

**DIVISION IV**  
**GRAVITY SEWERS, FORCE MAINS, AND PUMP STATIONS**

**SECTION 47**

**WASTEWATER PUMPS AND MOTORS**

**47.1 GENERAL**

The equipment covered by these specifications is intended to be standard submersible or above ground pumping equipment of proven ability as manufactured by a reputable firm having at least five (5) years experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as shown on the DRAWINGS.

All parts shall be so designed and proportioned as to have liberal strength, stiffness, and to be especially adapted for the work to be done. Ample space shall be provided for inspection, repairs, and adjustment. All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer and be of Type 304 stainless steel. Brass or stainless steel nameplates giving the name of the manufacturer, voltage, phase, rated horsepower, speed, and any other pertinent data shall be attached to each pump with stainless steel rivets. The nameplate rating of the motors shall not be exceeded.

The pumps shall be capable of handling raw unscreened domestic wastewater and minimum 3 inch diameter solid spheres. Pump operation shall be controlled automatically by means of float-type liquid level sensors in the wet well. Submersible pumps shall be mounted in the wet well as shown on the STANDARD DRAWINGS. Above ground pumps shall be installed as shown on the STANDARD DRAWINGS (See approved manufacturer's list in appendix).

**47.2 PUMP CONSTRUCTION**

**47.2.1 SHAFT**

The pump shaft shall be of Series 300 or 400 stainless steel or carbon steel. When a carbon steel shaft is provided, the manufacturer shall demonstrate that any part of the shaft which will normally come in contact with the wastewater has proven to be corrosion resistant in this application. The shaft and bearings shall be adequately designed to meet the maximum torque required for any start-up or operating condition and to minimize vibration and shaft deflection. As a minimum, the pump shaft shall rotate on two (2) permanently lubricated bearings. The upper bearing shall be a single row ball bearing. The lower bearing shall be a two row angular contact ball bearing, if required to minimize vibration and provide maximum bearing life.

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**47. 2. 2 IMPELLER**

The impeller shall be constructed of bronze or stainless steel. All external bolts and nuts shall be of Type 304 stainless steel. Each pump shall be provided with a replaceable metallic wear ring system to maintain pump efficiency. As a minimum one stationary wear ring provided in the pump volute or one rotating wear ring provide on the pump impeller shall be required. A two part system is acceptable.

**47. 2. 3 MECHANICAL SEAL**

Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. Silicon carbide may be used in place of tungsten carbide for the lower seal. The pumped liquid shall be sealed from the oil reservoir by one face seal and the oil reservoir from the air-filled motor chamber by the other. The seals shall require neither maintenance nor adjustment and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing which are subject to opening and penetration by pumping forces shall not be considered equal to tandem seal specified and required.

**47. 2. 4 GUIDES FOR SUBMERSIBLE PUMPS**

A sliding guide bracket for submersible pumps shall be an integral part of the pump casing. Said bracket shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wet well with stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts. Sealing of the pumps to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided by no less than two (2) Type 316 seamless tubular stainless steel guides which will press it tightly against the discharge

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connection. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm or similar method of sealing will not be accepted as an equal to a metal to metal contact of the pump discharge and mating discharge connection. Approved pump manufacturers, if necessary to meet the above specification, shall provide a sliding guide bracket adapter. The design shall be such that the pumps shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pumps shall be easily removable for inspection or service, requiring no bolts, nuts, or fastenings to be removed for this purpose. Said installation shall not require personnel to enter the wet well. Each pump shall be fitted with a Type 304 stainless steel 3/4 inch lifting chain of adequate strength. A 1/4 inch stainless steel cable, air craft rating, shall be provided between the cable holder and the lifting chain.

**47.3 MOTORS**

**47.3.1 GENERAL REQUIREMENTS**

All motors shall be built in accordance with latest NEMA, IEEE, ANSI, and AFBMA Standards where applicable. Pump motors shall be housed in an air-filled, water-tight casing, and have Class F insulated windings which shall be moisture resistant. Motors shall be NEMA Design B rated at 155 degrees C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially, or non-submerged condition as required for the individual pump type. Submersible pumps shall be capable of running continuously in a non-submerged condition under full load without damage for extended periods. The motor shall be capable of a minimum of 10 starts per hour. If required by the CITY, before final acceptance, a field running test demonstrating this ability, with 24 hours of continuous operation under the above conditions, shall be performed for all pumps being supplied. Motors 25 horsepower and below shall be rated 230/460 volt 3 phase. Motors greater than 25 horsepower shall be 460 volt 3 phase.

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**47.3.2 HEAT AND MOISTURE SENSORS**

Each motor shall incorporate a minimum of one ambient temperature compensated overheat sensing device and one moisture sensing device. These protective devices shall be wired into the pump controls in such a way that if excessive temperature or moisture is detected the pump will shut down. These devices shall be self-resetting.

In lieu of moisture and temperature sensors, each pump motor may have its motor winding insulation resistance monitored automatically by an solid state electronics module. Each automatic module must have an individual disconnect terminal plug, manual shut off switch, three lights to indicate 10 M ohm, 5 M ohm, and 1 M ohm resistance values, two output circuits for external alarms, and two switches for manual testing. The power source shall be 110 VAC fused at 0.24 AMP. The test voltage shall be 500-700 volts d.c. The automatic module shall monitor the motor resistance only when the motor is off and shall activate an alarm system when the motor resistance drops to 1 M ohm.

**47.3.3 CABLES**

Cables shall be designed specifically for submersible or above ground pump applications, as required, and shall be properly sealed. A type CGB water-tight connector with a neoprene gland shall be furnished with each pump to seal the cable entry at the control panel. The pump cable entry seal design shall preclude specific torque requirements to insure a water-tight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable. The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. Secondary sealing systems utilizing epoxy potting compounds may be used. When this type of sealing system is used, the manufacturer shall supply a cable cap as part of the spare parts for each pump. All cables shall be continuous, without splices from the motor to the control panel. The junction chamber, containing the terminal board, shall be completely leak proof.

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**47.4 ABOVE GROUND PUMPS AND MOTORS**

Pumps shall be horizontal, base mounted, self-priming, non-clogging, electric driven, and of the centrifugal type. Each pump shall be mounted on a common steel base plate with and belt driven by an electric motor. Each pump shall be equipped with a removable cover plate allowing complete access to the interior of the pump without disturbing suction and discharge pipe connections. The pumps shall be oriented so that the discharge pipe arrangement is as shown on the STANDARD DRAWINGS.

**47.5 PUMP CONTROL SYSTEM**

Refer to Section 48 for control system specifications.

**47.6 SHOP PAINTING**

Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill-scale, rust, grease, dirt and other foreign matter. All pumps and motors shall be shop coated with a corrosion resistant paint proven to withstand an environment of raw wastewater. All nameplates shall be properly protected during painting.

Gears, bearing surfaces, and other similar surfaces obviously not intended to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the CITY up to the time of the final acceptance test.

**47.7 HANDLING**

All parts and equipment shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. Finished surfaces of all exposed pump openings shall be protected by wooded planks, strongly built, and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

**47.8 WARRANTY**

The pump manufacturer shall warrant the units being supplied to the CITY against defects in workmanship and material for a period of five (5) years or 10,000 hours.

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**47.9 TOOLS**

One (1) set of all special tools required for normal operation and maintenance shall be provided for each new pumping station. All such tools shall be delivered to the CITY at or prior to the time of the station start-up.