstructions. All field cut or drilled edges shall be coated per the manufacturer's recommendations to prevent fiber blooming or fraying. All of the fasteners required for installation shall be supplied by the baffle manufacturer. The baffle panels shall be attached to the wall using 3/8" x 3-3/4" concrete expansion anchors with oversized 1/8" x 2-1/4" stainless steel washers, and hex nuts. Adjacent baffle panels are fastened together using 1/4" bolts, 2 flat washers, lock washer, and hex nut. All of the installation fasteners shall be stainless steel.
 - b. The density current baffle shall extend completely around the tank and shall be level, rigid and free of sway that could work anchors loose or cause undue wear.

2.04 FABRICATION

- A. Fabricate FRP weir plates as shown on the Drawings.
- B. FRP color shall be uniform throughout the material and shall match all FRP

parts in the clarifier. The exception to this requirement is the color of the launder cover, which shall be reviewed and approved by the owner.

- C. FRP weir plates shall be not less than one-quarter inch thick, molded in matched dies with notches formed and all edges sealed in the mold.
- D. Where FRP weir plates are machined or cut, seal the edges with a polyester gel-cote resin supplied by the plate manufacturer.
- E. FRP baffle sections shall be a minimum 3/16" thick and be installed as indicated on the drawings.
- F. Drill weir plates with 2-5/8" diameter holes at 2'0" maximum spacing to provide a minimum vertical or horizontal adjustment of two inches.
- G. Fabricate weir troughs, effluent boxes, scum baffles, velocity baffles, and hangers and supports as shown on the drawings.
- H. The radii of fabrication bends on items to be galvanized shall be not less than six times the material thickness.

2.05 ELECTRICAL

A. General

- 1. Unless noted otherwise, all motor starters, fusible safety switches, relays, selector switches, pushbuttons, indicating lights and all other pilot devices necessary to form a complete operating electrical system for each mechanical item will be supplied, mounted and wired in Division 16, Electrical Work, as indicated on the Drawings. All electrical equipment supplied in this Item shall conform to Electrical, Division 16.
- 2. All electrical equipment, conduit and wiring not indicated on the Drawings, but necessary to provide a complete operating system shall be provided at no additional cost to the Owner.

2.06 ELECTRICAL CONTROLS

- A. All controls necessary for the fully automatic operation of the clarifier shall be provided.
- B. The local-mounted main control panel shall include the following items for each clarifier:
 - 1. Fusible disconnect switch with door handle
 - 2. Control transformer

3. NEMA size 0 starter
4. Door-mounted elapsed time meter (measuring in tenths of an hour)
5. Hand-Off selector switch
6. Full-voltage LED pilot lights (Power ON and RUN)
7. Clarifier torque overload alarm [red lens] pilot light
8. E-stop pushbutton
9. Re-set pushbutton
10. 600 VAC terminal block
11. Phenolic nameplates, black letters, white background
12. NEMA 4X stainless steel enclosure
13. Interface (via dry contact) for common alarm signal to annunciator panel in WWTP Operations Building.

C. All conduit and wiring between the panel and motors and between the panel and utility power shall be furnished by the contractor installing the equipment.

D. Motors

1. Motors shall be polyphase electric, and be wound for 480 volts, 3 phase, 60 Hertz.
2. Furnish each motor in accordance with NEMA and IEEE standards, suitable for severe duty applications with all of the following requirements:
 - a. Totally enclosed with epoxy enamel finish coat.
 - b. All cast iron structural parts.
 - c. Epoxy coated air gap surfaces of rotor and stator.
 - d. Non-hygroscopic Class F insulation.
 - e. 1.15 service factor.
3. All continuous rated polyphase electric motors shall be of the "energy efficient type". Efficiency and losses shall be determined in accordance with the latest IEEE Standard 112 and NEMA Motor Generator Standards MG1-12.53a and MG1-12.53b.
4. Supply single phase electric motors with NEMA Standard frame dimensions, rated for continuous operation.

E. Electric Wiring:

1. The external conduit and wiring required for power and control to electrical equipment supplied in Division 16.
2. No conduit runs shall impede steps or walkway.

2.07 SOURCE QUALITY CONTROL

A. All structural steel components shall be fabricated in the United States and shall conform to the requirements of the "Specification for the Design,

Fabrication and Erection of Structural Steel for Buildings" published by the American Institute of Steel Construction. Except where specifically indicated otherwise, all plates and structural members shall have a minimum thickness of 1/4-inch.

- B. The equipment manufacturer's shop welds and welding procedures shall be in accordance with the requirements of the latest edition of ANSI/AWS D1.1 "Structural Welding Code - Steel" published by the American Welding Society.

2.08 FINISHES

- A. All fabricated carbon steel or cast iron components for submerged service shall be primed meeting Section 09900. Complete field finishing of all materials under Section 09900 as required excluding galvanized, aluminum, bronze, plastic or other items which do not require field finishing. Contractor shall be responsible for touch up prior to equipment acceptance.
- B. All fabricated carbon steel or cast iron components for non-submerged service shall be hot dipped galvanized. Contractor shall be responsible for touch up prior to equipment acceptance.
- C. Electric motors, speed reducers, and other self-contained or enclosed components shall be supplied with the manufacturer's standard finish coating. Contractor shall be responsible for touch up of surfaces prior to equipment acceptance.
- D. Apply rust preventative compound to all machined, polished, and nonferrous surfaces which are not to be painted or galvanized.
- E. Compatibility: Contractor responsible for compatibility of shop coatings with field finishes. Contractor to provide written specifications on field finishes to equipment manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.
- B. Delivery and Storage:
 - 1. Upon delivery of the equipment to the jobsite, the Contractor shall take inventory of the shipment and immediately report to the

Equipment Manufacturer any discrepancies between the Equipment Manufacturer's packing lists and shipping documents.

2. The Contractor shall be responsible for off-loading and protection of all equipment against damage and during on-site storage and installation. Damaged equipment and materials will be replaced by the Contractor at the Contractor's expense.

3.02 INSTALLATION

- A. Manufacturer's Instructions: Installation shall be as shown on the plans and in accordance with the manufacturer's recommendations, installation instructions and assembly drawings. Manufacturer's installation instructions and assembly drawings shall be submitted and approved by the Engineer prior to shipment of equipment.
- B. Furnish any service items required for initial operation. Prepping equipment shall be in accordance with the manufacturer's recommendations.
- C. Install all associated items including piping and operating items.
- D. Pipe Bracing: Pipes shall be supported and braced to adequately support all loads as necessary to prevent any sagging or undue strain on the piping.
- E. Install concrete floor topping with the scraper mechanism as recommended by the manufacturer. Manufacturer's representative shall inspect the existing condition of the floor and make recommendations for the new floor finish.
- F. Prior to the assembly all stainless steel bolts and nut threads shall be coated with a non-seizing compound by the CONTRACTOR.

3.03 FIELD QUALITY CONTROL

- A. The manufacturer shall schedule two (2) trips to the project site for start-up assistance and inspection of installed equipment for proper operation including but not limited to the installation of grout at the base of the clarifier.
- B. After the CONTRACTOR has installed the equipment and the units are capable of being operated, the equipment manufacture shall furnish a qualified representative for a minimum of two (2) days (up to 16 hours) to inspect the equipment and to supervise field testing and startup for the CONTRACTOR.
- C. Manufacturer's Field Service: A qualified manufacturer's representative shall provide a written report to the Owner or Owner's Representative

certifying that the equipment has been installed, lubricated, in proper alignment and operates satisfactorily throughout the entire operating pressure and capacity ranges at rated settings. The manufacturer shall provide the Contractor and Owner copies of the report after it has been signed by the Contractor and Owner. The report shall also include verification of transfer of all spare parts and operator training approved by Owner.

D. All field tests shall be conducted at the Contractor's expense.

E. Tests:

1. A torque test shall be conducted on one (1) circular clarifier mechanism. The testing shall be carried out under the supervision and approval of the ENGINEER before the mechanisms are placed into operation. The purpose of the test shall be to verify the structural integrity of the mechanism and drive. Manufacturer shall provide a serviceman to provide supervision during all tests.
2. The torque test shall consist of securing both of the rake arms by cable to anchor bolts installed by the CONTRACTOR in a tank floor at locations recommended by the manufacturer. A torque load shall be applied to the scraper arm by turning on the motor. The magnitude of the applied load shall be measured by a calibrated load cylinder from the distance of the line of action of each cable to the centerline of the mechanism. Readings shall be taken at 100 and 120 percent of the design torque value. The test load shall be applied such that the torque overload device can be used to indicate and signal the alarm and motor cutout torque values of the drives. Upon completion of the test the anchor bolts shall be removed and the holes grouted.
3. All equipment required for the test shall be provided by the manufacturer. After a successful test, the equipment shall be returned to the equipment manufacturer.

3.04 OPERATOR TRAINING

- A. After equipment has been shown to operate satisfactorily, provide operator training for OWNER'S personnel. Training shall take place while manufacturer's representative is at the job site for equipment inspection but after satisfactory operation of equipment.

END OF SECTION

SECTION 11262

ULTRAVIOLET EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Unit including accessory, equipment, display readouts, cleaning rack, electrical control panel and related connections.
- B. Furnish all labor, material, equipment, products, incidentals and testing required and necessary to provide a complete and operational system install where noted on the drawings and as specified within these specifications.
- C. The unit shall include all manufacturers lamp modules, monitoring system, ground fault interrupter receptacles, junction boxes, electrical work necessary connecting conduit, wiring controls, control panels within requirements of Division 16. Ultraviolet disinfection system shall be furnished with lamp modules in flow channel with level control as shown on the drawings.
- D. Manufacturer providing ultraviolet system shall have sufficient exterior rated outlets for lamp modules for continuous service. The power source shall be provided with ground fault interrupter protection.
- E. Coordinate all work with this equipment and any other associated equipment, installed and specified under other sections of these specifications.

1.02 RELATED SECTIONS

- A. Section 03100 - Concrete Formwork: Placement of anchors bolts and inserts.
- B. Section 09900 - Painting.
- C. Section 16111 - Conduit and electrical power to equipment unit controls.

1.03 REFERENCES

- A. ASTM American Society for Testing Materials
- B. ANSI American National Standards Institute

- C. AWWA American Water Works Association
- D. FM Factory Mutual
- E. IEEE Institute of Electrical & Electronic Engineers
- F. JIC Joint Industry Conference
- G. NEC National Electric Code
- H. NEMA National Electrical Manufacturers Association
- I. OSHA Occupational Safety and Health Administration
- J. UL Underwriters' Laboratories Incorporated

1.04 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data: Provide unit capacities, physical dimensions, utility requirements and locations, point loads.
- C. Shop Drawings: Indicate equipment location, rough-in and anchor placement dimensions and tolerances, clearances required and elevation.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent work.
- E. Maintenance and Operating Instructions
 - 1. Three (3) copies of each Manufacturer's maintenance and operating instructions manual shall be provided with the equipment at the time of delivery.

1.05 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 01700 - Contract Closeout: Procedures for submittals.
- B. Operation Data: Include description of system operation, adjusting and testing required.
- C. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

1.06 QUALITY ASSURANCE

- A. The UV dose produced by the system shall not be less than 30,000 uWatt. sec/cm² after one year (8750 hours) of lamp operation measured in an effluent with a 65% UV transmission at 253.7 nm and with lamp output at 65% of its initial level after one year of operation and with no fouling on the lamp sleeves.
- B. Maintain one copy of each document on site.
- C. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience. Provide installation list for lamps parallel to flow in open channel of similar unit with design flow range as specified.

1.07 REGULATORY REQUIREMENTS

- A. Conform to applicable code for operating unit.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of unit.

1.08 WARRANTY

- A. Section 01700 - Contract Closeout.
- B. Correct defective Work within a two year period after Substantial Completion for Ultraviolet equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Trojan Technologies Inc, London, Ontario, System PTP D3600 K-1.
- B. WEDECO equivalent model
- C. Glasco equivalent model
- D. Or Engineer Approved Equal.
- E. Section 01600 - Materials and Equipment: Product options and substitutions. Permitted of equal or larger capacity that can out-perform unit as specified with no changes in equipment compatibility and layout at no additional cost, operational or maintenance cost to owner as approved by the engineer.

2.02 COMPONENTS

A. Ultraviolet Equipment Operational Criteria:

1. Service Location: Exterior.
2. General:
 - a. All material in contact with effluent shall be stainless steel or quartz.
 - b. All wiring exposed to ultraviolet light shall be Teflon coated.
 - c. All material exposed to ultraviolet light shall be stainless steel, anodized aluminum, quartz 214, or Teflon.
3. Ultraviolet Module:
 - a. Each ultraviolet lamp module shall consist of 4 lamps and their corresponding electronic ballast. Each lamp shall be enclosed in its individual quartz sleeve, one end of which shall be closed and the other end sealed by a lamp end seal and holder.
 - b. The electrical wires connecting the lamps and electronic ballasts shall be enclosed in the stainless steel frame and not exposed to the effluent.
 - c. Each ultraviolet module shall be provided with a standard 120 volt plug and weatherproof cable for connection to a receptacle. The cable shall be no longer than 10 feet. Lamp status shall be displayed on top of each UV module by watertight LED indicator lights.
 - d. The modules materials of construction shall be stainless steel type 316, anodized aluminum, quartz 214, or Teflon.
4. Ultraviolet Lamps:
 - a. Low pressure mercury slimline of the hot cathode instant start design in which the coiled filamentary cathodes are heated by the current.
 - b. 90% of ultraviolet output shall be within the wavelengths of 233.7 to 273.7 nm.
 - c. The operating life of the lamp shall be guaranteed for a period of one year by the ultraviolet system manufacturer.
5. Lamp End Seal and Lamp Holder:
 - a. The open end of the lamp sleeve shall be sealed by means of a sleeve nut which threads onto a sleeve cup and compresses the sleeve "O" ring.
 - b. The sleeve nut shall have a knurled surface to allow a positive hand grip for tightening. The sleeve nut shall not require any tools for removal.
6. Ultraviolet Lamp Sleeves:
 - a. Type 214 clear fused quartz circular tubing as manufactured by General Electric or equal.
 - b. Rated for ultraviolet transmission of 89% and shall not be subject to solarization.

- c. The nominal wall thickness shall be 1.0 to 2.0 mm.
- 7. Level Control Weir:
 - a. Located at discharge end of the UV channel.
 - b. Designed to maintain a minimum effluent level within minimal variations as required to keep lamps submerged.
 - c. Constructed of Type 304 stainless steel and other non-corroding materials.
- 8. Electrical:
 - a. Ultraviolet Disinfection System: 4 Lamps, 6 Modules, 2 Banks, 48 UV lamps, 1 control panel
 - b. Outdoor Weatherproof Cables: 10 foot 120 volt each.
 - c. Ground Fault Receptacles: Duplex interrupter circuitry.
 - d. Power Wattage: 4,200 Max, 120 volt, 60 Hz, 38.0 amps.
- 9. Cleaning Procedure:
 - a. Ultraviolet Lamp: Removable, clean by acid solution with non-abrasive cloth.

B. Ultraviolet Equipment Functional Criteria:

- 1. Effluent Disinfect Peak Flow: 1.4 MGD hydraulic.
- 2. Ultraviolet Transmission: 253.7 nm @ 65%.
- 3. Suspended Solids: <12 mg/l.
- 4. Coliform Discharge: <1,000/100 ml guaranteed.
- 5. The system supplied shall be arranged in the following manner:
 - a. Number of banks per channel 2
 - b. Number of UV modules per bank 6
 - c. Number of lamps per UV module 4
 - d. Total number of lamps 48
 - e. Number of System Control Monitoring Centers 2
 - f. Number of Level Controllers 1

C. Other operating Features:

- 1. Electrical Power Distribution Receptacle (PDR).
- 2. Ground Fault Interrupter: Two duplex receptacles.
- 3. Aluminum Junction Boxes: Individual NEMA 4X Rain Type mounted.

D. Manufacturer to provide associated equipment:

- 1. Coordinate all mounting features.

E. Anchors and Fasteners: 316 ANSI Stainless steel.

- 1. Anchor bolts shall be furnished by manufacturer and set in place prior to forming concrete structure.

F. Spare Parts: The following list of spare parts shall be furnish:

	<u>Item</u>	<u>Total Quantity</u>
1.	Complete Module	One (1) each
2.	Ultraviolet Lamps	Eight (8) each
2.	Quartz Lamp sleeves	Eight (8) each
3.	Lamp Holder Seals	Eight (8) each

G. Electrical Requirements:

1. General:
 - a. Each UV module will be powered from the Power Distribution Center through a bus bar and will include a relay board and watertight connectors.
 - b. Each ballast will drive two lamps.
 - c. Maximum power consumption will be no greater than 4.2 kW.
 - d. Electrical supply to each System Control Center will be 120 Volts, single phase, 2 wire (plus ground), 1.5 Amps.
 - e. Forced air cooling of control panels that contain electronic circuit boards will not be acceptable.

H. Control and Instrumentation:

1. Monitoring System
 - a. Two submersible UV sensors per bank will continuously monitor the UV intensity produced in the bank of modules. The sensor will measure the germicidal portion of the light emitted by the UV lamps.
 - b. UV intensity will be indicated on a three (3) character display in mW per square cm.
 - c. Elapsed time in hours (lamp age) will be indicated on a five (5) character display.
 - d. Both displays will utilize LEDs and will be visible in sunlight through the panel door.
 - e. A dry contact will be provided for remote indication of low UV intensity alarm.
 - f. Monitoring system will be enclosed in a fiberglass Type 4x wall or handrail mounted panel and is to be located less than twelve (12) feet from the LED end of the UV module.
 - g. Digital I/O modules rated for 10 amps will be provided to remotely indicate:
 - 1) Common Major Alarm Condition
 - 2) Bank status (one for each UV bank supplied).

2. Power Distribution Receptacle (PDR)

- a. Duplex ground fault interrupter receptacles will be provided by the UV manufacturer in water proof boxes and wall or handrail mountable.
- b. Receptacles will be mounted in an individual, impact resistant box with a Type 3R rain shield for outdoor installation.

2.03 SHOP FINISHING

- A. Finish: Manufacturer's Stainless Steel and two baked enameled coats for severe duty environment.

2.04 FIELD FINISHING

- A. Equipment unit: Complete field painting of all materials under Division 09900 as required excluding stainless steel, galvanized, aluminum, bronze, plastic or other items not requiring finish painting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.
- B. Verify that anchors are correctly positioned.

3.02 PREPARATION

- A. Provide anchors in concrete and setting plan for field installation.

3.03 INSTALLATION

- A. Install unit in accordance with manufacturer's instructions.
- B. Maintain equipment in proper working order to the satisfaction of the Owner or Owner's representative and is accepted and transferred to the owner at the conclusion of the project.
- C. Anchor unit securely in place.
- D. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect/Engineer.

3.04 ELECTRICAL

- A. Unless noted otherwise all motor starters, fusible safety switches, selector switches, and push buttons, will be supplied, mounted and wired in Div. 16, Electrical Work, as indicated on the Drawings. All electrical equipment supplied in this Item shall conform to Div. 16 Electrical Work.
- B. All electrical equipment, conduit and wiring not indicated on the Drawings, but necessary to provide a complete operating system shall be provided at no additional cost to the Owner.
- C. Electrical Wiring: The external conduit and wiring required for power and control to electrical equipment supplied in Section 11262, shall be supplied and installed in Div. 16, Electrical, as indicated on the drawings.
- D. Electrical Devices, Operational Controls, Sequence of Operation
 - 1. Coordinate installation with other electrical wiring as required.

3.05 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation with existing plant operation and effluent discharge.

3.06 UNIT OPERATION

- A. Auto, hand stop, continuous signal.
- B. Controls HOA switch.

3.07 FIELD QUALITY CONTROL

- A. Test: File a report on results.
- B. Inspection: File a report on installation.
- C. Manufacturer's Field Service:
 - 1. A qualified factory representative shall inspect, test, installed equipment to be sure it meets manufacturer's requirements.
 - 2. The factory representative shall revisit the job site as often and as necessary until all problems are corrected and the installation is entirely satisfactory to the owner or owner's representative.

3.08 ADJUSTING

- A. Section 01700 - Contract Closeout: Adjusting installed work.

- B. Adjust unit mechanism to achieve specified requirements.

3.09 DEMONSTRATION AND INSTRUCTIONS

- A. Section 01700 - Contract Closeout: Demonstrating installed work.
- B. Demonstrate and instruct Owner and/or operator on unit operation. A qualified factory representative shall instruct plant personnel on operation, care, required maintenance of the equipment. The factory representative shall revisit the job site as often but no less than one day. Describe unit limitations, safety requirements.
- C. Provide three copies of operation and maintenance manuals.

END OF SECTION

SECTION 11280

VALVES

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required for the installation, testing, and operation of equipment, all in accordance with the Contract Documents. Include all items not shown or specified but required for proper installation and operation of equipment.
- B. This section includes labor, materials, equipment, appurtenances, operators and incidentals required for process valves as shown and specified. Work includes all types of valves required for buried, exposed, submerged, and other types of piping except where otherwise specifically included in other Sections.
- C. Review installation procedures under other Sections and coordinate with the Work, which is related to this Section.

1.02 SECTION INCLUDES

- A. Butterfly valves
- B. Check valves - Lever and Weight or Lever and Swing Check valve.
- C. Mud valves.
- D. Plug valves.
- E. Ball valves.
- F. Gate Valves.
- G. Pinch Valves.
- H. Hydrostatic Relief Valves

1.03 RELATED SECTIONS

- A. Section 09900: Field Painting
- B. Section 15140: Supports and Anchors
- C. Section 15201: Process Piping

D. Division 16427: Electric Actuators.

1.04 REFERENCES

A. ANSI - American National Standards Institute

B. ASTM - American Society for Testing and Materials

C. AWWA - American Water Works Association

D. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-inch through 24-inch NPS.

E. NSF - National Sanitation Foundation

1.05 SYSTEM DESCRIPTION

A. Butterfly Valve

1. Air Lines - Valves are tight closing complete with operator and optional chain. Valve disc rotates 90 degrees from the full open to the tight shut position.

B. Check Valves

1. The check valves for water service shall conform to AWWA – C-508. Furnish valves three inches and smaller with bronze body and disc and with screwed ends.
2. Furnish valves four inches and larger with cast or ductile iron bodies and discs with bronze seats, rings, hinges, stud pin, counter weights, and nuts

C. Plug Valve

1. Valves are non-lubricated, eccentric valve with synthetic rubber faced plug. Valves are full port, 100% of line size, provided with limit stop that allows plug to rotate 90 degrees from fully open to fully closed. Valves are marked to show flow direction.

D. Ball Valves

1. The valves shall be designed for water, chemical and air service. The valve shall consist of the body, plugs, body seats, bearings, shafts and seals. They shall be full port and designed for pressure, temperature, air, and liquid intended. Valve plug shall rotate 90 degrees from the full

open to the tight shut-off position.

E. Gate Valves

1. Gate valves on water lines shall be solid wedge gate type. Gate valves on water lines shall be double disc, parallel or taper seat type. Provide valves with mechanical joint, flange, screw, or other type ends, as indicated on the Drawings or in the Valve Schedule.

F. Pinch Valves

1. A wastewater valve designed to control flow by pinching closed an elastomeric interior within a full cast metal that prevents blockage of solids in the flow. Provide valves with mechanical joint, flange, screw, or other type ends, as indicated on the Drawings or in the Valve Schedule and both manually and electrically operated.

G. Hydrostatic Relief Valves

1. Valves to be of floor and wall type as required to suit project conditions. All such valves are to be of the same manufacturer throughout project and installed per published recommendations of such. Valves shall be of flanged body style and complete with body, or wall pipe in length of concrete thickness being placed, with removable strainer.
2. The flap gate and body shall be cast iron ASTM A-126 Class B. The body seat ring shall be bronze and hinge pin of 316 SS. The gate shall have a neoprene rubber seat cemented and mechanically retained on both body and cover. The valve shall have a 4 or 6" flanged end faced and drilled to ANSI 125 pound template for connection to a 4' or 6" wall pipe. Crushed stone shall be placed outside the tank wall adjacent to the valve.
3. Valves to be furnished by Clow Valve, Trumbull Industries, American Darling or equal.

1.06 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data: Provide valve component size, physical dimensions, utility requirements and locations.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Butterfly Valve: Shop test in accordance with AWWA C-504.

1.07 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Procedures for submittals.

1.08 SUBMITTALS AT PROJECT CLOSEOUT

A. Section 01700 - Contract Closeout: Procedures for submittals.

B. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and spare part sources.

1.09 QUALITY ASSURANCE

A. All materials are new and the best quality. Manufacturer's name and pressure rating marked on valve body.

1.10 WARRANTY

A. Section 01700 - Contract Closeout: Procedures for Submittals.

B. Record actual location of valves.

1.11 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.

B. Deliver and store in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 BUTTERFLY VALVES (AIR SERVICE)

A. Manufacturers:

1. DeZurik Corp. or equal
2. Henry Pratt Co.
3. Approved equal
4. Substitutions Refer to Section 01600: Material and Equipment.

B. Manufactured of cast iron or cast steel body, cast iron, bronze or stainless steel disc, stainless steel shaft, resilient EPDM rated for 250 degree seat. Flanges drilled to ANSI Standards. Use cadmium plated bolts and nuts with rubber gaskets, which meet the following specifications:

1. Bolts: ASTM A-307, Grade B with ANSI B18.2 hexagon heads, ANSI B1.1 coarse thread series, Class 2A fit.
2. Nuts: ASTM A-307, ANSI B18.2 heavy hexagon dimension, ANSI B1.1 coarse thread series, Class 2B fit.
3. Cadmium plate bolts and nuts after the threads are cut. Cadmium plating thickness range of 0.0003 to 0.0005 inches.
4. Gaskets: One-eighth inch thick, full face or ring type, red rubber, all flanged joints. Air line service requires gasket to be rated at a minimum temperature of 250 degrees F.

C. Valve operation:

1. Operators: Rated torque capability of the valve operator to be sufficient to seat, unseat, and rigidly hold in any intermediate position the valve plug it controls under the stated operating conditions.
2. Manual Operators: worm and gear operated. Totally enclose worm gear operators in a gear case suitable for running in oil with seals provided on all shafts. Furnish all shaft bearings with permanently lubricated bronze bearing bushings. Actuator to clearly indicate valve position. Provide an adjustable stop to set closing torque. Actuator housing constructed of semi-steel. Zinc or cadmium plate all exposed nuts, bolts, and washers. Chain length measured from centerline of valve to five feet above floor.

2.02 PLAIN SWING CHECK VALVE - 4 INCHES AND LARGER

A. Manufacturers:

1. Clow Corporation
2. American-Darling
3. APCO
4. Or equal; Substitutions Refer to Section 01600: Material and Equipment.

B. Meet requirements of AWWA C-508, cast or ductile iron body and disc, stainless steel hinge shaft, Flanges drilled to ANSI B16.1 Standard. Closure assembly to close by gravity under no flow conditions in a horizontal position.

1. Provide net flow areas when fully open of not less than pipe cross section.
2. Provide hinge shaft of stainless steel for sewage applications and of stainless steel or bronze for use in water lines.
3. Equip valves with ANSI B16.1 standard flanges or AWWA C-111 mechanical joint ends as required.

4. Lever and weight or lever and spring valves shall be equipped with adjustable outside controls as specified.

2.03 MUD VALVES

A. Manufacturers:

1. Clow Corp.
2. M & H Division of Dresser Industries
3. Or equal; Substitutions Refer to Section 01600: Material and Equipment.

B. Constructed of cast iron body, bronze stem, stem nuts, disc rings, and seat; stainless steel nuts and nuts. Flanges drilled to ANSI 125 lb. Standard. Gaskets: One-eighth inch thick, full face or ring type, red rubber.

C. Valve stands and extension stems: Valve stands are cast iron, floor mounted type. Provide extension stem of stainless steel pipe with adjustable guide bearings so spaced that the ratio of the unsupported length of stem to the stem is not greater than 200, with 10-ft being the greatest distance center to center. Thread and key or pin couplings to the stems. Furnish bronze bushed stem guides adjustable in two directions. Install pipe sleeve where extension stem passes through concrete.

D. Non-rising stem valve: Bronze bushed floor box, extension stem, nut and wrench. Extension stems extend to within six inches of the floor box cover. Provide suitable length for floor box to account for slab thickness.

E. Rising stem valve: Floor stand or bench stand with eight inch diameter hand wheel.

F. Valve operation:

1. Operators: Rated torque capability of the valve operator to be sufficient to seat, unseat, and rigidly hold in any intermediate position the valve plug it controls under the stated operating conditions.
2. Manual Operators: Worm gear operated. Totally enclose worm gear operators in a gear case suitable for running in oil with seals provided on all shafts. Furnish all shaft bearings with permanently lubricated bronze bearing bushings. Actuator to clearly indicate valve position. Provide an adjustable stop to set closing torque. Actuator housing constructed of semi-steel. Zinc or cadmium plate all exposed nuts, bolts, and washers.

2.04 PLUG VALVES

A. Manufacturers:

1. DeZurik
2. Keystone
3. Clow
4. Or equal. Substitutions: Refer to Section 01600: Material and Equipment.

B. Construction shall be of cast iron body, plug and bonnet; seating surfaces of body made of greater than 90% nickel. Flanges drilled to ANSI Standards. Use cadmium plated bolts and nuts with rubber gaskets, which meet the following specifications:

1. Bolts: ASTM A-307, Grade B with ANSI B18.2 hexagon heads, ANSI B1.1 coarse thread series, Class 2A fit.
2. Nuts: ASTM A-307, ANSI B18.2 heavy hexagon dimension, ANSI B1.1 coarse thread series, Class 2B fit.
3. Cadmium plate bolts and nuts after the threads are cut. Cadmium plating thickness range of 0.0003 to 0.0005 inches.
4. Gaskets: One-eighth inch thick, full face or ring type, red rubber, all flanged joints
5. Valve has a minimum port area 100% of line size, provided with limit stop that allows plug to rotate 90 degrees from fully open to fully close.
6. The valve body, plug and bonnet shall be cast iron, ASTM A126, Class B. Provide upper and lower stem bushings of non-corrosive material and stem seals of compression packing or "O" rings.

C. Valve stands and extension stems: Valve stands are cast iron, floor mounted type with operator for valve to have worm gear and wheel operation on the floor stand. Provide extension stem of Schedule 40 steel pipe cold rolled or bronze with adjustable guide bearings so spaced that the ratio of the unsupported length of stem to the stem is not greater than 200, with 10-ft being the greatest distance center to center. Thread and key or pin couplings to the stems. Furnish bronze bushed stem guides adjustable in two directions.

D. Operators: Rated torque capability of the plug valve operator to be sufficient to seat, unseat, and rigidly hold in any intermediate position the valve plug it controls under the stated operating conditions.

E. Manual Operators: Totally enclose worm gear operators in a gear case suitable for running in oil with seals provided on all shafts. Furnish all shaft bearings with permanently lubricated bronze bearing bushings. Actuator to clearly indicate valve position. Provide an adjustable stop to set closing torque. Actuator housing constructed of semi-steel. Zinc or cadmium plate all exposed nuts, bolts, and washers.

- F. Actuator housing constructed of semi-steel. Zinc or cadmium plate all exposed nuts, bolts, and washers. Electric Operators: See Division 16.

2.05 BALL VALVES

- A. Manufacturers: 2" and smaller shall be;

- 1. Powell 4204B
- 2. Jamesbury A22BB
- 3. Or equal; Substitutions: Refer to Section 01600: Material and Equipment.

- B. Manufacturers: 3" to 8";

- 1. Powell
- 2. Williamette
- 3. Or equal; Substitutions: Refer to Section 01600: Material and Equipment.

- C. Manufacturers: 8" and up;

- 1. Pratt
- 2. Or equal; Substitutions: Refer to Section 01600: Material and Equipment.

- D. Manufacturers: Chemical Resistance

- 1. Plastic Engineered Products Inc.
- 2. Plastic Piping System
- 3. Or equal; Substitutions: Refer to Section 01600: Material and Equipment.

- E. Ball valves shall be full port, tight shut-off, complete with operators, hand wheels, floor stands, extension stems, wrenches, chains, stem guides etc. True union balls shall be provided for all small pipe and chemical service. Chemical resistant valves shall be suitable for design operation. Flanged end and water valves 3 inch and larger shall conform to AWWA C507. Design pressure shall be 150 psi and 300 psi test pressure unless noted otherwise.

- F. Valve Stands and Extension Stems: Furnish valve stands and extension as required. Valve stands shall be cast iron, floor mounted type; mount operators for valves specified to have worm gear and wheel operation on the floor stands. Provide extension stems of Schedule 40 steel pipe, cold rolled steel or bronze with adjustable guide bearings so spaced that the

ratio of the unsupported length of stem to the stem radius shall not exceed 200, however, in no case shall the distance between guides exceed ten feet center to center. Thread and key or pin couplings to the stems.

- G. Operators shall be properly sized and assembly of valve operators to the valve is responsibility of the valve manufacturer. The rated torque capability of each operator shall be sufficient to seat, unseat, and rigidly hold in any intermediate position the valve ball it controls under operating conditions.
- H. Valves four inches and smaller shall be wrench operated and valves six inches and larger shall be worm gear operated. Provide valves six feet or more above the operating floor, with a cross bar and chain, or a wheel and chain. Measure length of chain from centerline of valve to five feet above floor.
- I. Valves and actuators for submerged and buried service shall have seals on all shafts, and gaskets on valve and actuator covers to prevent entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals. Provide stainless steel nuts, bolts, springs for submerged and buried service.
- J. Totally enclose worm gear operators in a gear case suitable for running in oil with seals provided on all shafts. Furnish all shaft bearings with permanently lubricated bronze bearing bushings. Actuator shall clearly indicate valve position. Provide an adjustable stop to set closing torque. Construct the actuator housing of semi-steel. Zinc or cadmium plate all exposed nuts, bolts, and washers.
- K. Valves for air service shall be rated for 250° F and be corrosion resistant material.

2.06 GATE VALVES

A. Manufacturers:

- 1. American-Darling
- 2. Clow
- 3. DeZurik
- 4. Or equal; Substitutions: Refer to Section 01600: Material and Equipment.

B. Construction:

- 1. All gate valves smaller than three inches shall be solid wedge gate, non-rising stem type, wheel operated, designed for 125 psi working

water pressure. Furnish with screwed ends, unless otherwise specified. Buried valves shall be nut operated and installed with valve boxes and covers stamped with 'water' on the outside of the cover.

2. Valves less than three inches shall meet requirements of AWWA C515 if bodies are ductile iron, AWWA C509 if bodies are cast iron.
3. All gate valves three inches and larger shall be operated by nuts, wheels or other means as indicated in the schedule.
4. Furnish valves 20 inches and larger with gear operator by means of spur or bevel gears where indicated on the Drawings or in the Valve Schedule.
5. Provide all horizontally mounted valves 20 inches and larger, with two bronze-lined rollers or bronze-faced tracks and suitable scrapers. Equip the body with guides or tracks which shall be straight and true. The guides of horizontally placed valves shall be substantially faced with bronze, securely fastened, and machined smooth and true.

2.07 PINCH VALVES

A. Manufacturers:

1. Red Valve
2. RF Valve
3. DeZurik
4. Or equal; Substitutions: Refer to Section 01600: Material and Equipment.

B. Valves are to be of the full cast metal body, mechanical pinch type with flange joint ends on both the body and the sleeve trim. The valve shall have face-to-face dimensions of standard gate valves, in accordance with ANSI B16.10 up to 12" size. Sizes 14" and larger shall have a face to face dimension no longer than twice the nominal valve port diameter. The flanges shall be drilled to mate with ANSI B16.1, Class 125/ANSI B16.5, and Class 150 flanges.

C. The sleeve trim shall be one piece construction with integral flanges drilled to be retained by the flange bolts. The sleeve trim shall be reinforced with calendared nylon or calendared polyester fabric to match service conditions. The sleeve trim shall be connected to the pinch bar by tabs imbedded in the sleeve trim-reinforcing ply. All internal valve metal parts are to be completely isolated from the process fluid by the sleeve trim.

D. The sleeve shall feature a cone-shaped profile, with a 8" diameter inlet port concentricity reducing to a 6" diameter at a point, which is exactly 1/2 the face to face length. The 6" port shall continue through to the outlet port of the valve. Flow direction indication shall be provided on the exterior of the sleeve and the exterior of the valve by means of a

directional arrow, and by the word "inlet" on the rim of the inlet flange.

- E. The steel mechanism shall be double acting with pinching of the sleeve trim occurring equally from two sides. ACME threads shall be used on all valve mechanisms. There shall be no cast parts in the operating mechanism. The stem shall be non-rising and have a non-rising hand wheel. The hand wheel shall be constructed of welded, tubular steel and be connected to the stem by means of a single retaining bolt. The hand wheel shall be fitted with a lubrication fitting to allow lubrication of the stem. A valve position indicator rod shall pass through the center of the stem, retaining bolt, and hand wheel to provide visual position indication. Bevel gear operators shall be provided on all valves over 8" size. Lifting eyelets shall be provided on the top of the valve body where applicable.
- F. Rotating the handle clockwise lowers a pinch bar above the sleeve, while raising a pinch bar below the sleeve simultaneously, pinching the sleeve closed at the center of the valve. Turning the handle counter-clockwise separated the two pinch bars to open the valve.

2.08 ACCESSORIES

- A. Furnish operators, guides, stands, extension stems as required for each installation for a complete operating system as indicated on the drawings or in the valve schedules.

2.09 FINISH SURFACE

- A. All surfaces that will come in contact with potable water shall be finished with coatings approved by NSF.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01039 – Coordination and Meetings: Verification of existing conditions before starting work.

3.02 PREPARATION

- A. Butterfly valve: Shop paint all valves and appurtenances not constructed of brass, bronze or polished chrome, before shipment in accordance with AWWA Specification C-504. Provide on machined surfaces a protective universal rust inhibitive material coating.
- B. Check valve: Shop coat all ferrous metal parts with a universal rust inhibitive primer.

- C. Mud Drain valve: Coat all valve parts and accessories not brass, bronze or stainless steel with asphalt varnish. Provide on machined surfaces a protective material coating such as grease or shellac.
- D. All potable water service valves: Water contact coatings shall be NSF approved.

3.03 INSTALLATION

- A. Butterfly valve: carefully and accurately install to the elevation given.
- B. Place all valves with their shaft in the horizontal position unless noted otherwise.
- C. Plug valves shall be installed with the plug in the upper half of the valve body.
- D. Furnish all necessary lubrication equipment, oil or grease for initial filling of gear boxes, operators, etc.
- E. Maintain equipment in proper working order to the satisfaction of the Owner (Owner's representative) and is accepted and transferred to the owner at the conclusion of the project.
- F. Anchor unit securely in place.
- G. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Engineer.

3.04 APPLICATION

- A. Field paint as required under section 09900.

3.05 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation with piping and equipment installation.

3.06 FIELD QUALITY CONTROL

- A. System leak tests (water or wastewater service):
 - 1. Apply a hydrostatic pressure test and a leakage test in accordance with AWWA C600 and/or AWWA C605, as applicable.
 - 2. Duration of test: 2 hour minimum.
 - 3. Test to be observed by the Engineer.

4. Repair leaks and retest. If valve found to be of faulty design or fabrication, repair or replace at no additional expense to owner.

B. System leak tests (air service):

1. Subject system to a 25 psig air test.
2. Duration of test: 10 minute minimum, with no drop in pressure.
3. Locate any leaks indicated during the tests by a soapsuds test, if necessary.
4. Test to be observed by Engineer.
5. Repair leaks and retest.

3.07 ADJUSTING

- A. Section 01700 - Contract Closeout: Adjusting installed work.

- B. Adjust unit mechanism to achieve specified requirements.

3.08 DEMONSTRATION AND INSTRUCTIONS

- A. Section 01700 - Contract Closeout: Demonstrating installed work.

1. Manufactures representative shall be present at the time of start up to check the installation and proper valve operating pressure settings.

- B. Provide three copies of operation and maintenance manuals.

3.09 SCHEDULES

- A. See Valve Schedule on Drawings for additional valve features and requirements. See Drawings for specific locations of valves.

END OF SECTION

SECTION 11282

TELESCOPING VALVES

PART 1 GENERAL

1.01 SCOPE

- A. Packaged manufactured Telescoping Valve unit including accessory, equipment, pipe, operator, supports or wall connections.
- B. Furnish all labor, material, equipment, products, incidentals, testing required necessary to provide a complete and operational system install where noted on the drawings and as specified within these specifications.
- C. Coordinate all work with this equipment and any other associated equipment, existing or installed and specified under other sections of these specifications.
- D. Furnish, install, test and adjust all telescoping control valves and accessories required for the proper completion of the work as indicated on the Drawings and as specified.

1.02 RELATED SECTION

- A. Section 09900 – Painting

1.03 SYSTEM DESCRIPTION

- A. Each telescoping valve shall be a complete unit.
- B. Provide valves so indicated with "V" notches to maintain water levels as indicated on the Drawings.
- C. Valve travel shall be as indicated on the Drawings.

1.04 SUBMITTALS FOR REVIEW

- A. Product Data: Provide physical dimensions and locations.
- B. Shop Drawings: Indicate dimensions and tolerances, anchorage and mooring arrangements required. Give any additional requirements or recommendation necessary for application of equipment at location of equipment.

1.05 SUBMITTALS FOR INFORMATION

- A. Manufacturer's Installation Instructions: Indicate special installation or protection requirements at point of operation. Contractor shall be responsible for coordination and installation requirements as recommended by the manufacturer of equipment furnished.
- B. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.06 SUBMITTALS AT PROJECT CLOSEOUT

- A. Operation Data: Include description of system operation, adjusting and testing required.
- B. Maintenance Data: Identify system maintenance requirements, servicing cycles and lubrication types required.

1.07 QUALITY ASSURANCE

- A. Equipment Rating: Provide any additional information to support operational certification requirements.
- B. Maintain one copy of each document on site.
- C. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

1.08 WARRANTY

- A. Correct defective Work within a one year period after Substantial Completion for operating mechanical devices.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Latanick Equipment, Inc., Huron, Ohio
- B. Walker Process Equipment, Inc., Aurora, Illinois
- C. Or equal.

2.02 MATERIALS

- A. Slip Pipe Tubing shall be stainless steel or seamless drawn brass not less than .125 inch wall thickness.

2.03 DESIGN

- A. The minimum tube size shall be five and one-half inches O.D. for six inch valves, seven inches O.D. for eight inch valves, and nine inches O.D. for ten inch valves.
- B. The slip tube shall be able to travel a distance designated in the drawings.
- C. Provide bail of substantial design and to allow proper clearance over the tube.
- D. All parts shall be of ample strength to handle all possible stresses to which they may be subjected.
- E. Provide extension stems, if required, of 304 stainless steel with an unsupported length to radius ratio of 200 or less.
- F. Connection between slip tube and operator stem shall not impede with flow of liquid out of the valve and shall be a complete welded connection.

2.04 ACCESSORIES

- A. Provide valve support stand of cast iron or steel with the base drilled for foundation bolts. Furnish wall mounted support for valves that are attached to a vertical wall. Centerline of valve should not extend past 12 inches from the face of the wall. Anchor bolts for supports are to be supplied by the Contractor but shall be 304 stainless steel of a size and type recommended by the valve manufacturer for the appropriate application. Rack attached to the valve stem shall pass through a gear box situated on the top of the stand. The rack and the gears shall be machine cut from hardened steel. Provide gear and operating shafts with oil impregnated bearings or means of lubrication.
- B. Furnish handwheel arrangement with gears and rack so designed that one revolution of the handwheel or crank will produce not less than four inches of valve travel, and so that one revolution can be easily accomplished in either direction with one hand in one second. The handwheel must be at least 18 inches in diameter.
- C. For safety of operation and for protection from dirt and weather provide a transparent cover for the rack, with a means of indicating the position of the valve. Cover shall be weather and UV resistant and means to indicate position shall be permanent and fade resistant.
- D. In order to provide a tight seal for the tube furnish a cast iron companion

flange for attachment to the cast iron pipe installed under another Section, and insert an accurately cut neoprene gasket between the flanges.

- E. Furnish and install floor sleeves and fully adjustable bronze bushed stem guides as required.

PART 3 PRODUCTS

3.01 EXAMINATION

- A. Install the valve and operating mechanism accurately to line and elevation in the locations indicated on the Drawings or where directed.

3.02 PREPARATION

- A. Shop coat all parts not brass or bronze with rust inhibiting paint suitable for submerged service. Apply one shop coat of machinery enamel to valve stand and hand wheel before shipment.
- B. Field painting shall be performed in accordance with Section 09900, Painting.
- C. Provide exchange system as recommended by manufacturer for placement in this section.

3.03 INSTALLATION

- A. Install unit in accordance with manufacturer's instructions.
- B. Maintain equipment in proper working order to the satisfaction of the Owner or Owner's representative and is accepted and transferred to the owner at the conclusion of the project.
- C. Anchor unit securely in place.
- D. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by the Owner.

3.04 FIELD QUALITY CONTROL

- A. Test: File a report on results.
- B. Inspection: File a report on installation.
- C. Manufacturer's Field Service:

1. A qualified factory representative shall inspect, test, installed equipment to be sure it meets manufacturer's requirements.
2. The factory representative shall revisit the job site as often and as necessary until all problems are corrected and the installation is entirely satisfactory to the owner or owner's representative.

3.05 ADJUSTING

- A. Adjust unit mechanism to achieve specified requirements.

3.06 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate and instruct Owner, Owner's representative or operators on unit operation. A qualified factory representative shall instruct plant personnel on operation, care and maintenance of the equipment. The factory representative shall revisit the job site as often as necessary but no less than one day. Describe unit limitations.
- B. Provide three copies of operation and maintenance manuals.
- C. Provide one spare rack cover with position indicator.

END OF SECTION

SECTION 11287

STOP GATE AND SLIDE GATE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-manufactured stop gates and slide gates shall be aluminum and complete with frame, slide, guides, as required to complete the installation.
- B. Furnish all labor, material, equipment, products, incidentals and testing required and necessary to provide a complete and operational system install where noted on the drawings and as specified within these specifications.
- C. The unit shall be constructed and operate in accordance with manufactures instructions.
- D. Coordinate all work with this equipment and any other associated equipment, existing or installed and specified under other sections of these specifications.

1.02 RELATED SECTIONS

- A. Section 03100 - Concrete Form Work: Placement of guides and inserts.

1.03 REFERENCES

- A. ASTM - American Society for Testing and Materials

1.04 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Shop Drawings: Indicate equipment location, rough-in and anchor placement dimensions and tolerances, clearances required and elevation/design requirements.

1.05 SUBMITTALS FOR INFORMATION

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Manufacturer's Installation Instructions: Indicate special installation requirements and position.

1.06 WARRANTY

- A. Section 01700 - Contract Closeout: Warranties and Bonds.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer:

1. Rodney Hunt
2. Waco
3. Halliday, Inc.
4. Or equal

- B. Section 01600 - Materials and Equipment: Product options and substitutions.

2.02 COMPONENTS

- A. Stop gates shall be of the type indicated in the Stop gate Schedule or on the Drawings.
- B. Stop gates shall have square or rectangular openings as specified or as noted on the drawings.
- C. Anchors
 1. Anchor shall be furnished by manufacturer and set in place prior to forming new concrete. Furnish extruded one piece anchor.

2.03 FRAMES

- A. Frames shall be extruded shapes suitable for wall or surface mounting or for embedding in concrete as requires or as designated on the Drawings. Gate seats and frame shall be an integral unit

2.04 GUIDES

- A. Guide slots shall be one-eighth inch wider than the slide gate thickness and one and one-quarter inches deep. Frame dimensions shall be as indicated in the Stop Gate Schedule or as noted on the Drawings.

2.05 STOP GATE SLIDE

- A. Fabricate gate slide of one-quarter inch minimum thickness material and

of the dimensions indicated in the Stop Gate Schedule. Reinforce aluminum slides as necessary to limit deflection to 1/360 of span. Fiberglass slides shall be reinforced rigid sandwich type of construction. Hand holds shall have a one inch minimum diameter grip and adequate size for ease of operation.

2.06 SLIDE GATE

- A. The slide gate disc will be reinforced with U-shaped aluminum extrusions welded to the plate to keep deflection of the gate to 10,000th of its span under the design head.
- B. The guides and inverts shall be of extruded aluminum ASTM B221 6061 designed for rigidity and have a weight of not less than 3.0 pounds per linear foot. The guides shall be designed to embed in or mount to the face of the concrete and shall be provided with keyways to lock them into the concrete. The invert of the frame shall be welded to the lower ends of the guides, which will incorporate an ultrahigh molecular weight double winged polymer strip on both the upstream and downstream side of the disc. The strips will be held in dovetailed grooves. The guides shall be designed with keyways to lock it into the concrete. The invert of the frame will be an aluminum extrusion welded to the lower ends of the guides to form a seating surface for the resilient seal. Where the guides extend above the operating floor they shall be sufficiently strong so that no further reinforcing will be required.
- C. The seals will be resilient neoprene and mounted on the bottom of the disc or installed into the invert member to provide flush bottom enclosure. Under a design seating of less than 20 ft. (from gate invert) or unseating head of 10 ft., the leakage shall not exceed 0.1 gallons per minute per foot of seating perimeter.
- D. Stems shall be ASTM A276 Type 304 stainless steel. Stem threads shall be of the machine cut Acme type. Stems shall be designed to transmit in compression a minimum of two times the rated output of the hoist at 30 lbs. effort on the handwheel. The L/r ratio of the unsupported stem shall exceed 200. Stem guides will have polymer or bronze bushings.
- E. Actuator will be handwheel and hoist shall be sized to permit operation of the gate under the full operating load with a maximum effort of 30 lbs on the handwheel. The hoist nut will be magnesium bronze ASTM 8584 and hoist nut shall be supported on roller bearings with a lubrication fitting without disassembly of the hoist.
- F. All necessary attaching bolts, studs, and anchors will be Type 344 stainless steel and will be furnished by the slide gate manufacturer.

2.07 STOP PLATES

- A. Stop plates shall be constructed of 1/4" 6061-T6 aluminum alloy, reinforced with aluminum angles as shown on the Drawings.
- B. Stop plate grooves shall be of compatible material resistant to seizing.
- C. All fasteners and anchors shall be stainless steel.
- D. Stop plates shall have a handle extending above the plate or a slot cut in the plate for ease in lifting. A schedule is given on the Drawings and/or Specifications.
- E. Stop plate grooves shall be of the type shown and scheduled on the Drawings and/or Specifications.
- F. All stop plates and stop plate grooves shall be fabricated to fit the field-measured openings.

2.08 FLUSH BOTTOM SEAL

- A. Provide gates so designated with a solid neoprene seal attached to the bottom of the slide or to the bottom cross member of the frame, flush with the invert.

2.09 MATERIALS

- A. Materials shall conform to the following ASTM Standards indicated below.

<u>MATERIAL</u>	<u>ASTM STANDARD</u>
Aluminum (Structural)	B221, Alloy 6061-T6 or B308 Alloy 6061
Fiberglass	30% glass fiber

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that anchors are correctly positioned.

3.02 PREPARATION

- A. Provide rough-in frame and anchors for placement by Section 03100 - Concrete Form Work.

3.03 INSTALLATION

- A. Install unit in accordance with manufacturer's instructions plumb and true.
- B. If aluminum guides are supplied, provide bituminous coating in contact with concrete.

3.04 FIELD QUALITY CONTROL

- A. Inspect/test gates for proper alignment and operation in the presence of the superintendent.

3.05 ADJUSTING

- A. Section 01700 - Contract Closeout: Adjusting installed work.
- B. Adjust unit mechanism to achieve specified requirements.

END OF SECTION

SECTION 11310

INFLUENT AND RAS PUMP SYSTEM

PART 1 GENERAL

1.01 SCOPE

- A. Two (2) influent pumps installed in an existing dry pit with valves and accessories as shown on the Drawings and one (1) complete pump station (RAS) consisting of precast concrete wet well, and valve pit, meter pit, submersible pumps, motors, valves, piping, guide rail system, discharge piping, magnetic flow meter and fittings, hoists, flow control valves, and lifting chain with hooks, level control devices, power supply, access frame and covers, various appurtenances for a complete operating system as herein specified or shown on the contract drawings.
- B. Furnish all labor, material, equipment, products, incidentals and testing required and necessary to provide a complete and operational system. Install where noted on the drawings and as specified within these specifications.
- C. The unit shall include all manufacturers motors, starters/electrical work necessary connecting conduit, wiring controls, control panels within requirements of Division 16.
- D. Coordinate all work with this equipment and any other associated equipment, installed and specified under other sections of these specifications.

1.02 RELATED SECTIONS

- A. Section 01700 – Contract Closeout
- B. Section 02050 – Demolition
- C. Section 02130 – Trench Excavation, Bedding and Backfill
- D. Section 02222 – Excavation
- E. Section 02229 – Rock Removal
- F. Section 02607 – Manholes and Covers
- G. Section 03300 – Concrete
- H. Section 03410 – Precast Concrete Structures
- I. Section 09900 – Painting

J. Section 11280 – Gates and Valves

K. Division 16 – Electrical

1.03 REFERENCES

A. ASTM - American Society for Testing and Materials

B. IEEE - Institute of Electrical and Electronic Engineers

C. NEMA - National Electrical Manufacturers Association

D. SSPC - Steel Structures Painting Council

1.04 SUBMITTALS FOR REVIEW

A. Section 01300 - Submittals: Procedures for submittals, contract drawings shall not be copied for use as shop drawings.

B. Product Data: Provide data on joint devices, attachment accessories and admixtures.

1.05 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Procedures for submittals.

B. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent work.

C. Maintenance and Operating Instructions

1. Three (3) copies of each Manufacturer's maintenance and operating instructions manual shall be provided with the equipment at the time of delivery.

1.06 SUBMITTALS FOR CLOSEOUT

A. Section 01700 - Contract Closeout

B. Spare Parts for each Lift Station

1. One (1) Spare float
2. Two (2) Spare hatch operating keys
3. One (1) seal kit with spare parts; one (1) additional set of bearings for each pump.

4. Spare parts utilized during start-up and prior to acceptance of the equipment shall be replaced by the Contractor at no additional cost to the Owner.
5. Spare parts shall be shipped with the pumping equipment and stored by the Contractor until turned over to the Owner during project closeout and shall be accompanied by documentation signed and dated by the contractor's and owner's representatives.

1.07 QUALITY ASSURANCE

- A. Factory test each pump using water with a factory certified motor, the same size as that specified.
- B. Tests shall consist of checking each pump at its rated speed, head, capacity, efficiency, and brake horsepower; and at such other conditions of head and capacity to properly establish the performance curve.
- C. Submit copies of the performance curves to the Contractor for Engineer review prior to releasing the pumps to the Contractor.
- D. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

1.08 WARRANTY

- A. The manufacturer of the pumping unit shall guarantee the pumps and accessories to be of quality construction, free from defects in material and workmanship for a period of one year, excepting only those items that are normally consumed in service such as light bulbs, oil, grease, packing, "O" rings, etc.
- B. The pumping unit manufacturer shall be solely responsible for the guarantee of the units and all components. The guarantee will be effective upon acceptance of the installation by the Owner.
- C. Major components, such as pumps, pump motors, etc., and accessory components failing to perform as specified, or proven defective in service during the guarantee period, shall be replaced, repaired or satisfactorily modified by the Contractor without cost to the Owner.
- D. Delivery and Handling of Equipment
 1. Inspect all equipment and materials against reviewed Shop Drawings at time of delivery.
 2. Equipment and materials damaged or not meeting the requirements of the reviewed Shop Drawings shall be immediately returned for

replacement or repair.

E. Storage

1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
2. Store all equipment and materials in a dry, covered, ventilated location and protect from harm according to the manufacturer's instruction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Pump Manufacturer:

1. Flygt Pumps
2. Xylem Pumps
3. Or equal

B. Contractor shall supply pumps from same manufacturer for pumps for the influent pumping station and for the RAS pump system. Control panels for the project shall likewise be supplied by the same manufacturer.

2.02 COMPONENTS

A. Operating Conditions:

1. Each pump shall have an initial capacities and total heads as indicated on the Contract Drawings and/or in the table at the end of this section.
2. Pump motors shall be as specified on the Contract Drawings.
3. Pump efficiency at design shall be a minimum of 30%.

2.03 EQUIPMENT

A. For each lift station, furnish pumps, motors, and accessories including the access frame and lid in accordance with the following specifications:

1. Provide pumps and motors for installation in a cast-in-place wet well in accordance with the manufacturer's instructions.
2. Each pump shall be designed as a completely submersible wastewater pump capable of pumping raw wastewater consisting of water, grit, and biological solids.
3. All major pump parts shall be ASTM Class 30 cast iron or better finished with an epoxy paint system.
4. All nuts, bolts, and miscellaneous hardware in contact with the pumped material shall be 316 stainless steel.

5. All mating surfaces where watertight sealing is required shall be machined and fitted with necessary gaskets or O-rings.
- B. Each pump shall be supplied with a quick discharge connection/slide rail system to automatically connect the pump to the discharge piping without any adjustments, fasteners, or clamps. Personnel shall not be required to enter into the basin to remove or reinstall the pumping equipment.
- C. All major parts of the pumping unit including casing, impeller, suction cover, wear rings, motor frame and discharge elbow shall be manufactured from gray cast iron, ASTM A-48 Class 30. Casings shall have smooth surfaces devoid of blow holes or other casting irregularities. Casing design shall be centerline discharge with a large radius on the cut water to prevent clogging. Units shall be furnished with a discharge elbow and 125 lb. flat face ANSI flange. All exposed bolts and nuts shall be 304 stainless steel. All mating surfaces of major components shall be machined and fitted with NBR o-rings where watertight sealing is required. Machining and fitting shall be such that sealing accomplished by automatic compression of o-rings in two planes and o-ring contact is made on four surfaces without the requirement of specific torque limits. Internal and external surfaces are prepared to SPPC-VISI-SP-3-63 then coated with a zinc-chromate primer. The external surfaces are then coated with a Corothane I Coal Tar paint.
- D. Each pump shall be provided with a replaceable cast iron A 48, Class 30 slide rail guide shoe attached to the pump discharge flange. The guide shoe shall direct the pump down two vertical guide rails and onto the discharge connection in a simple lineal movement. The buildup of sludge and grease on guide rails shall not present problems during the lifting operation. The guide shoe shall be designed with integral hooks at the top to transmit full weight of the pump to the base plate flange, making metal to metal contact with the pump discharge forming a seal without the use of bolts, gaskets or other elastomeric seals. No portion of the pump shall be supported directly on the bottom of the wet well, guide rails, or lifting cable.
- E. Double mechanical seals operating in an oil bath shall be provided on all units. The oil filled seal chamber shall be designed to prevent over-filling and include an anti-vortexing vane to insure proper lubrication of both seal faces. Lower face materials shall be silicon carbide, upper faces carbon vs. ceramic, NBR elastomers, and 304SS hardware. Seal system shall not rely on pumping medium for lubrication.
- F. The contractor shall provide two lengths of schedule 40 stainless steel guide rail pipe for each pump. Guide rail shall be sized by the pump manufacturer. All accessories to attach the guide rails to the wet well shall be provided as shall be 316SS.

- G. The pump end shall consist of a dynamically balanced, single vane or two vane, impeller operating in a non-concentric pump case.
1. Pump wearing surfaces shall be easily replaceable with simple hand tools and shall require no remaking of any parts.
 2. Scroll type pump cases which tend to unbalance impeller side loading with resultant shaft stress shall not be considered equal.
- H. The impeller shall be single or radial multi-vane, open design. It shall be dynamically balanced and shall be designed for solids handling with a long thru-let without acute turns. The inlet edge of the impeller vanes shall be angled toward the impeller periphery so as to facilitate the release of objects that might otherwise clog the pump. The design shall also include back pump out vanes to reduce the pressure and entry of foreign materials into the mechanical seal area. In addition, a lip seal shall be located behind the impeller hub to further reduce the entry of foreign materials into the seal area. Impellers shall be direct connected to the motor shaft with a slip fit, key driven, and secured with an impeller bolt. The design shall include a replaceable cast iron suction cover. The suction cover shall be designed such that it may be adjusted to maintain working clearances and hydraulic efficiencies.
- I. The motor shall be secured in place by standard threaded fasteners and shall require only simple hand tools for removal or replacement.
1. No bolts shall protrude through the motor housing for fastening the stator onto the housing.
 2. The motor housing shall be provided with means to prevent overheating while running in a totally, partially, or non-submerged condition for a minimum period of 30 minutes. Motor windings shall be copper, insulated with moisture resistant Class F insulation. Stator shall be dipped and baked three times min, in Class F varnish and hot shrunk fitted into the stator housing.
 3. Motor shall be wound for 460 volts, 3 phase. Motor shall have 1.15 service factor. Motor shall be variable frequency rated. Motor shaft shall be one piece 403SS AISI 403 material, rotating on two permanently lubricated ball bearings designed for a minimum B-10 life of 60,000 hrs
 4. Motor shall be equipped with moisture sensors and thermal switches. Manufacturer to provide compatible relays for installation in control panel.
 5. Motor shall be an air filled induction type with a squirrel cage rotor, shell type design, built to NEMA MG-1 design B specifications
- J. A slide rail assembly consisting of 316 stainless steel upper and lower rail brackets, pump guide brackets, and C channel rails shall be provided to allow the pumps to be installed or removed without requiring personnel to enter the wet well.

1. The C channel rails shall support the pump at the required distance from the basin floor to provide unrestricted flow of material into the pumps.
 2. Brackets shall be attached to the pumps for positioning of the unit on the guide rails during installation or removal of the units.
 3. The stationary fitting shall have a Neoprene diaphragm clamped between the stainless steel rail and the stationary cast iron discharge.
 4. The cast iron moveable fitting when in position shall be held against the stationary fitting by the construction of the stainless steel rail aligning the moveable fitting to the flexible diaphragm for proper sealing of the two surfaces under pressure.
- K. Other automatic discharge connections requiring rotation of the pump to affect sealing shall not be considered equal.
- L. A stainless steel lifting cable of a size recommended by the pump manufacturer and length as indicated on the Drawings shall be provided for each pump. Provide sufficient cable to attach to the hoist cable.

2.04 FOUNDATION

A. Wet Well

1. The foundation for the concrete wet well shall be constructed of Class A reinforced concrete to the dimensions shown on the drawings and sloped to provide flow toward the pump intakes.
2. The base for the concrete wet well shall be of precast reinforced concrete, with bottom integrally cast with the sides. Bottom reinforcement shall be adequately tied to side reinforcement.
3. The base shall be approved by the owner. The base shall be set plumb and at the proper elevation, as shown on the drawings. All joints between the precast manhole sections, which make up the wet well, shall provide Class B concrete fill in the base of the wet well, as shown on the drawings. The concrete fill shall be troweled smooth.
4. Wall shall be vertical and of the diameter shown on the drawings. Precast reinforced walls shall have a minimum shell thickness of 6 inches and shall meet the requirements of ASTM C-478.
5. Adjoining sections or rings shall be firmly keyed together by means of approved tongue and groove joints with rubber gaskets meeting the requirements of ASTM C-443.
6. Pipe penetrations will be sealed using a watertight, flexible boot.
7. The top slab of the wet well shall be constructed of Class A reinforced concrete, as shown on the plans.
8. The supplier of the precast wet well structure shall supply design calculations signed and sealed by a registered structural engineer in Ohio that the entire structure is capable of withstanding the earth,

- groundwater, traffic and other working loads that may be imposed on the structure prior to the fabricating and shipping of the wet well to the site.
9. An access frame assembly of the size shown on the drawings shall be installed on the top slab. Access frame and covers shall be fabricated of aluminum. All fittings shall be flush to minimize trip hazards.
 10. A Class 150 vent, 4" size, pipe shall be provided for the wet well area. The outlet of the vent shall be provided with two #14 gauge mesh bronze wire screens secured to the vent inlet. An alternate "mushroom" style vent with a screened opening equal or greater in area in nominal 4" pipe size is also acceptable.

2.05 VALVE CHAMBER

- A. A separate valve chamber shall be provided with the pump station. The chamber shall be constructed of precast reinforced concrete in accordance with Section 2.04 to the dimensions shown on the drawings.
- B. The vault shall be installed level but the interior base shall be sloped toward the lift station to facilitate draining of water accumulated in the vault.
- C. Pipe and valves shall be supported with concrete formed and poured in the field with Class QC1 concrete. Concrete shall not interfere with operation of bolts and nuts on any fittings.

2.06 METER CHAMBER

- A. A separate meter chamber shall be provided with the pump station. The chamber shall be constructed of precast reinforced concrete in accordance with Section 2.04 to the dimensions shown on the drawings.
- B. The vault shall be installed level but the interior base shall be sloped toward the lift station to facilitate draining of water accumulated in the vault.
- C. Pipe and meters shall be supported with concrete formed and poured in the field with concrete. Concrete shall not interfere with operation of bolts and nuts on any fittings.

2.07 PORTABLE HOIST

- A. One (1) S.S. portable lifting hoist, Halliday D2B36D or approved equal, shall be provided with a lifting capability of 1000 lbs at the dimensional distance center line of socket to center line of pump as shown on drawings.
- B. One S.S. hoist sockets, Halliday D2E or approved equal, shall be provided and installed on the concrete wet well top slab. Socket shall be recessed to prevent a tripping hazard.

- C. Lifting cable shall be of sufficient length to attach to winch assembly on davit arm on one end and pump on the other end. Cable shall be S.S. 316, ¼" diameter or another size recommended by the manufacturer with S.S. eyehook for connection to pump, and swagger ball for S.S. connection to winch assembly.

2.08 ACCESS FRAMES AND COVERS

- A. The wet well aluminum access frames and covers shall be manufactured with ¼" thick, one piece aluminum extruded frame, with a continuous concrete anchor as part of the one piece extrusion.
- B. The door panels shall be ¼" thick aluminum diamond plate, to withstand a live load of 300 lbs. per square foot, with a safety factor of times 3. The doors shall be provided with stainless steel hinges with tamperproof fasteners.
- C. All hardware shall be stainless steel. The doors shall open to 90° and lock automatically in that position with a stainless steel release handle. Doors shall be provided with a stainless steel lifting handle, stainless steel locking bar, or stainless steel snap-lock with removable key handle. The doors shall close flush with the top of the frame, resting on a ½" wide lip around the entire inside of the frame for added support. Any contact of aluminum with concrete will necessitate a coal tar epoxy coating to protect the aluminum surface.
- D. The valve vault access frame and covers shall meet the requirements of the access frames and covers for the wet well as specified above.
- E. Sizing of the access frames and covers shall be as per plans and/or pump and valve supplier's recommendation.
- F. The pump station access hatch shall be equipped with a fall protection safety grate. Grating panel(s) shall be aluminum with a powder coat paint finish that is safety yellow (or safety orange) in color. Panel shall be designed to meet the requirements of OSHA standard 29 CFR 1910.23 and be equipped with a hold open device to lock the grating panel(s) in the open position. Hold open device and all hardware shall be Type 316 stainless steel. Panel shall be rated to withstand a live load equal to, or greater than, the design rating of the related access cover. Manufacturer shall provide a twenty-five year warranty against defects in material and workmanship.

2.09 PIPING

- A. Piping in the wet well basin shall be ductile iron, and shall terminate in a FL

x PE piece for passing through the basin wall. The plain end piece shall sufficiently extend through the basin wall for the MJ solid sleeve field connection. A packed sleeve or appropriate flexible seal shall be used in the basin wall, where each pipe passes through, with non-shrink grout, to provide a waterproof and gas-tight joint. Flanges shall be attached to discharge elbows for bolting directly to piping in the valve chamber at time of installation. Inlets into the basin shall be equal to booted manhole connection used elsewhere on the project. Uni-Flanges will be acceptable inside vaults only.

- B. Piping in the valve chamber shall include as shown: swing check valves, plug valves, necessary flanged elbows, tees, and discharge M.J. connector.
- C. All piping shall be mounted in the valve chamber and supported in place, ready to bolt to connect to PE piping outside the chamber. A 2" drainpipe shall be provided from the valve chamber into the RAS well. A check valve shall be provided at the end of the drainpipe to prevent liquid leakage into the valve chamber from the well similar to Tideflex TF-2 or equal.

2.10 GENERAL PUMP STATION REQUIREMENTS

- A. The discharge piping shall extend beyond the exterior wall of the wet well to the adjacent cast-in-place concrete valve pit. Provide check valves and plug valves, bypass piping, valves and quick connect, and support as necessary in the valve pit.
 - B. Provide junction boxes and PVC coated galvanized steel conduit as indicated on the Drawings. Junction box to be NEMA 4 stainless steel with backplate. Termination for float switches and motor sensors termination shall be to terminals. No conduit will be allowed on the deck of the structure.
 - C. Furnish two sets of data plates. Attach one stainless steel data plate to the pump, showing the manufacturers name, pump size and type, serial number, impeller or plunger diameter, capacity and head rating and other pertinent data. Second set of data plates to be attached to control panel.
 - D. All machine bolts, nuts and cap screws shall be of the hex head type. Hardware or parts requiring special tools or wrenches shall not be used.
 - E. Furnish stainless steel anchor bolts with nuts and washers, as recommended by pump manufacturer.
 - F. Equipment shall be provided with Tnemec Alkyd-Phenolic Series 37 or equal, primer and Tnemec Hi-Build Epoxoline Series 66 or equal finish.
1. All surfaces shall be completely cleaned and ground smooth. Fill exterior

surfaces as required.

2. All surfaces shall be treated before painting. Apply one coat of primer surface to exterior surfaces. One coat of white shall be applied to interior surfaces and two coats of finish enamel to the exterior.
3. The number and size of corrosion inhibitors shall be determined by the size of the enclosure.

2.11 ELECTRICAL REQUIREMENTS

- A. Unless noted otherwise all motor starters, fusible safety switches, float switches, relays, capacitors limit switches, selector switches, pushbuttons, indicating lights programming, and all other pilot devices necessary to form a complete operating electrical system for each mechanical item will be supplied.
- B. Each equipment enclosure shall be provided with means to gain access for control and maintenance purposes to all devices from the front. An exterior, lockable, hinged door shall enclose all devices including the control panel.
- C. All control switches, pilot lights, elapsed time totalizes, and motor overload reset pushbuttons shall be mounted on an interior hinged panel. A sub panel shall be provided for mounting relays, terminal strips, motor circuit protectors and starters, VFD's, etc.
- D. Furnish engraved laminated plastic nameplates with 1/4 inch black letters on a white background for each panel mounted instrument. Tag all instruments and components inside with embossed plastic tape labels.
 1. All electrical equipment shall be marked to show voltage, current, and other electrical ratings or characteristics to assure safe application. All markings shall be clear and legible and of a permanent nature.
- E. Control wiring shall be #14 AWG minimum, UL Style 1015, FR-1 rated nineteen strand copper with red ac control, yellow foreign voltage, and blue dc control. Ground wire shall be #14 AWG minimum 90xC, green.
- F. All wiring installations shall be grouped, bundled, supported and routed horizontally and vertically, to provide a neat appearance. Panel enclosures shall be grounded by means of a copper equipment grounding conductor.
 1. Isolation barriers shall be provided as necessary to prevent access to open terminals or the rear sub panel upon opening exterior door.
 2. Tag all wire, cable and conduit at each end or termination with suitable tags, printed, stamped, or engraved with wire, cable or conduit number. The figures on the tags shall be clear and legible.

- G. The main disconnect switch handle shall be accessible upon opening exterior door.
- H. A ground fault receptacle shall be provided and located inside cabinet, accessible upon opening exterior door.
- I. A pump control panel factory assembled in a NEMA 4X stainless steel enclosure shall be provided and prewired to identified terminal blocks. Panel installation shall be made by the General Contractor with all interconnection wiring included.
 - 1. Incoming power shall be 460 volts, 3 phase, 3 wire with ground.
 - 2. Enclosure shall be sized as required to house the associated control equipment with 10% spare back panel space.
 - 3. Enclosure shall be configured for exterior installation on a unistrut frame as reflected on the Drawings.. Power and control cables shall enter from bottom of enclosure.
 - 4. Provide as a part of the enclosure package for the RAS pumps, a stainless sun shade that will assist in keeping direct sunlight from heating the control panel and the VFD's that reside inside the panel. The shade shall be manufactured by Tracom Fiberglass Products or equal. The shade should have dimensions a minimum of 1'-6" greater in width than the control panel and be mounted so that the shade is at least 12 inches above the top of the panel.
- J. The control panel shall include the following basic items:
 - 1. A main 3-pole circuit breaker disconnect switch sized to handle operation of pump and other loads. The switch shall be suitable for 460 volts.
 - a. Switch shall be heavy-duty industrial type.
 - b. Switch handle mechanism shall provide means of padlocking in the OFF and ON positions.
 - 2. Provide transient volt surge suppression (TVSS) at main disconnect switch. Provide disconnect breaker for TVSS.
 - 3. Molded case switch and Class RK5 fuses for the pump(s), properly sized for the pump provided or MCP's may be used.
 - 4. Provide variable frequency drives (VFDs) sized for pump operating loads.
 - 5. Motor control circuit and associated devices shall operate on 120 volts, single phase supplied from a control transformer within the enclosure.
 - 6. Provide relays as needed to interface with SCADA system. Refer to Section 16900 for the alarm and interface requirements.
- K. A Hand-Off-Automatic (HOA) selector switch for the motor control circuit. Selector switch and contact blocks shall be rated heavy duty and oil tight.
 - 1. Switch shall be furnished with standard size legend plate reading Hand-

Off-Auto.

2. Contact blocks shall have a continuous current rating of 10 amperes at 120 volts AC.
3. In the Hand mode, the associated pump will operate continuously.
4. The Auto mode will allow the associated pump to interface with the SCADA system PLC.
5. The Off mode shall shut down the pump and disable the associated controls.

- L. The RAS pump station control system shall be managed by the SCADA system PLC in a lead, lag control mode. The lead pump will start and ramp up to operating speed when level exceeds the lead pump start level. The level controller shall cause the lead pump VFD to increase the pump speed to maintain the desired level setpoint. When the wet well level continues to increase and exceeds either a high level or high deviation setpoint, the lag pump shall be started. The level controller shall adjust the output signal to the lead pump VFD so that a smooth transition from one pump to two pump operation occurs without a large surge in pump station flow. When the lift station level decreases, the reverse sequence shall occur. The station shall be equipped with a back-up float control system.

1. Provide a float based level system to serve as a back-up control and high level alarm. Float switches shall be mercury switches hermetically sealed within the float suspended with 3-conductor immersion-rated control cable with cast iron weight affixed to cable above the float. Switch contacts shall be used in pilot-control circuits and be rated 12 amps at 115 or 230 volt AC. Float switches shall be attached to a weighted stainless steel chain which will be fastened to a stainless steel eye bolt accessible from the top of the wet well without entering the wet well for removal.

M. General:

1. Should the lift station level decrease to the low level setpoint, the pumps shall be stopped. The pumps will not restart until the wet well level increases to the level controller operating setpoint.
2. Should the level increase to the high level alarm float, the alarm light shall be turned on and the remote alarm contact shall be made. The lag pump shall start.
3. The alarm light shall be turned on with the following conditions:
 - a. High wet well level
 - b. VFD fault
 - c. Pump fault (over temp)
 - d. Level sensor fault
4. Should the operating pump VFD (starter) fault and fail to restart, the lag pump shall be started and become the lead pump.
5. On a level sensor fault, the pumps shall operate on a fill-up pump down

mode. Operating between the stop float and the start float with the high level float operating as previously described. The pump speed shall be set at 100% when operating in this mode.

- N. Station panels shall incorporate red running indicating lights. Legend plate shall read "Running." Lamps shall be LED's.
- O. Control relays shall be plug-in type with socket. Socket shall have screw terminals. Contacts shall be silver-cadmium, rated 10 amperes at 120 volts AC. Relay shall have three pole, double throw contacts (3PDT). Relay shall have a manual operator and pilot light.
- P. The control panel shall be provided with appropriate climate control and insulation for the equipment installed. Temperature limits shall be as required by the equipment manufacturers. Design outside temperature range shall be -10 °F. to 105 °F.
- Q. Panel shall each incorporate a step down transformer and appropriate components to provide for the required single phase loads.
- R. Panel shall each incorporate an elapsed time totalizer function for pumps. Totalizers shall be digital and shall have a minimum of six digits to provide the range of time measure in tenths of hours, non-resettable and operate on 120 volt 60 hertz.
- S. Provide a submersible pressure transducer in accordance with Section 16901 to determine and transmit levels within the station wet well. The transducer shall be mounted using a stainless steel cable system consisting of a 2' long 1-inch NPT type 316 stainless steel pipe with coupling, bolt, cable clamps and hardware in a location that will not interfere with adjacent equipment and that is accessible for service without entering the wet well.
- T. The control panel(s) shall be completely wired at the factory. All wiring shall be done in accordance with applicable code and standards, which include as a minimum the latest National Electrical Code and OSHA Rules. All wiring shall be color coded and numbered.
- U. The control panel shall incorporate terminal strips for interface with the SCADA control panel.
- V. All cables shall be rated for submersible duty, extra hard service.
 - 1. A ground wire shall be included in each cable, sized per NEC 250.
 - 2. Minimum size shall be 14 AWG for control wiring and 12 AWG for power conductors. Power conductors shall be sized at 125% of motor full load

current and NEC 400-5.

3. Length of cable shall be as required with an additional minimum of two (2) feet of cable.

W. The external conduit and wiring required for power supply to electrical equipment will be furnished and installed under Division 16.

1. Electrical warning tape shall be installed in the trench 3 inches below finish grade, whenever power feed is directly buried.

PART 3 EXECUTION

3.01 TESTING AND STARTUP

- A. The pumps provided shall be factory tested at three points to verify the pump performs at the design points.
 1. Tests shall consist of checking the unit at its rated speed, head, capacity, efficiency and brake horsepower, and at such other conditions of head and capacity to properly establish the performance curve.
 2. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.
- B. The Contractor shall test all power and control devices in each Control Panel for proper operation.
- C. A factory trained service technician shall be provided for a minimum of one day for each lift station to test and make adjustments to the control panel to place each into operation and provide training in operation and maintenance.
- D. After all testing has been completed to the satisfaction of the Owner and/or Engineer, each Lift Station and Control Panel System shall operate for a minimum test period of 30 days.
 1. Cumulative down time of all components furnished shall not exceed 1/2 hour as recorded by the Engineer during the test period.
 2. System documentation shall be delivered on the last day of test period. Test period shall not end until system documentation has been delivered.
- E. If the cumulative downtime limit for either lift station is exceeded, the Engineer shall have the following options:
 1. Extend the test period as required until the cumulative downtime during the preceding 30 days does not exceed 1/2 hour as recorded by the Engineer.
 2. Sub-systems which have no components contributing to the cumulative

downtime will be approved as a partial acceptance.

3. Subsystems which have components that contributed to the cumulative downtime shall have their test period begin after all repairs and adjustments have been made.

3.02 SCHEDULE

- A. Each pump shall be as specified or equal and have the following characteristics:

<u>Name</u>	<u>No. of Pumps</u>	<u>Type</u>	<u>Drive</u>	<u>GPM</u>	<u>TDH, ft</u>	<u>HP</u>
INFLUENT	2	Dry pit non clog	VFD	175 350	24.5 37	10.0, max
RAS	2	Submersible non clog	VFD	140 410	26 37	7.5, min
3" discharge, minimum efficiency 40%						

END OF SECTION

SECTION 11320

SLUDGE TRANSFER PUMP STATION

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

- A. The work under this section shall govern the installation, testing and start-up of a wet pit submersible grinder type sludge pumping system that will be pumping aerobically digested waste activated sludge, complete with all appurtenances in accordance with the drawings and as specified herein.
- B. Work of this Section includes, but is not limited to:
 - 1. The Contractor shall furnish, install, test and start-up at the locations shown on the Drawings one (1) simplex submersible centrifugal sewage grinder pump package as specified herein, including but not necessarily limited to all pumps, motors, valves, piping, guide rail system, discharge elbows, hoists, lifting chains with hooks, mercury float switches with weights, power supply, and ancillary equipment as herein specified or shown on the Contract Drawings and required for a complete installation. A spare pump ready for complete and easy installation in the wet well will be provided for a total of two (2) pumps.

1.03 QUALITY ASSURANCE

A. Qualifications and Manufacturers

- 1. The Contractor shall base his bid proposal on the materials and equipment specified in this Section.

B. Maintenance and Operating Instructions

- 1. Two (2) copies of each Manufacturer's maintenance and operating instructions manual shall be provided with the equipment at the time of delivery. Any revisions during start-up to the operating instructions shall be made in each of three (3) final copies of the Operation and Maintenance Manuals prior to final payment being made to the Contractor.
- 2. Expedite submittals of Shop Drawings for equipment and materials with long delivery times.

C. Spare Parts

1. One (1) seal kit with spare parts; one (1) additional set of bearings for each pump.
2. Spare parts utilized during start-up and prior to acceptance of the equipment shall be replaced by the Contractor at no additional cost to the Owner.
3. Spare parts shall be shipped with the pumping equipment and stored by the Contractor until turned over to the Owner during project closeout.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling of Equipment

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

B. Storage

1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
2. Store all equipment and materials in a dry, covered, ventilated location and protect from harm according to the manufacturer's instruction.

PART 2 PRODUCTS

2.01 GENERAL

- A. Each pump shall be rated at 460 volts, three phase, 60 hertz, and suggested 2 HP and 3450 RPM or parameters approved by the Engineer.
- B. All machined surfaces exposed to the sewage water to be re-painted similar to Tnemec Omnithane primer and finish epoxy similar to Tnemec N140 Pota Pox or equal with finished mill thickness 10 to 20 mills.

2.02 ACCEPTABLE MANUFACTURER:

- A. The electric motor driven, totally submersible grinder sewage pumps shall be manufactured by Keen Pumps, Hydromatic,, Barnes, or Flygt Corp. or equal.

2.03 SUBMERSIBLE GRINDER PUMPS AND ACCESSORIES

- A. The Contractor shall furnish and install all pumps, fittings and related equipment in accordance with the drawings and as specified herein.
 - 1. The pumping units required under this Specification shall be complete including pumps, motor with proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength stability and stiffness and to be especially adapted for the work to be done. Ample room shall be provided for inspection, repairs and adjustments.
 - 2. All metal components within the wet well, with the exception of the pumps, motors, station piping and related appurtenances, shall be 304 stainless steel.
 - 3. Each foundation plate for each pump shall be designed and accurately anchored into position. All necessary foundation bolts, plates, nuts and washers shall be furnished by the manufacturer for installation by the Contractor.
 - 4. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed and all other pertinent data shall be permanently attached to each pump and/or motor.
 - 5. Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine run-away speed of the unit due to back flow through the pump.
 - 6. The pump manufacturer shall factory test all pumps prior to shipment in accordance with the standards of the Hydraulic Institute. For all pumps, flow, TDH, and input kW shall be tested and recorded for at least five points on the pump performance curve. Certified copies of the test reports shall be furnished to the Owner for approval prior to shipment.

2.04 PUMPS

- A. The Contractor shall furnish and install the required number of submersible grinder sewage pumps, of the required size and capacity, as referenced in the Drawings.
- B. The grinder unit shall be capable of shearing and reducing to a fine slurry all material normally found in domestic and commercial sewage such as sanitary napkins, disposable diapers, cloth diapers, wash rags, wood, rubber, plastics, etc. The slurry shall be capable of freely passing through a 1-1/4 inch piping system including check and gate valve.
- C. The pump shall be of the centrifugal type and the grinder shall consist of two stages with the rotating cutter mounted on the pump shaft directly against the impeller. The stationary cutter shall be mounted on an

adjustable bottom plate. The grinder unit shall be on the suction side of the pump impeller and discharge directly into the impeller inlet leaving no exposed shaft to permit packing of ground solids. The cutting action of the second stage shall be perpendicular to the plane of the first cut for better control of the particle size. The stationary cutter shall have slots to facilitate better flow. The bottom plate shall be cast with grooves threading outward from the center opening of the plate to the outer diameter. The cutter material shall be similar to an ANSI 440C stainless steel with the addition of cobalt, vanadium and molybdenum for superior abrasion resistance and a hardness of 58-62 Rockwell C.

The upper (axial) cutter and stationary cutter ring shall be reversible to provide new cutting edges to double life. The stationary cutter ring shall be a slip fit into the suction opening of the volute and held in place by at least three (3) 300 series stainless steel screws and a retaining ring. The lower (radial) cutter shall macerate the solids against the I.D. of the cutter ring and extrude them through the slots of the cutter ring to eliminate any roping effect which may occur in single stage cutting action. The upper (axial) cutter shall fit over the hub of the shaft by a 300 series stainless steel countersunk washer in conjunction with a 300 series stainless steel flat head cap screw threaded into the end of the shaft.

- D. Impeller shall be bronze or cast iron, multi-vane, semi-open, non-overloading design. Impeller must be capable of being either factory or field trimmed to meet specific performance conditions. Impellers shall be hydraulically and statically balanced at the factory, and machined for threading on to the pump shaft. Wear or field trimming shall not deter the factory balance.
- E. The pump/motor shaft shall be constructed of 416 or 420 stainless steel and shall be keyed to accept the impeller. The impeller and grinder unit shall be secured to the shaft by a stainless steel locking bolt or nut. The shaft shall be designed to meet the maximum torque required at any start-up condition or operating point in the system. When operating the pump design point, the shaft shall have a maximum deflection of 0.45 mm at the lower seal face and a maximum deflection of 0.45 at the wear ring area.
- F. The design shall be such that the pumps will be automatically connected to the piping system when lowered on to the discharge fitting. Pumps shall be easily removed for service or inspection, not requiring the removal of nuts, bolts or other fasteners, or the need for personnel to enter wet well.
- G. Each pump shall be equipped with a 300 series stainless steel lifting bail with an opening of at least eight inches in diameter and a series 300 stainless steel cable of adequate strength and length to permit the raising and lowering of the pump on stainless steel rails for maintenance and

inspection. Rails will be sized and oriented in relation to the pump and discharge base by the manufacturer.

- H. The stator casing and oil casing shall be constructed of ASTM A48 gray cast iron with all parts coming into contact with raw sewage protected by a coat of PVC epoxy primer with a compatible epoxy finish coat or other approved coating.
- I. All external bolts and nuts shall be 300 series stainless steel.
- J. The pump casing shall have a machined connection system that will attach to the ASTM A48 cast iron discharge connection. The sliding guide bracket may be an integral part of the pump unit or a separate bolted to the pump discharge via a standard ASA bolt pattern. Sealing of the guide bracket to the discharge base shall not require movement of the pump, hydraulic pressure, or machined faces. The discharge connection shall be bolted to the floor of the sump with 316 stainless steel anchor bolts and so designed as to receive the pump connection without the need of any bolts or nuts. No portion of the pump shall bear directly on the floor of the sump.
- K. The sealing of the sump unit to the discharge connection shall be accomplished by a downward motion of the pump, with the entire weight of the pump guided by one (1) or two (2), Type 304, Schedule 40 stainless steel guide rails, effecting a seal by the weight of the pump pressing against the face of the flange of the discharge connection. No portion of the pump shall bear against the floor of the sump. Intermediate supports of 304 stainless material shall be provided every 15 feet.
- L. Each pump shall be equipped with two (2) seals. The lower seal (pump side) shall be of the mechanical type with silicon carbide faces. The upper seal shall be a lip type seal and shall also be a mechanical seal with silicon carbide faces. The oil chamber separates the pump from the motor and provides lubrication for the seals. Each stationary seal face shall be sealed with an O-ring. The seal faces shall be held in place by individual independent springs. The seals shall not require routine maintenance or adjustment and shall not be damaged when the pump is run dry. Seal oil inspection must be achieved without disassembly of the pump. Seals must not require the pumped liquid to act as a lubricant. The seals shall require neither maintenance nor adjustment and shall be easily replaceable.
- M. The pump shall be fitted with an oil chamber in which the shaft mechanical seals operate. The chamber shall be fitted with a drain and inspection plug easily accessible from the outside of the pump. The oil used in the chamber shall be environmentally safe, non-toxic oil.

- N. The pump motor shall be a high efficiency NEMA Design B with a minimum 1.10 service factor based upon the nameplate horsepower rating. De-rating the motors to achieve the specified services is not acceptable. Motors shall be rated at 155 degrees C for continuous operation in a totally, partially or non-submerged condition. Motors shall be non-overloading and capable of 15 starts per hour minimum. The motor windings shall be provided with the minimum two over-temperature sensors set at 140 degrees C, one in each phase, all wired in series. The sensors shall be self-resetting and wired into the pump controls in a manner that will shut the pump down if the sensor opens.
- O. Unless otherwise noted or shown on the drawings, motors shall be rated at 460 volts, three phase, and shall be FM approved for Class 1, Division 1, group C & D locations.
- P. The pump motor shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or nonsubmerged condition under full load without damage for extended periods. The pump motor shall be non-overloading at any point on the pump operating curve.
- Q. An electronic probe shall be provided in the oil chamber to detect the leakage of water. A solid-state device mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe. If the water enters the oil chamber the probe will activate a warning light in the control panel.
- R. The motor shaft shall rotate on permanently lubricated ball bearings properly sized to withstand the axial and radial forces induced by the impeller. The ABFMA minimum B-10 bearing life shall be at least 50,000 hours.
- S. Pumps shall be provided with a cable entry design that shall preclude specific torque requirements to insure a watertight and submersible seal. Sealing of the power cable entrance into the terminal chamber shall be by one of the following systems:
1. Cable terminal box on side of motor housing, with cable entry sealed to insure that no entry of moisture is possible into the high-voltage motor/terminal area even if the cable is damaged or severed below water level.
 2. A compressed grommet seal on the cable's outer jacket only, with a sealed terminal board between the cable entry and motor housing as a secondary seal against leakage through a damaged cable jacket. A moisture detector shall be provided in the sealed junction chamber area to signal and shut down the pump motor before shorting or motor damage can occur.

2.05 FLOAT/CABLE HANGER:

- A. A 300 series stainless steel cable holder with a minimum of six hooks of sufficient length and strength to provide support for each separate cable shall be furnished. Sharp corners and edges shall be ground smooth to prevent abrasion and cutting of the electrical cable and insulation. The cable holder shall be of sufficient length and strength to provide support for each separate cable, except that the pump power and lift cables may use the same hook position, provided the cables do not foul one. The float/cable hanger shall be easily accessed from the hatch opening.

2.06 CABLE

- A. Pump motor cable shall be of the SO/SOW type suitable for submersible pump applications with the rating permanently embossed on the cable. Pumps shall be supplied with power and sensor conductors encapsulated in a single cable, where practical. Cable length shall be sufficient to reach the control panel without the need for junction boxes or splices. Cable sizing shall conform to NEC requirements for the full load current of the pump motor. Cables shall consist of a P-MSHA approved type SPC insulated cable with a double jacketed protection system. The cables shall have a neoprene outside and synthetic rubber inside, and shall exceed industry standards for oil, gas and sewage resistance. Individual conductors shall be type RUW. Stainless steel strain relief cord grips shall be provided for each pump cable.
- B. The power cable(s) from each pump shall be pulled to the control panel through conduit. Only one set of pump power cables shall be pulled per conduit. All float switches shall be pulled through a separate conduit. Minimum conduit diameters shall be as recommended by the pump manufacturer and shall be in accordance with NEC.

2.07 CABLE ENTRY SYSTEM

- A. The cable entry system shall consist of the cable fastened by means of a cord grip in the top of the pump. The top of the pump shall contain a waterproof junction box which will provide space to connect the power cord to the motor leads. The motor leads shall seal between the motor housing and junction box by means of a rubber compression fitting around each wire.

2.08 RAIL ASSEMBLY

- A. The lift-out rail system shall permit easy removal and installation of the pump and lower check valve without the necessity of personnel entering the wet-well. Each lift-out system shall consist of: a cast iron discharge

base/elbow, cast iron pump carrier and sealing plate, and stainless steel pump guide plate. Pump carrier also to include neoprene ball valve with stainless steel insert. All exposed hardware shall be 300 series stainless steel.

- B. The discharge elbow shall be 1 ¼" X 2" NPT and shall be integral to the base assembly.
- C. The sealing plate/elbow shall have a female mating end and shall be bolted to the pump. A simple downward sliding motion of the pump and guide plate on the guide rails shall cause the unit to be automatically connected and sealed to the base. The open face of the sealing plate shall have dove-tailed groove machined into the face to hold a sealing O-ring. The O-ring shall provide a redundant leak-proof seal at all operating pressures.

2.09 CHECK VALVE

- A. A ball check valve shall be provided as an integral part of the pump guide plate assembly. The check valve ball shall move automatically out of the path of flow along two cast rails within elbow and provide an unobstructed full flow through the valve body. When the pump stops the ball shall automatically roll back to the closed position, which provides a positive seal against any back pressure. A stainless steel insert, which is pressed into the valve body/pump carrier, allows ball to seat against it.

2.10 SHUTOFF VALVE

- A. A 3" DIP plug valve type shut off valve with full port and cast iron body, plug and bonnet. Valve shall be quarter turn nut operated with handle provided to operate the shutoff valve.

2.11 JUNCTION BOX

- A. The junction box shall be constructed of structural plastic for corrosion resistance and of adequate thickness to provide stability and mechanical strength. The junction box shall have a fully gasketed cover that is held in place by four (4) captive stainless steel screws with heads of adequate size so that they may easily be installed and removed without the use of special tools. The heads of the screws shall be totally encapsulated so that no metal parts are exposed. The cover shall be fastened to the main body of the junction box by means of a totally corrosion-resistant tether to prevent dropping the cover during service.
- B. An adequate number of sealing-type cord grips shall be supplied for incoming pump and level control cords. The cord grips shall be made of

non-corrosive material, such as PVC or nylon, and shall make an effective seal around the wire jacket. The cord grips shall seal to the junction box with an O-ring or gasket.

- C. The junction box shall have a PVC solvent weld type conduit hub of adequate size to accommodate the number of wires required for pump and level control operation. The incoming wires shall be sealed by an external EY type seal-off (supplied by others) so that condensation from the conduit or groundwater will not enter the enclosure. The interior of the enclosure shall be of adequate size to accommodate the wires and connections for pump and level control operation.
- D. The wires running between the control panel and the junction box shall be color-coded and fastened to the pump and level controls by means of adequately sized and insulated twist lock or crimp connectors.
- E. The junction box shall be designed to NEMA 6 standards for occasional submergence.

2.12 PLUG-IN CONNECTOR

- A. A waterproof male plug shall be supplied on the pump power and control cord and shall mate to a female socket mounted in the junction box. The plug and cord shall be of the proper size to handle the voltage and current requirements of the pump. The plug and receptacle shall be of the molded to cable and double face design. The female half shall fit like a cork into the flexible shroud portion of the male. In addition, individual neoprene shoulders around contacts shall fit into recesses in female section. The cable shall be neoprene molded, one-piece design, and the connector shall have a threaded coupling for positive tight connection and quick release. The mating connectors shall have an indexing tab to insure proper alignment.

2.13 LEVEL CONTROLS

- A. Pump on, off, and alarm levels shall be controlled by two (2) mercury tube float switches. Alarm and off pump on shall be controlled by the same float. Switches shall consist of a mercury tube switch sealed in a corrosion-resistant polypropylene housing with a minimum of 18 gauge, 2-wire, SJOW/A jacketed cable. The cable shall be of sufficient length to reach the junction box with no splices. The level controls shall be tethered to a PVC float pole so that adjustment or replacement may be done without the use of any tools. Level controls shall be UL/CSA listed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install as indicated and in accordance with manufacturer's written instructions.
- B. Paint touch up is required on all ferrous metal surfaces where necessary.

3.03 TESTING

- A. Factory Performance Tests: The pump manufacturer shall provide factory performance tests in accordance with the Hydraulic Institute Standards, latest edition. Certified performance curves shall be submitted for capacity, power requirements and pump efficiency at specified minimum operating head, shut off head and at least three other points.
- B. Field Testing:
 - 1. Field testing shall be provided by the Contractor with the representative of the pump manufacturer present, and witnessed by the Engineer and the representative of the serving utility.
 - a. A three point pump performance test shall be performed, measuring the amperage draw, voltage, discharge pressure and the rate of flow.
 - b. The rate of flow and head shall be within 10 percent and 5 percent, respectively, above the approved curve for acceptance.
 - c. The test results shall be provided to the serving utility prior to the final inspection of the system.
 - d. Upon completion of each station, the PUMP MANUFACTURER shall inspect the installation and submit a certificate stating that the installation of the equipment is satisfactory, and that the equipment is ready for operation.

3.04 START-UP AND FINAL INSPECTION

- A. The Contractor shall schedule with the Engineer and the Owner for start-up and final inspection at the completion of the work.
- B. Prior to the final test, the Contractor shall flush all influent lines to the station and then shall remove all debris and sediment that has accumulated in the station bottom.
- C. The Final Acceptance Test shall demonstrate that all items of these specifications have been met by the equipment as installed and shall include, but be limited to, the following items:

1. That the quick release lift out feature functions properly and allows the pumps to be easily raised and lowered.
 2. That all units have been properly installed and are in correct alignment.
 3. That the units operate without overheating or overloading any parts without objectionable vibration.
 4. That there are no mechanical defects in any of the parts.
 5. That the pumps can deliver the specified pressure and quantity of raw, unscreened sewage.
 6. That the pump sensors and controls perform satisfactorily as to control sequence; i.e. correct start and stop elevations, and proper alarm level functions.
- D. If the pump performance does not meet the Specifications, corrective measures shall be taken or the pumps shall be removed and replaced with pumps which satisfy the conditions specified. A 24-hour operating period of the pumps will be required before acceptance.

3.02 SCHEDULE

- A. Each pump shall be as specified or equal and have the following characteristics:

<u>Name</u>	<u>No. of Pumps</u>	<u>Type</u>	<u>Drive</u>	<u>GPM</u>	<u>TDH</u>	<u>HP</u>
Sludge Dewatering Feed 3" discharge, minimum efficiency 40%	1, and 1 spare	Submersible non clog	VFD	23 45	13' 15'	2 min.

END OF SECTION

SECTION 11360

ROTARY PRESS

PART 1 GENERAL

1.01 SCOPE

A. Work Included:

1. This section includes furnishing and installing one (1) Rotary Sludge Press System (Press) for dewatering aerobically stabilized waste activated sludge. Ancillary equipment will include but is not limited to sludge and polymer metering, sludge conditioning system, control system, hydraulic system, conveyor, and other equipment required for a complete and operational system in compliance with the following specification and as shown on the Drawings.
2. All equipment supplied under this section shall be furnished by or through a single Rotary Press System Supplier who shall coordinate with the Contractor, the design, fabrication, delivery, installation and testing of the Press components. The Press Supplier shall have the sole responsibility for the coordination and performance of all components of the Press system with the performance and design criteria specified herein.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to General Conditions, Supplementary Conditions, and sections in Division 1 of these Specifications.
 - a. Section 05530 - Grating and Floor Plates
 - b. Section 09900 - Painting
 - c. Section 11280 - Valves
 - d. Section 11320 - Sludge Transfer Pump
 - e. Section 16170 - Process Control Panels and Hardware

C. System Description

1. The Rotary Press will be designed to dewater aerobically digested waste activated sludge.
2. The Rotary Press will be a complete prefabricated unit which will include a sludge conditioning system, a gravity drainage section, a pressure section, control system, a conveyor system and all other equipment required for a complete and operational system.
3. The Rotary Press, commercial model, is supplied with one (1) dewatering channel and can receive one (1) future dewatering channel.

Each channel is enclosed and the sludge and polymer mix remain free of contact to the atmosphere outside the flocculating, dewatering and pressing chambers except in the receiving conveyor and dewatering drain. Flocculated sludge is fed at a low, constant pressure not exceeding 7 PSI into the channel where it is dewatered.

4. A Rotary Press comprises at least the following components:
 - a. Drive System
 - b. Dewatering channels
 - c. Rotary Press base
 - d. Cake outlet chutes
 - e. Cake horizontal and lifting conveyors
5. Operative Conditions
 - a. Sludge Feed Rate: 100 lbs. dry solids / hr
 - b. Sludge Feed Concentration: 1-2%
 - c. Polymer Dosage: 10-18 active lbs. Polymer / ton dry sludge
 - d. Capture: -96-98%
 - e. Final Cake: 16+%

1.02 QUALITY ASSURANCE

- A. Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and have at least 25 installations of the specified model of rotary press that have been in successful operation at similar installations and with a minimum of a five (5) year history of satisfactory production acceptable to the Owner. References shall be made available upon request.
- B. The Press shall be fully assembled and shop tested at the manufacturing facility prior to shipment. Shop testing shall include a minimum of four (4) hours of run time. The Contractor, Engineer, Owner, or the Owner's representative reserve the right to witness the shop test. A minimum two (2) week notice shall be provided prior to the test to allow for travel coordination.
- C. Qualification of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper installation of the work in this Section.
- D. Fabricated assemblies shall be shipped in convenient sections permitted by carrier regulations and properly match-marked for ease of field installation.

1.03 SUBMITTALS AND SUBSTITUTIONS

- A. Comply with pertinent provisions of Section 01300.
- B. The following product data shall be submitted in accordance with the

approved Construction Schedule required in Section 01310 of these Specifications:

1. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
 2. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 3. Full scale field test data demonstrating the performance required in this Section of the Specifications. If such data is not available, the Contractor shall be responsible for running performance tests at start-up. The specified performance must be met before the equipment is accepted. All testing costs shall be borne by the Contractor.
- C. Upon completion of this portion of the Work, as a condition of its acceptance, deliver to the Engineer three copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.
1. O&M Manuals will thoroughly address all items of equipment, components, options, accessories, and ancillary devices provided with equipment components.
 2. O&M Manuals will include the following minimum information in addition to that normally provided or required by the manufacturer; and in addition to the specific requirements identified in equipment specification sections.
 - a. Title Page
Project Name, Equipment model
Manufacturer Information
 - b. Table of Contents
 - c. Equipment introduction, description of each item of equipment and system addressed in O&M Manual. Use project specific equipment name plate, tag numbers, manufacturing date.
 - d. Rotary Press installation Procedure
 - e. Lifting instruction
 - f. Storage and installation recommendations
 - g. Rotary Press individual operating Instructions
 - h. Principle of operation of the rotary press
Process overview
Zones description
Effect of parameters
 - i. Flocculator individual operating instructions
Flocculator Operation Instruction
Sludge sample operation
Jar testing procedure

- j. Equipment automatic operating instructions
 - Recirculation Cycle
 - Dewatering Cycle
 - Wash Cycle
 - Shutdown sequence
 - Safety instruction
 - Recommended daily check list
 - Filtrate sampling procedure
- k. Maintenance instructions
 - Introduction and safety instructions for maintenance
 - Rotary Press
 - Preventive maintenance,
 - Cleaning Exterior/Interior
 - Lubrication chart and mechanical check list
 - Recommended Preventive maintenance with schedule
 - Adjustment and Maintenance: Seals, deflector and inlet spacer
 - Assembly Procedures
 - Disassembly procedures
- l. Flocculator
 - Recommended Preventive maintenance with schedule
 - Cleaning
 - Lubrication chart and mechanical check list
 - Replacement of the seals
 - Assembly Procedures
 - Disassembly procedures
- m. Main maintenance operation
 - For each item or product provided.
 - Identifying only provided options and accessories.
 - Listing complete model number as needed to order an exact duplicate.
- n. General drawings as follows:
 - Showing all parts, assemblies, and sub-assemblies.
 - Showing arrangement and inter-relationship of all parts and equipment.
 - Showing controls and direction of flows.
- o. Electrical drawings as follows:
 - Showing all control devices and prefabricated wiring and conduit.
 - Complete and accurate control schematics.
 - Control panel layouts.
 - Identifying all termination's and terminal strips.
 - Settings for all configuration dip switches.
 - Identify each different source of power.
 - Use nomenclature specific to project.
 - Listing and rating of all fuses or breakers.
- p. A description of the functions including:

A description of the automatic cycles.

A list of all the alarms.

A description of all the screens in the operator interface.

Listing of set points for all adjustable devices.

- q. List of recommended spare parts.
- r. List of recommended and alternate consumables and expendable such as lubricants and filters.
- s. Clear and concise written instructions, with illustrations as required, for the following:
 - 1) Normal operating procedures.
 - 2) Long term storage procedures.
 - 3) Adjusting and troubleshooting procedures
 - 4) Copies of all information provided as part of the approved Product Data or Shop Drawing submittals.
- t. A professionally prepared DVD, covering all aspects of press operation and maintenance, including:
 - 1) Press and component disassembly and re-assembly, including channels, speed reducer drive, flocculator mixer, system piping, field instruments, pneumatic controls, control valves, seals, etc.
 - 2) Maintenance of all dewatering system components, including flocculation system, pneumatic system, dewatering channels, control valves and control elements, such as meters, pressure regulators, pressure sensors, etc., mixers, drives and variable speed controllers.
 - 3) Operational controls including pressure adjustments, press speed, sludge and polymer feed, as they relate to control and response to operator variation.

- D. To be selected as an approved equal a submittal showing compliance with these specifications shall be submitted ten (10) days before bid opening. Selected equipment manufacturers will be added by addendum.

1.04 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01600.

1.05 WARRANTY

- A. Manufacturer shall provide a written one year standard warranty from the date of contract substantial completion of the rotary press equipment to guarantee that there shall be no defects in material or workmanship in any item supplied.
- B. Wear parts as deflectors, scrapers and seals will be warranted for two thousand five hundred hours of operation.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Fournier Industries, Inc. Thetford Mines, Quebec
- B. Prime Solutions
- C. Or Engineer approved equal
- D. To be selected as an approved equal a submittal showing compliance with these specifications shall be submitted ten (10) days before bid opening. Selected equipment manufacturers will be added by addendum.
 - 1. The design and layout shown on the drawings are based on the Manufacturer listed above. If equipment other than that of the Manufacturer shown is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the CONTRACTOR wishing to make the substitution to submit with the request a revised drawing of the mechanical equipment and basin layouts acceptable to the ENGINEER.
 - 2. Changes in architectural, structural, electrical, mechanical and plumbing requirements for the substitution shall be the responsibility of the CONTRACTOR wishing to make the substitution. This shall include the cost of redesign by ENGINEER or ENGINEER'S SUBCONSULTANTS. Any additional cost incurred by affected subcontractors shall be the responsibility of the CONTRACTOR and not the OWNER. Any such changes to the plans shall be stamped by a professional engineer registered the State of Ohio.

2.02 ROTARY PRESS COMPONENTS

- A. Drive System
 - 1. Speed Reducer
 - a. The speed reducer will be selected to accommodate all two channels.
 - b. The speed reducer will be a foot mounted type with spiral bevel and helical gears. The speed reducer will be fabricated according to ANSI/AGMA 6010 standard with a cast iron housing. The Bevel gears will have a minimum of AGMA quality of 9 and the helical gears a minimum of AGMA 10. Output shaft will be made of steel with a minimum yield of 59,000 PSI. Output shaft will have a minimum diameter of 6 3/16 inches. The speed reducer will be mounted on a steel base epoxy painted. No parts of the speed reducer, including gearbox seals will be in direct contact with either the sludge, filtrate or

cake. The output seal will be an integral part of the speed reducer housing; there will be no bolt on output cover to cause leakage, shaft or gear misalignment.

- c. The speed reducer will be designed to drive a maximum of two dewatering channels; a fabricated steel protective cover will be used to prevent personal injury from the rotating shaft extension destined to receive the future dewatering channel.
2. Motor:
 - a. The motor will be selected to accommodate all two channels. The electric motor will be 60 Hz, 3 phase, 1800 rpm totally enclosed high efficiency, TEFC, 7.5 hp, service factor 1.15, insulation "F" class, design "B". Motor voltage will be 480 incoming. The motor is directly coupled to the speed reducer.

B. Dewatering Channels

1. The dewatering channel of the Press will be mounted on the gear reducer output shaft. Each channel will be an independent self-contained modular unit which can be interchanged with other Rotary Presses of the same model. The low-speed shaft seal of the speed reducer will, in no way, act as a filtrate seal for the dewatering channel. All material in direct contact with the flocculate sludge or with the cake will be in stainless steel or plastic made.
2. Each channel will be numbered with a white laminated plate with black numbers. Except for filtration elements, the channel will be made of painted carbon steel.
3. Each channel will consist of:
 - a. Filtration elements: the filtration elements will be made of 316 stainless steel and be hard chrome plated for wear resistance. The filtration elements will be a non-clogging design, which do not require wash water during operation.
 - b. Scrapers: To clean the filtration elements, each channel will be equipped with six (6) stainless steel scrapers.
 - c. Filtration Wheels: The wheels will be made of cast iron ASTM A48 Class 40. The casting will have wall sections with a minimum thickness of ½ inch, so designed to withstand internal pressures of up to 300 psi. the surface preparation and painting will be as defined in this specification. Contact surfaces for the seals will be made from polished stainless steel 316L and have a surface finish from 16 to 32 RMS.
 - d. Deflector: Deflector will be fabricated from a molybdenum disulphide-filled nylon (Nylatron).
 - e. Fiberglass gland covers, bushings and seals:
 - 1) the gland covers will be made from ¼ inch thick minimum fiberglass with a minimum of 3 to 6 layers depending on the cover sections. This cover will be used to compress the UHMW gland

- cover seal between the housing and filtration wheel. The cover will have an outlet in its lower section to drain the filtrate.
- 2) An additional opening is made for the outside wheel wash water system connection and air bleeding device. For inspection or maintenance, an opening port is located at the rear portion of the cover to permit easy access.
 - 3) Two (2) UHMW bushings will guide the gland cover on the filtration wheel. Sealing will be assured by three (3) "O-rings", two (2) between bushings and the filtration wheel, and one (1) between the gland cover and the housing.
- f. Housing: Each housing shall be made from 5/8" thick steel plate. The surface in direct contact with the cake will be stainless steel lined. Housing is supported by the filtration wheel through a set of bushing. Rotating of the housing is restricted by a torque arm, connecting the channel housing to the gear reducer base support. Each housing is interchangeable with other Rotary Presses of the same series.
- g. Wash system:
- 1) The wash system will be provided for use as a daily cleaning of the inside of the channel(s) and the outside of the filtration wheel(s).
 - 2) One (1) wash manifold is located inside the channel at the sludge inlet. This manifold is made of a stainless steel tubing assembly, equipped with twenty-eight (28) flush type stainless steel sprinklers.
 - 3) For maintenance purposes, the manifold assembly is assembled to a mounting plate bolted and sealed to the gland cover. All sets of nozzles detach from the water supply using a quick disconnect system for easier maintenance.
 - 4) The system will be equipped with a check valve to prevent the back flow of sludge into the wash system.
- h. Filtrate Collector: Each channel will be equipped with a removable filtrate collector. Filtrate collector will be made of low linear density polyethylene (LLDPE). Filtrate outlet connection will be 7.5" dia. Each filtrate collector will include two (2) sampling ports to sample filtrate. Sampling port will be closed by a removable plug.
- i. Filtrate Collector Manifold: Each filtrate collector will be piped to a manifold. Manifold will be made with Sch. 80, 6" dia. PVC piping. Manifold outlet will be equipped with a 90° elbow. The filtrate collector will be designed to accommodate all two (2) channels.

C. Rotary Press Base

1. Base will be fabricated from bend 3/8" thick steel plate. Base will be a close shape to optimize rigidity and spread the load evenly to the supporting floor. Anti-rotation device fixations are integrated to the base to facilitate the installation. The rotary press base will be designed to

accommodate all two (2) channels.

D. Cake Outlet Chutes

1. Every cake outlet will have a chute with an inspection door. The chute will be made in low linear density polyethylene (LLDPE). A hole for mounting of a cake sensor shall be provided for this purpose.

2.03 FLOCCULATOR AND FEED MANIFOLD

A. Flocculator:

1. The flocculator model 05-300-900 will be designed with a tank capacity of 17 gallons and for 100 PSI pressure and a maximum temperature of 140 °F. The body and bolted cover will be fabricated of painted carbon steel. The thickness of the body will be 3/8". The flocculator inlet manifold will be made of stainless steel. Top cover plate will be fabricated from 1 1/4" mild steel plate. Three lifting lugs will be supplied to facilitate handling.
2. The agitator will be variable speed and driven by a gear motor, helical type, hollow shaft, Nord Gear model SK0282 or equal. Hollow shaft will be 1 3/16" dia., 4.03 to 1 ratio, 1 HP energy efficient motor, 1750 RPM, 3 PH, 60 Hz, Voltage as per customer requirement, continuous duty, Insulation class F, CSA, CE & UL approved.
3. The seal at the agitator shaft and the flocculator cover will consist of two (2) lip seal contacts with grease cavity in between. A grease fitting will allow the cavity to be lubricated. The shaft seal wear sleeve will be fabricated from stainless steel. The wear sleeve will be polished to a surface finish of 16 rms and will be hardened by nitriding.
4. The flocculator will be fabricated from carbon steel and painted (inside and outside), as described in Section 2.03A.
5. The flocculator will have the following connections:
 - a. Sludge inlet
 - b. Sludge outlet
 - c. Pressure sensor fitting (Ref.: Press inlet pressure)
 - d. Wash water connection
 - e. Polymer connection
 - f. Air purge
 - g. Spare inlet 3/4" (19 mm)
6. The sludge inlet and outlet connections will be 3 inches diameter with machine groove to adapt type 77 Victaulic coupling or equivalent.
7. Threaded connections for service and instrumentation will be located on the inlet manifold of the flocculator.
8. The flocculator will be equipped with an air breather. The air breather will be located at the top of the flocculator and hook up to the potable water line for occasional back wash and to the drain line to collect any sludge

leak. Breather will be made of PVC.

9. Systems that do not utilize a flocculation vessel and variable speed agitator shall not be allowed or considered as a valid "or-equal".

B. Feed Manifold

1. Piping between the flocculator and the Press will be made of schedule 10, 316 stainless steel.
2. The feed manifold and other accessories will be tested in the shop at 100 psi hydrostatic pressure.
3. Pipe fittings shall be grooved end type as described below
 - a. On the lines less than 10 feet long: Style 77 Victaulic joints or equivalent.
 - b. On the lines more than 10 feet long: Style 07 "Zero Flex" Victaulic joints or equivalent.
 - c. Flange-to-flange joints: Style 741 "Vic-flange" or equivalent;
 - d. For butt or field adjust joint coupling, the Victaulic style 99 "Roust-A-Bout" or equivalent.
4. Valves and accessories
 - a. Two pneumatically-actuated valves will be installed on the sludge line between the rotary press and the flocculator. The valves shall meet the following characteristics:

Valve

Type	Two-way ball type Full port
Size diameter	3" (76,2 mm) dia.
End connection	ANSI 125# Flanged
Body material and facing	Painted cast iron
Ball material	Ductile iron / Teflon fuse ball
Shaft	Stainless steel
Seat type	RPTFE
Manufacturer	Quality Certified Valve, American Valve, Sure Flow or equivalent

Actuator

Type	Pneumatic double acting (2-pistons design on geared shaft)
Nominal torque at 81 PSI (560 kPa)	2390 lbs in (270 Nm)
Manufacturer	FESTO or equivalent

Position indicator

Type	Visual Position switches
Switches	SPDT
Protection	Watertight IP67
Manufacturer	FESTO or equivalent

Sludge feed and recirculation valves shall be piloted by solenoid valve located in the Rotary Press Junction Box (ref. section 4.3.6). The valve body shall be made of anodized die cast aluminium and will have an insulation rated IP65. The working pressure shall be in the range of 36 to 116 PSI (248 to 800 kPa). The solenoid valve with manual override shall be 24 VDC. Solenoid valve shall be Festo model no. VMPA1-M1H-M-PI or equivalent.

b. Isolation and Process Valve:

- 1) All valve(s) will be compatible with the nominal operating pressures of the different systems and will be designed to resist the operating temperatures and the contained fluids. The valves will be of equal diameter as the piping except where indicated otherwise.
- 2) At the inlet of each channel, a shut-off valve will be supplied. The valve will be ball type with the following characteristics:
 - a) Valve type: Full port
 - b) Nominal size: 76.2 mm (3")
 - c) Body material: Painted cast iron
 - d) End connection: ANSI 150# flanged

- e) Ball material: Ductile iron / Teflon fused
 - f) Seat: RPTFE
 - g) Actuator: Lever
 - h) Manufacturer: Quality Certified Valve, American Valve, Sure Flow or equivalent.
- 3) All other valves other than the one above will be ball valve, type full port, SS316 body, PTFE seat. Acceptable manufacturers are Quality Certified Valve, American Valve, C.F.F., Trueline, H&P or equivalent.
- c. Wash water valve
- 1) For automatic control purposes, a pneumatic actuator shall be installed to control the wash water valve to each individual channel. The valve shall meet the following characteristics:

Valve

Type	Ball type Full port
Size diameter	1 inch (25,4 mm) dia.
Body material and facing	Type 316 stainless steel
Maximum pressure	1000 PSI (6,9 MPa)
Manufacturer	C.F.F. model no. SS-3DM or equivalent

Actuator

Type	Pneumatic spring return type Aluminium anodized body
Manufacturer	Festo model no. VMPA1-M1H-M-PI or equivalent.

Wash water valve shall be piloted by solenoid valve located in the Rotary Press Junction Box (Ref. Section 4.3.6). The valve body shall be made of anodized die cast aluminum and will have an insulation rated IP65. The working pressure shall be in the range of 36 to 116 PSI (248 to 800 kPa). The solenoid valve with manual override shall be 24 VDC. Solenoid valve shall be Festo model no. VMPA1-M1H-M-PI or equivalent.

d. Polymer check valve

- 1) A stainless steel check valve will be installed on the polymer line to prevent sludge from entering the polymer feed line. The check valve will start to open at 0.5 psig and will be fully opened at 1.0 psig. The valve will be spring assisted for silent closing and minimizing the effect of water hammer. The valve temperature limit will be 20 °F to 400 °F. The model will be SC600TSSSSM from IFC or equal, 1" NPT.

e. Flocculated sludge sampler

- 1) A flocculated sludge sampler will be supplied. The device will consist of a transparent PVC tube to inspect the texture of the flocculated sludge. A vent and a sludge inlet valve will allow filling and draining the sampler without dismantling or adding any pipes, tubes or plugs. The sampler is easily removable for maintenance.
- a) 2" stainless steel isolating valves will be installed to isolate,

- drain or sample sludge;
 - b) 3/4" wash and vent stainless steel valves will be supplied.
 - f. Wash water pressure gauge and switch
 - 1) A pressure gauge will be installed at the flocculator on the wash water line. The pressure gauge will be a 2-1/2", liquid filled. The scale will be 0 to 160 PSI.

2.04 MISCELLANEOUS

A. Painting and Protection:

1. Equipment and steel piping as well as wetted parts follow Section 09900

B. Materials:

1. The steel used in the construction will meet the following standards:
 - a. Tubing: CSA G40.21 - 44W (US equivalent ASTM A 500)
 - b. Structural shape: CSA G40.21 - 44W (US equivalent ASTM A 572)
 - c. Plate: CSA G40.21 - 44W (US equivalent ASTM A 36)
 - d. Sheet: ASTM A569
 - e. Shaft: ANSI-1045
 - f. Stainless steel: ANSI 304, ANSI 316
2. Special tools
 - a. Special maintenance tools will be supplied. Those will include a torque wrench and lifting bolt for wheel and housing. The special maintenance tools will be delivered into a steel case.

C. Fasteners:

1. All fasteners to be used will be made according the ANSI/ASME B18 standards.
2. Except if otherwise noted, ASTM F738M stainless steel bolts and ASTM F836M stainless steel nuts (property class A1-50 for both, or equal) will be used for all wetted parts and the following assemblies:
 - a. Channel housings
 - b. Gland covers to channel housing
 - c. Filtrate collector to channel housing
 - d. Filtration wheels to the inner spacer
 - e. Scraper blades to outer spacer
 - f. Wash water system support to gland cover
 - g. Deflector
 - h. Actuator support
 - i. Speed reducer output shaft to its cap plate
 - j. Identification plates
3. Except if otherwise noted, ASTM F568M steel plated bolts and ASTM F563M steel plated nuts (property class 4.6 or equal) will be used for

bolting the following assemblies:

- a. Interior bushing to the gland cover hub
- b. Actuator support to the channel assembly
- c. Channel sludge inlet to the channel housing
- d. Anti-rotation plate to the channel housing
- e. Channel housings to outer spacers
- f. Lifting devices to the channels
- g. Speed reducer to reducer base
- h. Motor bell housing to the speed reducer input
- i. Input and output flocculator piping
- j. Flocculator

D. Welding

1. All the welding will be performed under the AWS Standard, CSA Standard, or equivalent.

E. Noise Level

1. The noise level of each of the equipment will not exceed 75 dBA measured at 1 meter from the source.

F. Interchangeability

1. All parts from press or from channel will be interchangeable with another.

2.05 ELECTRICAL, CONTROLS, INSTRUMENTATION

A. General: Controls for the sludge pump, polymer unit, flocculation system, press and conveyors shall be in enclosures provided by the Press manufacturer, who shall be responsible for proper sizing and function of the controls at 480 VAC, unless specified otherwise. The power to the control panel will be 480 V, 3ph, 60 Hz.

1. Main control panels will be installed will be installed in a controlled environment out of direct sunlight and in a temperature range of 35 to 104 degrees F.
2. Controls shall be designed to accept incoming power supply per the Drawings and shall include a step down transformer as needed to achieve 120 volts.
3. Control panel shall be constructed to meet the appropriate NEMA classification requirements and will include a main, lockable disconnect. The panel will be constructed by a UL certified panel build facility and will be supported by the appropriate UL labeling.
4. Controls shall be tested prior to shipment.
5. Panel and panel mounted devices shall be labeled with engraved I.D.

markers that reference back to the system schematics. Tags shall be white with black core, engraved as required. Refer to Section 16195.

6. Contractor shall be responsible for all field wiring and power cables between the bar screen Main Control panel and the Local Push Button Station.

B. Basic Principle of Operation

1. The dewatering unit will consist of one (1) rotary press with its flocculator, along with control devices necessary to maintain an adequate proportion of flow and pressure, resulting in an uniform feed of sludge and diluted polymer to the press.
2. The feed sludge is pumped to the flocculator as to maintain a constant pressure at its inlet. To accomplish this, the rotating speed of the feed sludge pump will be adjusted according to the internal pressure of the flocculator as to maintain the pressure close to the set value.
3. The diluted polymer is pumped to the flocculator in such a way as to obtain a specified polymer-sludge dosage. The dosage is controlled by adjusting the speed of the diluted-polymer pump and is a function of the speed of the sludge pump, and a set value entered by the operator. From the flocculator, the flocculated sludge is fed into each of the channels of the Rotary Press.
4. The channel outlet pressure is controlled by modulating a restrictor device at the cake outlet. The applied air pressure of the restrictor's actuator is controlled to maintain a constant outlet pressure.
5. A local control cabinet is used to operate the system and to change the basic parameters.

C. Components

1. Main Control Panel (Rotary Press System)
 - a. Enclosure shall be NEMA 12.
 - b. Enclosure shall not be located in an explosive environment.
 - c. Main Control panel shall be designed with a SCCR rating of 18KA at 480 VAC minimum and labeled as such, unless otherwise specified.
 - d. All terminals utilized in the main panel shall be 600V rated terminals and 20% spare terminal space shall be provided for any potential future revisions.
2. The screen manufacturer shall provide one (1) Primary Control Panel mounted remotely to the screen as described in 2.05 E.

D. Instrumentation

1. Sludge and Polymer Flowmeters:

Sludge flowmeter:

The sludge flowmeter will be installed at the flocculator inlet.

The instrument will have the following specifications:

Type	Electromagnetic
Measured error	±0,5%
Diameter/measuring range	2" -10-300 gpm/3" - 24-800 gpm
Process temperature	-4 °F to 176 °F (-20 °C to 80 °C)
Electrical connection	1/2"NPT
Process connection	Flange type
Display/operation	Two line display with backlit / push button
Output signal	4-20mA
CSA/FM approval class	Class 1 division 2
Liner material	Polyurethane
Electrode material	316L SS
Protection	IP67/Nema 4X
Company	Endress & Hauser
Series	10W80

Polymer flowmeter:

The polymer flowmeter will be installed at the flocculator inlet.

The instrument will have the following specifications:

Type	Electromagnetic
Measured error	±0,5%
Diameter/measuring range	1/2" -1-27 gpm/1" - 2,5-80 gpm
Process temperature	-40 °F to 356 °F (-40 °C to 180 °C)
Electrical connection	1/2"NPT
Process connection	Flange type
Display/operation	Two line display with backlit / push button
Output signal	4-20mA
CSA/FM approval class	Class 1 division 2
Liner material	PTFE
Electrode material	316L SS
Protection	IP67/Nema 4X
Company	Endress & Hauser
Series	10P25

2. Inlet pressure gauge and pressure transmitter will be installed at the flocculator inlet. The instrument will have the following specifications:
 - a. Type: Digital pressure transducer, capacitive, ceramic
 - b. Typical linear: $\pm 0.075\%$
 - c. Operating pressure range: 0-30 PSI
 - d. Proof pressure (without any damage to the transducer): 270 PSI
 - e. Electrical connection: 1/2" NPT
 - f. Calibration: Between 0 and 30 PSI
 - g. Output: 4-20 mA, with Hart Communication; Inside + LCD
 - h. Process connection: 1/2" NPT/M
 - i. FM Approbation, Classes: 1, 11, 111 Division 1
 - j. Diaphragm material: Ceramic
 - k. Company: Endress & Hauser
3. Outlet pressure control
 - a. Cake outlet pressure will be controlled by air pressure on the bellows actuating the vertical restrictor.
 - b. Adjustable airline pressure regulator will be used to control the outlet pressure. Each channel will have its own in line air regulator. Regulator will be relieving type, pressure range 5 to 100 PSIG, 1/4 inch port, with 125 PSIG pressure gage. Regulator will be Festo Model # MS4N-LR-1/4-D6-AS or equivalent.
4. Cake sensing
 - a. Each channel will have a cake sensor mounted on the outlet chute cover. For easy maintenance, the sensor will be equipped with a quick connector.
 - b. This sensor will be manufactured by Schneider Electric XT218A1PCM12..
5. Wash water pressure switch
 - a. A pressure switch will be installed on the wash water line at the flocculator. The pressure switch will be 1/4" NPT, SPST/NO. The switch shall cover an adjustable range of 30 to 120 PSI. The switch will be shop calibrated at 60 PSI and sealed. The dry contact of the switch will be used to produce a low pressure alarm on the operator interface.

E. Process control cabinets

1. Prewired control cabinet
 - a. Prewired control with connection to field devices and field wiring through terminal strips, in a NEMA 12 enclosure will be provided. As per customer requirement, the control shall operate on 480 volts, 60 Hz, three phase. The control cabinet shall include the following:
 - 1) Back-panel mounted components and devices consisting of (but not limited to) the following:
 - a) Main fused disconnect switch

- b) Circuit breakers for PLC, HMI and others control devices
 - c) Variable frequency drive (VFD)
 - d) Programmable logic controller (PLC)
 - e) DC power supply
 - f) Relay
 - g) Safety relay
 - h) LAN modem (Internet communication)
- 2) Door mounted components consisting of (but not limited to) the following:
 - a) Power warning alert indicator
 - b) Operating handle for main fused disconnect switch
 - c) Emergency stop push button
 - d) Human machine interface (HMI)
- 2. Programmable Logic Controller
 - a. A programmable logic controller will be used to control the Rotary press and the related equipment. PLC shall have Ethernet/IP communication to communicate with the HMI and the plant network. PLC will be:
 - 1) Allen-Bradley CompactLogix Series L10 or equal for (1) Rotary press only.
 - b. The PLC will require the following signal types:
 - 1) Analog inputs: 4-20 ma
 - 2) Analog outputs: 4-20ma
 - 3) Discrete inputs: 24 VDC
 - 4) Discrete output: Dry output
- 3. Human machine interface
 - a. A human machine interface will be used to operate the Rotary press and the related equipment. HMI will have a built-in Ethernet communication port to communicate with the PLC and USB port. HMI will be:
 - 1) For (1) Rotary Press only
 - 2) Allen Brandley, 2711P series (Panelview Plus 7)
 - 3) 18-bit Colors
 - 4) TFT Color LCD (5.7" - 14.5cm)
 - 5) 600 x 480 (VGA)
 - 6) 24 VDC (35W or less)
- 4. IP54, IP66, NEMA 12/13/4X indoor use only Variable Frequency drive (VFD)
 - a. Variable frequency drive will be used to control the speed of the Rotary press and the flocculator. VFD will have overload protection and ramp regulation capability. Configuration and programming will be done via a keypad. Run command, status and speed control shall be handle using communication network (VFD Ethernet/IP or RS485/DSI). As per customer requirement, VFDs will be powered with 480 VAC, 3-phase, 60Hz. Output will be 480 VAC, 3-phase, 0-60Hz. VFD rating 5 HP and more will be flange mounted type, in

order to keep the heat outside the control cabinet. VFD will be the following:

1) Rotary Press

Qty: One (1) for each rotary press motor
Power: As per motor requirement
Company: Allen-Bradley or equal
Model: Powerflex 52X Series

2) Flocculator

Qty: one (1) for each flocculator motor
Power: 1 HP
Company: Allen-Bradley or equal
Model: Powerflex 52X Series

5. LAN modem

- a. Qty: One (1)
- b. Company: eWon or equal
- c. Model: Cosy 131 or Equal

6. Rotary press junction box

- a. A pre-wired Nema 4X FRP enclosure junction box shall be installed on the rear of the rotary press gearbox. Wash valves and cake detection sensor shall be routed to this junction box and connected to terminal blocks. The Rotary press junction box shall include, but not limited to, the following components:

- 1) I/P converter
- 2) Air filter and regulator
- 3) Solenoid valve for pneumatic control of sludge feeding and recirculation valve
- 4) Solenoid valve for pneumatic control of wash water valve

- b. To insure proper air quality and inlet pressure control to system, an air regulator and an air filter are furnished and installed on the air inlet supply of the Rotary press junction cabinet. The air regulator and air filter shall be rated for air purity class 3.7 per DIN ISO 8573-1, high efficiency general purpose protection for a particle removal down to 5 microns, including water and oil aerosols. 1/4" NPT type connection, fully automated drain, maximum pressure 175 PSI, operating temperature between 35 °F & 140 °F (2°C & 60°C), an integrated air regulator shall include a manometer, range 0-175 PSI with lockable rotary knob. Air regulator shall be Festo Model no. MS4N-LFR-1/4-D7-CRV-AS or equivalent.

7. Emergency stop push button

- a. An emergency stop push button will be installed in front of the rotary press and wired to the junction box.

F. Programming

- 1. Control - Process parameters and control will be accessible to the pre-program PLC via operator interface. The operator will have access to

the following:

- a. Sludge inlet pressure
- b. Polymer/Sludge ratio
- c. Rotary press rotating speed
- d. Flocculator agitator speed
2. Manual control of each equipment
3. Protection and Alarms programming
 - a. High inlet pressure, stop the dewatering system
 - b. Zero flow on sludge input flow, stop the dewatering system
 - c. Cake flush, stop the dewatering system
 - d. Preventive maintenance notice, alarm only
 - e. Low air pressure, stop the dewatering system
 - f. Any motor did not start, stop the dewatering system
4. Programming will include at the minimum the following alarms:
 - a. Rotary press faulted
 - b. Rotary press did not start
 - c. Flocculator faulted
 - d. Flocculator did not start
 - e. Sludge pump faulted
 - f. Sludge pump did not start
 - g. Sludge pump low flow
 - h. Polymer pump faulted
 - i. Polymer pump did not start
 - j. High inlet pressure
 - k. Cake flush
 - l. Low air pressure
 - m. Preventive maintenance warning
5. Operative interface screens – the operator interface will be built to give friendly usage to the operator. The following screen page will be available to the operator:
 - a. Menu page
 - b. Cycle start-stop page
 - c. Parameter page
 - d. Sludge pump control loop page
 - e. Rotary press manual operation page
 - f. Preventive maintenance advise page

2.06 Screw Conveyor System

A. Description

1. The screw conveyor system shall transport mechanically dewatered wastewater treatment plant sludge from the rotary presses to the final discharge point area as shown on the Drawings.
2. The screw conveyors system shall be provided complete with all necessary components, drives, motors, instrumentation, controls,

ancillary items and supports, except as otherwise shown or specified herein.

3. The design of the sludge conveying and system shall be based upon the Contract Drawings, these Specifications and the manufacturer's experience with existing systems of similar sizes, capacities and handling material with similar characteristics.
4. The Contract Drawings, and this Section, provide equipment descriptions, minimum requirements and mandatory features of the equipment to be furnished. It is the Manufacturer's responsibility to design and furnish the equipment complete in all details, performance, and reliability meeting the requirements and intent of the Contract Drawings and these Specifications.
5. The equipment shall be furnished complete with all accessories, special tools, and other appurtenances as specified herein or as may be required for a satisfactory installation.

B. The screw conveyors shall be designed and manufactured in accordance with the following listed Standards and Specifications, including applicable addenda in effect as of the date of bid submission. They shall be considered an integral part of this specification and shall govern the design, fabrication, testing and inspection of equipment, except as otherwise shown or specified herein.

1. American Gear Manufacturers Association (AGMA)
2. American Welding Society
3. Conveyor Equipment Manufacturers Association (CEMA)
4. National Electrical Manufacturers Association (NEMA)
5. Anti-Friction Bearing Manufacturers Association (AFBMA)
6. American National Standards Institute (ANSI)
7. National Fire Protection Association (NFPA)
8. American Society for Testing Materials (ASTM)
9. Joint Industrial Council (JIC)
10. American Society of Mechanical Engineers (ASME)
11. Underwriters Laboratories Inc. (UL)
12. Institute of Electrical and Electronic Engineers (IEEE)
13. American Institute of Steel Construction (AISC)

C. Hardware

1. Design of all support structures, platforms and bracing shall be in accordance with AISC Standards. Structural Welding shall conform to American Welding Society Structural Code D1.1-82.
2. Hardware requiring special tools or wrenches shall not be used.

D. General Requirements

1. Structural design shall be in accordance with American Institute of Steel Construction AISC Standards.
2. Except as otherwise indicated, welding shall comply with ANSI/AWWA D100 and AWWA C206, and the following:
 - a. Welding shall be by the metal-arc method or gas-shielded arc method described in the American Welding Society's "Welding Handbook" as supplemented by other AWS standards. Welding shall conform to American Welding Society Structural Code D.1.1-82. Qualification of welders shall comply with AWS Standard AWS D1.198.
 - b. During assembly and welding the component parts shall be clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall comply with the AWS code. Upon completion of welding, weld splatter, flux, slag and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance with uniform weld contours and dimensions. Sharp corners on material that is to be painted or coated shall be ground to a minimum of 1/32" on the flat.
3. Material type, thicknesses and dimensions shall conform to the screw conveyor schedule requirements unless otherwise specified, or required for structural considerations.

E. Conveyor Troughs

1. Horizontal and inclined conveyor trough bodies shall be "U" type for horizontal conveyors and "O" type for inclined conveyors with trough dimensions conforming to the requirements of CEMA Standard 300, with exceptions as noted herein. The conveyor trough bodies shall be rolled to shape with both side flanges formed with the trough body. Trough end flanges, welded to each trough section, shall be provided for joining adjacent sections or connecting trough end plates to the trough sections. Each conveyors trough sections must not exceed 8 feet (96 inches) from flange to flange.
2. Conveyor troughs shall be equipped with a wear liner across the entire inside length. The wear liner shall be fabricated of oil filled high density UHMW polyethylene. The wear liner shall be provided in 4-foot long sections for ease of replacement. The wear liner shall be held in place using clips welded to the inside of the trough. Clips shall be placed away from the conveyor spiral path.
3. Each conveyor shall be equipped with a drainage valve at its lower end. The drainage valves must be stainless steel ball valve of 2 inches in diameter.
4. Conveyor troughs for shaftless screw conveyors shall be furnished with anti-floatation devices. Anti-floatation devices shall be installed at a minimum distance of every sixteen (16) feet of conveyor length.

F. Conveyor Covers (U Shape only)

1. A sectional plate shall cover the entire trough, with exception of the inlet chute connections located. Cover segments at inlet chute connections shall extend, on each side, beyond the inlet chute connection and shall be bolted in place. Each cover section shall be not greater than 6-feet in length. The cover segments shall be arranged so that the trough flange and a trough stiffener provide support to each edge.
2. The covers open for maintenance and cleaning purposes. The cover shall be bolted.

G. Conveyor End Plates

1. End plates shall be bolted to the trough end flange. End plates shall be designed to support the drives, bearings and gear reduction assembly.
2. Where shafts penetrate the end plates, the end plate shall be provided to accommodate the stuffing box provided.

H. Conveyor Chutes

1. Trough inlet and discharge chutes shall be bolted to the adjoining equipment as shown on the Contract Drawings. Inlet and discharge chutes shall be supplied with reinforced rectangular or circular flanges.

I. Drive Train Equipment

1. The conveyor drive train equipment shall transmit power to the conveyor drive shaft using a shaft mounted speed reducer connected to an electric motor. Drive units shall be rigidly supported to avoid all visible "wobble" movement under any operating conditions. Any leakage coming from the trough passing through the shaft seal shall leak through the adapter end plate to atmosphere rather than into the gear motor.
2. Drive Shaft Assembly components:
 - a. Drive Shaft
 - b. Seal plate
 - c. Hollow Shaft Gear Reducer
3. The tail end shall consist of the following components
 - a. Zero Speed Sensor
4. Drive shafts for the shaftless screw conveyors are to be complete with mating connections appropriate for mating to the shaftless screw assembly. The drive shall be of adequate diameter to handle all radial, thrust and torsion loads. The drive shafts shall be mounted to the shaftless spiral by a flanged connection.

J. Drive Motor

1. Drive motors shall be of the high starting torque (NEMA B or C design), TEFC, squirrel cage, AC induction type suitable for continuous severe duty service. The motor shall have Class F, MG 1 Part 31.4.4.2 Inverter Duty insulation, and a Class B temperature rise at 40°C ambient temperature. The drive motor shall be high efficiency with a 1.15 service factor.
2. The drive motor shall operate at 1800 rpm nominal speed and be sized to operate without overloading when the screw conveyor is operating at, or below, the design capacity. The minimum motor horsepower shall be as specified on the conveyor schedule elsewhere herein.

K. Speed Reducer

1. The speed reducer shall be a gearmotor enclosed shaft mount, type unit with a double or triple reduction ratio, as may be required. The speed reducer shall mount directly on the driven shaft and utilize a standard CEMA mounting to support structure. Screw Conveyor Package design flange shall be Nord Gear Corp. or equal.
2. The speed reducer sealing system shall be a Quadrilip system that has four components for sealing lubricant inside and contaminants outside of the speed reducer. The system must include a double lip seal, a single lip seal and grease pack barrier (grease lip). The sealing system shall also include diverting ports to avoid any possibilities of contamination to the gear reducer oil, even if the first seals broke down.
3. The speed reducer housing shall be constructed of 1-piece corrosion resistant gray cast iron torsional stiff. All housings bore and mounting faces shall be machined in one step to produce extremely precise tolerances, thus ensuring accurate positioning of gear teeth, bearing & seals and a longer life of all components.
4. All speed reducer gearing shall be of helical design. High speed gears shall be ground and low speed gear skive hobbled. Gears hardness shall be 58 Rc minimum. With an overload capacity of 275%
5. The speed reducer bearings shall be ball or tapered roller type and provide a 50,000-hour B-10 life at the expected design loading rate. All seals shall be double lip, spring-loaded type and made of nitrile rubber. Shaft seals shall be quadrilips two nitrile seals, which consists of 2 sealing lips, a trash guard lip and a grease chamber between the seals.
6. The speed reducer shall be manufactured to Quality Class 8 per AGMA Standard 6001-C88, minimum. The gear reducer shall be selected for AGMA Class 11 service with a 1.4 service factor based on motor nameplate horsepower.

7. The speed reducer shall be as manufactured by Nord Gear Corp., or equal.

L. Conveyor supports

1. The conveyor troughs shall be supported using saddle type supports shaped to the profile of the troughs and extending to a common fixed distance below the centerline of the screw. Saddle type supports shall be located not greater than 16-feet center-to-center. Separate support points shall be provided (when possible) under the drive end and tail end assemblies. These supports are to be bolted to the trough flange.
2. Troughs thickness shall be design to maintain through shape under loading. Transverse stiffeners shall not be used in order to allow easy maintenance of the UHMW liner and for the flight maintenance.
3. Support loadings are to be based on a completely filled trough, weight of the conveyor and the dynamic loading when operating.
4. The Contractor shall coordinate with the Conveyor Equipment Supplier support locations with the facility structural constraints. Access to other process systems and equipment shall not be restricted by the conveyor supports.
5. Each conveyor shall be field shimmed as required to conform to the manufacturer's installation tolerances.

M. Shaftless Screw Assemblies

1. The shaftless screw flights shall be cold rolled spirals fabricated from high strength carbon spring steel bars with a minimum tensile strength of 100,000 psi and a minimum Brinnell hardness of 200.
2. Shaftless screw conveyor spiral flights shall be formed in a forming machine to the diameter and pitch required. Each formed section shall be factory welded into full lengths. Where the length of the conveyor precludes shipping, sub-sections of flighting shall be divided into maximum shipping lengths and welded together in the field.
3. Field splicing of flighting sections shall be by full penetration welds done in strict accordance with the manufacturer's instructions using AWS certified welders.
4. Spiral flighting shall be connected to the drive shaft using a flanged connection plate that shall be welded to the spiral on one end. Transition between the flighting and connection flange shall be smooth and fabricated to the tolerances listed below. The drive shaft shall have a matching mating flange and shall be bolted to the flight connection plate.

N. Safety Devices and Zero Speed Limit Switches

1. Motion failure alarm unit shall equip each conveyor. The motion sensor shall be a non-contacting type probe. This probe shall be able to read screw rotation outside of the process, by reading disruption of the magnetic field by the ferrous target (flight).
2. The electronic unit shall operate on 120 volts AC power supply and shall be rated NEMA 4X or IP67. The probe signal shall be relay interconnected with a PLC digital input.
3. The zero speed sensors shall be located at the opposite end of drive. The PLC is always counting pulses, without any pulse count a PLC digital output shall be activated for an alarm or shall stop the whole system. Relay switch contacts shall be rated 120 VAC and interlocked with MCC motor starter.
4. Zero speed detection switches shall be Siemens model Sitrans WM100, or equal.

O. Conveyor Control

1. Conveyors shall be controlled by the rotary press PLC and operator interface.
2. The control panel shall incorporate a normally open (NO) relay that closes upon operation of the inclined conveyor. The relay shall provide interface to energize the heat trace circuit for the conveyor.

P. Weather Protection: The conveyor tube shall be supplied with a heating system to prevent material from freezing inside the machine. The system shall be suitable for outdoor weather protection to a minimum temperature of -13° F (-25° C). Heating system will consist of a series of mat-type heat trace elements surrounded by an insulating jacket. Refer to Specification Section 16620 for heat trace, insulation and thermostat requirements. Operation of the heat tracing shall interface with the controls that initiate operation of the conveyor.

2.07 SCREW CONVEYOR SCHEDULE

Identifier	Reception conveyor
Conveyor Type	Horizontal, Mono-Directional, Shaftless
Material handle	Cake from discharge of rotary press
Mass Flow Capacity	1.33 Wet ton/hr
Loading at nominal capacity	45%
Material density	45 lbs / cubic feet
Temperature	40°F to 100°F
Flight nominal diameter	9-inches diameter
Flight Pitch	Full Pitch
Flight section	2 1/2" X 3/4"
Flight material	High strength chrome alloy steel, 200 brinnell min
Flight diameter tolerance	+ 0, - 1/4"
Flight pitch tolerance	± 1/4"
Conveyor nominal Length	166"
Conveyor slope	0 degrees
Trough body	U-Trough 304 stainless 11 gages thick
Trough cover	304 stainless 12 gage thick
Trough end flanges	304 stainless 3/8" thick
Trough end plates	304 stainless 1/4" thick
Discharges chutes	304 stainless 1/8" thick
Support	304 stainless 5/16" thick
Liner	Oil filled UHMW 3/8" thick
Inlet	One (1) future Two
Inlet type	Inlet cake chutes from rotary presses
Outlet	One (1)
Outlet type	To inclined conveyor
Gear reducer manufacturer	Nord Gear or equal.
Gear reducer model	SK2282 SCP
Power	1 HP 460V/3ph/60hz
Output speed	24 RPM
Special Requirements	2" drain Screw Conveyor Package gear motor flange

Identifier	Inclined conveyor
Conveyor Type	Inclined, Mono-Directional, Shaftless
Material handle	Cake from discharge of rotary press
Mass Flow Capacity	1.33 Wet ton/hr
Loading at nominal capacity	45%
Material density	45 lbs / cubic feet
Temperature	40°F to 100°F
Flight nominal diameter	9-inches diameter
Flight Pitch	5-inches Pitch
Flight section	Double flight with external section: 2 ½" X ¾" and internal section: 1" X ½"
Flight material	High strength chrome alloy steel, 200 brinnell min
Flight diameter tolerance	+ 0, - 1/4"
Flight pitch tolerance	± 1/4"
Conveyor nominal Length	240"
Conveyor slope	33 degrees
Trough body	Tubular O-Trough 304 stainless 10 gages thick
Trough end flanges	304 stainless 3/8" thick
Trough end plates	304 stainless 1/4" thick
Discharges chutes	304 stainless 1/8" thick
Support	304 stainless 5/16" thick
Liner	Oil filled UHMW 3/8" thick
Inlet	One (1)
Inlet type	From reception conveyor
Outlet	One (1)
Outlet type	Chute
Gear reducer manufacturer	Nord Gear or equal.
Gear reducer model	SK2282 SCP
Power	1.5 HP 460V/3ph/60hz
Output speed	45 RPM
Special Requirements	2" drain Screw Conveyor Package gear motor flange

2.08 ANCHORAGE AND FASTENERS

- A. Anchor Bolts: All anchor bolts shall be a minimum of 1/2 inch diameter and made of type 304 stainless steel. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.
- B. Fasteners: All fasteners shall be type 18-8 stainless steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the Work of those trades for interface with the work of this Section.

3.03 INSTALLATION

- A. General: The equipment shall be installed properly to provide a complete working system. Installation shall follow the supplier's recommendations.
- B. Manuals: The equipment supplier shall furnish three (3) copies of operation and maintenance manuals which will be retained at the installation site to assist plant operators. The manual shall include information listed previously in this specification including but not limited to the supplier's erection and assembly recommendations, a complete parts list, and a list of recommended spare parts.
- C. Conveyors shall be set upon level, fully grouted foundations so that connecting flanges, screwed connection, or flexible connection shall meet without strain or distortion.
- D. Outside conveyor will be jacketed, insulated and heat traced per Section 16620. Mat-type heat trace units will be installed on the underside of the U-channel of the conveyor. Insulation line aluminum jacket shall be secured around the conveyor with wide band stainless straps clasps built for easy dismantling and re-installation.

- E. Shop Assembly: The equipment specified herein shall be completely factory assembled and inspected prior to shipment.
- F. The Contractor shall furnish to the Owner, through the Engineer, a written report prepared by the equipment manufacturer's field service technician certifying that:
 - 1. The equipment has been properly installed, in accordance with manufacturer's recommendations.
 - 2. The equipment check out and initial start-up activities have been completed in accordance with manufacturer's recommendations and under the technician's supervision.
 - 3. The equipment is in accurate alignment.
 - 4. The equipment is free from any undue stress imposed by connecting piping or anchor bolts.
 - 5. The equipment has been operated under full load and that it operates satisfactorily and in compliance with the requirements of this section.

G. Testing:

- 1. After completion of installation, Contractor shall provide for testing. Testing of the Rotary Press shall demonstrate that the equipment is operational through the sequence of operational events, and that the equipment will coordinate operation of the various parts of the system, namely, consistent flow from the pump, accurate measurement of the sludge and polymer, consistent feed of polymer, efficient operation of the gravity and press sections of the press, operation of the conveyor systems and shut-down procedure. Testing shall also demonstrate the shutdown procedures when the equipment detects alarm conditions.
- 2. All screw conveyor equipment shall be fully assembled and operated prior to shipment to the job site. Operation shall be smooth free of vibrations or unwarranted noise in starting or operation, or unwarranted high starting or no load running amperage draw.

3.04 START UP SERVICE

- A. The Contractor shall include with his bid the on-site service of the manufacturer's field service technician for a period of two (2) eight (8) hour days to be designated by the Engineer for servicing and checking the equipment and one (1) day for the purpose of training plant personnel.

END OF SECTION

SECTION 11365

POLYMER BLENDING AND FEED EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. The polymer system shall include a skid mounted system able to receive mixed or neat polymer and blend with water supplied by others and provide proper detention to activate and lengthen polymer to usable sizes to a local feed location.
- B. Equipment included with the polymer system includes:
 - 1. Single Motor Mixing Chamber
 - 2. Dilution water controls
 - 3. Peristaltic or Diaphragm Neat polymer pump
 - 4. System Controls
 - 5. System Accessories (as specified in Part 4 below)
- C. The polymer system shall be a complete skid mounted system including all interconnecting piping and wiring.
- D. Should equipment of a different type, size, weight or design of equipment, which otherwise differs from that specified herein or shown on the Drawings, be offered and determined to be the equal of that specified, such equipment shall be acceptable only on the basis that any revisions in the design and/or construction of the structure, piping, appurtenant equipment, electrical work, etc., required to accommodate such a substitution shall be made at no additional cost to the Owner, shall be the responsibility of the Contractor and shall be approved by the Engineer.

1.03 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. American National Standard Institute (ANSI)
2. Occupational Safety and Health Administration (OSHA)
3. National Electrical Manufacturers Association (NEMA)
4. National Electrical Code (NEC)
5. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 SUBMITTALS

A. Contractor shall provide all submittals in accordance with the requirements of Section 01300.

B. The following product data shall be submitted in accordance with the approved Construction Schedule required in Section 01310 of these Specifications:

1. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
2. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
3. Full scale field test data demonstrating the performance required in this Section of the Specifications. If such data is not available, the Contractor shall be responsible for running performance tests at start-up. The specified performance must be met before the equipment is accepted. All testing costs shall be borne by the Contractor.

C. Upon completion of this portion of the Work, as a condition of its acceptance, deliver to the Engineer three copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.

1. O&M Manuals will thoroughly address all items of equipment, components, options, accessories, and ancillary devices provided with equipment components

D. Product Data:

1. One (1) electronic copy of submittal data will be supplied for the system.
2. Component data and shop drawings of the system will be supplied, including dimensions, weight, and parts list.
3. Control panel elevation, control schematics and component data will be

supplied.

E. Record Documents:

1. Manufacturer's warranty form in which manufacturer agrees to repair or replace components that fails in materials or workmanship within specified warranty period.

F. Operation and Maintenance Manuals. Provide complete operation and maintenance manuals for all equipment, in accordance with the requirements of Section 01730, Closeout Procedures.

1.05 QUALITY ASSURANCE

- A. Manufacturer shall have minimum five years' experience in manufacturing polymer activation and fee systems.
- B. All equipment provided under this section shall be obtained from a single supplier or manufacturer who shall assume full responsibility for the completeness and proper installation of the polymer activation and feed system.
- C. To insure quality and unit responsibility, the polymer activation and feed system must be assembled and tested by the manufacturer at its facility and be a standard regularly marketed product of that manufacturer. The manufacturer must have a physical plant, technical and design staff and fabricating personnel to complete the work specified.
- D. Prior to shipment the system shall be inspected for quality of construction verifying all fasteners and fittings are tight, all wires are secure and connection whisker-free. The system shall be tested under pressure for a minimum of one hour at 100 psi. If leaks are found they shall be fixed and a new test shall be conducted for one hour at 100 psi until the plumbing system is verified to be leak free.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
- B. The polymer activation and feed system shall be capable of effectively activating and fully blending with water a homogenous polymer solution ranging from 0.01% to 0.5% concentration.

2.02 ACCEPTABLE MANUFACTURERS

- A. USGI Polyblend PB
- B. Prominent
- C. OR-TEC
- D. Or Engineer Approved Equal

2.03 SYSTEMS REQUIRED:

Max Polymer Solution Feed Rate	gpm	4
Max Rated Neat Polymer Feed *	gph	1.5
Max System Operating Pressure	psig	70

2.04 SYSTEM DESCRIPTION

A. True Multi-Zone Mixing Chamber

1. Polymer and water shall be mixed in a chamber designed to create sufficient mixing energy.
 - a. The chamber shall contain a minimum of three distinct chambers. Dual or single mixing chamber designs shall be unacceptable.
 - b. The design shall include a motor-driven impeller that will create high fluid shear at point of polymer and water introduction. Systems that solely use a hydraulic means to activate polymer shall not be accepted.
 - c. Polymer solution shall undergo a tapered mixing intensity slope as it exits the initial shear zone and passes through a second, and third mixing zones isolated by baffles.
 - d. Each chamber shall contain Polymer activation efficiency consistent over the entire dilution water range.
2. Mixing chamber shall be opaque to prevent solution degradation from ultraviolet light and to inhibit the growth of algae in the chamber. Clear or translucent mixing chambers shall be unacceptable.
3. Impellers shall be driven by a 1/2 HP maximum wash-down duty motor.
 - a. Motor shall be TEFC.
 - b. Impeller speed shall be 1730 rpm, minimum.
 - c. Motor shall be direct-coupled to impeller shafts.

B. Dilution Water Control

1. Dilution water shall be split into two streams except in the case of the smallest standard unit where only Primary dilution is necessary for

proper operation. Primary water flow shall supply the mixing chamber. Secondary water flow, if applicable, shall be used to post dilute the activated polymer stream to desired feed concentration.

- a. If applicable, secondary water flow shall be used to post dilute the activated polymer stream to desired feed concentration.
 - b. These two streams shall be completely blended by an integrated static mixer prior to application injection point.
2. Unit shall have an electric solenoid valve for on/off control of total dilution water flow. Controls for the solenoid valve shall be factory installed/included in the polymer control system.
 3. Flow indicators and flow control valves shall be provided for the dilution water stream.
 4. The polymer system shall include an analog control valve that is to be controlled by the rotary press PLC (4-20ma) in order to maintain a constant polymer solution concentration at a variable flow.
 5. The primary dilution water rotameter shall include a flow switch to sense loss of dilution water flow.
 6. Unit shall include a transparent static mixer in the solution discharge line.

C. Injection valve

1. The polymer injection valve shall be easily removed via a twist-lock connection for routine maintenance needs. Injection valves installed via a threaded connection shall not be acceptable. Injection valves that are installed inside the mixing chamber, or which require mixing chamber disassembly for servicing will not be accepted.
2. The valve shall be easily disassembled with basic hand tools for cleaning during maintenance.
3. The injection valve shall be sealed into the chamber top with two o-rings and shall have been tested while installed in the system to maintain a pressure of 100 psig.

D. Neat Polymer Metering Pump

1. Unit shall have one neat polymer metering pump. Pumps shall be either a peristaltic (tube) or positive displacement diaphragm type design. Gear pumps, or progressive cavity pumps shall not be acceptable. Pumps shall be supplied per the following
 - a. Peristaltic Pumps
 - 1) Internal diameter of the pump tubing will be 5.0 or 8.0 mm.
 - 2) Polymer pump shall operate on 0-15 VDC.
 - 3) Pump Monitor will stop unit in the event of pumping tube breaks, empty chemical supply or other polymer supply interruptions.
 - 4) Polymer pump shall accept a 4-20mA signal for speed control. Pump will also accept a 0-10 VDC or pulse input for speed control.

- 5) Pump shall have a built in tube failure detection system that senses chemical in the pump head, shuts off the pump and activates a 1 amp alarm relay (dry contact closure).
- b. Diaphragm Metering Pump
 - 1) The polymer pump shall be a microprocessor controlled solenoid driven diaphragm metering pump. All pump functions shall be accessible via an illuminated LCD screen and a membrane style keypad.
 - 2) The pump shall be programmable so that the stroking speeds can be modified to accommodate various polymer viscosities.
 - 3) Polymer pump shall accept a 4-20mA signal for speed control. Pump will also accept a 0-10 VDC or pulse input for speed control.
 - 4) The pump shall be equipped with a fault annunciating relay which will be monitored by the system controller.
 - 5) The pump shall supply a Pump Running feedback signal which will be monitored by the system controller.
2. The system shall have the provision to mount the neat polymer pump in either a flooded suction or suction lift configuration depending on the application requirements.

E. Controls

1. The unit shall include system controls housed in a Nema 4X polycarbonate enclosure
2. The system shall be controlled through an On-Off-Remote circuit controlled by a three-position switch and a two position switch that will determine the source (Local or Remote) for the controlling 4-20mA signal. The controls shall include a menu driven LCD display to allow for custom configuration of the system.
 - a. When the On-Off-Remote switch is in the Remote switch position, the unit shall accept a run signal. Unit is manually controlled in the On position.
 - b. The system shall accept a 4-20 mA analog signal to pace the polymer metering pump.
 - c. The system shall accept a 4-20 mA analog signal to pace the primary dilution water control valve.
 - d. The unit shall provide hand or remote status indication via dry contact output.
 - e. The unit shall provide a running status indication via dry contact output.
 - f. A dilution water flow sensor shall detect the loss of water flow. Upon sensing that water flow has been interrupted for any reason, the controller will place the polymer pump and mix chamber on standby and will restart it automatically when flow is restored.
 - g. The systems shall incorporate automatic chamber flush controls that

will be initiated upon system shut down. Timing for flush and the ability to disable the flush cycle shall be part of the custom programming options. The system shall also allow the ability to manually initiate a chamber flush cycle.

- h. The controller shall offer the ability to adjust the following control parameters
 - 1) Chamber water fill time
 - 2) Chamber water flush time
 - 3) Wait for dilution water flow time
 - 4) Calibration and scaling of the incoming control 4-20mA signal
 - 5) Calibration of the outgoing 4-20mA signal
 - 6) Fail state due to the loss of the incoming control 4-20mA signal
- i. The system shall have the provision to switch the controls to handle Mannich polymer in lieu of the standard emulsion polymer settings.

2.05 TECHNICAL DATA

A. Connections – Plumbing

- 1. Dilution water inlet, 3/4" FNPT
- 2. Neat polymer inlet, Supplied Tubing
- 3. Solution discharge, 3/4" FNPT

B. Connections – Electrical

- 1. Standard, grounded male plug – 120 Volt, 1 Phase, 60 Hz, 20 Amps
- 2. 4-20 mA signal input for control
- 3. Terminal blocks – dry contact input for remote start

C. Materials of Construction

- 1. PP/PE Structural frame
- 2. Plumbing – PVC
- 3. Mixing chamber – PVC

- D. Pressure Rating – The mixing chamber shall be rated for a minimum of 100 psig operating pressure and shall have a maximum design pressure of 150 psig.

2.06 ACCESSORIES

- A. Calibration cylinder: A suitably sized calibration cylinder shall be supplied for the neat polymer feed pump. Cylinder shall be mounted to frame with PVC isolation ball valves. Cylinder shall be calibrated in mL, and be constructed of clear PVC with slip on cap and ½ inch NPT vent connection.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. The equipment shall be installed per the contract documents and manufacturer's recommendations.
 - 1. Provide a manufacturer's certificate showing the equipment has been satisfactorily calibrated and tested.
 - 2. An authorized manufacturer's representative shall inspect the installation of all work furnished under this section and shall provide a certificate of proper installation.

3.02 MANUFACTURERS SERVICES

- A. The manufacturer or manufacturer's representative shall provide the services of an experienced, authorized representative the equipment specified herein who shall be present at the jobsite and/or classroom designated by the City/District for the minimum man-days listed for the services shown below time travel excluded
 - 1. One man-day per site for inspection, start-up, functional testing and certificate of proper installation.
 - 2. One man-day per site for training and commissioning.

3.03 WARRANTY

- A. Polymer feed system shall be warranted for a period of 12 months from the date of substantial completion.
- B. Damage due to makeup water particulates will not be considered as a warranty defect and will be the responsibility of the Owner.

END OF SECTION

SECTION 11371

AIR DIFFUSERS

PART 1 GENERAL

1.01 SCOPE

- A. This section includes the design, manufacture, installation and start-up of a flexible membrane, medium or fine pore aeration system including in-basin aeration components as shown on the Drawings and as specified herein.
- B. The aeration system manufacturer shall provide single source responsibility for the complete aeration system including in-basin piping, diffuser assemblies and support components.
- C. Membrane diffusers shall be utilized in both the Aerobic Digester and the Post Aeration Tank and diffusers will be from the same manufacturer in both tanks.
- D. Coordinate all work with this equipment and any other associated equipment installed and specified under other sections of these specifications.

1.02 RELATED SECTIONS

- A. Section 11374 – Positive Displacement Blowers
- B. Section 15201 – Process Piping

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Design in-basin air piping and diffusers to diffuse air throughout the aeration tank(s) in accordance with the specifications.
 - 2. Design each diffuser assembly to provide uniform air release over the specified airflow range.
 - 3. Design the aeration system to provide the minimum specified oxygen transfer efficiency at the specified airflow and operating pressure.
- B. Design Conditions
- C.
 - 1. Average Daily Design Flow: 0.40 mgd

2. Design Influent Dissolved oxygen concentration
 - a. Aerobic Digester: 0.2 mg/l
 - b. Post Aeration Tank: 0.2 mg/l
3. Tankage
 - a. Aerobic Digester
 - 1) Qty: 2
 - 2) Non pass through
 - 3) Dimensions: 55 ft diameter by 9.5 ft. side water depth total, 55/2 ft. diameter per tank
 - 4) Material to be aerated: Waste Activated Sludge (WAS) from oxidation ditch process, no primary waste
 - 5) Blower used: Positive Displacement
 - b. Post Aeration Tank
 - 1) Qty: 1
 - 2) Passes, each: 1
 - 3) Dimensions per pass
 - a) Length: 13 ft. 8 inches
 - b) Width: 3 ft. 3 inches
 - c) Side Water Depth: 9 ft. 0 inches
 - d) Total Wall Height 18 ft. 6 inches

1.04 SUBMITTALS

A. General:

1. A detailed engineering submittal package shall be provided in sufficient detail and scope to confirm compliance with the requirements of this section. Submittals shall be complete for all required components. Partial submittals will not be accepted.
2. Submit information in accordance with Section 01300.

B. Shop Drawings:

1. Detailed layout drawings for in-basin aeration components. Layout drawings shall include:
 - a. Layout and configuration of aeration system.
 - b. Detail drawings of diffuser assemblies showing components, method of construction, and attachment mechanism to air header distribution piping.
 - c. Detail drawings of all piping connections including drop to manifold, manifold to header and inline connections for manifold and headers.
 - d. Detail drawings of pipe support components.

C. Product Data:

1. Detailed listing of materials and materials of construction.
2. Product literature.

D. System Design and Performance Data:

1. Certified Oxygen Transfer Performance Curve:
 - a. Certified curve shall be an oxygen transfer efficiency in percent versus air fluxrate defined as scfm per active diffuser surface area in tap water at 14.7 PSIA, 20°C and zero dissolved oxygen at the specified submergence.
 - b. The certified curve shall be based on aeration test results from a full-scale test facility. Minimum acceptable tank size is 200 square feet with a maximum length to width ratio of 3.5.
 - c. Certified curve results shall be prepared and sealed by a professional engineer.
2. Include complete air headloss calculations for the aeration equipment from the top of the dropleg to the farthest diffuser bubble release point.
3. Design calculations showing uniform air distribution (+10% maximum variation) through lateral piping and diffuser element orifice system.
4. Design calculations for piping and support components.
5. Design calculations showing the size of the orifices in the diffuser body designed specifically for this project to enable consistent flow of air throughout the system.
6. Quality Assurance Testing:
 - a. The membrane diffuser shall be sampled and tested for air distribution uniformity, dynamic wet pressure and dimensional tolerances.
 - b. Test samples shall be selected from the membrane lots to be used on the project. A minimum of 1% random samples shall be selected from each lot.
 - c. Sampling and testing shall be conducted in the supplier's shop.
 - d. Dynamic wet pressure and dimensional tolerance test samples shall be drawn from the sample lot selected for uniformity testing.
 - e. Test diffuser elements for dynamic wet pressure by submerging a diffuser unit at least two inches in tap water and operate at an air rate of 5 scfm per square foot $\pm 10\%$. DWP values shall be within $\pm 10\%$ of average value. DWP is defined as the pressure to operate at the specified conditions minus submergence and flow control losses.
7. Endurance Testing:
 - a. Certified endurance test data shall be supplied for the diffuser units proposed in accordance with the following test conditions:
 - 1) Operate diffuser unit while submerged 12 inches in clean water through at least 1 million cycles on/off shall be supplied.
 - 2) Cycles shall be at least 10 second duration.

- 3) Membranes shall retain initial headloss, dimensional tolerances, SOTE and visual characteristics.
8. Product Experience:
- a. The supplier shall have experience in the design, manufacture, supply and commissioning of fine pore, flexible membrane aeration equipment identical to the type specified for this project.
 - b. The equipment submitted shall be of proven design and shall be referenced by at least three installations of similar size, having been in successful operation for a period of not less than five (5) years prior to bid date.
 - c. If the Contractor elects to submit a substitute aeration system that does not comply with the above experience requirements, a bond guaranteeing the replacement of the aeration system shall be provided with the submittal package.
 - 1) The bond term shall be for a period of five (5) years. This term shall include the specified warranty period plus three (3) additional years.
 - 2) If the operation of the aeration system as determined by the Owner is unsatisfactory, the Contractor shall repair, modify or replace the entire aeration system in a manner acceptable to the Owner.
 - 3) Normal wear or malfunctions due to neglect or abuse shall not be considered justifiable reasons for unsatisfactory operations.
 - 4) The presence of chemical compounds that are aggressive to the membrane material are not considered as normal wear or service.
 - 5) If the Contractor fails to correct deficiencies identified by the Owner within six (6) months of the date first notified in writing, the Owner shall at its own discretion make all necessary repairs or replacement and deduct all associated costs from the Contractor's bond.
9. Guarantee:
- a. All equipment and workmanship furnished under this contract shall be guaranteed to be free of defects in materials and workmanship for a period of two (2) years from the date of shipment. Any such defects, which occur within the stipulated guaranty period, shall be repaired, replaced or made good at no cost to the Owner.
 - b. The guarantee shall include the capacity and integrated performance of the aeration components.

E. Installation Instructions:

1. Installation requirements and guidelines for all proposed equipment shall be provided.
2. Information on the aeration system shall include but not be limited to:
 - a. Diffuser unit assembly.

- b. Diffuser assembly attachment.
- c. Piping components and assembly.
- d. Piping support components.

F. Operation and Maintenance Data:

- 1. Operations and maintenance data for all proposed equipment shall be provided.
- 2. Information on the aeration system shall include but not be limited to:
 - a. Air flow balancing.
 - b. Diffuser assembly maintenance and membrane replacement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sanitaire, a division of Xylem, Inc

B. Pre-approved equal.

- 1. Information on approved equal manufacturers shall be submitted to the Owners Representative no less than 10 days prior to the bid date. Owner may accept or reject application at their discretion.

2.02 MATERIALS

A. Welded Stainless Steel Components:

- 1. Sheets and plates of Type 304L stainless steel with 2D finish conforming to AISI 304L and ASTM A240.
- 2. Limit carbon content to 0.30% maximum.
- 3. Provide a 304L stainless steel drop pipe. Extend stainless steel portion from the air main connection to a point three feet above the manifold.
- 4. Provide stainless steel manifolds as shown on the drawings perpendicular to the air distribution header. Support manifold with a minimum of two stainless steel supports. Maximum spacing between supports shall not exceed 8 feet. Design manifold, connections and supports to resist thrust generated by expansion or contraction of the air distribution header.

B. Non-welded Stainless Steel Components:

- 1. Sheets and plates of Type 316 stainless steel conforming to AISI 316 and ASTM A240.

C. Fasteners and Anchorage Components:

- 1. 18-8 series stainless steel.

D. PVC Pipe and Fittings (Schedule 40 and 80):

1. Base material shall be ASTM D-1784.
2. Pipe shall be manufactured in accordance with ASTM D-1785 and ASTM D-2665.

2.03 COMPONENTS

A. Diffuser Types

1. Silver Series II, Post Aeration and Silver Series II LP, Aerobic Digester
2. Or equal.

B. Air Headers, Manifolds, and Piping

1. All piping, connection, and bracing are specified on drawings or in Section 15140 and 15201.

2.04 AERATION EQUIPMENT

A. System Performance

1. Aerobic Digesters

- a. The aeration-mixing system shall be designed to meet the following:

- 1) SCFM = 684 scfm, total in two (2) tanks
- 2) Discharge Pressure = 6.2 psig
- 3) Diffuser Unit DWP = 18 inches H₂O maximum
- 4) Diffuser Submergence = 8.5 feet maximum
- 5) Standard Oxygen Transfer Efficiency = 14.8 % min

- b. The diffusers shall not exceed the following:

- 1) Air Fluxrate = 5.5 scfm/ft² of active diffuser surface area at the design airflow.
- 2) Active Surface Area = 172.7 ft² minimum
 - a) Active surface area shall be defined as the net perforated area of the media or membrane and shall reflect only that portion of the membrane which can be demonstrated to produce uniform air discharge under the full operating range proposed for the diffuser.

2. Post Aeration Tank

- a. Air shall be added to the plant effluent to ensure minimum required dissolved oxygen in the effluent and the system shall be designed to meet the following:

- 1) SCFM = 88 scfm
- 2) Discharge pressure = 5.2 psig
- 3) Diffuser Submergence = 8.0 ft maximum

4) SOTE = 15% minimum

B. Flexible Membrane, Fine Pore Diffusers (Aeration and Sludge Storage Basins): the disc and membrane shall be designed for the specific use in each basin.

1. Each diffuser assembly shall be factory assembled.
2. The diffuser shall consist of three elements: An ABS housing; a stainless steel retaining ring; and a PVC movable disc. The movable disc is inserted between the diffuser housing and the stainless steel retaining ring, and is free to rise and fall within the space provided between the housing and the retaining ring. As air is discharged through the diffuser, the disc rises and air is permitted to pass around the entire periphery of the diffuser into the liquid.
3. The diffuser shall be fully supported over full height and circumference with an ABS support frame.
 - a. Use of a non-fully supported diffuser membrane is not acceptable.
4. The diffuser base shall be equipped with lugs for engagement of the disc valve retainer ring. The base stem shall have $\frac{3}{4}$ inch NPT male threads for connection to the air header system.
5. Retainer ring shall be 316 stainless steel and shall attach to the base housing by spring action of the mounting prongs into the base lugs
6. The diffuser unit shall be fully capable of operating under continuous or intermittent conditions and shall be designed with check valve capabilities to prevent entry of mixed liquor into the diffuser unit or air piping on air shutdown or interruption of air supply.
7. Each diffuser shall incorporate a PVC disc type check valve that will cover the entire air discharge area of the diffuser base and will effectively seal against a flat surface preventing any leaking of water into the diffuser when air pressure is terminated.
8. The base shall include an air flow control orifice to maintain adequate headloss for uniform air distribution throughout the system.
9. Individual diffuser units shall be provided with an internal end cap.
10. Diffuser assemblies shall be completely factory assembled with diffuser units, support base units, check discs and retainer rings factory installed.
 - a. Field solvent welding or assembly of diffuser is not acceptable.
11. Diffuser assemblies shall be shipped to the jobsite assembled and properly crated and protected for shipment and handling.
12. Diffuser base unit and threaded connection shall be ABS plastic construction and shall be capable of withstanding an external force of 4,800 inch-pounds without structural failure of the air distribution pipe, diffuser units connection or threaded connection into the lateral

C. Aeration System Piping:

1. Out-of-basin air piping including blower manifold, air header, and header stubs are required and are to be supplied by the Contractor.
 - a. Header stubs shall extend to the inside top of the wall and terminate with a full diameter, vertical face, flange.
 - b. Out-of-basin piping may be unlined ductile iron, galvanized steel, stainless steel, or painted carbon steel.
 - c. The Contractor shall provide an isolating/balancing valve for control and distribution of air to the aeration grid and to allow isolating of the grid for inspection and maintenance on the header stub.
 - d. Isolation/balancing valve shall be positioned for accessibility from the top of the tank.
2. Drop pipe shall be provided with a flanged top connection and plain end.
 - a. Drop pipe shall extend from the top connection to within 3 feet of the air manifold.
 - b. Material of construction for the drop pipe shall be schedule 40, stainless steel. Drop pipe shall conform to ASTM A-774 and A-778
 - c. Drop pipe shall connect to air manifold piping by means of a wrap-around clamp adapter.
3. All submerged manifolds and header components shall be Schedule 40 PVC minimum. Manifolds must be submerged to all PVC pipe. Sch 40 PVC pipe shall conform to ASTM D-1784 and D-1785.
 - a. Use of PVC piping shall only be employed when diffuser mounting system reinforces pipe wall at each mounting location.

D. Supports

1. Manifold and air header supports shall be 304 stainless steel and include manifold hold-down, guide straps, anchor bolts and supporting structure. Guide straps shall be a minimum 2 inches wide. Provide supports with a mechanism to provide for plus or minus 2 inch vertical adjustment for alignment of the manifold in the field. Supports shall be designed to allow for complete removal from the tank (less anchor bolt) to facilitate cleaning and maintenance of tank bottom.
2. Supports shall accommodate longitudinal movement in the piping components due to the thermal expansion and contraction over a temperature range of 100°F. and shall restrain the axial and rotational movement of the pipe while providing for unrestrained longitudinal movement.
3. Guide supports shall consist of a self-limiting hold down and sliding mechanism. Hold down and sliding mechanism shall provide a full circumferential 1.5 inch wide contoured bearing surface with chamfered leading edges to minimize binding of the air distribution header. Sliding mechanism shall provide minimum resistance to movement of the air distribution header under full buoyant up-lift load. Worm gear clamps shall not be used.

4. Fixed supports shall consist of a hold down mechanism and self-limiting clamp device and shall provide a 1.5 inch wide contoured bearing surface for the air distribution header. Clamping device shall positively grip the air distribution header when tight and be self-lifting to prevent over stressing the header if the clamp is over tightened. Worm gear clamps shall not be utilized.
5. Provide supports with a mechanism to provide for plus or minus 1.5 inch vertical adjustment for alignment of the air distribution headers in the field. Adjusting and aligning mechanism shall be infinitely adjustable within its limits to allow precise leveling of the air distribution headers and diffuser assemblies to within plus or minus ¼ inch of a common horizontal plane without removing the header from the support.
6. Attach supports to tank floor with one stainless steel expansion type anchor bolt designed for embedment in 3000 psi concrete. Size anchor bolts with pull-out strength, design safety factor of 4 or more.
7. The integrated pipe support assembly shall be designed to withstand the associated uplift force of the piping and diffuser assemblies with a minimum design factor of safety equal to ten (10).

E. Header and Manifold Pipe Joints

1. Provide positive type connection joints bolted or flanged or threaded union type for all submerged header and manifold joints.
2. Bell and spigot, slip on or expansion type joints shall not be utilized for submerged joints. All joints must be positive locking type.
3. Threaded union joints shall consist of a spigot section solvent welded to one end of a distribution header, a threaded socket section solvent welded to the mating distribution header, an "O" ring gasket and a threaded screw on retainer ring. Solvent welding shall be done in the factory. Flanged joints shall be of follower type with stainless steel hardware and shall have standard 125 lb. drilling.

F. Spare Parts:

1. The Contractor shall furnish the following spare parts and store as directed:
 - a. Two (2) – Diffuser head/membrane assemblies for each application complete and factory assembled, ready to be installed into the header.
 - b. One (1) - Diffuser support with anchor bolts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Contractor shall furnish, inspect, store, and install aeration system in accordance with manufacturer's written instructions and approved submittals.
- B. Diffuser assemblies on a common grid shall be installed within an elevation tolerance of $\pm 1/2$ inches.
- C. Contractor shall provide all valves, air header piping, wall sleeves with seals, wall pipes, and concrete pedestals as necessary to complete the system as shown on the plans.
- D. Air piping including blower manifold, header, and in-basin piping must be clean prior to delivering air up the diffusers.
- E. Contractor shall be responsible for cleanliness of piping and may be required to manually clean pipe, or air or water flush piping as required.

3.02 START-UP

- A. After installation is completed, the Contractor shall perform the following field tests in the presence of the Engineer and the Owner.
 - 1. Fill the reactor to the bottom of the diffuser assemblies.
 - 2. Adjust the pipe supports and diffuser assemblies such that all diffuser units are installed within $\pm 1/2$ inches of the design diffuser elevation.
 - 3. Fill the reactor to a level of 2 feet above the top of the diffusers.
 - 4. Release air to the system and inspect the system for air leaks at all piping or diffuser connections.
 - 5. Check all membrane for cuts or tears that may have occurred during the installation.
 - 6. Adjust any piping or diffusers that show leaks or disproportionate amount of airflow.
 - 7. Operate the blowers at the design air rate and observe air release and air distribution patterns.
 - 8. All water, air, power and labor associated with testing and adjustment of diffuser assemblies are to be supplied by Contractor.

3.03 MANUFACTURER'S FIELD SERVICES

- A. A manufacturer's representative shall be present at the job site to inspect the installation of the equipment, start-up the system, and train operations and maintenance personnel on the supplied equipment.
- B. Services including a minimum of one (1) trip with a minimum of one (1), 8-hour day onsite shall be provided.

END OF SECTION

SECTION 11374

POSITIVE DISPLACEMENT BLOWERS

PART 1 GENERAL

1.01 SCOPE

- A. Provide all labor, materials, tools, equipment and incidentals required to provide and install positive displacement blower with appurtenances as shown on the Drawings, as specified in this Section and other related sections.
- B. The overall dimensions of the blower shall enable it to be installed in the space provided, with all fixtures specified herein, shown on the Drawings and as Scheduled at the end of this Section.
- C. The Positive Displacement Blower shall include the following:
 - 1. Blower and fabricated steel base.
 - 2. Motor and drive.
 - 3. Accessory equipment.
 - 4. Anchor Bolts and Threaded Fasteners.
 - 5. Repair parts and special tools.
 - 6. Testing, installation, cleaning, training, commissioning, maintenance and other services and provisions as called for herein.
 - 7. Vibration Pad.
 - 8. Sound Barrier Enclosure, where shown on the Drawings.
- D. Connections of electrical, control and instrumentation components shall be furnished and installed by the ELECTRICAL CONTRACTOR as part of Division 16.
- E. Equipment Control Panel shall be provided under Section 16170.
- F. All manufacturer/supplier electrical work including original equipment manufacturers work is to be in strict conformance with the requirements of Division 16.

1.02 QUALITY ASSURANCE

- A. The specifications in this Section are subject to the administrative and procedural requirements specified in Division 1, as well as the broader requirements of the General Conditions.

B. Reference Standards: Comply with all Federal and State of Ohio laws and ordinances, as well as applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:

1. ANSI: American National Standards Institute.
2. ASME: American Society of Mechanical Engineers.
3. NEMA: National Electrical Manufacturers Association.
4. NEC: National Electrical Code.
5. CAGI: Compressed Air and Gas Institute.

1.03 SUBMITTALS

A. Product Data: Comply with Section 01300, and provide the following:

1. Manufacturer's literature, illustrations, specifications and engineering data.
2. Air flow rates and pressures.

B. Shop Drawings: Comply with Section 01300 and provide the following:

1. Complete description in sufficient detail to permit an item-by-item comparison with the Specifications.
2. Dimensional and materials shop drawings for all equipment to be furnished under this Section (include weights).
3. Layout drawings for all equipment showing typical and specific installation details.
4. Wiring diagrams for all electrical and instrumentation equipment (schematic and point-to-point).
5. Electrical power requirements.
6. Details of all accessories.
7. Manufacturer's installation and testing instructions.
8. Manufacturer's standard guaranty.

C. Maintenance and Operating Instructions: Comply with Section 01730 and provide the following information:

1. Detailed parts lists.
2. Repair data.
3. Electrical diagrams.
4. Mechanical diagrams.
5. Trouble shooting data.
6. Test data.
7. Repair parts and maintenance materials.

D. Repair Parts and Maintenance material: Comply with Section 01730 for new and replacement equipment.

E. Quality Control Submittals:

1. Design Data.
2. Test Reports.
3. Installation Instructions.
4. Field Installation Reports.

F. Project Record Documents: Comply with Section 01700.

G. Installation Instructions: Furnish manufacturer's printed instructions for assembly and complete installation and connection of all equipment.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Blowers:

1. Each blower shall be of the rotary positive displacement type and be constructed with inlet and discharge connections oriented as shown on the Drawings.
2. The blower case shall be of one-piece construction with separate head plates, and shall be made of ASTM A48 Class 30B close-grained cast iron suitably ribbed to prevent distortion under the specified operating conditions. Each head plate shall incorporate a vent to the atmosphere to prevent pressurization of the oil chambers.
3. The blowers shall meet noise limitations of 75 dB at three (3) feet from the enclosure.
4. The impellers and shafts on the aeration and sludge blowers shall be made from high-strength ASTM A395-60-45-15 ductile iron. The shafts are cast integrally with the impellers. The impellers shall be of the straight, two-lobe involute type and shall operate without rubbing, liquid seals or lubrication. The impellers shall be statically and dynamically balanced by removing metal from the impeller body. Each shaft is fitted with a cast iron ASTM A48 Class 30B sleeve and ductile iron piston ring, SAEJ929. The piston ring is located on the shaft at the point where the shaft passes through the head plate.
5. The impeller shall be timed by a pair of accurately machined forged steel gears.
6. Each impeller and shaft assembly shall be supported by oversized anti-friction bearings engineered for long service life and fixed to control the axial location of the impeller/shaft in the unit.
7. A roller bearing shall be provided at all four (4) locations. A wavy washer shall be installed on the gear end of both shafts to between the bearing and bearing clamp to absorb axial thrust loading.
8. Each blower will include a certified 1 PSIG slip test per ASME PTC. Certification shall be provided.
9. Each bearing shall be provided with a positive lip type oil seal designed to prevent lubricant from entering the air stream, and a lip type oil seal on each shaft designed to reduce air leakage at the point where the shaft extends through the head plate of the blower casing. Further provision shall be made to vent the impeller side of the oil seal to atmosphere to eliminate any possible carry-over of lubricant into the air stream.
10. The impeller shall be timed by a pair of SAE 8620 carburized and hardened steel spur gears. The gears shall be hardened to 58-62 Rockwell hardness and mounted on the shafts with a tapered fit and secured by a locknut. Timing gears and gear end bearings shall be oil splash lubricated from oil housings.
11. All fasteners shall be SAE J429 Grade 5, ASTM A449-Type 1, material minimum.
12. The blower speed shall not exceed 80% of the maximum design speed of the blower.

B. Motors and Drives:

1. The blower shall be driven by a totally enclosed fan cooled horizontal, NEMA DESIGN B, high efficiency motor. Motor horsepower shall be as shown in Schedule.
2. The motor shall not be overloaded nor have their service factor reduced when the blower is operating at the speed and differential pressure shown in Schedule.
3. The motor shall be premium efficient per 2011 NEMA premium standards, mill and chemical duty, with a 1.15 service factor, suitable for outdoor installation.
4. Voltage Rating: 460 volts, 3 phase, 60 Hertz.
5. The motor shall be connected to the blower through heavy-duty single drive belt. Motor bases shall incorporate a means to easily adjust belt tension. Drive guards shall be provided in accordance with OSHA. The belt sheave shall allow for a three-belt system or other system that will diminish belt wear.

C. Accessory Equipment:

1. Each blower shall be provided with an inlet filter, inlet silencer, expansion joints, discharge silencer, pressure relief valve, check valve, butterfly valve, wafer type butterfly valve, high temperature cut-off switch, vibration pad, and other accessories as shown on the Drawings.
2. Inlet filter shall be of the dry element type having a washable filter media. The filter shall be sized to pass 100% of the blower flow with a pressure drop not to exceed 3 inches of W.C. for a clean filter. The sizing and design of the filter shall be suitable for fully exposed outdoor service and provided with a weather hood. The filter element shall be cleanable and replaceable. The filter shall be equipped with a filter restriction indicator suitable for up to 20 inches of water column.
3. Inlet silencer shall be of the chamber-absorptive type with inlet and outlet connection to match the blower arrangement as shown on the Drawings. The silencer shall be sized for 100% of the blower flow with a pressure drop not to exceed 5.5 inches of water column. at the scheduled blower operating conditions.
4. Discharge silencers shall be of the chamber-absorptive type with inlet and outlet connections to match the blower arrangement as shown on the Drawings. The silencer shall be sized such that a pressure drop of 5.5 inches water column shall not be exceeded at the scheduled blower operating conditions.
5. A pressure relief valve shall be mounted on the blower discharge silencer. Pressure relief valve shall be a spring-type relief valve having 10% maximum accumulation at the maximum blower operating capacity. Valve shall have stainless steel inserts and discs and rated for temperatures up to 300 degrees F. Valve shall be factory set at 1 psig

above operating pressure.

D. Butterfly Valves:

1. Location: Outlet of each blower package.
2. Type: Seated wafer type.
3. Size: As shown in Schedule.
4. Required Features:
 - a. Cast iron body.
 - b. Self-lubricating bronze bearings.
 - c. Resilient seats.

E. Check Valves:

1. Location: Outlet of each blower package.
2. Type: Short form type designed for air systems.
3. Size: As shown on schedule.
4. Required Features:
 - a. Cast iron bodies
 - b. Aluminum internal assemblies with EPDM seal members.
 - c. Rated for continuous duty to 35 psig and 300 degrees F.

F. Each blower shall have a 4 1/2" diameter, petra turret case, phosphor bronze bourdon tube, stainless steel movement, liquid filled, grade 2A accuracy, 1/4" NPT connection pressure gauge with a 0-15 psig scale on systems operating up to 10 psig and 0-30 psig for higher pressures. Gauge shall have a 1/4" brass snubber and isolation valve. Gauge shall be U.S. Gauge 1980 or equal.

G. Provide a full package galvanized steel all weather sound barrier enclosure for each blower as shown on the Drawings and as specified herein. Enclosure shall have the following features:

1. A fan-ventilated enclosure of steel segmental construction shall be provided for each blower assembly.
2. It shall be comprised of two side panels, two end panels and a cover, all secured together with latching closures.
3. The panels shall be of 2-4" thick tongue and groove construction to guarantee specified noise levels. The outer shell shall be 18-gauge solid galvanized steel and the panel interior shell shall be 22-gauge perforated galvanized steel.
4. Each enclosure will include two hinged door panels for the inlet filter and blower/motor/belt drive.
5. One side shall be specially louvered and ducted to channel air directly to the blower intake filter/silencer.
6. The other side and end panels shall be louvered such that the movement

of air induced by the ventilating fan through the enclosure shall pass across the blower and motor for optimum cooling effect. The louvers shall be shielded against precipitation and airborne debris.

7. A port shall be provided at a convenient location through the enclosure for the blower discharge conduit.
8. The acoustics media shall be mineral wool.
9. Roof-mounted dome exhauster with either a 1/6 or 1/4 horsepower, 115/230-volt single-phase ODP motor depending on the size of the enclosure.

H. The ventilating fan fractional horsepower motor shall be provided for the blower housings.

I. Controls:

1. High temperature cut-off switch shall be SPDT output; NEMA 4 enclosure; internal adjustment with reference dial and immersion stem for each blower. Provide a SPDT NEMA 4 thermostat to control the exhaust fan for each enclosure.
2. The blowers shall be operated manually by equipment described in Division 16.

J. Anchor Bolts and Threaded Fasteners:

1. Supply Type 316 stainless steel anchor bolts, fasteners, nuts, washers and screws for all equipment under this Section.

K. Repair Parts and Special Tools:

1. Any special tool required to perform routine maintenance functions, such as replacement of gears and bearings, shall be furnished with the blowers.
2. Provide the following repair parts for each blower:
 - a. One (1) complete set of belts.
 - b. One (1) complete set of filter elements.

L. Manufacturers:

1. Roots, by Dresser Industries,
2. Gardner Denver packaged by Excelsior Blower Inc.
3. Or Equal.

2.02 FABRICATION

- A. Shop Assembly: Each blower shall be completely factory assembled by a factory authorized distributor or representative.
- B. Shop/Factory Finishing:
 - 1. Blowers shall be painted as specified in Section 09900.
 - 2. Machined, polished and nonferrous surfaces shall be coated with corrosion prevention compound.
- C. Field Painting:
 - 1. Touch up per Section 09900.

2.03 SOURCE QUALITY CONTROL

- A. Manufacturer's Requirements:
 - 1. Blower manufacturer shall have in place a full capability service organization.
 - 2. Such service organization shall include at least one stocking distributor in the State of Ohio.

PART 3 EXECUTION

3.01 EXAMINATION AND VERIFICATION OF CONDITION

- A. Assure that all materials delivered to the job site have been fabricated in accordance with the approved Shop Drawings and are free from obvious shipping damage or defects.
- B. Examine locations to receive blowers for proper anchor bolt locations and any unevenness, irregularities or incorrect dimensions.
- C. Notify the OWNER immediately of all unsatisfactory or non-conforming conditions.

3.02 PREPARATION

- A. Delivery and Handling of Equipment:
 - 1. Inspect all equipment and materials against approved Shop Drawings at time of delivery.
 - 2. Equipment or materials damaged or not meeting the requirements of the approved Shop Drawings shall be immediately returned for replacement

or repaired.

3. Blowers shall come completely assembled and protected on wooden skids. Blower suction and discharge ports shall be protected against entry of foreign objects.

B. Storage:

1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
2. Store all equipment and materials in a dry, covered, ventilated location and protected from harm according to the Manufacturer's instructions.
3. Cap all pipe connections.
4. Blowers shall remain on original skid until time of actual installation.

3.03 INSTALLATION

- A. Installation shall be in complete accordance with approved Shop Drawings, Manufacturer's instructions, and recommendations, as shown on the Drawings and as specified herein.
- B. Piping shall be supported independent of blowers.
- C. Connect all piping, valves and accessories as detailed on the Drawings and approved Shop Drawings.
- D. Installation shall include furnishing and applying lubricants as recommended by the manufacturer.
- E. Complete all job-site-installed electrical and control system wiring and components in compliance with Division 16 of the specifications.
- F. Grease bearings as per manufacturer's recommendations prior to starting blowers.
- G. Check for proper rotation.
- H. Adjust vibration mountings to remove excessive vibration.
- I. CONTRACTOR shall verify that structures, pipes and equipment are compatible.
- J. Make adjustments required to place system in proper operating condition and leave blowers in working order.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service Report: Manufacturer's representative shall

perform field inspection of all components prior to placing in operation and submit Manufacturer's Installation Inspection Report addressing the following:

1. List of deficiencies found.
2. Recommended corrective action for all deficiencies.
3. Certification by Manufacturer's representative that items are properly installed and adjusted.

B. Manufacturer's representative shall revisit the jobsite as often as necessary until all trouble is corrected and the OWNER is completely satisfied.

3.05 CLEANING

A. Comply with Section 01700.

3.06 INSTRUCTION OF PERSONNEL

A. On-Site Training: The manufacturer's representative shall visit the job site and train the operations staff on proper operation of the blower system including background training of positive displacement compression, safety features, troubleshooting, maintenance requirements and timing, belt and sheave replacement, and instrumentation.

B. Operations, Maintenance, Electric and Instrumentation: Four (4) hours minimum.

3.07 STARTING OF SYSTEMS/COMMISSIONING

A. Comply with Section 01650.

3.08 EQUIPMENT SCHEDULE

A. Blowers shall not exceed 80% of maximum design speed. Sound enclosures are required for the blowers.

B. Digester Blowers:

Location	Aeration
Quantity	3
Design Flow	340 SCFM
Pressure	6.2 PSIG

Site Conditions	720 feet elevation 85% RH 95 DEG F
Motor HP	20
Outlet Size	6-inch

C. Post Aeration Blower:

Location	Post Aeration
Quantity	1
Design Flow	88 SCFM
Pressure	5.2 PSIG
Site Conditions	720 feet elevation 85% RH 95 DEG F
Motor HP	5
Outlet Size	2-inch

END OF SECTION

SECTION 11375

OXIDATION DITCH AND MIXING EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

- A. Furnish, install and test Oxidation Ditch and Mixing Equipment including:
 - 1. Aeration disc assemblies with hardware
 - 2. Solid shaft assemblies
 - 3. Shaft-mounted drive assemblies
 - 4. Pillow block roller bearings with bearing base plates
 - 5. Weatherhood access platform and supports
 - 6. Stainless steel anchor bolts
 - 7. DO and ORP probes and support assemblies
 - 8. Integration with WWTP SCADA System
- B. Furnish all labor, material, equipment, products, incidentals and testing required and necessary to provide a complete operational system.
- C. Coordinate all work with this equipment and any other associated equipment installed and specified under other sections of these specifications.

1.02 SYSTEM DESCRIPTION

- A. Oxygen requirement to be controlled by disc immersion, rotational speed, and the direction of disc rotation.
- B. Raw sewage is to be introduced into any one of the two channels depending on the operating conditions. Recycle sludge is to be introduced to the outer or inner channel

1.03 SYSTEM PERFORMANCE

- A. Design Flow Rates
 - 1. Average Daily Flow = 0.4 MGD
 - 2. Peak Daily Flow = 1.0 MGD
 - 3. Peak Hourly Flow = 1.4 MGD
- B. Influent Characteristics of Wastewater

1. BOD₅ = 270 mg/l, 7 occurrences > 500 mg/l in past two years
2. TSS = 300 mg/l
3. NH₃ = 30 mg/l
4. pH = 8.15, avg; 8.7 peak

C. Projected NPDES Permit Limits for Effluent

Original Flow: 0.24 MGD
 Additional Flow: 0.16 MGD
 Total Flow: 0.40 MGD

	Secondary Limit (mg/l)	BADCT Limit (mg/l)	Combined Limit (mg/l)
TSS Weekly	45	18	34.2
TSS Monthly	30	12	22.8
S-NH ₃ Weekly	18	1.5	11.4
S-NH ₃ Monthly	18	1	11.2
W-NH ₃ Weekly	18	4.5	12.6
W-NH ₃ Monthly	18	3	12
CBOD Weekly	40	15	30
CBOD Monthly	25	10	19

Secondary limits = current limits except no current limit on ammonia, phosphorus. Current limit on pH is 6.5 to 9.0

1.04 RELATED SECTIONS

- A. Section 03100 – Concrete Formwork
- B. Section 03200 – Concrete Reinforcing
- C. Section 03300 – Cast in Place Concrete
- D. Section 05505 – Aluminum Railing, Grating and Stairway Fab
- E. Section 05530 – Gratings and Floor Plates
- F. Section 09900 – Paint: Field painting of exposed steel
- G. Section 11280 – Valves
- H. Section 11950 – Sluice Gates
- I. Section 15135 – Pipe Supports

J. Division 16 – Electrical

1.05 REFERENCES

- A. AGMA – American Gear Manufacturers Associates
- B. AISC – American Institute of Steel Construction
- C. ASCE – American Society of Civil Engineers
- D. ASTM - American Society for Testing Materials
- E. ANSI - American National Standards Institute
- F. AWS – American Welding Society
- G. AWWA - American Water Works Association
- H. FM - Factory Mutual
- I. IEEE - Institute of Electrical and Electronic Engineers
- J. JIC - Joint Industry Conference
- K. NEC - National Electric Code
- L. NEMA - National Electrical Manufacturers Association
- M. OSHA - Occupational Safety and Health Administration
- N. SSPC – Steel Structures Painting Council
- O. UL - Underwriters' Laboratories Incorporated

1.06 SUBMITTALS FOR REVIEW

- A. Section 01300 - Submittals: Procedures for submittals.
- B. Product Data: Provide unit capacities, projected effluent values, loading parameters, design parameters, oxygen requirements, dimensions, etc.
- C. Shop Drawings: The Contractor shall furnish detailed specific information with regard to the equipment and appurtenances proposed within 60 days of Contract Award. The Contractor shall furnish a complete set of detailed specifications and shop drawings including:

1. Size, type, construction and metallurgy of proposed equipment.
2. General arrangement and key plan for Oxidation Ditch.
3. General and detail arrangement sections and details for Oxidation Ditch.
4. Shaft mounted disc aerator drive assembly details.
5. General arrangement section and details of fiberglass weather hoods in aeration basin including clearance dimensions at the ends of each assembly and for opening the hoods.
6. Disc aerator layout including foundation support details.

1.07 SUBMITTALS AT PROJECT CLOSEOUT

- A. Follow Section 01700 - Contract Closeout: Procedure for submittals.
- B. Operation Data: Include description of system operation, adjusting and testing required.
- C. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required, and local spare part sources.

1.08 QUALITY ASSURANCE

- A. All materials and equipment incorporated in the work shall be new and of the best quality.

1.09 The Aeration/Mixing Equipment shall be provided by one manufacturer/supplier experienced in the design and production of similar type, size, and capacity equipment.

1.10 WARRANTY

- A. Section 01700 - Contract Closeout
- B. The Equipment Manufacturer must agree to pay 100% of the equipment purchase price (including the Energy Cost Penalty) for any modifications the manufacturer determines to be necessary to meet the specified minimum mixing efficiency and the specified aeration efficiency.
- C. Correct defective work within a one year period after substantial completion

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Evoqua Water Technologies

- B. Envirodyne Systems, Inc.
- C. Or Engineer Approved Equal.
- D. To be selected as an approved equal a submittal showing compliance with these specifications shall be submitted ten (10) days before bid opening. Selected equipment manufacturers will be added by addendum.
- E. The design and layout shown on the drawings are based on the Manufacturer listed above. If equipment other than that of the Manufacturer shown is submitted to the Engineer for consideration as an equal, it shall be the responsibility of the CONTRACTOR wishing to make the substitution to submit with the request a revised drawing of the mechanical equipment and basin layouts acceptable to the ENGINEER.
- F. Changes in architectural, structural, electrical, mechanical and plumbing requirements for the substitution shall be the responsibility of the CONTRACTOR wishing to make the substitution. This shall include the cost of redesign by ENGINEER or ENGINEER'S SUBCONSULTANTS. Any additional cost incurred by affected subcontractors shall be the responsibility of the CONTRACTOR and not the OWNER. Any such changes to the plans shall be stamped by a professional engineer registered the State of Ohio.
- G. The equipment manufacturer shall have not less than ten (10) successful years' experience in the design, construction, and operation of the equipment specified at ten (10) different plants.

2.02 MATERIALS

A. General

1. Provide, as shown on the plans, one (1) complete oxidation ditch wastewater treatment system.
2. The aeration equipment shall consist of four (4) complete rotary aerator assemblies to span the channels, as shown on the plans. The rotary aerators shall be designed for operation at a controlled discharge submergence of 9 to 21 inches, so that the oxygen transfer rate and power requirements can be varied with the flow and treatment requirements.

B. Design Criteria

1. Aeration requirements of the rotary aerator assemblies at Standard Operating Requirements of 68 degrees F and 30" Hg.

- a. Rotary aerator assemblies design oxygen transfer delivery (based on rotational speed of 43 RPM, and 16.0" disc immersion): 36.8 lbs. O₂ /hr total each channel.
 - b. Rotary aerator assemblies Maximum Oxygen Transfer Delivery, (based on rotational speed of 49 RPM and a 21" disc immersion: 58 lbs. O₂/hr, total each channel.
2. Each 10 hp aerator assembly shall be capable of transferring 29 lbs. O₂/hr at maximum speed and immersion
3. Capable of maintaining a 1.0 fps average cross-sectional velocity in each channel with a minimum basin mixing efficiency of 80,000 gals/1 BHP.
4. Disc aerator: capable of delivering a standard Aeration Efficiency (SAE) of 3.45 lbs. O₂/BHP-hr at a design delivery rate not to exceed 1.44 lbs. O₂/hr ft of shaft section.

C. Aeration Discs

1. There shall be provided not less than the specified number of circular aeration discs, located as determined by the supplier in order to provide the required oxygen requirements.
2. The discs shall be fabricated of 1/2" (13 mm) thick molded plastic compound resistant to any corrosive action of the mixed liquor being aerated. A multiplicity of cavities and raised triangular protrusions shall be provided in the disc to cause entrained air to be dispersed in the mixed liquor. Alternate acceptable aerator materials of construction shall be 1/4" (6 mm) thick type 316L stainless steel in 6" removable sections.
3. The aeration discs shall be firmly attached to the shafting by means of a shaft locking collar. This shaft locking 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 and at the periphery. Bolts, nuts and washers shall be 316 stainless steel.
4. The individual discs shall be adjustable to a minimum 6" (150 mm) spacing at any location in the oxidation ditch to provide flexibility in oxygen delivery.
5. Provide all necessary appurtenances with the aerator shaft to allow a maximum delivery rate of 2.81 lbs. O₂/hr/ft per shaft section by relocating discs.
6. Design discs to operate in two directions of rotation, resulting in a performance variation of 33% in oxygen transfer and power draw for one direction over the opposite. Performance variations based upon changes of aerator immersion or rotation speed shall not be allowed as a substitute for this feature.

D. Disc Aerator Shafting

1. Disc Aerator Shafting shall be solid 6" (150 mm) 1045 steel, made from ingot, turned and polished. Shaft ends shall be true concentric within 0.008" (0.203 mm) total indicator reading. Shaft end tolerance shall be +0.000" and 0.001" (-0.076 mm).
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. (3.0 m) length of shaft.
3. Each shaft section shall be supported by self-aligning, pressure grease lubricated, roller bearing pillow blocks set on adjustable anchor plates.
4. Bearings shall be double row spherical roller bearings with a 2 piece outer race design. Bearing to be contained in a solid one piece cast iron pillow block and use the 6000 series Shurlok® tapered adapter shaft mounting system.
5. 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.
6. Minimum B-10 bearing life will be 500,000 hours.
7. Grease application points shall be provided above the shaft for easy operation access.

E. Shaft-Mounted 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 be produce a maximum aerator speed of 49 RPM.
3. Motors shall be 10 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.

F. Weather Protection

1. Weatherhoods with support structures shall be provided to prevent the aeration discs from icing in cold weather and to prevent algae build-up on the discs during warm weather.
2. Hoods shall be constructed of 3/16" (4.76 mm) thick fiberglass with dimensions sufficient to assure clearance between the rotating aeration disc and shafting, and the hood. Support structures shall be galvanized steel. Hold down latches shall be provided to prevent uplift due to wind.
3. Each weatherhood shall withstand 100 mph (161 km/hr) wind load and 40 lb/sq ft (195 Kg/sq meter) snow load without deforming or failing.
4. Fiberglass used in the construction of the weatherhood assembly shall have the following properties:
 - a. Tensile Strength, average = 12,000 psi
 - b. Flexural Strength, average = 20,000 psi
 - c. Flexural Modulus, average = 900,000 psi
 - d. Glass Content, average = 25%-28%
5. Hoods shall be hinged and of sufficiently light weight such that individual hood sections can be raised manually by a single operator. Support bars shall be provided with self-locking pins at each end, to prop the hood in a raised position and prevent uplift due to wind. Each raised hood section shall provide accessibility to aerator, to facilitate addition, removal, or relocation of discs.
6. Hoods shall include fixed fiberglass end panels designed to provide splash protection. Neoprene seals shall be attached to the end panels to prevent water from moving along the shaft to the bearing.
7. All installation and assembly hardware shall be 316L stainless steel.
8. Support structure and grating shall be provided for access to the weatherhoods and shall be designed by professional engineer licensed in the State of Wisconsin.

G. Process Control System

1. The Process Control system shall be capable of communication with the WWTP SCADA System. The control panel shall be equipped with an Ethernet communication modem to interface with the SCADA system. The modem shall communicate using Ethernet IP protocol.
2. The Process Control System shall contain all interlocks, alarm functions and motor control as required for operation of the system. Shall be provided by the same manufacturer of the rotary aeration equipment.
3. System Function
 - a. The system shall be designed to monitor ORP (Oxidation-Reduction Potential) in the outer channel and dissolved oxygen (DO) in the inner channel and control oxygen delivery based on the ORP, DO, and process objectives. The control system shall control the on/off

operation and speed of the aerators to meet the process objectives.
(Aeration Control)

- b. Effluent flow shall be monitored by the control system. Operator selectable set-points shall be provided for notification of whenever the Stormflow threshold for this system has been achieved.
(Stormflow Control)

4. Control Panel

- 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
- b. 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 CPU must contain non-volatile memory card to be used for storing user application program, including comments and symbols, store parameterization, and configuration, and user data blocks, and provide battery free program backup. The system shall include a media converter to enable Ethernet communications.
- c. The PLC shall contain analog inputs of the 4-20 mA type and shall be provided for the following signals:
 - 1) Outer channel ORP
 - 2) Inner channel Dissolved Oxygen
- d. The PLC shall contain analog outputs of the 4-20 mA type for each of the aerator VFD's.
- e. Digital I/O shall be provided for monitoring status of all drives and motors connected and shall control on/off of the connected VFD's and motor starters.
- f. An Operator Interface shall be provided for entering selected functions and operating variables. The operator interface shall be PC based. Siemens or equal shall be the software used for the operator interface. Minimum screen size shall be 7".
- g. An emergency stop button shall be provided to disable all outputs and stop all drives in an emergency.
- h. Where used, operator lights and switches shall be industrial duty, rated NEMA 4X, and be 30.5mm nominal size. Pilot lights shall be of the push to test type. Relays supplied shall be industrial plug-in type, minimum DPDT, with contacts rated for 10 amps. Timers shall be multi-range, multi-function, industrial plug-in type. All wiring in the control panel shall be in wire-ways or suitably tie-wrapped to provide for neat appearance. All wires which connect outside the panel shall terminate on NEMA rated terminals.

5. Instruments

- a. One (1) dissolved oxygen analyzer/transmitter with one (1) dissolved oxygen probe shall be supplied. The analyzer shall be a Hach SC100 or equal. It shall have separate 4-20 mA outputs for each sensor. The probes shall be the LDO type from Hach or equal.

- b. One (1) ORP analyzer/transmitter with one (1) ORP probe shall be supplied. The analyzer shall be a Hach SC100 or equal. It shall have separate 4-20 mA outputs for each sensor. The probes shall be stainless steel. They shall be Hach model DRS5 or equal.
- 6. Control Programming
 - a. The aeration program will control using a system approach. Oxygen delivery to the entire process will be determined using all sensor inputs rather than each sensor control aerators in discrete reactors.
- 7. Standard I/O List
 - a. Analog Inputs:
 - 1) ORP #1
 - 2) DO #1
 - b. Analog Outputs
 - 1) Aeration Motor VFD #1 speed command
 - 2) Aeration Motor VFD #2 speed command
 - 3) Aeration Motor VFD #3 speed command
 - 4) Aeration Motor VFD #4 speed command
 - c. Digital Inputs:
 - 1) Aeration Motor VFD #1 Running
 - 2) Aeration Motor VFD #2 Running
 - 3) Aeration Motor VFD #3 Running
 - 4) Aeration Motor VFD #4 Running
 - 5) Aeration Motor VFD #1 Fail
 - 6) Aeration Motor VFD #2 Fail
 - 7) Aeration Motor VFD #3 Fail
 - 8) Aeration Motor VFD #4 Fail
 - d. Digital Outputs
 - 1) Aeration Motor VFD #1 Start
 - 2) Aeration Motor VFD #2 Start
 - 3) Aeration Motor VFD #3 Start
 - 4) Aeration Motor VFD #4 Start
- H. Rotor Immersion Gauge: Provide one (1) rotor immersion gauge for each channel to indicate disc submergence levels. Construct gauges of 14 gauge anodized aluminum with stainless steel mounting hardware.
- I. Anchor Bolts; Stainless steel furnished by the Manufacturer and set with proper projection by the Contractor in accordance with approved, certified drawings provided by the Manufacturer.
- J. Painting
 - 1. Base plates shafting shall be blast-cleaned then shop primed with one (1) coat of Sherwin Williams Co-poxy, polyamide epoxy.
 - 2. Motors, reducers, belt guards, bearings, couplings shall be painted with manufacturer's standard coating.

3. Provide balance of painting and surface preparation per Section 09900.

K. Spare Parts

- | | |
|----------------------------------|-------------------------------|
| 1. Five (5) | Complete Disc Assemblies |
| 2. One (1) of each type and size | Bearings (fixed and floating) |
| 3. One (1) set | ORP and DO probes |

L. Electric Motor

1. Supply each premium efficiency polyphase electric motor in accordance with NEMA and IEEE standards rated for 230/460 volts, suitable for severe duty applications and VFD rated with all of the following requirements:
 - a. Totally enclosed fan cooled with epoxy enamel finish coat.
 - b. All cast iron structural parts.
 - c. 1.15 service factor.
 - d. 10 hp, 1750 nominal RPM
2. Polyphase electric motors shall be Louis-Allis Severe Duty type, General Electric Severe Duty type or equal.
3. Thermal switches embedded in the stator winding end-turns shall be used to monitor motor over-temperature.
4. All continuous rated polyphase electric motors shall be of the "energy efficient type". Efficiency and losses shall be determined in accordance with the latest IEEE Standard 112 and NEMA Motor Generator Standards MG1-12.53a and MG1-12.53b.

M. Electrical Requirements

1. Unless noted otherwise all motor starters, fusible safety switches, relays, limit switches, selector switches, pushbuttons, indicating lights programming, and all other pilot devices necessary to form a complete operating electrical system for each mechanical item will be supplied.
2. The control panel shall be completely wired at the factory. All wiring shall be done in accordance with applicable code and standards, which include as a minimum the latest National Electrical Code and OSHA Rules. All wiring shall be color coded and numbered.
3. Each equipment enclosure shall be provided with means to gain access for control and maintenance purposes to all devices from the front. An exterior, lockable, hinged door shall enclose all devices including the control panel.
4. All control switches, pilot lights, elapsed time totalizes, and motor overload reset pushbuttons shall be mounted on an interior hinged panel. A sub panel shall be provided for mounting relays, terminal strips, motor circuit protectors and starters, VFD's, etc.
5. Furnish engraved laminated plastic nameplates with 1/4 inch black

letters on a white background for each panel mounted instrument. Tag all instruments and components inside with embossed plastic tape labels.

- a. All electrical equipment shall be marked to show voltage, current, and other electrical ratings or characteristics to assure safe application. All markings shall be clear and legible and of a permanent nature.
6. Control wiring shall be #16 AWG minimum, UL Style 1015, FR-1 rated nineteen strand copper with red ac control, yellow foreign voltage, and blue dc control. Ground wire shall be #14 AWG minimum 90xC, green.
7. All wiring installations shall be grouped, bundled, supported and routed horizontally and vertically, to provide a neat appearance. Panel enclosures shall be grounded by means of a copper equipment grounding conductor.
 - a. Isolation barriers shall be provided as necessary to prevent access to open terminals or the rear sub panel upon opening exterior door.
 - b. Tag all wire, cable and conduit at each end or termination with suitable tags, printed, stamped, or engraved with wire, cable or conduit number. The figures on the tags shall be clear and legible.
8. The main disconnect switch handle shall be accessible upon opening exterior door.
9. A ground fault receptacle shall be provided and located inside cabinet, accessible upon opening exterior door.
10. A factory assembled NEMA 4X stainless steel control panel shall be provided and prewired to identified terminal blocks. Panel installation shall be made by the General Contractor with all interconnection wiring included.
 - a. Incoming power shall be 120 volts, 1 phase, 3 wire with ground.
 - b. Enclosure shall be sized as required to house the associated control equipment with 10% spare back panel space.
11. The control panel shall include the following basic items:
 - a. Motor control circuit and associated devices shall operate on 120 volts, single phase.
 - b. Provide a common normally open relay contact for a Drive Control Panel Alarm.
12. An electronic Hand-Off-Automatic (HOA) selector switch for each motor control circuit shall be provided on the operator interface panel.
 - a. In the Hand mode, the associated drive will operate continuously.
 - b. The Auto mode will allow the associated drive to be operated as described by the control system.
 - c. The Off mode shall shut down the drive and disable the associated controls.
13. Variable frequency drives, subpanels, disconnects, overload resets, and related equipment necessary to interface the Oxidation Ditch Control Panel and the motors provided as a part of this specification shall be

supplied and installed by the Contractor in accordance with the provisions of Division 16.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Section 01039 - Coordination and Meetings: Verification of existing conditions before starting work.
- B. Verify that equipment anchors are correctly positioned.

3.02 PREPARATION

- A. Shop Painting
 - 1. Aerator support steel shall be galvanized after fabrication.
 - 2. Give all other exposed ferrous metals a minimum of one coat of shop primer.
 - 3. All surfaces must be dry, clean, and free of rust, scale, oil and grease. Clean steel surfaces by pickling (SSPC-SP8) or blasting to a minimum of SSPC-SP5.

3.03 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions. All grease fittings shall be mounted on main walkway handrails for ease of access.
- B. Touch up minor damaged surfaces caused during installation. Replace damaged components as directed by Engineer.

3.04 ELECTRICAL

- A. Unless noted otherwise all motor starters, fusible safety switches, selector switches, and pushbuttons will be supplied, mounted and wired in Division 16, Electrical Work, as indicated on the Drawings.
- B. All electrical equipment supplied in this Item shall conform to Division 16 Electrical Work.
- C. All electrical equipment, conduit and wiring not indicated on the Drawings, but necessary to provide a complete operating system shall be provided at no additional cost to the Owner.
- D. Electrical Wiring: The external conduit and wiring required for power and control to electrical equipment shall be supplied and installed in Division 16,

Electrical, as indicated on the drawings.

E. Electrical Devices, Operational Controls, Sequence of Operation

1. Coordinate installation with other electrical wiring as required.

3.05 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation with existing plant operation and effluent discharge.
- B. Provide a SCADA interface to enable the transmission of the oxidation ditch status to the SCADA PLC. The modem shall communicate using Ethernet IP protocol.

3.06 FIELD QUALITY CONTROL

- A. Start-up Services - Furnish the services of a qualified manufacturer's representative for a period of not less than two days to inspect and adjust the equipment furnished in this Item, and to make such tests on the equipment as are necessary to insure satisfactory operation. Start-up is to occur after all new treatment plant modifications are fully operational.
 1. Provide evidence that the shaft bearings are running with vibration within tolerance of the bearing manufacturer.
 2. Provide documentation that equipment runs as designed with both automatic, manual and SCADA digital input controls including automatic adjustment of speed of aerators from ORP and DO signal.
- B. After the equipment is in continuous satisfactory operation, furnish the services of a qualified manufacturer's representative for a period of not less than one 8-hour day for the sole purpose of instructing the Owner's personnel in the care and operation of this equipment. This time shall be separate from that time to start up and/or adjustment of the equipment.

END OF SECTION

SECTION 11950

SLUICE GATES

PART 1 GENERAL

1.01 SCOPE

A. Work Included:

1. This Section includes the furnishing and installation of wall thimbles, gate frames, sluice gates, slide gates, floor stands, extension stems, stem guides, operating devices, position indicators, wall brackets, floor boxes, anchors, stop plates, stop plate grooves and all appurtenances.
2. Motors and electrical work incidental to installation and operation of sluice gates and slide gates shall be included herewith unless otherwise directed under other Contract Sections.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Division 3: Concrete

C. Dimensions:

1. Sluice gates, slide gates and stop plates, operators and appurtenances shall be shown on the Drawings schedules as specified or as ordered.

1.02 QUALITY ASSURANCE

- A. Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of satisfactory production acceptable to the Engineer.
- B. Qualification of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper installation of the work in this Section.

1.03 SUBMITTALS AND SUBSTITUTIONS

- A. Comply with pertinent provisions of Section 01300.
- B. The following product data shall be submitted in accordance with the approved Construction Schedule required in Section 01310 of these Specifications:
 - 1. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades;
 - 2. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
 - 3. Test data required elsewhere in this Section.
- C. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Engineer three copies of an operation and maintenance manual compiled in accordance with the provisions of Section 01730 of these Specifications.

1.04 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01600.

PART 2 PRODUCTS

2.01 GENERAL

- A. Manufacturers
 - 1. Waterman Industries, Inc. P.O. Box 458, Grater, CA 93222
 - 2. Rodney Hunt Industries, Inc Orange, MA
 - 3. Or equal

2.02 SLUICE GATES

- A. Sluice gates and their appurtenances shall conform to applicable portions of AWWA Standard for Sluice Gates, C-501. All component parts shall be of the type of material shown, and interchangeable where size and material are the same without grinding, chipping or special fitting in the field. All mating and sliding parts shall be fully machined. All sluice gate parts, including lift shall be designed for the heads shown with a minimum factor of five. Sluice gates shall consist of an iron-bodied and bronze-mounted gate with bronze faced wedges and wedge blocks.
- B. The cover shall be of one piece cast construction with vertical and horizontal ribs, a reinforced pocket to receive the thrust nut, pads to receive the wedges, and a reinforced periphery around the back side of the cover

for machining of the dovetail grooves in which the seating faces shall be mounted. All wedge pads shall be machined, drilled and tapped to receive the wedge devices. The cover shall have fully machined tongues running the full length of each side to properly engage the guide rail grooves. A thrust nut shall be provided to attach the slide to the stem. The nut shall be threaded and, in the case of rising stems, provided with keys on two set screws locked into indents in the stem to prevent rotation of the stem. For non-rising stems, the stem shall turn freely in the thrust nut, to open and close the slides as the stem is rotated.

- C. Side wedges shall be adjustable but once set shall not rotate or move from the desired position. Top and bottom wedges shall withstand seating and unseating heads shown in the Schedule included in the Drawings. Side wedges shall be solid corrosion resistant high tensile strength material and shall be of sufficient number to provide a practical degree of water tightness. All wedge bearing surfaces and contact faces shall be machined to give maximum contact and wedging action.
- D. Frames shall be circular or rectangular flanged frames to connect with wall thimbles and provide for openings of the shape and dimensions specified unless otherwise indicated.
- E. Guides shall be of cast iron and of sufficient length so that at least one-half of the disc is within them at full opening.
- F. Operating stems and extensions shall be ASTM A-276 stainless steel with high finish corrosion-resistant restraint threads and shall operate without binding or jamming in the lift nut. Adjustable stem guides shall have bronze bushings.
- G. Seating faces for both covers and frames shall be malleable extruded corrosion resistant material of a shape that will fill and permanently lock in the full width dovetail grooves of the slide and the frame. No other means of attachment will be allowed. They shall be machined to a 63 micro-finish, or better.
- H. Wall thimbles shall be of cast iron and similar to Type "F" as manufactured by Rodney Hunt Mfg., Co., Hydro-Gate, or equal, unless otherwise noted. The front flange of the thimble shall be machined, drilled and tapped to receive the sluice gate attaching studs. Bolt pattern shall match gate bolt pattern. After machining, the front flange shall be marked with vertical centerline and the word "top" for correct alignment. Large square and rectangular opening thimbles shall be provided with grout holes in the invert to permit entrapped air to escape. The holes shall be 1½" in diameter, no more than two feet apart and shall be upstream and downstream of the water stop. A mastic type gasket shall be provided between the sluice gate

and the wall thimble. Anchor bolts shall be provided by the gate manufacturer shall be corrosion resistant and sized per the manufacturer's recommendation.

- I. Each extension stem shall be the same material and the same size as the stem of the gate it operates. Stems shall be fabricated from round bar stock of cold-finished steel, stainless steel or bronze. If the extension is more than 8 ft. long, intermediate stem guides shall be installed and supported from the wall by suitable brackets at 8-ft. intervals. Stems composed of two or more sections shall be joined by bronze couplings threaded and keyed to stems, or couplings of the same material as the stems, pinned, bolted or welded and pinned to the stems. Guides shall be adjustable in two directions and shall be so constructed that when properly spaced they will hold the stem in alignment and still allow enough play to permit easy operation. In section, couplings shall be stronger than the stems. Brackets and stem guides shall be made of cast iron and fully adjustable. The guide block shall be bushed where it contacts the extension stem.
- J. Gates manually operated by handwheel shall have easy operation, rising stem to allow measurement of the degree of opening and installed on a machined finished wall bracket designed to align the stem, operator and gate. Operation by handwheel or crank operated pedestal floor stands or bench stands as required. Each lift shall be provided with a threaded cast bronze lift nut to engage the threaded portion of the stem. The lift nut shall have a machined flange, fitted above and below with thrust ball or roller bearings. Handwheel lifts shall be without gear reduction while crank operated lifts shall have either a single or double reduction. Lifts having a reduction greater than 4:1 shall be two-speed. A maximum effort of 40 lbs. pull (25 lb. pull) on handwheel or crank, shall operate the gates under the specified operating head. The gears, when required, shall be steel with machine-cut teeth. Pinion gears shall be supported by bronze bushings or roller bearings. The lift mechanism shall be totally enclosed within a cast iron housing adequately provided with lubrication fittings. The pedestal shall be structural steel or cast iron. The crank shall be of cast iron with a revolving brass handle and shall be removable. The crank shall be a maximum of 15" long. All lifts for rising stems shall be provided with a counter type position indicator and a galvanized steel stem cover or a transparent plastic stem cover with mylar strip position indicator. Non-rising stem gates shall be provided with a counter type position indicator unless extension stems, valve boxes, or T-handle wrenches make an indicator impractical. Handwheels and crank input shafts shall be approximately 36" from the operating floor unless otherwise shown. The word "open" shall be cast onto the housing or handwheel indicating direction of rotation to open the gate.

2.03 LIFT ASSEMBLIES: SLUICE GATES

- A. Floor stands shall be of the enclosed gear pedestal lift type with single or double gears as required, and with thrust bearings above and below the flange on the bronze-lifting nut. Bevel and pinion gears shall be steel with cut teeth, and spur gear shall be cast iron with cut teeth. Bearings for the gear and pinion shaft shall be bronzed bushed. The lift shall operate on a 25-lb. pull on the crank. A clear butyrate plastic pipe stem cover shall be provided with Mylar open and close indication.
- B. The guides on self-contained gates shall extend above the operating floor. They shall be sufficiently strong so that additional reinforcing is not necessary. The yoke to support the operating bench will be formed by welding two angles across the top of the guides.
- C. Where the head frame extends higher than 4 ft. above the operating floor, the gate operator shall include a bevel gear assembly.

2.04 PAINTING AND FINISHING

- A. All un-machined surfaces of the cast iron sluice gates and slide gates shall be shop cleaned by shot or sandblasting and painted with one coat of a polyester resin primer.
- B. All surfaces in contact with the concrete shall have one shop coat of un-thinned bitumastic paint (Koppers 50 or equal). All other surfaces shall be mill finish. Mounting hardware shall be provided with the frame.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 IDENTIFICATION OF GATES

- A. Each valve installed in exposed process piping systems shall be provided with a 1-1/2" minimum diameter heavy brass tag. Each tag shall bear the identifying number of the valve and an identifying letter symbol of the service line as provided by the Engineer.
- B. The tags shall be attached to the valve by split-key rings soldered so that

ring and tag cannot be removed. The numbers and letters shall be of block type, with 1/2" high numbers and 1/4" high letters stamped thereon and filled with black enamel.

3.03 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.04 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations and shop drawings as approved by the Engineer.
- B. All aluminum construction in contact with steel or concrete shall be given a protective insulating bituminous coating prior to installation.
- C. Installation shall be as shown on the Drawings and in conformance with AWWA Standard C-501, Section 27, for sluice gates.
- D. Upon completion of the installation, carefully inspect each component and verify that all items have been installed in their proper location, adequately anchored, and adjusted to achieve optimum operation.

3.05 TESTING

- A. After installation the Contractor shall test each gate for satisfactory operation and water tightness against maximum operating pressure insofar as practicable.
 - 1. Without resilient seal
 - a. Seating head up to 20 ft. - 0.3 gpm/lin. ft. of perimeter.
 - b. Unseating head up to 20 ft. - 0.6 gpm/lin. ft. of perimeter.
 - 2. With resilient seal
 - a. Seating head up to 20 ft. - 0.2 gpm/lin. ft. of perimeter.
 - b. Unseating head up to 20 ft. - 0.4 gpm/lin. ft. of perimeter.

3.06 SERVICE

- A. Demonstrate to the Owner's operation and maintenance personnel the proper methods for operating and maintaining the equipment, and the contents of the operation and maintenance manual required to be submitted under Article 1.03 in this Section.
- B. The Contractor shall furnish to the Owner, through the Engineer, a written

report prepared by the equipment manufacturer's field service technician certifying that the equipment:

1. Has been properly installed and lubricated.
2. Is in accurate alignment.
3. Is free from any undue stress imposed by connecting piping or anchor bolts.
4. Has been operated under full load and that it operates satisfactorily and in compliance with the requirements of this Section.

END OF SECTION

SECTION 13500

PANEL SHADES

PART 1 GENERAL

1.01 SCOPE

- A. Instrument panel shades.
- B. Electrical local control panel shades.

1.02 REFERENCES

- A. ASTM D638 – Standard Test Method for Tensile Properties of Plastics.
- B. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
- C. ASTM D2583 – Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Test results of representative fiberglass reinforced plastic laminate.
- C. Shop Drawings: Information submitted for review shall include:
 - 1. Critical dimensions, jointing and connections, fasteners and anchors.
 - 2. Materials of construction.
 - 3. Sizes, spacing, and location of structural members, connections, attachments, openings, and fasteners.
 - 4. Color(s).
 - 5. Manufacturer's installation instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store products indoors or in weather protected area until installation. Protect from construction traffic and damage.

1.05 WARRANTY

- A. Warranty: Shades shall be warranted to be free of defects in workmanship and materials for a period of two years from shipment.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. The product shall be manufactured by:

1. TRACOM, Inc.; 6575-A Industrial Way, Alpharetta, Georgia 30004; Toll-Free Voice (877) 435-8637, Toll-Free Fax (866) 435-8637, www.tracomfrp.com.
2. Or equal.

2.02 PANEL SHADES

- A. Shade Type: Provide sunshades of single-piece construction with 3/4-inch thick marine grade plywood reinforcing panel laminated into the back of the shade.
- B. Shade Size: Sunshades shall be adequate in size to shade the instrument / local control panels as designated in the Drawings with the minimum clearances outlined.
- C. Materials:
1. One-piece, fiberglass reinforced plastic.
 2. Gloss inside surfaces, free of irregularities.
 3. Minimum 3/16-inch wall thickness.
 4. Minimum 30% glass by weight.
 5. Isophthalic polyester resin.
 6. All corners shall be of a smooth and with minimum radius of 1/4-inch.
 7. 15 mil white Isophthalic U.V. resistant gel coat on all surfaces.
 8. Tensile strength (ASTM D 638): 14,000 PSI.
 9. Flexural strength (ASTM D 790): 27,000 PSI.
 10. Flexural modulus (ASTM D 790): 1,000,000 PSI.
 11. Barcol hardness (ASTM D 2583): 50.
 12. Black vinyl edge trim.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that the shade is of the correct dimensions, fits the equipment to be covered, and is not damaged. Do not proceed with installation until condition deficiencies have been corrected.

3.02 INSTALLATION

- A. Install products in accordance with engineer's instructions, drawings, etc.
- B. Align the shade in the desired mounting position; horizontally leveling the shade with a bubble level.
- C. With a pencil, outline the desired location of the mounting holes on the mounting surface.
- D. Drill pilot holes in the outlined positions on the mounting surface. Drill to the desired depth of the mounting screws (mounting screws by others). The pilot holes should be drilled smaller the shank of the mounting screw.
- E. Position the shade against the mounting surface and install the mounting screws.
- F. Install the equipment either on the same mounting screws that support the shade or by screwing additional mounting screws into the shade.

3.03 ADJUST AND CLEAN

- A. Clean surfaces in accordance with the manufacturer's instructions.
- B. Remove trash and debris, and leave the site in a clean condition.

END OF SECTION

SECTION 15100

BUILDING SERVICES PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Valves.
- C. Sanitary sewer piping system.
- D. Domestic water piping system.
- E. Storm water piping system.

1.02 RELATED SECTIONS

- A. Section 02130 – Trenching, Bedding and Backfill.
- B. Section 15410 – Plumbing Fixtures and Equipment.

1.03 REFERENCES

- A. ANSI B31.2 - Fuel Gas Piping.
- B. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 125 and 250.
- C. ASME B16.3 - Malleable Iron Threaded Fittings.
- D. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250.
- E. ASTM A47 - Ferritic Malleable Iron Castings.
- F. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- G. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- H. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

- I. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- J. ASTM B32 - Solder Metal.
- K. ASTM B42 - Seamless Copper Pipe.
- L. ASTM B75 - Seamless Copper Tube.
- M. ASTM B88 - Seamless Copper Water Tube.
- N. ASTM B251 - Wrought Seamless Copper and Copper-Alloy Tube.
- O. ASTM B302 - Threadless Copper Pipe (TP).
- P. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- Q. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- R. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.
- S. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
- T. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- U. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- V. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- W. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- X. ASTM D3033 - Type PSP Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- Y. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- Z. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- AA. ASTM F493 - Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

BB. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Pipe.

CC. AWS A5.8 - Brazing Filler Metal.

DD. AWWA C651 - Disinfecting Water Mains.

1.04 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience or as otherwise listed.

B. Gas Service Line Installer: Personnel involved with the installation of the natural gas service line and distribution facilities within this project shall be qualified to perform such activities in accordance with the policies and procedures outlined by the local gas supplier. The Contractor shall coordinate with the local gas supplier to assure the requisite certifications and approvals are in place in advance of the start of work and shall provide the Engineer with a copy of the documentation outlining acceptability of the personnel designated to perform the work.

1.07 REGULATORY REQUIREMENTS

A. Perform Work in accordance with the applicable state and local plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section 01600.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A 74 service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. PVC Pipe: ASTM D 2665 or ASTM D 3034 where allowed by code.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D 2855, solvent weld with ASTM D 2564 solvent cement.

2.02 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A 74, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: ASTM C 564, neoprene gasket.
- B. PVC Pipe: ASTM D 2665, Schedule 40, DWV.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D 2885, solvent weld with ASTM D 2654, solvent cement.

2.03 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B 42, annealed.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: AWS A5.8, BCup silver braze, lead free.

B. CPVC: ASTM D 2846, Schedule 80.

1. Fittings: CPVC, ASTM F 493.
2. Joints: ASTM F 493 or ASTM D 2846, solvent weld.

2.04 DOMESTIC WATER PIPING, ABOVE GRADE, TO LAVATORY AND SERVICE SINK

A. Copper Tubing: ASTM B 88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B 32, solder, lead free, Grade 95TA.

B. CPVC: ASTM D 2846, Schedule, Schedule 80.

1. Fittings: CPVC, ASTM F 493.
2. Joints: ASTM F 493 or ASTM D 2846, solvent weld.

2.05 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A 74 service weight.

1. Fittings: Cast iron.
2. Joints: ASTM C 564, neoprene gasket system or lead and oakum.

B. PVC Pipe: ASTM D 2665 or ASTM D 3034 where allowed by code.

1. Fittings: PVC.
2. Joints: ASTM D 2885, solvent weld with ASTM D 2564 solvent cement.

2.06 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 3 Inches and Under:

1. Ferrous pipe: 150 psig malleable iron threaded unions.

2. Copper tube and pipe: 150 psig bronze unions with soldered joints.

B. Pipe Size Over 1 Inches:

1. Ferrous pipe: 150 psig malleable iron threaded or forged steel slip-on flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.
2. Copper tube and pipe: Class 120 slip-on bronze flanges; preformed neoprene gasket.

C. Grooved and Shouldered Pipe End Couplings:

1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; steel bolts, nuts and washers; galvanized for galvanized pipe.
2. Sealing gasket: "C" shape composition sealing gasket.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.07 VALVES (ABOVE GRADE)

A. Globe Valves:

1. Up to and including 3-inches:
 - a. MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder ends.
 - b. Acceptable Products:
 - 1) Milwaukee Model 572.
 - 2) Crane Model 1702.
 - 3) Stockham Model B-16.
2. 2-inches and larger:
 - a. MSS SP-85, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends.
 - b. Acceptable Products:
 - 1) Milwaukee Model 572.
 - 2) Crane Model 1702.
 - 3) Stockham Model B-16.

B. Ball Valves:

1. 4-inches and smaller: MSS SP-110, bronze, two-piece body, chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends.
2. Acceptable Products:
 - a. Crane Model 9200 Series.

b. Stockham Model 5206 Series.

C. Plug Valves:

1. 2 ½-inches and larger: MSS SP-78, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged ends. Provide level operator with set screw.

D. Reduced Pressure Zone (RPZ) Valves:

1. A Reduced Pressure Zone Assembly shall be installed at locations identified on the Drawings.
2. The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access cover secured with stainless steel bolts.
3. Body and shutoffs shall be constructed using Lead Free cast copper silicon alloy materials.
4. The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks and an air gap drain fitting.
5. The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA C511
6. Reduced Pressure Zone (RPZ) Valves shall be Watts Series LF009 or approved equal. Sizes of the valves shall be as designated on the Drawings.

E. Water Pressure Reducing Valves:

1. Up to 2-inches:
 - a. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded or double union ends.
 - b. Acceptable Products: Watts Model 223
2. Over 2-inches:
 - a. MS SP-85, cast iron body, bronze-fitted, elastomeric diaphragm and seat disc, flanged.
 - b. Acceptable Products: Watts Model 127W.

F. Relief Valves:

1. Pressure Relief:
 - a. AGA Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic direct pressure actuated.

- b. Acceptable Products: Watts Model 40.
- 2. Temperature and Pressure Relief:
 - a. AGA Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic direct pressure actuated, temperature relief maximum 210° F capacity, ASSME SEC IV certified and labeled.
 - b. Acceptable Products: Watts Model 40.

2.08 STRAINERS

A. Size 2-inch and under:

- 1. Class 150, threaded bronze body, 300 psi CWP, wye pattern with 0.8 mm (1/32 inch) stainless steel perforated screen.
- 2. Acceptable Products: Watts Model 77S.

B. Size 1 ½-inch to 4-inch:

- 1. Class 125, flanged iron body, wye pattern 1/16 inch stainless steel perforated screen.
- 2. Acceptable Products: Watts Model 77F.

PART 3 EXECUTION

3.01 GENERAL

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials in proper relation with adjacent construction and with uniform appearance for exposed work. Coordinate with work of other sections. Comply with applicable regulations and code requirements. Provide proper clearances for servicing.
- B. Support piping properly. Pitch to drain points. Install with pipe expansion loops, mechanical expansion joints and anchors.
- C. Maintain indicated fire ratings of walls, partitions, ceilings and floors at penetrations. Seal with fire stopping material to maintain fire rating.
- D. Clearly label and tag all components.
- E. Test and balance all systems for proper operation.
- F. Restore damaged finishes. Clean and protect work from damage.
- G. Instruct Owner's personnel in proper operation of systems.

3.02 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.03 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Install all pipe and valves per accepted practice and in a workmanlike manner.

3.04 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- I. Establish elevations of buried piping outside the building to ensure adequate cover.
- J. Provide support for utility meters in accordance with requirements of utility companies.

- K. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Section 09900.
- L. Excavate in accordance with Sections 02130 for work of this Section.
- M. Backfill in accordance with Sections 02130 for work of this Section.
- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Install water piping to ASME B31.9.
- Q. Sleeve pipes passing through partitions, walls and floors.
- R. Provide inserts for placement in concrete formwork.

3.05 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- D. Install gate, ball or butterfly valves for shut-off and to isolate plumbing equipment, pumps, tanks, injection points, part of systems, or vertical risers.
- E. Install globe valves for throttling, bypass, or manual flow control services.
- F. Provide plug valves in natural gas systems for shut-off service.

3.06 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot 2 percent minimum or as stated on drawings. Maintain gradients.
- B. Slope water piping and arrange to drain at low points.

3.07 PIPING SYSTEM WORKING PRESSURE RATINGS

A. Building piping systems to be installed as a part of this project shall conform to the following:

1. Water Distribution Systems, Below Ground: 150 psig
2. Water Distribution Systems, Above Ground: 150 psig
3. Soil, Waste and Vent Systems: 10-foot head of water
4. Storm Drainage Systems: 10-foot head of water

3.08 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from all outlets and from water entry, and analyze in accordance with AWWA C651.

3.09 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service for building complete with reduced pressure backflow preventer with by-pass valves.
- C. Provide new gas service complete with gas meter and regulator.

END OF SECTION

SECTION 15123

WALL AND FLOOR PIPES AND PIPE SLEEVES

PART 1 GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required for the installation, testing, and operation of equipment, all in accordance with the Contract Documents. Include all items not shown or specified but required for proper installation and operation of equipment.
- B. Section includes various wall and floor pipes and pipe sleeve materials for piping systems including mechanical/process, and heat, ventilating, and air conditioning system.

1.02 REFERENCES

- A. The specifications in this Section are subject to the administrative and procedural requirements specified in Division 1, as well as the broader requirements of the General Conditions.
- B. Reference Standards:
 - 1. American National Standards Institute, ANSI.
 - 2. American Society for Testing and Materials, ASTM.
 - 3. American Water Works Association, AWWA.

1.03 SUBMITTALS - Submittals shall meet the requirements of Sections 01300.

- A. General: Submittals shall meet the requirements of Sections 01300.
- B. Shop Drawings: Comply with Section 01300.

1.04 QUALITY ASSURANCE

- A. Equipment furnished under this section shall be the product of one manufacturer who will provide a single source responsibility for all components as specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: All pipe dimensions are for nominal inside diameter.

B. Materials:

1. Wall and Floor Pipes:

- a. Material: Same as specified for the piping.
- b. End Connections: As shown on Drawings or per approved Shop Drawings.
- c. Thickness: Same as specified for the piping.
- d. Collar: Provide collar about wall and floor pipe, at mid-point of wall for anchorage, and watertightness.
- e. Wall pipe with flanged end connections shall extend a minimum of 6 inches from the face of the walls unless otherwise shown. Mechanical joint end connections for wall pipe up to 12 inches shall extend a minimum of 6 inches from the face of the walls and for 12 inch and larger wall pipes the MJ shall extend a minimum of 9 inches from the wall.

2. Pipe Sleeves:

- a. Ferrous and Plastic Pipe: Use standard weight galvanized steel pipe or plastic pipe unless otherwise shown.
- b. Copper Pipe: Use Type K hard drawn copper pipe or plastic pipe unless otherwise shown.
- c. Collar: Provide integral collar at mid-point of wall for anchorage and watertightness.

3. Wall, Floor and Ceiling Plates:

- a. Bare pipes passing through walls, floors and ceilings in finished rooms provide escutcheon plates of cast brass or cast iron nickel plated, hinged with set screws.
- b. Insulated pipes passing through walls, floors and ceilings in finished rooms, provide plated escutcheon plates of 18 gage steel.

C. Material Schedule:

1. Size sleeves as follows:

<u>Pipe Size</u>	<u>Sleeve ID Minus Pipe or Insulation OD</u>
Less than 2-in.	1/2-in. to 3/4-in.
2-in. - 4-in.	3/4-in. to 1-1/4 in.
6-in. - 12-in.	1-1/4-in. to 2-in.
Over 12-in.	2-in. to 3-in.

2. For mechanical seals using pipe sleeves, provide pipe sleeve inner diameter in accordance with manufacturer's recommendations.

2.02 FINISHES

- A. Surface Preparation and Shop Priming: Comply with Section 09900
- B. Machined, polished and nonferrous surfaces shall be coated with corrosion prevention compound.
- C. Field Painting shall comply with Section 09900.

2.03 SOURCE QUALITY CONTROL

- A. Performance: All Work shall be performed by a firm experienced, properly manned, and tooled in the Work specified.

PART 3 EXECUTION

3.01 PREPARATION

- A. Delivery, Storage, and Protection: Comply with Section 01600 and the following:
 - 1. Deliver materials in manufacturer's original packaging.
 - 2. All material labels or tags shall be intact and legible.

3.02 INSTALLATION

- A. Wall and Floor Pipes: Install as shown on reviewed Shop Drawings.
 - 1. All piping shall be properly supported to prevent any movement when in service.
 - 2. Thoroughly plan the installation prior to placing any piping.
 - 3. Do not install wall and floor pipes and pipes through structural members unless specifically shown.
- B. Pipe Sleeves:
 - 1. Use sleeves wherever pipes pass through walls, partitions, floors and roofs unless otherwise specifically detailed.
 - 2. All sleeves through floor slabs in process areas shall extend a minimum of 4 inches above finished floor.
 - 3. All sleeves through floor slabs in finished areas shall extend a maximum of 1/2-inch above finished floor.
 - 4. Anchor sleeves to concrete and masonry walls as shown. Steel sleeves may be welded to reinforcing steel at Contractor's option.
 - 5. Except where mechanical seals provided, caulk and seal annular space between pipe and sleeve in accordance with Section 07900.
 - 6. All pipe joints and annular spaces in exterior walls or walls subjected to

hydrostatic pressure shall be completely watertight.

7. No pipe joints, fittings or valves shall be permitted within the sleeve.
8. Install sleeves through walls flush with each face.
9. Ensure that sleeves are not damaged or moved during placement of concrete.

3.03 CLEANING

- A. Remove and replace any damaged items found to be unsatisfactory after installation.
- B. Clean all debris from sleeves and the immediate area of the installation.
- C. Maintain the contracted installation in a clean undamaged condition until acceptance by the Engineer.

END OF SECTION

SECTION 15135

PIPING SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish all labor, materials, equipment and incidentals required for the installation, testing, and operation of equipment, all in accordance with the Contract Documents. Include all items not shown or specified but required for proper installation and operation of equipment.
- B. Section includes various hangers, brackets, expansion joints, and related items for the supporting of pipe.

1.02 REFERENCES

- A. The specifications in this Section are subject to the administrative and procedural requirements specified in Division 1, as well as the broader requirements of the General Conditions.
- B. Reference Standards:
 - 1. American National Standards Institute, ANSI.
 - 2. American Society for Testing and Materials, ASTM.
 - 3. American Society of Mechanical Engineers, ASME.
 - 4. B31.1, Code for Pressure Piping, Section 6, Chapter 1.
 - 5. Federal Specification, WW-H-171E.
 - 6. Manufacturer's Standardization Society of the Valve and Fittings Industry, MSS.
 - 7. National Fire Protection Association, NFPA.
 - 8. Ohio Basic Building Code.
 - 9. Underwriters Laboratories, UL.

1.03 SUBMITTALS

- A. General: Submittals shall meet the requirements of Sections 01300.
- B. Shop Drawings: Comply with Section 01300. Submit for 8" and larger pipe only.
- C. Product Data: Comply with Section 01300.

1.04 QUALITY ASSURANCE

- A. Equipment furnished under this section shall be the product of one manufacturer who will provide a single source responsibility for all components as specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The expansion joints and alignment guides shall include all necessary equipment and appurtenances as manufactured by the following:
 - 1. Flexonics Division, Universal Oil Products Company.
 - 2. Anaconda Metal Hose Division, Anaconda American Brass Company.
 - 3. Or Approved Equal.

2.02 MATERIALS

- A. Pipe Attachments: Pipe attachments shall conform to the Federal Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) SP-58, Pipe Hangers and Supports, Materials and Design. The following types of pipe attachments are acceptable for those types of piping systems shown on the Drawings:
 - 1. Adjustable Steel Clevis: A-A-1192A, Type 1.
 - 2. Steel Double Bolt Pipe Clamp: FS-WW-H-171D, Type 3.
 - 3. Steel Pipe Clamp: FS-WW-H-171D, Type 4.
 - 4. Adjustable Swivel Pipe Ring: FS-WW-H-171D, Type 6.
 - 5. Adjustable Steel Band Hanger: FS-WW-H-171D, Type 7.
 - 6. Riser Clamp: FS-WW-H-171D, Type 8.
 - 7. Light Duty Cleaves Hanger: FS-WW-H-171D, Type 12.
 - 8. Long Clips: FS-WW-H-171D, Type 26.
 - 9. Offset J-Hooks: FS-WW-H-171D, Type 27.
 - 10. Steel Pipe Covering Protection Saddle: FS-WW-H-171D, Type 404A.
 - 11. Insulation Protection Shield: FS-WW-H-171D, Type 41.
 - 12. Pipe Saddle Support: FS-WW-H-171E, Type 38.
 - 13. Pipe Stanchion Saddle: FS-WW-H-171E, Type 37.
 - 14. Structural Attachments: The following types of structural attachments are acceptable.
 - a. Side Beam Clamp: FS-WW-H-171D, Type 20.
 - b. Center I-Beam Clamp: FS-WW-H-171D, Type 21.
 - c. Welded Steel Bracket: FS-WW-H-171D, Types 32 and 33.
 - d. Side Beam Bracket: FS-WW-H-171D, Type 34.
 - e. Malleable Concrete Insert: FS-WW-H-171D, Type 18.
 - 15. Hanger Rod Attachments: Use as required to complete assembly:
 - a. Forged Steel Cleaves: FS-WW-H-171D, Type 14.

- b. Adjustable Turnbuckle: FS-WW-H-171D, Type 15.
 - c. Forged Steel Welders Eye Nut: FS-WW-H-171D, Type 17.
16. Expansion Joints:
- a. Type: Two-ply phosphor bronze seamless bellows.
 - b. Shrouds: Brass protective shrouds.
 - c. End Connections: Male and female solder end fittings or screwed ends with adapters for screwed to sweat ends.
17. Alignment Guides: Semi-steel spider with 4 guiding fingers and guiding cylinder with base.

2.03 FINISHES

- A. Steel Items: Hot-Dip galvanized after fabrication meeting the requirement of Section 05510, unless otherwise specified or shown on the Drawings.
- B. Steel or malleable iron materials used for the support of copper piping: Copper plated.
- C. Painting: Comply with Section 09900.
- D. All threaded surfaces shall receive one coat of industrial grade grease.

PART 3 EXECUTION

3.01 PREPARATION

- A. Delivery, storage and handling shall comply with Section 01600.
- B. Field measure the proposed installation to assure a proper installation.

3.02 INSTALLATION

- A. Pipe and coupling manufacturers shall review the pipe support system and make recommendations to the Contractor for every application and piping system. Contractor shall provide support system as recommended by the manufacturers, and as based on the Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) SP-58 and SP-69.
- B. Restrain, block, brace, support, or suspend pipe and fittings as shown on the Drawings and as specified to prevent displacement, vibration, sagging, warping, deformation, or failure of piping and fittings while allowing for expansion and contraction.
- C. Provide all necessary miscellaneous steel, inserts, anchors, and concrete to support and anchor piping.

- D. All piping supports will be anchored with materials compatible to piping and the supporting materials.
- E. Allow for piping expansion and contraction when placing anchors and supports.
- F. Provide anchors at locations shown on the Contract Drawings or specified. Unless shown otherwise, anchors shall be of sufficient thickness and strength to prevent any movement of the pipe at the anchorage point. Securely fasten anchors directly to the concrete or steel construction or indirectly through structural framing. For piping containing a heating medium, where anchorage typically is not shown, adhere to the following:
 - 1. Anchor horizontal runs over 50 feet at midpoint to allow expansion toward ends.
 - 2. Provide alignment guides, spaced according to manufacturer's recommendations, if expansion compensators (joints) are used.
- G. For lines containing a heated medium, and where piping geometry does not allow for proper thermal expansion, provide expansion compensators (joints).
- H. Supports and Hangers for Horizontal Piping:
 - 1. Where the exact location of piping is not shown on the plans, run piping in groups where practicable and generally parallel to building wall. Provide 1 inch minimum clearance between piping, pipe insulation, and other work.
 - 2. For new concrete work, accurately locate inserts for hangers and hanger rods in forms before concrete is placed. Fasten embedded items securely to prevent movement during concrete placement.
 - 3. Provide concrete supports as shown on the drawings in compliance with Division 3 Specifications.
 - 4. Install hangers, support units and concrete adjustment of piping after placement.
 - 5. All hangers and support units shall provide adjustment of piping after placement.
 - 6. Install all hangers and supports to allow free expansion and contraction of the pipe.
 - 7. Use only expansion anchors to support piping 4-inches and smaller. Use concrete inserts for pipe hangers and supports for pipe greater than 4 inches in diameter. Design expansion anchors to carry 100 percent of the full rod, hanger, and/or bracket and pipe load in compliance with Section 05500.

8. Install hangers and support units as recommended by manufacturer.
9. Locate hangers or supports immediately adjacent to any change in piping direction, and on both sides of valves, couplings, and heavy fittings, unless otherwise shown on the drawings.
10. Where proper hanger or support spacing does not correspond with joist or rib spacing, structural steel channels may be attached to joists or ribs and pipes suspended therefrom.
11. When hangers are used to support insulated piping with vapor barriers, provide shields conforming to FS-WW-H 171C, Type 41.
12. When hangers are used to support insulated piping without vapor barriers, provide saddles conforming to FS-WW-4-171C Type 40A.
13. Prevent contact between dissimilar metals when supporting copper tubing by use of copper plated, rubber or vinyl coated, or stainless steel hangers or supports.
14. Isolate thin walled stainless steel piping from carbon steel by use of plastic coated hangers or supports or PVC or vinyl tape at points of contact. All ferrous pipes shall be supported by (galvanized) steel pipe attachment.
15. Hangers shall be suspended from other piping only where shown on the Drawings.
16. Chain wire, strap, or perforated bar hangers shall not be used to hang pipe.
17. Size hanger rods according to the schedule below, unless otherwise shown on the drawings.

Nominal Pipe Size (in.)	Rod Diameter (in.)
1/2 through 4	3/8
6 and 10	1/2
12 and 14	5/8
16 and 18	1
20 and 24	1-1/8
over 24	See drawings

18. Space supports and hangers for all piping no farther apart than shown below unless otherwise shown on the Drawings:
 - a. Copper Tube:
 - 1) 2-inch or smaller - 6 feet -0 inches centers.
 - 2) 2-1/2-inch - 8 feet 0 inches center.
 - b. Steel Pipe:
 - 1) 1-inch or smaller - 6 feet -0 inch center.
 - 2) 1-1/4-inch to 6-inch - 8 feet -0 inch center.
 - 3) 8-inch and larger - 10 feet -0 inch center.
 - c. Cast-Iron Pipe: Two supports per length.
 - d. Plastic Pipe: 3 feet -0 inch on center for all sizes, unless otherwise recommended by manufacturer for 100 degrees F ambient temperature.

I. Supports for Vertical Piping:

1. Provide vertical support as shown on the drawings.
2. Where vertical piping smaller than 4-inch size passes through floors, ceilings, or roofs, provide riser clamp providing solid bearing on steel sleeve. Avoid excessive compression on plastic piping.
3. For insulated piping passing through floors, provide stand-offs on piping to prevent contact with wall sleeve.

J. Restraints:

1. Provide braces, kickers, rigid supports, thrust brackets, base bends with support pipe, concrete brackets, etc. as required to maintain system equilibrium.
2. In some cases, restraints for piping systems may not be indicated or shown in detail. Comply with the requirements of this section for all piping systems.

K. Acceptance and Service:

1. Acceptance:
 - a. Bring all piping systems up to operating pressures and temperatures.
 - b. Cycle systems to duplicate operating conditions.
2. Service:
 - a. Guarantee all piping systems hangers and supports for a period of one year after Substantial Completion.
 - b. Furnish all labor and materials to readjust and correct faults with hangers and supports for the piping systems installed.

L. Anchors shall be designed to prevent any pipe movement at pipe anchorage points. Anchors shall be securely fastened to the construction directly or indirectly through structural framing:

1. Piping 2-1/2-inches and Smaller: Anchor horizontal runs over 50 feet at midpoint to allow expansion toward ends. Anchor intervals shall not exceed 30 feet.
2. Provide alignment guides in accordance with expansion compensator manufacturer recommendations.

M. Provide expansion compensators where necessary to absorb expansion and contraction in heating lines as follows:

1. 30 feet on center for copper piping.
2. 50 feet on center for steel piping.

- N. Allow clearances for expansion and contraction of piping.
- O. Provide all necessary supports, angle iron stands, miscellaneous steel, inserts, anchor bolts and hangers for all equipment and piping furnished under this Contract.
- P. All copper piping shall be supported by plastic coated or copper plated steel pipe attachments.
- Q. Assemble all piping in such a manner to prevent any movement during operation.
- R. Use expansion anchors only to support rods, hangers, and brackets for piping 1-inch and smaller and only if the expansion anchors are designed to carry 100 percent of the full load, hanger and/or bracket and pipe load.
- S. Coordination: Review installation procedures under other sections and coordinate the Work that must be installed with or attached to the piping support.

3.03 FIELD QUALITY CONTROL

- A. Remove and replace any damaged found to be defective after installation.
- B. Patch or replace any damage caused by the installation of the piping supports.

END OF SECTION

SECTION 15140

SUPPORTS AND HANGERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Plumbing hangers and supports.
- B. Sleeves and seals.
- C. Flashing and sealing equipment and pipe stacks.

1.02 RELATED SECTIONS

- A. Section 15135 - Piping Supports.

1.03 REFERENCES

- A. ASME B31.9 - Building Services Piping
- B. ASTM F708 - Design and Installation of Rigid Pipe Hangers
- C. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- D. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- E. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practice

F. SUBMITTALS

- G. Product Data: Provide manufacturers catalog data including load capacity.

1.04 REGULATORY REQUIREMENTS

- A. Conform to applicable code for support of piping.
- B. Supports for Other Piping: In conformance with ASME B31.1, ASME B31.2, ASME B31.5, ASME B31.9, ASTM F708, MSS SP58, MSS SP69, and MSS SP89 as appropriate.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Grinnell.
2. Other acceptable manufacturers offering equivalent products.
 - a. B-Line.
 - b. Elcen.
 - c. Hilti.
 - d. Michigan.
 - e. Modern.
 - f. Unistrut.
3. Or equal

B. Hangers for Pipe Sizes ½ to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring, Grinnell 104, 108, or CT-109

C. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis, Grinnell CT-65, 260, or 300.

D. Multiple or Trapeze Hangers: As detailed on drawings.

E. Vertical Support: Steel riser clamp, Grinnell CT-121 or 261.

F. Hanger Rods: Carbon steel continuous threaded, Grinnell 146.

G. All support components shall conform to Manufacturer's Standardization Specifications SP-58 and SP-69. All pipe hangers and supports shall be in accordance with Ohio Basic Building Code Section 4101:2-51-11B.

2.02 FLASHING

A. Metal Flashing: 26 gage galvanized steel.

B. Metal Counterflashing: 22 gage galvanized steel.

C. Flexible Flashing: 47 mil thick sheet compatible with roofing.

D. Caps: Steel, 22 gage minimum; 16 gage (1.5 mm) at fire resistant elements.

2.03 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated, Walls: Steel pipe or 18 gage galvanized steel.

B. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls,

and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed. ProSet Systems or approved equal.

- C. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel.
- E. Firestopping Insulation: Glass fiber type, non-combustible; 3M Fire Barrier, or Dow Corning Fire Stop.
- F. Sealant: Acrylic caulk; 3M Fire Barrier, Dow Corning Fire Stop, Hilti, or Nelson for fire stopping uses.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum ½ inch space between finished covering and adjacent work.
- C. Place hangers within 12 inches of each horizontal elbow.
- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- F. Support riser piping independently of connected horizontal piping.
- G. Provide copper plated hangers and supports for copper piping.
- H. Design hangers for pipe movement without disengagement of supported pipe.

3.03 FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof

surface with manufactured flashing unit or with sheet metal worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. Roofing contractor will flash roof penetrations.

3.04 SLEEVES

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Extend sleeves through floors one inch above finished floor level. Caulk sleeves.
- C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration if work will be exposed when finished.
- D. Install chrome plated steel or stainless steel escutcheons at finished surfaces.

3.05 SCHEDULES

PIPE SIZE	MAX. HANGER SPACING	HANGER ROD DIAMETER
(Inches)	(Feet)	(Inches)
½ to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8

PIPE SIZE	MAX. HANGER SPACING	HANGER ROD DIAMETER
(Inches)	(Feet)	(Inches)
C.I. Bell and Spigot(or No-Hub)and at Joints	5	½

END OF SECTION

SECTION 15201

PROCESS PIPING

PART 1 GENERAL

1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section, including but not limited to Division 1, General Requirements.

1.02 DESCRIPTION OF WORK

- A. Exposed process piping.
- B. Buried process piping.
- C. Pipe supports, hangers and anchors.
- D. Couplings, sleeves and other miscellaneous piping accessories.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Piping and accessories for specific systems that are covered in other sections. Piping not included in other systems shall conform to this Section.
- B. Piping associated with plumbing, interior potable water systems and heating normally installed by a mechanical contractor.
- C. Section 02200 – Earthwork and Site Preparation
- D. Section 09900 – Painting
- E. Section 11280 – Valves

1.04 QUALITY ASSURANCE

- A. General: All materials shall be free from defects impairing strength and durability and be of the best quality for the purposes specified or shown on the Drawings. It shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected and be true to detail.
- B. Manufacturer's Qualifications

1. Provide piping and appurtenances that are the standard product in regular production by Manufacturers whose products have proven reliable in similar service for at least two years.
 2. Provide piping and appurtenances of the same type from a single manufacturer.
- C. The Contractor shall be responsible for making all field measurements prior to installation of his work. Any deviations in measurements between the field conditions and the Drawings shall be immediately reported to the Engineer.
- D. Testing
1. Manufacturer's certified test results as defined for the type of pipe shall be stamped approved by the Contractor and forwarded to the Engineer as a Reference Submittal. No pipe shall be installed which does not meet the requirements of these Specifications.
 2. All pipe, joints, and fittings shall be pressure tested as required by this Specification for the type of pipe. The Contractor shall notify the Engineer or Owner, in writing, at least 48 hours prior to performing the tests.

1.05 SUBMITTALS

- A. Provide technical submittals in accordance with Section 01300, Submittals, demonstrating piping and accessories conform completely to the requirements of this Section.
- B. Product Data
1. Catalog cut sheets and description of all items.
 2. Construction materials.
 3. Standard diameters, wall thicknesses and other pertinent dimensions of all sizes of piping and accessories.
 4. Support and anchor details with manufacturer's maximum recommended loads.
 5. Design calculations indicating support spacing requirements for all size pipe.
- C. Shop Drawings
1. Complete piping layout indicating type of pipe, diameter and location. Show dimensions from adjacent structure, equipment and other piping.
 2. Location of all pipe joints, sleeves, valves, and couplings.
 3. Location of all pipe supports and anchors.
 4. Details of pipe anchors, supports, couplings, and joints.
- D. Testing: Copies of all field test reports.

1.06 HANDLING, DELIVERY, AND STORAGE

A. General

1. Handling, delivery, and storage shall be in accordance with the manufacturer's recommendations.
2. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.
3. Interiors of piping shall be completely free of dirt and foreign matter.

PART 2 PRODUCTS

2.01 SLEEVES

- A. All sleeves in masonry construction shall be of galvanized steel pipe, all others shall be of minimum 20 ga, uniformly formed, galvanized sheet metal.

B. Sealing of Sleeves and Penetrations

1. Non-shrink grout
 - a. Manufacturer/Product
 - 1) Master Builders Masterflow #713
 - 2) Or Engineer approved equal.
2. Polyurethane sealer
 - a. Product/Manufacturer
 - 1) Vulkem 116/Mameco International
 - 2) Or Engineer approved equal.
3. Silicone sealer
 - a. Manufacturer/Product
 - 1) Dow-Corning #790
 - 2) Or Engineer approved equal.
4. Silicone Foam
 - a. Manufacturer/Product
 - 1) Chase #CTC PR-855 Chase-Foam
 - 2) Dow Corning #3-6548 Silicone RTV Foam
 - 3) Or Engineer approved equal.

2.02 PIPING

A. General

1. Location, sizes and material type of process piping shall be as indicated on the Drawings.

2. Ductile Iron Pipe may be utilized as an acceptable alternative to PVC pipe at the Contractor's discretion with no additional expense to the Owner.
3. The outside of all piping, valves, and fittings shall bear the Manufacturer's standard marking for type, pressure, etc.
4. All carbon steel pipe shall be fabricated from open hearth or electrical furnaces. No Bessemer pipe shall be installed.
5. All pipe and fittings shall be equal to or better than the grade specified.
6. Whenever Specifications call for close bending or coiling, use Grade B pipe.
7. All piping material shall be new and free from defects and shall be subject to standard mill test before being shipped.
8. Pipe shall be labeled.
9. Fittings shall have the Manufacturer's name or trademark legibly raised or cut into each piece, and shall bear the Manufacturer's standard marking for type, pressure, etc.
10. All pipe shall be cut off even and reamed full bore. Threads shall be cut smooth, true and to full standard size. Piping shall be installed clean of chips, burrs or oil.
11. No salvaged or used pipe shall be used without the written approval of the Engineer. Wherever such approval is given, the ends of the pipe shall be re-cut, square, cut new threads on screwed pipe, and thoroughly clean the pipe of all rust, dirt, scale and foreign matter before installation.
12. A detectable tracer tape shall be installed on top of all buried PVC pipelines. Tape shall be metallic with the usage "Force Main," "Waterline," etc., clearly written on the line. Material shall be 3" wide.

B. Pipe Materials

1. Ductile Iron Pipe
 - a. Pipe
 - 1) Standards
 - a) Flanged: ANSI/AWWA C115/A21.15
 - b) Non-flanged: ANSI/AWWA C151/A21.51
 - c) Thickness: Class 52 minimum
 - 2) Lining: Cement-mortar lining, ANSI/AWWA C104/A21.4
 - 3) DIP used for air shall not be lined but coated as specified
 - 4) Coating
 - a) Buried pipe: 1 mil asphalt coating, AWWA C151
 - b) Exposed pipe to be painted: Factory prime coat compatible with finished coat system.
 - b. Joints
 - 1) As shown on the Drawings. If not designated, use flanged joints for exposed piping and push-on joints for buried piping.
 - 2) Flanged
 - a) Ductile iron, ANSI A21.10

- b) Bolt Circles and Bolt Holes: ANSI B 16.1.
 - c) Class: Class 125 except lines with a test pressure exceeding 125 psi which shall have 250 flanges.
 - d) Gaskets: 1/8" rubber full faced.
 - e) Bolts and nuts
 - i. (Buried and exposed: Carbon steel per AWWA C115)
 - ii. (Submerged: Type 304 stainless steel)
- 3) Mechanical or Push-on
 - a) ANSI A21.11
 - b) Gaskets: plain tipped
 - c) Bolts and nuts: Alloy steel
- c. Fittings
 - 1) Types: Flanged or mechanical, as indicated on Drawings.
 - 2) Flanged: ANSI/AWWA C110/A21.10
 - 3) Mechanical joint
 - a) 3"-16": Full body ANSI/AWWA C110/A21.10 or short body ANSI/AWWA C153/A21.53.
 - b) Larger than 16": Full body ANSI/AWWA C110/A21.10
 - 4) Pressure rating: 250 psi minimum.
 - 5) Coating and lining: Identical to connecting piping.
 - 6) Base tees and bends: Drill and furnish with anchor bolts. Machine when used as pipe kicker.
- 2. Steel Pipe
 - a. Pipe
 - 1) ASTM A 53, Type A
 - 2) Wall thickness: Schedule 40 unless otherwise indicated.
 - b. Joints
 - 1) Threaded or flanged.
 - 2) ANSI B2.1
 - 3) Joint preparation: Teflon tape for screwed joints
 - c. Coating
 - 1) Buried pipe: Galvanized
 - 2) Exposed pipe: Factory prime coat compatible with finish coating system.
 - 3) Submerged pipe: Galvanized
 - d. Fittings for Schedule 40 pipe
 - 1) Type: Malleable iron
 - 2) Material: ASTM A47, Grade 32510
 - 3) Dimension: ANSI B16.3
 - 4) Threads: ANSI B2.1
 - 5) Weight: 150 lb., standard
 - e. Fittings for Schedule 80 pipe
 - 1) Type: Forged steel
 - 2) Material: ASTM A 181, Class 60
 - 3) Weight: 2,000 lb.
- 3. Stainless Steel Pipe

- a. Pipe
 - 1) ASTM A333, AISI Type 304
 - 2) Wall thickness: Schedule 40, unless otherwise indicated.
- b. Joints
 - 1) Threaded or flanged
 - 2) ANSI B2.1
 - 3) Joint preparation: Teflon tape
- c. Fittings
 - 1) Type: Stainless steel, ASTM A420, AISI Type 304
 - 2) Threaded or flanged
- 4. Copper Tubing
 - a. Federal Specifications WW-T-799C
 - b. Type: Type K, hard drawn, for all pipe cast in concrete, buried or where shown on the Drawings. Type L, hard drawn, for all other pipe applications.
 - c. Fittings: Nibco or equal, wrought solder type, ANSI B16.22.
 - d. Joints: Soldered, make with noncorrosive paste flux and solid string or wire solder. Core solder is not permitted.
- 5. Plastic Pipe
 - a. Type PSM Polyvinyl Chloride Pipe (PVC) for all gravity pipe designated as PVC on the Drawings.
 - 1) Gravity Sewer Pipe and fittings: Conform to ASTM D3034, SDR 35 for pipe diameters 4" through 15" and ASTM F679, SDR 35 for diameters 18" through 24".
 - 2) Joints: Flexible elastomeric gasket, conform to ASTM D3212.
 - 3) Fittings: Molded or fabricated of same material as pipe.
 - 4) Gaskets: Conform to ASTM F477.
 - 5) Bedding: Conform to ASTM D2321, Type 1.
 - b. Type PSM Polyvinyl Chloride Pipe (PVC) for force mains and waterline:
 - 1) Pipe: Conform to ASTM D2241, SDR 21.
 - 2) Joints: Flexible elastomeric gasket, conform to ASTM D3212.
 - 3) Fittings: Ductile iron, mechanical joint.
 - a) 3" – 16": ASTM C153
 - b) > 16": ASTM C110
 - 4) Bedding: Conform to ASTM D2321, Type 1
 - c. Type High Density Polyethylene (HDPE) for water lines and force mains:
 - 1) Pipe and fittings: Conform to AWWA C901 and ASTM F714.
 - 2) Joints: Butt Fusion per ASTM F2620.
 - 3) DR 11 for water line, Iron Pipe Size (IPS), DR 17 for wastewater force main
 - 4) Fittings: Molded or fabricated of same material as pipe.
 - 5) Bedding: Conform to ASTM D2321, Type 1.
 - 6) For 2-inch and larger water mains, isolation valves to be resilient wedge gate valves AWWA C515 or better.

- d. Chemical Feed and/or Odor Control and other process Pipe: Pipe shall be PVC Schedule 80, Type I, Grade I (Class 12454-B) conforming to ASTM D1784 and D1785.
- e. PVC for interior plumbing shall be domestically produced rigid polyvinyl chloride (PVC) compound, Type I Grade I, with a Cell Classification of 12454 as defined in ASTM D1784 and D1785, trade name designation H707 PVC. This compound shall be gray in color as specified, and shall be approved by NSF International for use with potable water (NSF Std 61).
 - 1) Schedule 80 - PVC Schedule 80 pipe shall be manufactured in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances. Each production run of pipe manufactured in compliance to this standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM D1785. All belled-end pipe shall have tapered sockets to create an interference-type fit, which meet or exceed the dimensional requirements and the minimum socket length for pressure-type sockets as defined in ASTM D2672. All PVC Schedule 80 pipe must also meet the requirements of NSF Standard 14 and CSA Standard B137.3 rigid PVC pipe for pressure applications, and shall bear the mark of these Listing agencies. This pipe shall have a flame spread rating of 0-25 when tested for surface burning characteristics in accordance with CAN/ULC-S102-2-M88 or equivalent.
 - 2) Schedule 40 - The material used in the manufacture of the pipe shall be domestically produced rigid polyvinyl chloride (PVC) compound, Type I Grade I, with a Cell Classification of 12454 as defined in ASTM D1784, trade name designation H707 PVC. This compound shall be white or gray in color as specified, and shall be approved by NSF International for use with potable water (NSF Std 61).
 - 3) Nipples: Short nipples shall be the same as the PVC pipe.
 - 4) Fittings: Fittings shall be schedule 80 and shall conform to ASTM D 2464 for threaded fittings 6 inches and smaller and ASTM D 2467 for socket-type fittings 8 inches and smaller. For threaded fittings larger than 6 inches and for solvent welded fittings larger than 8 inches the fittings shall be schedule 80 per the manufacturer's standards. All fittings shall successfully pass the required pressure test.
 - 5) Flanges: PVC flanges shall be made of the same material as the pipe. Flanges shall match dimensions of ANSI B16.5, Class 150. Flanges shall be flat face.
 - 6) Unions: Unions shall have socket-type ends, EPDM o-rings, and shall be schedule 80. Material shall be Type 1, Grade I PVC, per ASTM D 1784.

- 7) Joints
 - a) Pipe and fitting joints shall be socket welded except where threaded and flanged joints are required to connect to unions, valves and equipment.
 - b) Screwed joints that are necessary to match up to threaded valves or fittings shall be made up with Teflon Tape only.
 - c) Flanged joints shall be made with solvent welded PVC flanges.
- 8) Solvent Cement
 - a) IPS 717: 6" and greater
 - b) IPS 719: Less than 6"
- 9) Gaskets for flanges: PTFE/EPDM envelope gasket
- 10) Bolts and Nuts for Flanges
 - a) Bolts: Type 316 stainless steel conforming to ASTM A 193, Grade B8M
 - b) Nuts: silicon-bronze
 - c) Provide a washer under each nut and under each bolthead. Washers shall be of the same material as the bolts.
 - d) Lubricant shall be TRX-Synlube by Ramco, Anti-Seize by Ramco, Husk-It Husky Lube O'seal, or equal.
- 11) Threaded Ends: Taper pipe threads. All threaded female fittings shall be 316 stainless steel reinforced.
- f. A detectable tracer tape shall be installed on top of all buried plastic pipeline

C. Piping Accessories

1. Wall and Floor Pipes
 - a. Material: Same as specified for the piping connected to wall or floor pipe, unless otherwise approved by Engineer.
 - b. End Connections: As shown or approved by Engineer.
 - c. Thickness: Same as specified for the piping connected to wall or floor pipe.
 - d. Collars: Provide collars at mid-point of wall for anchorage and watertightness unless otherwise shown or approved by Engineer.
 - e. Pipes ends shall be flush with wall face unless otherwise shown.
 - f. Flanged ends and mechanical joint bells shall be drilled and tapped for studs. Provide studs of same material as connected piping except submerged and buried studs shall be of stainless steel.
2. Pipe Sleeves
 - a. Ferrous and Plastic Pipe: Use standard weight galvanized steel pipe unless otherwise shown.
 - b. Copper Pipe: Use Type K hard drawn copper pipe unless otherwise shown.
3. Cast Wall Sleeves
 - a. Material: Cast iron furnished with integral wall collar.

- b. Dimensions: As required for mechanical joint or calked joint pipe to pass through sleeve. Length as required.
- 4. Mechanical Wall Seals
 - a. Provide link type mechanical seals where indicated, suitable for 20 psi working pressure. Install double seals in wall penetrations unless otherwise indicated.
 - b. Product/Manufacturer
 - 1) Link-Seal; Thunderline Corporation or equal
- 5. Wall and Ceiling Plates
 - 1) Bare pipes passing through walls and ceilings in finished rooms: Provide escutcheon plates of cast brass or cast iron nickel plated, clevis or split ring and hinged with set screws.
 - 2) Insulated pipes passing through walls and ceilings in finished rooms: Provide plated escutcheon plates of 18 gage steel.
- 6. Bellows Expansion Joints and Flexible Couplings
 - a. Manufacturer: Belmont Packing & Rubber Co. or equal
 - b. Uniformly machined bellows of high density TFE. Bellow designed to completely shield the flanges.
 - c. Flanges: Ductile iron, 125/150 lb drilling.
 - d. Restriction Bolts: Provide to prevent bellows extension safe limit.
 - e. Pressure Rating: 50 psi at 130 deg F
- 7. Flanged Coupling Adapters
 - a. Manufacturer
 - 1) Rockwell
 - 2) Dresser Industries
 - 3) Or equal
 - b. Material
 - 1) Body and Flange: Steel conforming to ASTM A282, Grade C.
 - 2) Follower: Ductile iron, ASTM A-536 through 12" and steel as specified above for sizes over 12".
 - 3) Bolts and Nuts: Alloy steel conforming to ANSI A 21.11. Cadmium plate as specified herein.
 - 4) Gasket: Rockwell Grade 30, or equal.
 - c. Size and Type: As shown on the Drawings and to suit type, class, and size of pipe.
 - d. Flanges: AWWA Class D or Class E. Use Class E when test pressure specified is above 200 psi.
 - e. Painting
 - 1) Interior Surface: Vinyl or coal tar epoxy coating.
 - 2) Exterior Surface: One coat of primer compatible with finish paint system.
 - f. Tie Bolts, Lugs, and Clamps
 - 1) Provide restraining system for various pipe lines as noted on Drawings or in the Schedules. See details shown on Drawings.
 - 2) Steel Piping: Refer to AWWA Manual 11 for restraining system design.

8. Steel or Cast Compression Couplings
 - a. Manufacturer
 - 1) Rockwell
 - 2) Dresser Industries
 - 3) Or equal
 - b. Material
 - 1) Rockwell Type 411, Dresser Style 138 Couplings:
 - a) Sleeves: Steel for all sizes of ductile and steel pipe.
 - b) Flanges: Malleable or steel
 - 2) Rockwell Type 431, Dresser Style 53 Coupling
 - a) Sleeves: Gray iron
 - b) Flanges: Malleable or ductile iron
 - 3) Bolts and Nuts: Alloy steel cadmium plated as specified herein. Number of bolts as recommended by the Manufacturer to suit the specified pressure ratings and conform to ANSI 21.11.
 - 4) Gaskets: Rockwell, Grade 30, Dresser standard, or approved equal.
 - c. Size and type: To suit size and type of pipe shown on the Drawings, and specified herein. Minimum sleeve length unless otherwise indicated on Schedule of Valves, Gates and Accessories.
 - d. Tie Bolts, Lugs and Clamps
 - 1) Provide restraining system for various pipe lines as noted on Drawings or in the Schedules.
 - 2) Steel Pipe: Refer to AWWA Manual 11 for restraining system design.
 - e. Painting: One exterior coat of primer compatible with finish paint system. Coat interior of steel couplings with Rockwell or Dresser standard coal tar epoxy.
9. Flange Rubber Expansion Joint
 - a. General: Flanged rubber expansion joints shall allow axial compression or expansion, lateral movement, and axial deflection.
 - b. Construction
 - 1) Lining: Leakproof layer of synthetic or natural rubber.
 - 2) Body: Fabric and rubber compounds with steel reinforcing.
 - 3) Cover: Synthetic or natural rubber with protective paint coating.
 - 4) Flanges: ANSI 125 lb. hole pattern. Provide 3/8" split steel retaining rings.
 - c. Provide restraining rods and gusset plates between connecting flanges.
 - d. Pressure rating: 125 psi
 - e. Manufacturers: Red valve Redflex, PROCCO Series 200, Mercer or equal.
10. Ferrous Fasteners: All bolts, nuts, and other ferrous fasteners used in the installation of piping systems shall be alloy steel conforming to ANSI 21.11 cadmium plated in accordance with Fed. Spec. QQ-P-41 6a, Class 3, Type II, except "T" bolts used with mechanical joint pipe.

- a. Expansion Joints for PVC and CPVC Pipe
 - 1) Type: Bellows type with restriction bolts
 - 2) Pressure Rating: 50 psi
 - 3) End Connections: Flanged
 - 4) Manufacturer: Belmont Packing & Rubber Co., or equal.
- b. Cutting-In-Sleeves
 - 1) Manufacturers: American Pipe, M&H Valve Company, Clow Corp. or equal.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. General

- 1. Piping shall be installed in a manner to permit easy removal of valves and disconnection of equipment. Unions or flanged joints shall be installed for this purpose.
- 2. Piping shall be installed, supported, guided, and anchored to properly provide for movement due to expansion and contraction without undue strains on the joints and in such a manner that it will not sag, buckle or sway.
- 3. Piping shall not be supported from other pipes, conduits, ducts or similar installations.
- 4. No piping shall be supported by the equipment to which it is connected. Install base elbows, hangers or other approved independent method of support for the pipe.
- 5. Connections to equipment shall be arranged to facilitate ease of removal and service without dismantling of the runouts of main piping, and shall be installed by the use of multiple elbows or other similar methods to minimize strain on the equipment connections.
- 6. No field-fabricated welding fittings shall be permitted. All welding tees, elbows, reducers, and caps shall be commercially manufactured products.
- 7. All open ends of pipes, including equipment connections, shall be properly sealed at all times during installation to keep dirt and all foreign material out of the piping. Plugs used shall be commercially manufactured products.
- 8. Pipe size reductions shall be made with factory-fabricated eccentric reducers, concentric reducers, or reducing fittings and shall be installed not to cause pocketing or inhibit the flow of the material.
- 9. Install shut-off valves or cocks with unions on all connections to equipment and on each side of traps and control valves as required for ease of proper servicing and maintenance.
- 10. Unless otherwise indicated, the discharge from pressure-and temperature-relief valves and equipment drains shall be piped to the

nearest floor or hub drain, installed with an approved air gap as required, and arranged for safe discharge.

11. No pipe shall penetrate any structural member without the written approval of the Engineer. Where such penetration is allowed, the structural member shall be reinforced subject to the approval of the Engineer.

12. Flanges and Gaskets

- a. Where forged steel flanges are to be bolted to cast iron flanges, a smooth or flat-face forged steel flange with a full-face gasket shall be used.
- b. All gaskets, other than teflon envelope or full-face, shall be of the flat ring type, with the outside diameter of the gasket extending to the edge of the bolts.
- c. Gaskets for all joints shall have an inside diameter equal to the outside diameter of the pipes on which they are to be used to ensure that no portion of the gasket will project into the ports of valves, pipe, or fittings.
- d. The dimensions of all gaskets shall conform to ANSI Standard B-16.21 for nonmetallic gaskets.

13. Provide flanged coupling adapters as necessary to accommodate ease of piping installation according to Contractor's layout plan.

14. Installation shall include all rough-in and final connections to equipment and services as provided in the Contract Documents, for the services and equipment to be functional.

- B. Cross Connections and Interconnections: No devices, equipment or pipe connections shall be installed that will provide a cross-connection or interconnection between a potable water supply and any source of nonpotable water such as a drainage system, a soil or waste pipe, or a boiler or cooling tower where the water may be chemically treated.

3.02 PIPE EXPANSION CONTROL: INSTALLATION

A. General

1. Install expansion loops or joints as required, to limit strain and movement of the piping.
2. All loops shall be cold sprung when installed.
3. Install conforming manufactured guides for each loop and joint to maintain the proper pipe alignment and minimize undue stresses on the piping and joints.
4. All mechanical joints and guides shall be installed in accordance with the Manufacturer's recommendations.
5. Install conforming manufactured pipe anchors at the midpoint between loops and joints. Installation and design shall be subject to the approval of the Engineer.

6. Manufacturer shall be held responsible for the proper capacity of the joints, with a minimum 25% allowance beyond the anticipated expansion and contraction in the piping.

- B. Polyvinyl Chloride (PVC) Pipe: Provide expansion joints in straight piping runs over 50' and at least every 50'.

3.03 EXPOSED PIPING: INSTALLATION

A. General

1. Do not obstruct passageways, headroom, door and window operation, and similar areas with the installation of the piping and supports.
2. Painting of piping is specified in Section 09900 of the Contract Documents.
3. Install straight runs true to line and elevation.
4. Install vertical pipe plumb in all directions.
5. Install piping parallel or perpendicular to building walls. Piping at angles and 45 deg runs across corners shall not be accepted unless specifically shown.

B. Joints

1. General

- a. Make joints in accordance with the pipe Manufacturer's recommendations and the requirements below.
- b. Cut piping accurate and square. Assemble without forcing or springing.
- c. Ream all pipes and tubing to full inside diameter after cutting. Remove sharp edges on end cuts.
- d. Remove all cuttings and foreign matter from the inside of pipes and tubing before installation.
- e. Thoroughly clean all pipe, fittings, valves, specials, and accessories before installing.
- f. Thoroughly wire brush, wipe clean and dry all spigot mating surfaces immediately before pipe is installed.

2. Threaded Joints

- a. Use standard right-hand tapered full depth threads on steel piping.
- b. Apply before installation an approved joint compound to the male threads only.
- c. Leave three pipe threads maximum exposed at each connection.

3. Solder Joints

- a. Ream or file pipe to remove burrs.
- b. Clean and polish contact surfaces of joints
- c. Apply flux to both male and female ends.
- d. Insert end of tube full depth into fitting socket.
- e. Heat joint evenly.

- f. Form continuous solder bead around entire joint circumference.
- 4. Flanged Joints: Use hexagon head nuts and bolts. Assemble flanged joints with gaskets and gasket compounds in compliance with the applicable material specifications. Tighten flange bolts evenly.
- 5. Plastic Pipe Joints: Comply with Manufacturer's recommendations.
- 6. Welded Joints: Comply with all applicable requirements of Code for Pressure Piping, ANSI B13.1 Section 6, and AWWA C206 for steel pipe and fittings.

C. Unions

- 1. Install dielectric unions where dissimilar metals are connected except at bronze or brass valves installed in ferrous piping.
- 2. Provide a union downstream of each screwed end valve.
- 3. Provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.

D. Eccentric Reducers: Use eccentric reducers where shown and where air or water pockets would occur in mains because of reduction in pipe size.

E. Transitions between Types of Pipe: Provide all necessary adapters, specials and connector pieces when connecting different types and sizes of pipe or connecting pipe furnished by different Manufacturers.

F. Restraints, Supports and Thrust Blocks

- 1. Install restrained joints as shown, specified, recommended by Manufacturer or otherwise required.
- 2. Provide concrete and metal cradles, collars, kickers, and blocks as indicated.

G. Expansion Coupling

- 1. Install expansion couplings in tension to facilitate their removal.
- 2. Set stretcher bolts for maximum allowable elongation of expansion coupling as recommended by the Manufacturer.

H. Adjustment: Adjust all parts and components as required to provide correct operation.

I. Hangers, Supports and Attachments: Installation

- 1. General
 - a. Attach supports to structural steel members, concrete or masonry, except as specifically noted on Drawings.
 - b. No supports shall be attached to metal decking.

- c. No burning, cutting, welding to, or drilling of structural steel shall be permitted without approval of the Engineer or Owner.
 - d. Supports shall not be located to obscure halls or passageways.
 - e. Attachments to bar joists shall be as follows:
 - 1) The total number of attachments to an individual joist shall not exceed the length of that joist in feet divided by 6.
 - 2) The load transmitted to a joist by an attachment shall not exceed 75 lb. Trapezes to be supported shall be located in such a way that they can be supported by a sufficient number of joists and hangers to meet this requirement. Provide supplemental structural members to meet this requirement.
 - 3) Attachments to steel joists must be at panel point.
 - 4) Loads applied to the bottom chord must be applied concentrically to the joist.
 - 5) When the above requirements cannot be met for an item, the Contractor shall submit to the Engineer with the steel joist Shop Drawings, information as to what the item is, how much it weighs, methods of support, location of supports and magnitude of load on the support and any other information needed to properly attach the item to the steel joists.
 - f. Unless shown on the Drawings, pipe hangers shall not be attached to purlins, truss vertical or diagonal members, sway bracing, tie rods or sag rods. Piping supports for 6" and larger pipe may not be tied to building steel without the addition of strengthening steel to compensate for the forces exerted by the piping, as approved by the Engineer.
 - g. Lugs, plates and angle clips that are used as a part of an assembly for the support or guiding of pipe may be welded directly to the pipe.
2. Horizontal Piping
- a. General
 - 1) Adequately support piping system so there will not be any undue strains on joints, sagging, or swinging. Locate hangers near or at all change in piping direction and concentrated loads. Provide vertical adjustment type to maintain proper pitch and alignment and allow for unrestricted expansion and contraction of the piping.
 - 2) Fasten hangers to building steel or structural members wherever practicable.
 - 3) Provide angle irons anchored to wall to horizontally brace pipe where spans exceed 12' below elbows or tees.
 - 4) Support base elbows and piping near floors, using a minimum of one pier per pipe length.
 - b. Polyvinyl Chloride (PVC) Pipe: Space pipe supports in strict accordance with pipe Manufacturer's recommendations.
3. Vertical Piping: Support piping on floors and stabilize with wall anchors.
4. Structural Attachments

- a. To Concrete - Use Grinnell Fig 281, Wedge Type Concrete Insert, or Grinnell Fig 282, Universal Concrete Insert, where corrosion is a factor. If inserts have been omitted, use expansion shield properly spaced to carry the load, or drill through the concrete and secure the rod to steel plates above. If support is required under hollow precast concrete, use toggle bolt with wings crosswise to the hole.
 - b. To Steel Beams - Where pipe size is 2" or less, use Grinnell Fig 225. Where pipe size is more than 2" use Grinnell Fig 292, Malleable Beam Clamp. If a bar joist type of construction exists, use Grinnell Fig 61 or Fig 62, Top Beam Clamp.
 - c. Where welding to beam is permitted, use Grinnell Welding Beam Attachment, Fig 66.
 - d. To wooden ceilings and beams, use Grinnell Fig 153, Pipe Hanger Flange.
5. Intermediate Attachments
- a. Continuous threaded rod shall be used wherever possible.
 - b. No chain, wire or perforated strap shall be used.
6. Pipe Attachments
- a. When thermal expansion in excess of 1/2" axially is anticipated, use Grinnell Fig 174, Adjustable Swivel Pipe Roll, or Grinnell Fig 271, Pipe Roll Stand. Where pipe is insulated, use a pipe covering protection saddle Grinnell Fig 160 through 166A in conjunction with the roll device.
 - b. For vertical pipe, use Grinnell Fig 261.
 - c. Where it is necessary to support horizontal piping from walls, use Grinnell Fig 194, 195, or 199, steel brackets with backing plates. Where pipe can be supported close to the wall, use a Unistrut type "J" conduit and pipe hanger.
 - d. Piping installed with insulation shall be supported by Grinnell Fig 260, Clevis Hangers, sized for and used with a Fig 167, Insulation Shield.
 - e. For pipe supported from the floor, use Grinnell Fig 258, Pipe Saddle Support, anchored to the floor.
 - f. Where several pipes or conduits are to be installed together, trapeze hangers may be used. The horizontal support may be angle iron or Uni-Strut, with 1/2" minimum rods, to be reviewed by the Engineer.
 - g. Double nuts shall be installed on all rod supports for pipe attachments.

J. Identification of Piping

- 1. Coordinate color-coding of both insulated and noninsulated piping with Section 09900, Painting. Painting of piping is Work of Section 09900, Painting.
- 2. Identify contents of piping and direction of flow in compliance with General Provisions.

3.04 BURIED PIPING: INSTALLATION

A. General

1. Minimum piping cover shall be 4' unless otherwise indicated.
2. Wherever pipes are installed below a slab resting on grade or whenever pipes pass below footings of any structure, concrete having a slump of not over 8 in. shall be placed 6 in. around the pipe for its full length beneath the slab or to the full width of the footing.

B. Bedding Pipe

1. Trenches shall be excavated to lines and grades indicated. Trenches shall be of sufficient width to permit proper making of joints and, where necessary, placing of sheeting and bracing, but, within these limits, shall be as narrow as possible. Sheeting and bracing shall be used at the expense of the Contractor where necessary, to prevent caving in of trenches.
2. All sheeting and bracing shall be removed as trenches are backfilled. Where pipe would be laid in organic material, same shall be removed to minimum of 3 ft below bottom of pipe and replaced with approved compacted fill material.
3. Bed pipe evenly over the lower third of its circumference unless otherwise indicated.
4. Provide a uniform support for the entire length of pipe, except for bells and other joints for which a recess of sufficient depth to relieve joints of load and to allow space for making and inspecting joints around entire circumference shall be provided.
5. Existing material unsuitable for bedding shall be replaced with granular bedding material.
6. Backfill shall not be placed above the top of the pipe until elevations, gradient, alignment, and pipe joints have been checked, inspected, and approved by the Contractor. All pipe shall be held in place by cable and winch or other suitable method during backfill operations so that there will be no movement in the pipe joints.
7. Carefully deposit backfill material to a depth of 12" above top of pipe by methods which shall prevent damage or movement of the pipe. Thoroughly compact bedding and backfill materials with hand held pneumatic compactors.

C. Laying Pipe

1. Comply with Manufacturer's instructions and with AWWA C600 where applicable.
2. Install all piping true to line and grade shown unless otherwise indicated.
3. Slope piping uniformly between elevations shown.

4. Ensure that water level in trench is at least 6" below bottom of pipe.
 - a. Lay no pipe in water.
 - b. Maintain dry trench until jointing and backfilling are complete.
5. Lay pipe beginning at lowest point and proceed toward the higher elevations. Point spigot ends in the direction of flow.
6. Lay all pipes with ends abutting.
7. Excavate around joints in bedding and lay pipe so that only the barrel bears directly on the trench bottom.
8. Joint deflections shall not exceed Manufacturer's recommendation.
9. Take every precaution to ensure that no foreign material enters the piping prior to and during installation.
10. Carefully examine all pipe and fittings for cracks, damage or other defects while suspended above the trench just before installation. Remove defective materials from site.
11. Remove all dirt, gravel, sand, debris or other foreign material from the pipe interior before the pipe is moved into the trench.
12. Wire brush bell and spigot mating surfaces and wipe clean and dry immediately before pipe is laid.
13. Close the open ends of piping with a watertight plug whenever laying is not in active progress.
14. Field cut pipe, where required, using specially designed machine.
 - a. Make cuts carefully to avoid damage to pipe or lining and to leave smooth right angle end.
 - b. Taper cut ends and file sharp edges smooth.
 - c. Avoid flame cutting.
15. Blocking under piping shall be permitted only when acceptable to the Engineer for special conditions. Comply with AWWA C600 requirements where permitted.
16. Touch up protective coatings satisfactorily prior to backfilling.

D. Jointing Pipe

1. Completely clean all jointing surfaces and adjacent areas just before making joint.
2. Lubricate and adjust gaskets and "O"-rings as recommended by Manufacturer.
3. Check each gasket carefully for proper position around full circumference of the joint after "O"-rings are compressed and before pipe is brought fully home.
4. Comply with AWWA C111 and all applicable Manufacturer's recommendations pertaining to jointing pipe.
5. Mechanical Joints
 - a. Center and push the plain end into the bell.
 - b. Firmly press the gasket evenly into the bell.
 - c. Slide the gland to the bell for bolting.
 - d. Oil bolt threads.

- e. Tighten all bolts alternately 180 deg opposite to each other to seat the gasket evenly. The maximum torque shall be as follows:

Bolt Size (inches)	Applied Torque (ft-lb)
5/8	50
3/4	80
1	90
1-1/4	110

- f. Apply heavy bituminous coating to all bolts and nuts.

6. Flanged Joints

- Use hexagon head nuts and bolts. Bolts shall fully project through the end of the nut to 1/4" maximum.
- Use 1/8" thick full-face gaskets, unless otherwise specified.
- Comply with Manufacturer's rating and instructions for specified service.
- Clean and lubricate bolt threads and gasket faces.

E. Restraints, Supports and Thrust Blocks

- Install restrained joints as shown, specified, recommended by the Manufacturer or otherwise required.
- Provide concrete and metal cradles, collars, and blocks as shown.

F. Transitions between Types of Pipe

- Provide all necessary adapters, specials and connector pieces when connecting different types and sizes of pipe or connecting pipe furnished by different Manufacturers.
- Encase all such connecting joints with concrete at least 6" thick all around and not less than 1 foot each side of connecting joint.

G. Closures

- Provide all closure pieces shown or required to complete the Work.
- Locate closures in straight runs of pipe.

3.05 SLEEVES: INSTALLATION

- Provide and accurately locate all sleeves required under this Section. Set sleeves true to line, grade and position, plumb or level, and maintain as such during the work under other Divisions.
- Sufficient advance notice shall be supplied to the proper trade to enable the installation to progress.

- C. Whenever improper location or insufficient notice is provided for the installation of the sleeves, such work shall be done as Work of this Section, with no change in the Contract Sum or the Date of Substantial Completion.
- D. Sleeves shall not penetrate any structural member except as shown on the Drawings.
- E. Provide 8" clear space between sleeves unless otherwise indicated on the Drawings.
- F. Sleeves shall be of the full thickness, with the exposed ends flush and smooth, with the structure in which they are installed.
- G. Wherever water might get into the sleeve, the sleeves shall extend 1" above the finished surface and be made watertight. The exposed end shall be smooth and neatly finished.
- H. On all piping passing through a sleeve, the piping insulation shall be continuous through the sleeve. The sleeve shall be sized to allow a 1" annular space between the sleeve and the bare pipe or insulation.
- I. Sealing of Sleeves and Penetrations
 - 1. Where sleeves are embedded through cast-in-place concrete walls or slabs on or below grade, the joints between the concrete and the sleeve shall be sealed with a polyurethane sealer.
 - 2. Where sleeves pass through boxed out or cored openings in concrete walls or floor slabs on or below grade, a bonding agent shall be applied to the concrete surface and a non-shrink grout shall be installed between the concrete and the sleeves. After the grout has cured, the joints between the grout and the sleeves on both sides of the wall or floor shall be sealed with a polyurethane sealer.
 - 3. Where sleeves pass through exterior building walls above grade, the joints between the wall and sleeve on both sides of the wall shall be sealed with silicone sealer or the opening shall be sealed with a silicone foam.
- J. The 1" annular space around pipes passing through sleeves shall be filled with silicone foam having a minimum service temperature rating at least 15 deg F (8.3 deg C) higher than the temperature of the pipe service passing through it.

3.06 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping

1. Locations of existing piping shown shall be considered approximate.
2. Contractor is responsible for determining exact location of existing piping to which he must make connections, may disturb during earth moving operations, or may affect in any way by his work.

B. Removing Existing Pipelines from Service

1. Pipelines shall not be removed from service unless approved by the Engineer or Owner.
2. Notify the Engineer or Owner at least 48 hr prior to taking pipeline out of service.

C. Work on Existing Pipelines

1. Cut piping as shown or required using machines designed specifically for this work.
2. Install temporary plugs to keep out all mud, dirt, water and debris.
3. Provide all necessary adapters, fittings, pipe and appurtenances.
4. Comply with all applicable specification requirements for installing new pipe, including connections or modifications and for cleaning testing and disinfecting portions of existing piping modified or to which connections are made.

3.07 TESTING

A. General

1. All pipelines shall be tested to prove tightness of the final assembly. The Engineer shall be given 24 hours' notice before each test.
2. All tests required by governing authorities shall be satisfactorily made.
3. Provide all necessary testing apparatus, including gages, pumps, hoses, and fittings.
4. Repair and retest pipelines which fail to hold specified test pressure or which exceed the allowable leakage rate.
5. Test pressures specified apply at the lowest elevation of the pipeline section being tested unless otherwise noted.
6. The Contractor is responsible for all testing and shall pay all costs incurred during the specified testing.
7. Contractor shall submit to Engineer for approval, method for disposal of water used for testing purposes a minimum of five days prior to testing.

B. Hydrostatic Pressure Testing

1. General
 - a. Conduct hydrostatic pressure testing on all process piping in accordance with AWWA C600.

- b. Slowly fill section to be tested with water and expel all air. Install corporation cocks as necessary to remove air.
 - c. Apply test pressure for two hours.
- 2. Exposed Piping
 - a. Allow any concrete which may be affected by the testing to reach design strength before testing.
 - b. Ensure that all supports and restraint protection are securely in place.
- 3. Buried Piping
 - a. Place and compact backfill to at least the pipe centerline before testing, unless otherwise required or acceptable to the Engineer. Backfill and compact around all blocking before testing and as required to assure restraint by harnessed joints.
 - b. Allow concrete for blocking to reach design strength before testing.
- 4. Test Pressure
 - a. Piping connected to pump suction and discharge: 150% of specified maximum operating head of pump.
 - b. Gravity flow ductile iron pipe: 150% of maximum static water head of pipe section being tested.
 - c. Liquid chemical feed piping: 100 psi

C. Exposed Piping: Additional Testing

- 1. Gaseous Chemical Pipe Testing
 - a. Completely purge piping with dry compressed nitrogen or air.
 - b. Fill pipeline with dry air or nitrogen and pressurize as follows:
 - 1) Chlorine Gas Vacuum: 150 psi
 - 2) Carbon dioxide: 300 psi
 - c. Test all joints with soapy water solution. No leakage shall be evident.

3.08 CLEANING AND DISINFECTION

A. General

- 1. All piping systems shall be cleaned and flushed out prior to operation. If it is necessary to place the system in operation by sections, then the cleaning shall be done by sections. Notify Owner prior to start of Work.
- 2. Inspect inside of piping 24" diameter and larger and remove all debris, dirt and foreign matter.
- 3. All piping, including equipment installed in connection with the piping, conveying liquids shall be filled and flushed several times to eliminate all debris and contaminants.
- 4. Where pumps are installed, install temporary strainers ahead of pumps and circulate the medium through several cycles. The system shall be flushed out and the temporary strainers removed. Strainers shall have a free area of at least 3 times the cross sectional area of the attached pipe.

5. Prior to turning over the Work, this Contractor shall remove and clean all strainers, traps, and dirt pockets.

B. Disinfection

1. Standard: AWWA C651 unless otherwise acceptable to the Engineer.
2. Disinfect all potable water piping.
3. Flush piping with water at 2-1/2' per sec minimum velocity prior to disinfection.
4. Water for flushing, testing and chlorination will be furnished by Owner at no cost to Contractor.
5. Chlorine shall be supplied by Contractor.
6. All other labor, material and equipment including chlorination taps and blow-off taps shall be furnished and paid for by the Contractor.
7. Chlorine Concentration
 - a. Maintain chlorine concentration between 50 and 100 parts per million for water entering the pipe.
 - b. 25 parts per million minimum residual concentration shall remain after 24 hr retention period.
 - c. Repeat the operation as necessary to provide complete disinfection.

3.09 CLEANING/RECONDITIONING EXISTING EQUIPMENT AND PIPING SYSTEMS

A. Identification of Existing Piping

1. Coordinate color-coding of both insulated and non-insulated piping with Section 09900, Painting. Painting of piping is Work of Section 09900, Painting.
2. Identify contents of piping and direction of flow.

END OF SECTION