

## SECTION 11176 - SUBMERSIBLE NON-CLOG PUMPS

### City of San Diego, CWP Guidelines

#### PART 1 -- GENERAL

##### 1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing heavy-duty submersible non-clog pumps with submersible electric motors, discharge elbows, guide bars and brackets, access frames and covers, and all appurtenant work, with discharge connections 4 inches and larger.
- B. Each pump shall be of the vertical shaft, centrifugal type, suitable for pumping fluids containing sewage solids. Pumps shall be designed for continuous operation under submerged, partially submerged or totally dry condition without damage to the pump and motor.

##### 1.2 RELATED SECTIONS

- A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.
  - 1. Section 11175 Pumps, General

##### 1.3 FACTORY TESTING

- A. The CONTRACTOR shall be responsible for all costs associated with inspection and testing of materials, products, or equipment at the place of manufacture. This shall include costs for travel, meals, lodging, and car rental for [two] OWNER-designated inspectors for [ ] days required to complete such inspections or observations exclusive of travel days, if the place of manufacture, fabrication and factory testing is more than fifty (50) miles outside the geographical limit of the City. The CONTRACTOR shall not be responsible for salary or salary-related costs of the inspectors. The CONTRACTOR shall comply with the requirements of Section 01400.
- B. In addition to the factory tests indicated in Section 11175, each pump shall be tested for performance at the factory to determine head versus capacity, efficiencies, and kilowatt draw required for the operating points indicated. All tests shall be run in accordance with the American Hydraulic Institute Standards. Testing shall also include the following:
  - 1. Impeller, motor rating, and electrical connections shall first be checked for compliance with the Contract Documents.
  - 2. A motor and cable insulation test for moisture content or insulation defects shall be made.
  - 3. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
  - 4. The pump shall be run for 30 minutes submerged, a minimum of 6 feet under water, at 1/4, 1/2, 3/4, and full flow, without cavitation or overheating.

5. After operational test described in Item 4, the insulation test described in Item 2 shall be performed again.

C. A written report stating the tests have successfully been completed and providing the results of the test shall be furnished for each pump.

#### 1.4 GUARANTEES AND WARRANTIES

A. The CONTRACTOR shall furnish a manufacturer's warranty, in writing, for at least 5 years or 10,000 operating hours, for the pumping units, against defects in materials and workmanship.

### PART 2 -- PRODUCTS

2.1 PUMP NAME [ ] - (P-[ ] through P-[ ])

#### A. General:

1. Number of pumping units -[ ]
2. Location -[ ]
3. Service -[raw sewage,] [unscreened][ ]
4. Operation (hours per day) -[ ]
5. Type of drive -[constant] [variable] speed
6. Sump classification [Class 1, Division 1, Groups C and D]
7. Pump removal method -[rails or cables]

#### B. Operating Conditions:

1. Capacity (gpm) max -[ ]  
at design point -[ ]  
min -[ ]
2. NPSH available at suction (ft) -[ ]
3. Pump head (TDH-ft) at max, gpm -[ ]  
at design point -[ ]  
at min gpm -[ ]
4. Total discharge head (ft) at min capacity -[ ]
5. Wire-to-water efficiency at design point, min (percent) -[ ]

6.	Liquid to be pumped	-[raw sewage, containing grit, fats, organic materials, and petroleum products]
7.	Specific gravity of liquid	-[ ]
8.	Liquid temperature (degrees F)	-[ ]
9.	Minimum size of spheres passing through pump (in.-dia.)	-[ ]
10.	Max pump speed (rpm)	-[ ]
11.	Max motor speed (rpm)	-[ ]
12.	Min motor size (hp)	-[ ]
13.	Power supply	-[480-volt] [3-phase] [60-Hz]

## 2.2 PUMP REQUIREMENTS

### A. **General:**

1. The pumps shall be controlled by [local or remote, manual starters, with the addition of a low water cut-off float switch].
2. Each pump shall be capable of continuous operation at full load with a water level of [36] inches above the invert of the wet pit, without cavitation or overheating of the motor. The maximum expected ambient temperature inside the sump is 115 degrees F.
3. Each pump, with its cable and appurtenances, shall be able to withstand continuous submergence to a minimum depth of 65 feet, when running or off, without leakage.
4. Each pump shall be able to operate for short periods at zero static suction head without causing any damage to any part of the unit.

### B. **Pump Construction:** Construction of submersible non-clog pumps shall conform to the following requirements:

1. Connections: Machined metal-to-metal quick disconnect type, for withdrawal of unit from above, without disconnecting pipe. When lowered into place, the pump shall automatically connect and lock into the discharge pipe without touching the floor.
2. Pump Design: Single stage, centrifugal type, close-coupled to sealed electric motor, for operation in dry or wet pit, without external cooling.
3. Impeller: Two-port or 3-port non-clog type dynamically balanced, with replaceable wear rings in casing, to handle raw unscreened sewage, solids, and fibrous materials.
4. Pump Shaft: Same diameter along its length, without machined shoulders. Minimum surface finish: 12 micro-inches.

5. Bearings: Permanently lubricated, heavy-duty axial and radial ball or roller bearings, top and bottom, double shielded with a minimum L-10 life of [50,000] hours, at continuous, maximum load and speed, supported by detailed calculations, to be submitted with the shop drawings.
6. Seals: Independent double mechanical shaft seals, easily replaceable, oil lubricated, with moisture detector probes, alarm, and test circuits. The seals shall not require any maintenance or adjustment, nor any differential pressure to effect sealing.
7. Oil Chamber: To supply oil for lubrication and cooling of the shaft seals.
8. Support: Cast duckfoot bend or discharge elbow with machined face, anchored to sump floor.
9. Cables: Each pump shall be furnished with the necessary cables for power connection, moisture detection, and overload protection, sheathed, coded, and suitable for submersible pumps, and of sufficient length for direct connection to the terminal boxes indicated. All cables shall be connected to the pumps and tested at the factory.
10. Lifting Devices: Each pump shall be furnished with Type 304 stainless steel guide rails with brackets and stainless steel Flygt Grip-Eye system of sufficient operating length, or with a stainless steel guide cable system with hooks and tension device.
11. Access Cover: Unless otherwise indicated, each pump shall be provided with a hinged access cover with frame cast into the top slab. Cover shall be aluminum, skidproof design, with flush locking mechanism and shall be designed to support a uniform live load of [ ] pounds per square foot with a safety factor of three. The doors shall be provided with stainless steel hinges, and lifting handle shall open to 90 degrees and lock automatically in that position. All hardware shall be stainless steel. Frame shall include upper attachment for guide rails and attachments for lifting chain and power cable. Access frames and covers shall be sized as indicated.

**C. Materials:**

- |   |   |
|---|---|
| 1. Pump, volute, oil casing, sliding bracket, motor frame | -cast iron, ASTM A-48   |
| 2. Impeller   | -cast iron, ASTM A-48   |
| 3. Pump shaft   | -[Type 316, 420, or 431 stainless steel] [SAE 1045 carbon steel with or without stainless steel sleeve] |
| 4. Exposed bolts, nuts, washers                           | -Type 316 or 304 stainless steel  |
| 5. Mechanical seals                                       | Independently operating double tungsten-carbide and carbon rings with stainless steel springs           |

6. Wear rings Type 304 stainless steel and nitrile rubber with steel insert, or other corrosion-resistant material

## 2.3 MOTOR

- A. **Approval:** The pumping system, including the motor and wiring, shall be approved by a nationally approved testing agency for explosion-proof service. The system shall be rated [Class I, Division 1, Group C and D] service as determined by the National Electric Code and approved by a nationally recognized testing agency (UL or FM) at the time of bidding of the project. The CONTRACTOR shall include in his bid a copy of certificate of approval.
- B. **Insulation:** Pump motors shall be designed for continuous duty in hazardous locations. The stator and stator leads shall be moisture-resistant, triple varnished and insulated according to Class F, capable of withstanding temperatures of up to 155°C. The allowable temperature rise of the motor at full load condition shall not exceed 80°C. The motor shall be capable of sustaining a minimum of 10 starts per hour and of operating continuously.
- C. **Stator:** The motor stator shall be mounted in an air-filled, watertight casing, and shall not be fixed in place by externally-mounted screws which may cause leakage in the motor.
- D. **Rating:** The motor shall be non-overloading all throughout the pump curve and shall have a combined service factor of 1.10 or greater.
- E. **Junction Box:** The motor shall have a junction box capable of being sealed completely from the stator casing to prevent leakage through the junction box into the stator housing should a motor cable be damaged.
- F. **Cable Entry:** The cable entry water seal design shall be such that it precludes specific torque requirements to ensure a watertight and submersible seal. Epoxies, silicones, or other secondary sealing systems shall not be used.
- G. **Cooling System:** Each pump shall be provided with an adequately designed cooling system using a wastewater jacket [and] [or] thermal radiator integrally cast with the stator casing. Cooling medium channels and ports shall be non-clogging by virtue of their dimensions.
- H. **Motor Protection:** Integral thermal sensors in the motors, one for each phase, shall be provided to monitor stator temperatures. These sensors shall be used in conjunction with and supplemented by external motor over-current protection fitted at the control panel.

## 2.4 CONTROLS

- A. The CONTRACTOR shall provide a complete control system housed in a motor control center with hinged, gasketed door and all necessary components as indicated, to provide the following for each pump:
1. Magnetic starter
  2. Disconnect switch
  3. Hand-Off-Remote setting
  4. On-Off switch at remote location

5. Pilot light
6. Low water alarm with contact and bell, one only
7. Level control float switches
8. Alarm reset switch, one only
  
9. Intrinsically safe switches shall include submersible sealed cables and stainless steel wall bracket
10. Dry contacts for remote alarm indication
11. Control and status module by the pump manufacturer

## 2.5 SPARE PARTS

- A. The following spare parts shall be provided for each pump:

1. 2 sets all gaskets and O-rings
2. 2 sets all bearings
3. 2 sets mechanical seals
4. 1 submersible cable with termination kit

Spare parts shall be packed and boxed as indicated in Section 11000.

## 2.6 MANUFACTURERS

- A. Products shall be manufactured by one of the following (or equal):

1. Flygt Corporation, model [        ];
2. K.S.B. Pumps, model [        ].

# **PART 3 -- EXECUTION**

## 3.1 INSTALLATION

- A. The pumps, piping, and controls shall be installed in accordance with the manufacturer's instructions and recommendations at the locations indicated. Installation shall include furnishing the required oil and grease for initial operation in accordance with the manufacturer's recommendations. Anchor bolts shall be set only after the discharge piping has been properly installed, to ensure exact fit with embedded piping components.

## 3.2 COATING

- A. All ferrous surfaces and passages of pumps, motors, and supports, in contact with the process fluid, shall be epoxy-coated in accordance with Section 09800, or with the pump manufacturer's equivalent coating.

## 3.3 FIELD TESTING AND TRAINING

- A. Field testing and operator training shall be as indicated above and in accordance with Section 11175.

\*\* END OF SECTION \*\*