PART 1 - SECTION 432110 - PROGRESSING CAVITY PUMPS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. References

1. AISI American Iron and Steel Institute
2. ASTM American Society for Testing and Materials
3. IEEE Institute of Electrical and Electronic Engineers
4. NEMA National Electrical Manufacturers Association
5. SSPC Steel Structures Painting Council
6. NFPA 70 National Electric Code (NEC)

1.2 SUMMARY

A. This section includes the furnishings and installation of positive displacement, progressing cavity pumps and all pertinent accessories, complete and in place, ready for service as shown on the Drawings and described in this section. This includes:

1. Two (2) Sludge Dewatering Feed Pumps, equipped with VFDs.

B. The pump shall include all drives, VFDs as applicable, drive shafts, couplings, piggy-bag arrangement with belts and belt guards, drive bases, pump bases, anchor bolts, and other appurtenances as specified or required for a complete installation.

C. All pumps shall be of the same manufacturer. Equipment Schedule is provided at the end of this section.

D. The pumping units shall be of the self-priming, positive displacement, progressing cavity type.

E. 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.

F. The unit shall include all manufacture's motors, starters/electrical work necessary connecting conduit, wiring controls, control panels within requirements of Division 26. Motor starters shall be provided under Division 26 by the Electrical Contractor.

G. Coordinate all work with this equipment and any other associated equipment, installed and specified under other sections of these specifications.

H. The Supplier shall examine the Site conditions, intended application, and operation of the pump system and recommend the pump which will best satisfy the indicated requirements.

I. All work performed under this section shall be in accordance with all approved trade practices and manufacturer's recommendations.

1.3 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

B. Provide equipment that is a standard product of the manufacturer.

C. The pumps, gear reducers, and motors shall be a product of the manufacturers' regularly engaged in the manufacturing of equipment having similar service and equal size for a minimum of ten (10) years and a minimum 20 installations at equivalent applications. Supplier shall provide a list of names and dates of installations for verification by the engineer or Owner's Representative.

D. Factory test each pump using water with a factory certified motor, the same size as that specified. 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. Submit copies of the performance curves to the Contractor for Engineer review prior to releasing the pumps to the Contractor. The standards of the Hydraulic Institute shall govern the procedures and calculations for these tests.

E. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

1.4 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Division 1 Specification Sections.

B. Product Data: Submit the manufacturer's technical data and installation instructions including certified pump curves with efficiency, capacity, head, speed, brake horsepower required, and operating point required for each pump.

C. Shop Drawings: Submit the manufacturer's technical data and installation instructions including certified pump curves with efficiency, capacity, head, speed, brake horsepower required, and operating point required for each pump.

1. Complete description in sufficient detail to permit an item-by-item comparison with the Specification. Complete description in sufficient detail to permit an item-by-item comparison with the Specification,
2. Dimensions and required clearances,
3. Pump with motor weights
4. Performance data including pump curves showing overall pump efficiencies, low rate, head, break horsepower, motor horsepower, speed and shat-off head.
5. Materials of construction
6. Layout drawings for all equipment showing installation details and anchor bolt layout.
7. Wiring diagrams for all electrical equipment.
8. Deviations from Contract Documents.

9. Manufacturer's installation and testing instruction.
10. Manufacturer's standard guarantee.
11. Certification from the pump supplier that site conditions have been examined.

D. Maintenance and Operating Instructions, including the following additional information:

1. Recommendations for short- and long-term storage.
2. Explanation of operating safety considerations.
3. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.
4. Repair parts and maintenance materials.
5. Troubleshooting data.
6. Repair data.
7. Manufacturer’s warranty.

1.5 DELIVERY, STORAGE AND HANDLING

A. All equipment shall be delivered in the largest pieces practical for field assembly by the Contractor. Individual pieces shall be permanently tagged with welded erection marks or stainless-steel tags cross referenced with information on the manufacturer's erection and assembly drawings.

B. Packing, Shipping, Handling and Unloading.

1. Comply with Section 016600, Product Handling and Protection.

C. Acceptance at Site.

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.

D. Storage and Protection

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 instructions.

1.6 SEQUENCING

A. Do not install equipment until design strength of all cast-in-place concrete supporting elements has been attained and all supporting steel has been adequately bolted, braced, and welded.

B. Comply with Section 011100 Summary of Work.

1.7 WARRANTY

A. The pump manufacturer shall guarantee the complete pumping assemblies for a period of 12 months after acceptance or 18 months after shipment, whichever occurs first. The warranty as specified here shall cover all defective parts, material, and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the specification, the acceptable manufacturers:

1. Moyno Pumps.
2. Or Engineer Approved equal.

B. Contractor choosing an alternative shall refer to the Bid Form. Any proposed alternative must provide all of the qualities described within this specification along with the bid.

2.2 PUMP CONSTRUCTION

A. General:

1. The pumps shall be heavy duty, positive displacement, single stage, progressing cavity type. The pumps shall be cradle mounted to allow the normally vertical suction port to be rotated to any angle perpendicular to the centerline to facilitate piping connections.

B. Pump Suction and Discharge Casing

1. The pump casing shall be designed for the type of service specified and shall be of sufficient strength, weight, and metal thickness to ensure long life, accurate alignment, and reliable operation.
2. The suction and discharge connections shall be ANSI/B16.1 flanges sized for the pump specified.
3. Two (2) square hand-hole side plates on each side of the pump, 180° apart, large enough to permit easy inspection of the drive shaft joint and mechanical seal and servicing of pump.
4. The casing shall have 3/4-inch FNPT connection for vent or drain. The connections shall be at the highest and lowest point of the housing regardless of suction orientation.
5. There shall be a top inspection cover integral to the design to allow for inspection of rotor joint and clean out of the suction body.

C. Stator

1. Stators shall be of double helix design and chemically bonded to the inside of a carbon steel tube. The stator shall be fastened to the suction housing and discharge flange with removable clamp rings to facilitate stator removal. The stator seals shall be designed to prevent the material being pumped from contacting the stator bonding and tube.

D. Rotor:

1. The rotor shall be single helix tungsten coated alloy steel in accordance with ASTM A-331, Grade 4150 cold finish with a yield strength exceeding 55,000 psi. The rotor shall be of one-piece design with integrally machined rotor head. Rotors made in long lengths and cut to

size, with welded rotor heads, are not permitted. 1) The pump shall be provided with a fiber deflector to prevent ragging around the pump connecting rod and rotor head.

E. Joints

1. Gear joints shall be of the grease lubricated crowned gear type, totally enclosed and protected by a wire reinforced elastomeric seal.

2. Mechanical components of the gear joints shall be designed to operate for 10,000 hours at the manufacturer's published maximum speeds and pressures.

3. The connecting rod shall pass through the shaft seal area inside the hollow drive shaft quill so that no eccentric loads are imparted on the shaft seal area.

F. Shaft Seal

1. The stuffing box shall be equipped with a split packing gland and split Teflon lantern ring to permit repacking of the pump without removing the bearings or drive shaft components. Fittings shall be provided for grease lubrication of the packing. Pump manufacturer shall supply the following parts for the seal water system: Y-strainer, pressure gauge, ball valve, pressure regulator valve, and pressure switch for each new pump.

G. Pump Drive Shaft

1. The drive shaft shall be of one-piece construction through the bearings and shaft seal area. This design shall permit disassembly of the universal joints without affecting the alignment of the shaft in the shaft sealing area.

2. The quill portion of the shaft shall be hard chrome plated.

H. Bearings

1. The tapered roller type with diverging pressure angle bearings shall grease lubricated and integral to the pump. Close-coupled pumps which do not utilize integral bearings are not permitted. Bearings shall be designed to provide a minimum B-10 service life of 100,000 hours when operating at the maximum operating conditions without periodic lubrication. The bearings shall be protected from contaminants with a bearing cover plate bolted to the bearing housing. The bearings shall be enclosed in a separate housing, incorporating a bearing spacer and bolted bearing cover eliminating bearing shimming.

2. The stuffing box shall be equipped with a split packing gland and split teflon lantern ring to permit repacking of the pump without removing the bearings or drive shaft components. Fittings will be provided for (grease) (water) lubrication of the packing.

I. Motor mounted in a piggy-bag arrangement with belts and guards:

1. Motor shall be of sufficient size so that there will be no overload on the motor above rated nameplate horsepower under any condition of operation from shut-off to zero head, unless otherwise specifically permitted in this Section.

2. Motor Enclosure Type: TEFC

3. Motors shall be suitable for use on adjustable frequency drives.

J. Belt Drive:

1. Belt drives shall be either V-belt or cogged timing belt. V-belt and sheave groove dimensional tolerances shall be in accordance with the "Engineering Standards – Multiple V-Belt Drives" published by the Multiple V-Belt Drive and Mechanical Power Transmission

Association. Belt drives shall have a service factor of at least 1.6 at maximum speed based on the nameplate power rating of the drive motor. The speed reduction ratio of belt drives shall not exceed 5 to 1. Sufficient clearance shall be provided for access to the stuffing box. Each belt drive shall include a sliding base or other suitable means of tension adjustment. Belt drives shall be the piggy-back type.

2.3 ACCESSORIES

A. Pump dry-run protection

1. The pump shall have a thermal probe attached to the stator to monitor stator temperature.

2. The probe shall be connected to a control that would trigger a switch to activate an alarm and/or to shut the pump down to prevent dry run (not ruin the stator). The pump safety control instruments shall be provided by the pump manufacturer and installed in the Control Panel by the Control Integrator.

B. Over Pressure Protection: Each pump unit shall be supplied with a silicone-filled isolation ring with a dual mounted gauge and single point pressure switch. The pressure ranges for the switch and gauge shall be selected specifically for each specified service. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the plans and be constructed with a carbon steel body and fittings with a Buna sleeve.

1. A discharge pressure gauge and pressure switch shall be furnished by the pump manufacturer for each pump. The pressure shall read in pounds per square inch. The range of each pressure transmitter shall be 0-50 psig.

2. The pressure switch and gauge shall be protected by a radial gauge isolator capable of covering the full pressure range. Flat diaphragm isolators are not acceptable.

3. The switch shall be SPDT, NEMA 4.

C. Suction side pressure gauges:

1. Gauge connection shall be 3/4-inch diameter.

2. Each connection shall include a shutoff needle valve and necessary length of pipe to allow the mounting of a pressure gauge. The open end of the gauge connection shall be plugged to prevent the accumulation of debris.

3. Each pump shall be supplied with liquid filled pressure gauge(s) with snubber and diaphragm seal. Liquid shall be glycerin-water mixture. Suction gauge shall be adequately sized to indicate suction conditions. The gauges shall be properly installed on the pump suction and discharge lines.

4. On suction side, the gauges shall operate over a range of 20 inches of mercury vacuum to 10 psig pressure.

5. Manufacturer: Gauges shall be a product of H.O. Trerice, Ashcroft, Wika or equal.

D. The Contractor shall provide expansion joints for pump suction and discharge lines. Flexible Expansion Pump Connectors: Expansion joints shall be a rubber spool type of a single, open wide arch design. Joint construction shall consist of a Butyl tube and cover, reinforced with a suitable woven fabric. Joints shall be designed to meet the design pressures and temperature for the system. Expansion joints ends shall be flanges drilled to 150 lbs class standards, and be full rubber faced and integral to the body. Flange backing rings of cast iron with a built-

in support sleeve shall be provided. Expansion joints shall be Flexicraft Industries, Flextra 150 Model, or equal.

E. Data Plates: Attach stainless steel data plates to the pump, showing the manufacturer's name, pump size and type, serial number, capacity and head rating, and other pertinent data. Attach a special data plate to the pump frame listing identification of the frame and bearing numbers.

F. Hardware: All machine bolts, nuts and cap screws shall be hex head. Hardware or parts requiring special tools or wrenches shall not be used.

2.4 CONTROLS

A. The Electrical Contractor shall provide the Ethernet IP connection to Screw Press Control panel for the Dewatering Feed Pumps.

B. Dewatering Feed Pumps will be controlled by VFD's to be provided by the electrical contractor. Reference specification section 262419.

C. Each pump shall be provided with easily identifiable terminal points to facilitate the exchange of the central control functions between the pumps and the process control system as indicated on the Contract Drawings

D. Sludge Dewatering Feed Pumps

1. Local Control Panel shall be equipped with Hand/Off/Auto selector switch to be provided by Electrical Contractor.

2. Interlocks: Pump #1 or 2 and the Screw Press.

3. When selector switch is set to automatic mode of operation "AUTO" at the Dewatering Feed Pump and Screw Press, the dewatering system runs together, and operation is controlled from the Screw Press HMI Screen. The flowmeter controller located in the Sludge Dewatering Building on the Dewatering Feed Pump force main to the Screw Press, it shall control the VFDs on the feed pump.

   Note, there are only manual valves installed on the pump suction and discharge piping. The flow path shall be set by opening corresponding valves on the suction and discharge piping prior starting dewatering operation.

4. The "Hand" mode of operation is manly for the equipment maintenance, it initiates the Pump run only from the Local Control Panel.

5. Alarms
   a. If Pump stops running, it triggers an Alarm and shut down the Screw Press.
   b. If Screw Press stops running, it shall stop the Pump operation.
   c. Pump Alarms
      1) Pump running dry.
      2) Over pressure.
      3) Motor overload.
      4) If Pump stops running it shall annunciate an Alarm and stop Screw Press.

2.5 SPARE PARTS AND SPECIAL TOOLS

A. Spare parts to be provided for each pump supplied:

1. One (1) complete mechanical seal
2. One (1) one rotor
3. One (1) stator
4. One (1) connecting rod assembly.
5. One (1) joint kit
6. One (1) set V-belts, where applicable.
7. One (1) complete set of any special tools required to dismantle pump.

2.6 SURFACE PREPARATION AND PAINING

A. Shop Finishing

1. Protect all exposed ferrous metals with a minimum of one coat of shop primer. Apply an additional coat of two-part epoxy to motors, pumps, gear boxes, and other similar equipment.
2. All surfaces must be dry, clean, and free of rust, scale, oil and grease. Clean steel surfaces by pickling or blasting to a minimum of SSPC-SP6.
3. Surface preparation, application and minimum DFT millage to be as per the paint manufactures published recommendation.
4. Painting shall be in accordance with the manufacturer standards.

B. Field Painting

1. All rust, scale, dirt or other foreign matter shall be removed by solvent cleaning, wire brushing, short blasting or other standard commercial cleaning procedure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment and accessories in accordance with reviewed Shop Drawings and manufacturer's instructions, as specified herein and shown on Contract Drawings.

B. Furnish and set stainless steel anchor bolts with nuts and washers in accordance with the manufacturer's recommendations.

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 supply and control to electrical equipment supplied in this Section shall be furnished and installed in Division - 16, Electrical.

E. Motor size: Any deviation in motor size must be approved by the Engineer. Any electrical equipment or wiring that must change to accommodate a different size motor will be at no additional cost to the Owner.

F. The grade and amount of oil and grease shall be in accordance with the manufacturer's recommendations.

G. Initial lubrication required for startup and field test operation shall be furnished and applied in accordance with the manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

A. The manufacturer shall furnish the services of a qualified representative for a period of not less than one day to inspect and adjust the equipment furnished in this section. This qualified representative shall also conduct such tests as necessary to demonstrate satisfactory operation and to instruct the Owner's personnel in the care and operation of the equipment.

B. The service representative of the Manufacture shall be present at the site for two (2) work-days, to furnish the startup services and training of the Owner's personnel covering the operation, mechanical maintenance and electrical requirements. If additional service is required due to the mechanisms not being fully operational, at the time of service requested by the contractor, the additional service days will be at the contractor's expense.

C. For the purposes of this section, a work-day is defined as an eight hour period at the Site, excluding travel time.

3.3 TESTING

A. After completion of installation, the pumps shall be completely tested to demonstrate compliance with operating requirements as specified.

3.4 MAINTENANCE

A. Comply with the requirements of Section 017823

B. Repair Parts and Maintenance Material:

1. Supply tools and a repair parts kit for the pump furnished as recommended by the manufacturer.

3.5 PUMP SCHEDULE

A. SLUDGE DEWATERING FEED PUMPS

1.	Location	-	Sludge Transport / Electrical Building
2.	Service Equipment	-	Sludge feed from the Sludge Wet Well to Dewatering
3.	Fluid service	-	Aerobically Digested waste activated sludge.
4.	Percent of Solids	-	2% to 6%
5.	Quantity	-	2
6.	Number of stages	-	1
7.	Design flow capacity	-	70 gpm
8.	Design flow pump head	-	26.32 ft

9.	Maximum pump speed	-	300 RPM
10.	Suction Lift	-	22 ft
11.	Duty	-	Constant
12.	Minimum motor size	-	5 Hp
13.	Motor Speed	-	1750 RPM
14.	Drive	-	VFD
15.	Ambient environment	-	Indoors
16.	Fluid temperature	-	Ambient
17.	Type of suction port	-	Flanged
18.	Suction and Discharge:	-	6" 125 # FF ANSI per ASME 16.5B
19.	Maximum overall length:	-	56 inch

END OF SECTION 432110