

**SECTION 44 42 56.04
SUBMERSIBLE PUMPS**

EQUIPMENT AND COMPONENT NUMBER(S)

PMP-3211: WAS Pump 1.
PMP-3212: WAS Pump 2.
PMP-8611: PDPS Pump 1.
PMP-8612: PDPS Pump 2.
PMP-2511: Tank Drain Pump 1.
PMP-2512: Tank Drain Pump 2.
PMP-1805: Septage Equalization Pump and Septage Equalization Pump Spare.

PART 1 GENERAL

1.01 SUMMARY

- A. All Large Wastewater Submersible Pumps, control panels and accessories provided under this section shall be supplied by a single manufacturer. All Small Submersible Pumps, control panels and accessories provided under this section shall be supplied by a single manufacturer. Both may be provided by a single manufacture if that manufacturer's equipment is submitted and approved.

1.02 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
1. American Bearing Manufacturers Association (ABMA):
 - a. 9, Load Ratings and Fatigue Life for Ball Bearings.
 - b. 11, Load Rating and Fatigue Life for Roller Bearings.
 2. American Society of Mechanical Engineers (ASME): B16.1, Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 150.
 3. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
 4. Hydraulic Institute Standards (HIS):
 - a. 11.6, Rotodynamic Submersible Pumps for Mechanical and Electrical Acceptance Tests.
 - b. 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
 5. National Electrical Manufacturers Association (NEMA).

6. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code.
 - b. 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.
7. UL.

1.03 DEFINITIONS

- A. Terminology pertaining to pumping unit performance and construction shall conform to ratings and nomenclature of Hydraulic Institute Standards.

1.04 SUBMITTALS

A. Action Submittals:

1. Make, model, weight, and horsepower of each equipment assembly.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction, including cable seal details.
3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over entire operating range of pump, from shutoff to maximum capacity. Indicate separately head, capacity, horsepower demand, overall efficiency, and minimum submergence required at guarantee point.
4. For variable speed motors, provide variable speed curves for every 50 rpm over the operational range.
5. Power and control wiring diagrams, including terminals and numbers.
6. Motor data, in accordance with the requirements of Section 26 20 00, Low-Voltage AC Induction Motors.
7. Adjustable frequency drive data, in accordance with the requirements of Section 26 29 23, Low-Voltage Adjustable Frequency Drive System.
8. Factory-finish system.
9. L-10 bearing life calculations per ABMA.
10. If required, wiring for motor protection module.
11. Seismic anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Seismic Anchorage and Bracing.

B. Informational Submittals:

1. Seismic anchorage and bracing calculations as required by Section 01 88 15, Seismic Anchorage and Bracing.
2. Special shipping, storage and protection, and handling instructions.
3. Manufacturer's printed installation instructions.
4. Factory and Field Performance Test Reports and Log.
5. Manufacturer's Certificate of Compliance, in accordance with Section 01 67 00, Product Requirements, that factory finish system meets requirements specified herein.

6. Suggested spare parts list to maintain equipment in service for period of 5 years. Include list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
7. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
8. Operation and Maintenance Data as specified in Section 01 78 23, Operation and Maintenance Data.
9. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 67 00, Product Requirements.

1.05 EXTRA MATERIALS

A. Furnish for each set of pumps:

1. One set mechanical seals.
2. One complete set of special tools required to dismantle pump.

PART 2 PRODUCTS

2.01 SMALL SUBMERSIBLE PUMPS

A. General: Pumps furnished under this section to be provided by a single manufacturer.

B. Septage Equalization Pump (PMP-1805) and Septage Equalization Pump Spare:

1. Quantity: Two (one installed, one shelf spare).
2. Manufacturers and Products:
 - a. Liberty Pumps, Model LSG204M.
 - b. Or equal.
3. Physical Characteristics:
 - a. Type: Heavy-duty, grinder style, close-coupled submersible centrifugal sewage ejector pump.
 - b. Volute: Cast iron, powder coated epoxy leg mounted.
 - c. Rail mounted with non-sparking powder coated ductile iron, with stainless steel upper rail support. Rails to be Type 316 stainless steel pipe supplied by the Contractor.
 - d. Impeller: Type 316 stainless steel.
 - e. Cutter: Type 440 stainless steel, Rockwell C58.
 - f. Motor Enclosure: cast iron, Nitrile O-ring seals with powder coated epoxy corrosion-resistant exterior finish.
 - g. Power/Control Cord with Bare Leads: Length: 35 feet.

- h. Motor: continuous-duty, built-in thermal overload protection switch.
 - 1) Power Supply: 460-volt, three-phase, 60 Hz.
 - 2) Motor Rating (hp): Two.
 - 3) Pump Speed (rpm): 3,450.
- i. Shaft Seals: Dual mechanical type with moisture detection switch.
- j. Shaft: Type 416 stainless steel.
- k. Bearings: Ball type, upper and lower.
- l. Oil filled motor cooling.
- m. Stainless Steel Retrieval Chain: Length as required for installation depth.
- 4. Functional Characteristics: Grinder style pump with cutting system to shear solids into small particles prior to being passed through the pump discharge by the impeller.
- 5. Performance Characteristics:
 - a. Rated Capacity (gpm): 30.
 - b. Rated Total Dynamic Head (feet): 75.
 - c. Shut-off Head Range (feet): 100 to 110.
 - d. Pump and Electrical Driver: Meet requirements for Class 1, Division 1, group C&D location in accordance with NFPA 70.

2.02 LARGE WASTEWATER SUBMERSIBLE PUMPS

A. Manufacturers: As specified in Pump Data Sheets Supplement.

B. General Characteristics:

- 1. Physical Characteristics:
 - a. Submersible, vertical shaft, centrifugal non clog type, for pumping wastewater.
 - b. Equipment consists of pump complete with motor, control system, guide rail, anchoring brackets, base elbow, power cable, and pump lifting cable and control panel and level switches.
 - c. Pumps furnished under this section to be provided by a single manufacturer.
 - d. Mating surfaces to be watertight and fitted with nitrile O-rings.
- 2. Functional Characteristics:
 - a. Where adjustable speed drives are required, furnish a coordinated operating system complete with pump, drive, and speed controller.
 - b. Motor and rotating parts shall be removable from motor end of pump.
- 3. Performance Characteristics:
 - a. Designed for continuous operation under submerged or partially submerged conditions, and intermittent operation when totally dry without damage to pump or motor.

- b. Pump and Electrical Driver: Meet requirements for class, group, and division location in accordance with NFPA 70.
 - c. Pumps fitted with dynamically balanced nonclog impellers designed to pass course solids and stringy materials.
 - C. Supplements: Additional requirements are attached to this specification as Pump Data Sheets in Article Supplements.
 - D. Components:
 - 1. General:
 - a. Physical Characteristics:
 - 1) Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in readily visible location.
 - 2) Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer, and as specified in Section 05 50 00, Metal Fabrications. Coat in accordance with Section 09 90 00, Painting and Coating.
 - 3) Manufacturer's standard epoxy system for continuous submergence in corrosive water.
 - b. Functional Characteristics: None.
 - c. Performance Characteristics: None.
 - 2. Lifting Arrangement:
 - a. Physical Characteristics:
 - 1) Guide rails shall be stainless steel.
 - 2) Attach stainless steel wire rope of minimum 45 feet permanently to pump and access platform.
 - b. Functional Characteristics: Pump and motor to be lifted continuously with independent hoist along guide rails.
 - c. Performance Characteristics: Pump and motor shall glide smoothly along guide rails for pump removal and installation.
 - 3. Sliding Guide Bracket:
 - a. Physical Characteristics:
 - 1) Integral part of pump unit.
 - 2) Pump unit to be guided by no less than two guide bars, or equivalent cable system, and pressed tightly against discharge connection elbow with metal-to-metal contact or through use of profile-type gasket, provided gasket is attached to pump's flange and can be easily accessed for inspection when pump is lifted out of wet well.
 - 3) Pump metal parts that come into contact with guide rail or cable system shall be made of nonsparking materials.
 - b. Functional Characteristics: None.
 - c. Performance Characteristics: None.

4. Pump Motor and Sensor Cables:
 - a. Physical Characteristics:
 - 1) Cable Entry System:
 - a) Junction chamber and motor separated by stator lead sealing gland or terminal board that prevents foreign material entering through pump top.
 - b) Utilize cable with factory-installed sealing gland with nonshrink epoxy seal system.
 - c) O-ring compression seal between sealing gland and cable entry point shall also be acceptable.
 - b. Functional Characteristics: Suitable for submersible pump application.
 - c. Performance Characteristics:
 - 1) Cable sizing shall conform to NFPA 70 specifications for pump motors.
 - 2) Cables shall be of sufficient length to reach junction boxes without strain or splicing.
 - 3) Motor Protection Module: If required, provide pump with a motor protection module for remote mounting. The Drawings are based on first named submersible pump manufacturer and motor protection module. If pump and motor protection module other than first named manufacturer is provided, provide revised wiring for the motor protection module.
 - 4) Motor nameplate horsepower not to be exceeded at head-capacity point on pump curve.

2.03 FACTORY FINISHING

- A. Physical Characteristics: Prepare, and prime, and finish coat in accordance with Section 09 90 00, Painting and Coating, System No. 2.
- B. Functional Characteristics: None.
- C. Performance Characteristics: None.

2.04 SOURCE QUALITY CONTROL

- A. Pump:
 1. All pumps provided shall be hydrostatic tested per HIS 11.6.
 2. Small Submersible Pumps: Manufactures standard factory testing meeting HIS 11.6 requirements.

- 3. Large Wastewater Pumps:
 - a. Factory Performance Test:
 - 1) In accordance with HIS 11.6, Grade 1U.
 - 2) Include test data sheets, curve test results, and performance test logs.
 - b. Conduct on each pump.
 - c. Perform under actual or approved simulated operating conditions.
- B. Submersible Motor Functional Test: In accordance with HIS 11.6.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. Mount the discharge elbow to the floor of the wet well floor with stainless steel bolts.
- C. Connect piping without imposing strain to flanges.
- D. No portion of pump shall bear directly on floor of sump.

3.02 FIELD FINISHING

- A. Touchup damaged areas in accordance with and as specified in Section 09 90 00, Painting and Coating.

3.03 FIELD TESTING AND FACILITY STARTUP

- A. Field Testing and Facility Startup shall be in accordance with the requirements of Section 01 91 14, Equipment Testing and Facility Startup.
- B. Facility startup specifies the order and prerequisites for the following tests of the equipment:
 - 1. Field functional testing.
 - 2. Software operational testing.
 - 3. Performance testing.
 - 4. Demonstration testing.
- C. All Field Testing and Facility Startup shall be performed using a qualified representative provided by the Manufacturer as specified in Section 01 91 14, Equipment Testing and Facility Startup, Section 01 43 33, Manufacturers' Field Services, and as elaborated upon in this section.

3.04 FIELD QUALITY CONTROL

A. Functional Test: Conduct on each pump.

1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
2. Flow Output: Measured by plant instrumentation and storage volumes.
3. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.
4. Test for continuous 3-hour period.
5. Test Report Requirements: In format agreed to by Contracting Officer prior to conduct of testing. Record flow head, temperature, current, voltage, and other data every 15 minutes during the 3-hour testing.

B. Performance Test:

1. Conduct on each pump as specified in Section 01 91 14, Equipment Testing and Facility Startup Performance Test:
 - a. Conduct on each pump provided:
 - 1) Test in accordance with Hydraulic Institute Standard 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.
 - 2) Perform under simulated operating conditions at full rated speed.
 - a) Adjust operating conditions in order to obtain flow and head performance readings for seven operating points per tested operating speed.
 - 3) Test Records and Report: Prepare and submit a complete test report along with the test records in accordance with Hydraulic Institute Standard 14.6, Appendix H.
 - 4) Use of plant instrumentation is allowed for tests. Provide additional instrumentation required to obtain required test data per the Hydraulic Institute.

3.05 MANUFACTURER'S SERVICES

A. Manufacturer's Representative:

1. Present at Site or classroom designated by Contracting Officer, for minimum person-days listed below, travel time excluded:
 - a. 2 person-days for installation assistance and inspection.
 - b. 2 person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
 - c. 1/2 person-day for prestartup classroom or Site training.
 - d. 1 person-day for facility startup.
 - e. 1/2 person-day for post-startup training of Contracting Officer's personnel. Training shall not commence until accepted detailed

lesson plan for each training activity has been reviewed by Contracting Officer.

- B. See Section 01 79 00, Demonstration and Training, and Section 01 91 14, Equipment Testing and Facility Startup.

3.06 SUPPLEMENTS

- A. The supplements listed below, following “End of Section,” are a part of this specification:
 - 1. WAS Pump 1 and WAS Pump 2 Data Sheet.
 - 2. Tank Drain Pump 1 and Tank Drain Pump 2 Data Sheet.
 - 3. Plant Drain Pump 1 and Plant Drain Pump 2 Data Sheet.

END OF SECTION

**WAS PUMP 1 AND WAS PUMP 2
DATA SHEET**

Tag Numbers: PMP-3211 and PMP-3212

Pump Name: WAS Pump 1 and WAS Pump 2

Manufacturer and Model Number:

(1) Xylem Flygt; NP 3127 SH 3~Adaptive 445 (180mm) w/ Mix-Flush System; Model 4901

(2) Or equal

SERVICE CONDITIONS

Liquid Pumped (Material and Percent Solids): Waste Activate Sludge

Pumping Temperature (Fahrenheit): Normal: 60 Max Min _____

Specific Gravity at 60 Degrees F: _____ Viscosity Range: _____

Abrasive (Y/N) Y Possible Scale Buildup (Y/N): Y

Min. NPSH Available (Ft. Absolute): _____

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Rated: 167 Secondary: 110

Total Dynamic Head (Ft): Rated: 34 Secondary: 40

Maximum Shutoff Pressure (Ft): 54

Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 55

Max. Pump Speed at Rated Capacity (rpm):

Constant (Y/N): Y

Adjustable (Y/N): N

PHYSICAL CHARACTERISTICS

Pump Type: Heavy-Duty Nonclog (Y/N) Y Other: _____

Volute Material: Cast Iron ASTM A48

Pump Casing Material: Cast Iron ASTM A48

Motor Housing Material: Cast Iron ASTM A48

Wear Rings Case (Y/N): N Material: _____

Wear Ring Impeller (Y/N): N Material: _____

Elastomers: Nitrile Rubber

Fasteners: Stainless Steel

Impeller: Type: Double-Shrouded Non-Clog (Y/N): _____

Other: Self Cleaning Semi-Open

Material: Hardened iron

Shaft Material: Carbon Steel, ASTM A576 with stainless steel sleeve or all stainless steel.

Base Elbow: Cast Iron ASTM A48

Double Mechanical Seal (Y/N): Y Bearing Life (Hrs): _____

DRIVE MOTOR (See **Section 26 20 00**, Low-Voltage AC Induction Motors.)

Max. Horsepower: 7.5 Voltage: 460 Phase: 3 Synchronous Speed (rpm): 1,800

Enclosure: Submersible

CLASSIFICATION: Class 1, Group D, Division 2

Other Features: _____

Moisture Detection Switches (Y/N): Y

Thermal Protection Embedded in Windings (Y/N): Y

REMARKS:

Provide each WAS pump with a flush valve factory installed on the pump volute. The operation of the valve shall depend only on the pump flow and pressure. The valve shall be in the open position upon pump start up and automatically close over an adjustable time between 20 seconds to 50 seconds. Means of closure time adjustment shall be provided on the valve exterior.

TANK DRAIN PUMP 1 AND TANK DRAIN PUMP 2 DATA SHEET

Tag Numbers: PMP-2511 and PMP-2512

Pump Name: Tank Drain Pump 1 and Tank Drain Pump 2

Manufacturer and Model Number:

(1) Xylem Flygt; NP 3127 SH 3~Adaptive 446 (173mm)

(2) Or equal

SERVICE CONDITIONS

Liquid Pumped (Material): Multiple wastewater streams include Raw Sewage, Aerobic Digester Decant and Recycle Activated Sludge

Pumping Temperature (Fahrenheit): Normal: 60 Max Min _____

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range: _____

Abrasive (Y/N) Y Possible Scale Buildup (Y/N): Y

Min. NPSH Available (Ft. Absolute): _____

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Rated: 150 Secondary: 238

Total Dynamic Head (Ft): Rated: 32 Secondary: 21

Maximum Shutoff Pressure (Ft): 50

Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 55

Max. Pump Speed at Rated Capacity (rpm): 1,740

Constant (Y/N): N

Adjustable (Y/N): Y

PHYSICAL CHARACTERISTICS

Pump Type: Heavy-Duty Nonclog (Y/N) Y Other: _____

Volute Material: Cast Iron ASTM A48

Pump Casing Material: Cast Iron ASTM A48

Motor Housing Material: Cast Iron ASTM A48

Wear Rings Case (Y/N): N Material: _____

Wear Ring Impeller (Y/N): N Material: _____

Elastomers: Nitrile Rubber

Fasteners: Stainless Steel

Impeller: Type: Double-Shrouded Non-Clog (Y/N): _____

Other: Self Cleaning Semi-Open

Material: Hardened iron

Shaft Material: Carbon Steel, ASTM A576 with stainless steel sleeve or all stainless steel.

Base Elbow: Cast Iron ASTM A48

Double Mechanical Seal (Y/N): Y Bearing Life (Hrs): _____

DRIVE MOTOR (See Section 26 20 00, Low-Voltage AC Induction Motors.)

Max. Horsepower: 7.5 Voltage: 460 Phase: 3 Synchronous Speed (rpm): 1,800

Enclosure: Submersible

CLASSIFICATION: Class 1, Group D, Division 2

Other Features: _____

Moisture Detection Switches (Y/N): Y

Thermal Protection Embedded in Windings (Y/N): Y

REMARKS: _____

PLANT DRAIN PUMP 1 AND PLANT DRAIN PUMP 2

Tag Numbers: PMP-8611 and PMP-8612

Pump Name: Plant Drain Pump 1 and Plant Drain Pump 2

Manufacturer and Model Number:

(1) Xylem Flygt; NP 3127 SH 3~Adaptive 445 (180mm)

(2) Or equal

SERVICE CONDITIONS

Liquid Pumped (Material and Percent Solids): Waste Activated Sludge and Raw Sewage

Pumping Temperature (Fahrenheit): Normal: 60 Max Min

Specific Gravity at 60 Degrees F: 1.0 Viscosity Range:

Abrasive (Y/N) Y Possible Scale Buildup (Y/N): Y

Min. NPSH Available (Ft. Absolute):

PERFORMANCE REQUIREMENTS

Capacity (US gpm): Rated: 150 Secondary: 108

Total Dynamic Head (Ft): Rated: 36 Secondary: 41

Maximum Shutoff Pressure (Ft): 54

Min. Rated Pump Hydraulic Efficiency at Rated Capacity (%): 54

Max. Pump Speed at Rated Capacity (rpm): 1,740

Constant (Y/N): N

Adjustable (Y/N): Y

PHYSICAL CHARACTERISTICS

Pump Type: Heavy-Duty Nonclog (Y/N): Y Other:

Volute Material: Cast Iron ASTM A48

Pump Casing Material: Cast Iron ASTM A48

Motor Housing Material: Cast Iron ASTM A48

Wear Rings Case (Y/N): N Material:

Wear Ring Impeller (Y/N): N Material: _____

Elastomers: Nitrile Rubber

Fasteners: Stainless Steel

Impeller: Type: Double-Shrouded Non-Clog (Y/N): _____

Other: Self Cleaning, Semi-Open

Material: Hardened iron

Shaft Material: Carbon Steel, ASTM A576 with stainless steel sleeve or all stainless steel.

Base Elbow: Cast Iron ASTM A48

Double Mechanical Seal (Y/N): Y Bearing Life (Hrs): _____

DRIVE MOTOR See Section 26 20 00, Low-Voltage AC Induction Motors

Horsepower: 7.5 Voltage: 460 Phase: 3 Synchronous Speed (rpm): 1,800

Enclosure: Submersible

CLASSIFICATION: Class 1, Group D, Division 1

Other Features: _____

Moisture Detection Switches (Y/N): Y

Thermal Protection Embedded in Windings (Y/N): Y

REMARKS: _____
