

SECTION 11315

PROGRESSIVE CAVITY PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope

1. Furnish and install horizontal progressive cavity pumps
 - a. Pumps SCP-1 and SCP-1 for secondary clarifier scum pumping
 - b. Pumps DSP-1 and DSP-2 for aerobically digested sludge pumping
 - c. Pumps SCP-1, SCP-2, DSP-1 and DSP-2 installed in Pumping and Disinfection Building
2. Each pumping unit to be furnished complete with electric motor, coupling connected drive train, coupling guard, body, rotor, stator, shafting, mechanical seals, bearings, base plate, anchor bolts, and all other appurtenances and accessories as specified herein and as required for proper installation and operation
3. Pump seals to be water lubricated by nonpotable water system
4. Provide manufacturer's field services

B. Additional Requirements Specified Elsewhere

1. Section 01010: Summary of Work
2. Section 01340: Shop Drawings, Product Data and Samples
3. Section 01400: Quality Control
4. Section 01600: Materials and Equipment
5. Section 01730: Operating and Maintenance Data

C. Related Requirements Specified Elsewhere

1. Section 02615: Ductile Iron Pipe
2. Section 03600: Grout
3. Section 05501: Anchor Bolts and Drilled-In Anchors
4. Section 09900: Painting
5. Section 13300: Utility Control System
6. Division 16: Electrical

D. Definitions: Definitions of terms and other hydraulic considerations as set forth in the Hydraulic Institute Standards

1.2 QUALITY ASSURANCE

A. Design Basis

1. Robbins & Myers, Moyno Pump Division, Series 2000 pumps
2. Seepex, Inc., Series N pumps

3. Netzsch, Inc., Nemo Pump Division
4. Equivalent products of other manufacturers may be accepted subject to compliance with design, function, materials, and performance of the specified items

B. Reference Standards

1. Hydraulic Institute Standards

1.3 SUBMITTALS

A. In accordance with Section 01340

B. Shop Drawings and Product Data

1. Submit sufficient data to verify compliance with these specifications and to illustrate construction and assembly of the products
2. Submit complete fabrication, assembly, foundation, and installation drawings
3. Submit detailed specifications and data describing materials, parts, devices, and accessories
4. Pumps
 - a. Name of manufacturer
 - b. Type and model
 - c. Rotative speed
 - d. Size of suction flange
 - e. Size of discharge flange
 - f. Type of bearings and bearing numbers
 - g. Net weight of pump
 - h. Complete performance curves
 - i. Maximum bhp requirement at extreme head condition
 - j. Shop painting data
5. Motors
 - a. Manufacturer
 - b. Type and model
 - c. Horsepower rating and service factor
 - d. Temperature rating
 - e. Full load rotative speed
 - f. Bearing types and numbers
 - g. Net weight
 - h. Full load current
 - i. Locked rotor current

C. Test Reports

1. Submit copies of field test reports
2. Reports shall include
 - a. Test Log
 - b. Description of test procedure, equipment and setup
 - c. Performance curves, plotted against pressure
 - 1) Capacity

- 2) Brake horsepower
- 3) Efficiency
- d. Plot curves to be easily read at scales consistent with the performance requirements

D. Certification of Compliance

1. Manufacturer's affidavit of compliance certifying
 - a. All equipment and materials comply with these specifications with any exceptions noted
 - b. Pumps have been properly installed and are operating within specification tolerances
 - c. All tests have been performed with satisfactory results

E. Operating and Maintenance Manuals in accordance with Section 01730

1.4 ANCHOR BOLTS

- A. Furnished with the equipment supplied
- B. Provide in accordance with Section 05501
- C. All anchor bolts, nuts and washers to be stainless steel per Section 05501

1.5 JOB CONDITIONS

A. Scum Pumps: SCP-1 and SCP-2

1. Pumped fluid
 - a. Activated sludge secondary clarifier surface scum from surface skimmer
 - b. Altitude: 5390 feet above sea level
 - c. Solids concentration: 0.01% to 3%
 - d. Temperature range: 0.5°C to 23°C

B. Digested Sludge Pumps: DSP-1 and DSP-2

1. Pumped fluid
 - a. Aerobically digested sludge from aerobic digesters to biosolids dewatering facilities
 - b. Altitude: 5390 feet above seal level
 - c. Solids concentration: 0.1% to 3%
 - d. Temperature range: 5°C to 23°C

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN REQUIREMENTS

A. General

1. Stable and free from cavitation and noise throughout the pump's head and capacity range at all speeds and suction submergences

2. Stable head - capacity curve
3. Minimum hydrostatic test pressure: 100 psi
4. Performance requirements based on previously reported liquid characteristics and elevation
5. Refer to Drawings for location of suction and discharge piping connections
 - a. Suction at motor end of pump assembly
 - b. Refer to specific manufacturer's product for direction of rotation for desired suction and discharge configuration

B. Scum Pumps: SCP-1 and SCP-2

1. Number of units: 2
2. Rated capacity at maximum design operating speed: 94 gpm
3. Total head at rated capacity: 6.7 psi
4. Maximum pump operating speed at rated capacity: 500 rpm
5. Maximum motor operating speed: 900 rpm, nominal
6. Maximum brake horsepower (bhp) required at input shaft for any point in operating range: 4.4
7. Maximum motor nameplate rating: 5 hp
8. Minimum diameter of test sphere: 0.6 inch
9. Maximum NPSH required at any point in operating range: 12.0 feet

C. Digested Sludge Pumps: DSP-1 and DSP-2

1. Number of units: 2
2. Rated capacity at maximum design operating speed: 230 gpm
3. Total head at rated capacity: 12.1 psi
4. Maximum pump operating speed at rated capacity: 500 rpm
5. Maximum motor operating speed: 900 rpm, nominal
6. Maximum brake horsepower (bhp) required at input shaft for any point in operating range: 6.7
7. Maximum motor nameplate rating: 15 hp
8. Minimum diameter of test sphere: 0.6 inch
9. Maximum NPSH required at any point in operating range: 12.0 feet

2.2 MATERIALS

A. Scum Pumps: SCP-1 and SCP-2

1. Body: Cast iron, ASTM 48
2. Rotor: High carbon steel, hard chrome plated, Brinell 550+
3. Stator: Synthetic rubber, EPDM, Durometer 70 plus or minus 5, enclosed in steel pipe sleeve
4. Drive shaft: Alloy steel, SAE 8620, hard chrome plated
5. Universal joints: Alloy Steel, SAE 8620
6. Bearings: Grease lubricated antifriction, minimum B-10 life of 100,000 hours at maximum rated head in accordance with AFBMA
7. Stuffing box gland, lantern ring, bolts, and nuts: Corrosion resistant
8. Mechanical seals
 - a. Metal components: 316 stainless steel

- b. Stationary face: Silicon carbide
- c. Rotary face: Silicon carbide

B. Digested Sludge Pumps: DSP-1 and DSP-2

- 1. Same as for scum pumps SCP-1 and SCP-2

2.3 FABRICATION AND MANUFACTURE

A. Applicable to SCP and DSP pumps unless otherwise noted

B. Pump Construction

- 1. Suction and discharge nozzles
 - a. ANSI 125 pound flanges
 - b. Tapped and plugged for pressure gauge connections
- 2. Stuffing box with mechanical seals
 - a. Single mechanical seal
 - 1) Cartridge seal system design with sleeve, gland and seal all in one
 - 2) Balanced o-ring seal design
 - 3) Flushing connection built into seal gland
 - 4) Field replaceable stationary and rotary face elements
 - b. Suitable for conversion to use standard packing
 - 1) Minimum of five (5) packing rings plus lantern ring in length
 - 2) Flushing connection at normal lantern ring position with temporary plug
 - c. Provide seal water connections as indicated on Drawings
- 3. Connection between the drive shaft and the rotor to be a geared ball and socket universal joint type
 - a. Protected from pumped fluid by a thick rubber diaphragm
- 4. Provide a conveniently located cleanout handhole at the driven or suction end of the rotor

C. Baseplates

- 1. Provide adequate openings to facilitate grouting, leveling and adjustment to fit up piping connections
- 2. Continuously weld and grind smooth all seams and contact edges between steel plates and shapes
- 3. Provide stainless steel trough beneath the pump gland
 - a. $\frac{3}{4}$ " drain connections
 - b. Convey gland leakage directly to drainage system in PVC piping or flexible PE tubing

D. Drive Assemblies

- 1. Inline gear joint connection
- 2. V-belt drive not acceptable
- 3. Fabricated steel coupling guard

E. Motors

1. Induction type, inverter duty rated, suitable for future use with adjustable frequency drive system
2. Motors to be sized for the altitude at location where equipment is to be installed
 - a. Sized so that under maximum continuous design load imposed by driven equipment, motor nameplate horsepower will not be exceeded
3. High efficiency design
4. 480 volt, 3-phase, 60 Hz
5. Service factor: 1.15, minimum
6. Duty cycle: Continuous, severe duty
7. Enclosure: TEFC or TENV
8. Conform with additional requirements of Section 01600

F. Balance

1. Accurately machine all rotating parts
2. Assembled pump to be in as near perfect rotational balance as practicable
3. Equipment which vibrates excessively will be rejected
4. The mass of the unit and its distribution shall be such that resonance at any operating speed is avoided
5. Limits
 - a. Maximum peak to peak vibration displacement at any point on the machine: 5.0 mils
 - b. Maximum peak to peak vibration displacement of shaft at face of stuffing box: 2.0 mils
 - c. Ratio of rotative speed to critical speed of unit or components: Less than 0.8 or more than 1.3

G. Accessories

1. Presence/absence detector
 - a. Dry pipe detector mounted in suction piping as indicated on the Drawings
 - b. Protect pump from dry running by automatic shutoff of pump when absence of fluid is detected
 - c. Integrally mounted sensor flange
 - d. Adjustable time delay, 0 to 30 seconds
 - e. Flange construction 150 lb., size to match suction piping
 - f. Princo Model L3515 or equal
2. High discharge pressure switch
 - a. Mounted in pump discharge piping as indicated on the Drawings
 - b. Protect pump, piping and appurtenances from overpressure damage by automatic shutoff of pump when a preset, high pressure point is reached
 - c. Flexible elastomer to isolate pressure sensing fluid within the device from the pumped fluid
 - d. Provide switch and pressure gauge configuration
 - e. Construction to allow installation between pipe flanges
 - f. Moyno Series W pressure sensor or equal

H. Control Panels

1. Provide a control panel for each pump
 - a. Suitable for mounting on Unistrut[®] supports or wall mounting at location indicated on the Drawings
 - b. Physical size of panel shall be held to the absolute minimum required
2. NEMA 4X enclosure with front panel mounted devices
 - a. Selector switches
 - b. Push buttons
 - c. Indicator lights
3. Selector switches
 - a. Main power disconnect switch capable of being locked in the "Off" position
 - b. Control power: On/Off
 - c. Alarm/protection circuits: On/Off
 - 1) Presence/absence detector
 - 2) High discharge pressure switch
 - 3) Pump overload
 - d. Pump control: Hand/Off/Auto
 - 1) In "Hand" position: Pump to run continuously
 - 2) In "Auto" position
 - a) Scum pumps SCP-1 and SCP-1 to start and stop in response to float switches in scum pits at clarifiers
 - b) Digested sludge pumps DSP-1 and DSP-2 to start and stop in response to SCADA system signal
 - 3) Alarm/protection circuits to be functional with selector switch in "Hand" or "Auto" position
4. Push buttons
 - a. Lamp test
 - b. Alarm reset
5. Indicator lights
 - a. Control power on: White
 - b. Alarm protection system on: Green
 - c. Pump running: Green
 - d. Pump in standby: Amber
 - 1) Illuminated when pump control selector switch in "Auto" position and pump not running
 - e. Presence/absence alarm: Red
 - f. High discharge pressure alarm: Red
 - g. High motor current alarm: Red
6. Motor overload protection system
 - a. Motor overload shock relay measuring motor current draw
 - b. Stop motor and annunciate alarm on high current draw
 - c. Set point to be adjustable
7. Alarms
 - a. Provide alarms and circuitry as specified herein to interrupt power supply to pump motor
 - b. Provide dry contacts to send individual alarm signals to remote location
8. Control panel to include
 - a. Motor starter

- 1) Full voltage, non-reversing for motors 7.5 hp and below
 - 2) For motors 10 hp and above, provide soft starting device that limits in-rush current to no more than 2.5 times full load amperage
 - b. Transformer suitable for supplying control power requirements
 - c. Relays, contacts and controllers to operate the pump as described herein
 - d. Fuses and fuse block for control circuits
 - e. Terminal block for all wiring connections
9. Clearly label all front panel mounted items on the outside front of the panel
- I. Shop prime in accordance with Section 01600 and Section 09900

2.4 SPARE PARTS

- A. Furnish spare parts as recommended by the manufacturer
- B. The following spare parts to be furnished as a minimum for each different pump furnished
1. One (1) stator
 2. One (1) rotor
 3. One (1) connecting rod with universal joint assembly on each end
 4. One (1) spare seal kit

PART 3 - EXECUTION

3.1 INSTALLATION

- A. In accordance with procedures recommended by pump manufacturer, Hydraulics Institute and as specified herein
- B. Accurately locate anchor bolts
1. Refer to Section 05501 for additional requirements
- C. Level, plumb, align, and wedge unit into position to fit connecting piping
- D. Grout pump base after initial fitting and alignment but before final bolting of connecting piping
- E. Take special care to maintain alignment of components
1. Correct any misalignment, noisy operation or other indications of improper setting
- F. No strain to be transmitted to the pump connections
- G. Test pump connections for piping stresses after final adjustment and bolting
1. Loosen connections
 2. If any movement or opening of joints is observed, adjust piping to fit

- H. Realign couplings and joints after grouting
- I. Do not shim between machined surfaces
- J. Field paint in accordance with Section 09900
- K. Remove all grease, dirt, excess paint, etc. from equipment surfaces prior to final acceptance
- L. Take precautions, as necessary, to properly protect all equipment from damage
 - 1. Installed equipment to be protected from further construction operations

3.2 FIELD QUALITY CONTROL

- A. Provide manufacturer's field services
 - 1. Qualifications of manufacturer's representative
 - a. Authorized representative of the manufacturer
 - b. Experienced in the application, installation, operation and maintenance of the subject work, materials and equipment
 - 2. Services provided by representative
 - a. Provide guidance regarding proper installation
 - b. Inspect, check, adjust and test equipment installed, as required, and approve final installation
 - c. Be present when equipment is placed in operation by Contractor and Owner's personnel
 - d. Revisit site as often as required to correct all problems until equipment installation and operation are acceptable to Engineer and Owner
 - 3. Manufacturer's representative to instruct Owner's personnel in the operation and maintenance of the equipment furnished, including classroom and field training
- B. Furnish three (3) copies of written report to Engineer certifying that
 - 1. Equipment is properly installed and lubricated
 - 2. Equipment is in accurate alignment and balance
 - 3. Equipment is free from any undue stress imposed by connecting piping, anchor bolts, etc.
 - 4. Equipment has operated satisfactorily under full load conditions and as specified through full operating range

END OF SECTION