

SECTION 44 42 56.11
VERTICAL INLINE MULTISTAGE CENTRIFUGAL PUMPS

EQUIPMENT AND COMPONENT NUMBER(S)

PMP-3320: RW Pump 1.
PMP-3420: RW Pump 2.
PMP-3520: RW Pump 3.

PART 1 GENERAL

1.01 SUMMARY

- A. All equipment called for under this section shall be provided by a single manufacturer, including but not limited to the Reclaimed Water (RW) and Non Potable Water (NPW) Pumps and Motors.

1.02 REFERENCES

- A. The following is a list of standards which 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: Classes 25, 125, and 250.
 3. ASTM International (ASTM): A48/A48M, Standard Specification for Gray Iron Castings.
 4. Hydraulic Institute (HI) Standards:
 - a. 9.6.4, Rotodynamic Pumps for Vibration Measurements and Allowable Values.
 - b. 11.6, Rotodynamic Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, Mechanical, and Electrical Acceptance Tests.
 - c. 14.6, Rotodynamic Pump for Hydraulic Performance Acceptance Tests.
 5. National Electrical Manufacturer's Association (NEMA): MG 1, Motors and Generators.
 6. Occupational Safety and Health Administration (OSHA).
 7. ISO 21940 Series and particularly Mechanical Vibration – Rotor Balancing – Part 11 Procedures and Tolerances for Rotors with Rigid Behavior.

1.03 DEFINITIONS

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

1.04 SUBMITTALS

A. Action Submittals:

1. Make, model, weight, and horsepower of each pump assembly.
2. Complete pump and motor catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Plan and section dimensional outline drawings of the pumps and motors identifying all components, anchor bolts, external connections, and appurtenances.
 - a. Include all components identified with quantity, part name and corresponding materials of construction complete with ASTM designation on sectional drawings.
4. Performance data curves showing head, capacity, horsepower demand, net positive suction head required (NPSH3), and pump efficiency over entire operating range of pump, from shutoff to maximum capacity.
 - a. Include the pump's preferred operating range (POR) and the manufacturer's defined maximum allowable operating range (AOR) for continuous steady state service on performance curves.
 - b. Indicate separately head, capacity, horsepower demand, NPSH3, and overall efficiency required at the AOR's minimum and maximum continuous stable flow conditions and at the Rated Conditions and at Secondary Conditions (if applicable).
5. For variable speed motors, provide performance data curves for 50 percent, 60 percent, 70 percent, 80 percent, and 90 percent of nominal speed.
6. Certified detail mechanical, and electrical drawings showing equipment dimensions, arrangement, assembly, including locations and type of connections and weights of major equipment and components.
7. Lateral and torsional critical speed analysis.
8. Structural response frequency analysis.
9. Power and control wiring diagrams, including terminals and numbers.
10. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
11. Factory finish system.
12. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

B. Informational Submittals:

1. Seismic anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Factory Functional and Performance Test Reports and Log.
3. Special shipping, storage and protection, and handling instructions.
4. Manufacturer's printed installation instructions.
5. Suggested spare parts list to maintain the equipment in service for a period of 1 year and 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
6. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
7. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

1.05 EXTRA MATERIALS

A. Furnish for the set of pumps, one of each of the following:

1. Complete set packing.
2. Complete set bearings.
3. Complete set gaskets and O-ring seals.
4. Complete set of shaft sleeves.
5. Complete set keys, dowels, pins, etc.
6. Complete mechanical seal.
7. Impeller.
8. Impeller shaft.
9. Impeller wear ring.
10. Head shaft.
11. One complete set of any special tools required to dismantle pump.

PART 2 PRODUCTS

2.01 GENERAL

A. Physical Characteristics:

1. Provide a complete, coordinated, and fully functional operating set of pumps in accordance with the data sheets attached as supplement at the end of this section.
2. Pumps supplied under this section are to be a standard product with proven reliability all by the same manufacturer .

B. Functional Characteristics:

1. Where adjustable speed drives are required, furnish a coordinated operating system complete with pump, drive, and adjustable speed controller.
2. Coordinate pump requirements with drive manufacturer and be responsible for meeting both pump and drive requirements.

C. Performance Characteristics:

1. Operating point(s) shall be achieved within the operating ranges of the pump curves and speed curves for the selected pumps.
2. Pumps shall meet the performance characteristics as listed in the data sheets attached as supplements at the end of this section.

2.02 SUPPLEMENTS

- A. Specific service, performance, and design requirements are attached to this section as supplements.

2.03 ACCESSORIES

- A. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.
- B. Lifting Lugs: Equipment weighing over 100 pounds.
- C. Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer, 1/2-inch minimum diameter, and as specified in Section 05 50 00, Metal Fabrications. Coat in accordance with Section 09 90 00, Painting and Coating.

2.04 FACTORY FINISHING

- A. Prepare and prime, and finish coat in accordance with Section 09 90 00, Painting and Coating, System No. 2.

2.05 SOURCE QUALITY CONTROL

- A. Factory Tests and Adjustments: Test one of each set of pumps actually furnished.
- B. Factory Test Report: Include test data sheets, curve test results, performance test logs, certified correct by a registered professional engineer.
- C. Functional Test: Perform manufacturer's standard, motor test on equipment.

D. Performance Test:

1. Conduct on each pump.
2. Perform under simulated operating conditions.
3. Test for a continuous 3-hour period without malfunction.
4. Test Log:
 - a. Record the following:
 - 1) Total head.
 - 2) Capacity.
 - 3) Horsepower requirements.
 - 4) Flow measured by factory instrumentation and storage volumes.
 - 5) Average distance from suction well water surface to pump discharge centerline for duration of test.
 - 6) Pump discharge pressure converted to feet of liquid pumped and corrected to pump discharge centerline.
 - 7) Calculated velocity head at the discharge flange.
 - 8) Field head.
 - 9) Driving motor voltage and amperage measured for each phase.
5. Adjust, realign, or modify units and retest in accordance with Hydraulic Institute Standards, if required.

E. Motor Test: See Section 26 20 00, Low-Voltage AC Induction Motors.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. Level base by means of steel wedges (steelplates and steel shims). Wedge taper not greater than 1/4 inch per foot. Use double wedges to provide a level bearing surface for the pump and driver base. Accomplish wedging so that there is no change of level or springing of the baseplate when the anchor bolts are tightened.
- C. Adjust pump assemblies such that the driving units are properly aligned, plumb, and level with the driven units and all interconnecting shafts and couplings. Do not compensate for misalignment by use of flexible couplings.
- D. After the pump and driver have been set in position, aligned, and shimmed to the proper elevation, grout the space between the bottom of the baseplate and the concrete foundation with a poured, nonshrinking grout of the proper category, as specified in Section 03 62 00, Grouting. Remove wedges after grout is set and pack void with grout.

- E. Connect suction and discharge piping without imposing strain to pump flanges.
- F. Anchor Bolts: Accurately place using equipment templates and as specified in Section 05 50 00, Metal Fabrications.
- G. Pipe pump drain(s) to nearest hub drain, unless shown otherwise on the Drawings.

3.02 FIELD FINISHING

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

3.03 FIELD QUALITY CONTROL

- A. Functional Tests: Conduct on each pump.
 - 1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
 - 2. Vibration Test:
 - a. Test with unit installed and in normal operation, and discharging to the connected piping systems at rates between low discharge head and high discharge head conditions specified, and with actual building structures and foundations provided shall not develop vibration exceeding 80 percent of the limits specified in HIS 9.6.4.
 - b. If units exhibit vibration in excess of the limits, or modify as necessary. Units which cannot be adjusted or modified to conform as specified shall be replaced.
 - 3. Flow Output: Measured by plant instrumentation and storage volumes.
- B. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.

3.04 MANUFACTURER'S SERVICES

- A. Manufacturer's Representative:
 - 1. Present at Site or classroom designated by the Contracting Officer, for minimum person-days listed below, travel time excluded:
 - a. 1 person-day for installation assistance and inspection.
 - b. 1 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
 - c. 1 person-day for prestartup classroom or Site training.
 - d. 1 person-day for facility startup.

- e. 1 person-day for post-startup training of the Contracting Officer's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed and accepted by the Contracting Officer.

3.05 SUPPLEMENTS

- A. The supplements listed below, following "End of Section," are a part of this specification:
 - 1. RW Pumps Data Sheet.
 - 2. RW Pumps Motor Data Sheet.

END OF SECTION

RW PUMPS DATA SHEET		
Service: <u>Reclaimed Water (RW)</u>		Basis of Design Pump Mfr.: <u>Grundfos</u>
Pump Names: <u>RW Pump 1, 2, 3</u>		Basis of Design Pump Model: <u>CR</u>
Equipment Tag Numbers: <u>PMP-3320, PMP-3420, PMP-3520</u>		
Quantity of Pumps: <u>3</u>	Operation: <u>Lead, Lag, Standby</u>	
Drive Type: ☐ Constant ☒ Adjustable		
LIQUID PUMPED	OPERATING CONDITIONS	SERVICE CONDITIONS
Type of Liquid: <u>Plant Effluent Water</u>	Capacity per Pump (U.S. gpm):	Ambient Temp (°F): Max <u> </u> Min <u> </u>
Pumping Temperature (°F):	Normal <u>250</u>	Rel. Hum (%): Max <u> </u> Min <u> </u>
	Rated <u>300</u>	
Normal <u>60</u> Max <u> </u> Min <u> </u>	Total Dynamic Head (ft): <u>315</u>	Altitude (ft): <u>6,800</u>
Specific Gravity @ <u>60</u> °F: <u>1.0</u>	Suction Lift (ft): <u> </u>	☒ Indoor ☐ Heated
Vapor Pressure (psia):	Max <u> </u> Rated <u> </u>	☐ Outdoor ☐ Unheated
Viscosity (CP) @ <u>60</u> °F: <u>1.0</u>	NPSH Available (ft): <u>20</u>	Will Pump be Submerged:
pH: <u>Neutral</u>		☐ Yes ☒ No
Corrosion/Erosion/Abrasion Caused by:		Area Classification: <u>Unclassified</u>
<u>N/A</u>		Other: <u> </u>
Remarks: <u> </u>	Remarks: <u> </u>	Remarks: <u> </u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>
PERFORMANCE REQUIREMENTS (manufacturer to supply missing data)		
Basis of Design Pump Curve No.: <u>CR4564-4</u>	Min. Continuous Flow (gpm): <u>80</u>	NPSH Required (ft water): <u>15</u>
Rated Speed (rpm): <u>3,560</u>	Max. Head, Rated Imp. (ft): <u> </u>	3% Head Drop <u> </u>
Efficiency (%): <u>90</u>	Max. Power, Rated Imp. (BHP): <u> </u>	Suction Specific Speed: <u> </u>
Rated Power (BHP): <u>26</u>		Factory Testing:
		☒ Required ☐ Not Required
Remarks: <u> </u>		
<u> </u>		
<u> </u>		

RW PUMPS DATA SHEET (CONTINUED)								
Equipment Tag Numbers: <u>PMP-3320, PMP-3420, PMP-3520</u>								
PUMP CONSTRUCTION DETAILS (manufacturer to supply missing data)								
Nozzles								
					Miscellaneous Connections			
	Size	Rating	Facing	Location			Size	Location
Suction	<u> 3 </u>	<u>150 psi</u>	<u>See Drawings</u>	<u>Pump Room</u>		Drain	<u> </u>	<u> </u>
Discharge	<u> 3 </u>	<u>150 psi</u>	<u>See Drawings</u>	<u>Pump Room</u>		Vent	<u> </u>	<u> </u>
						Pres. Gauge	<u> </u>	<u> </u>
Casing Mount:			Impeller Diameter (in.):			Bearings (Type/No.):		
Soleplate ☐ Bracket ☐			Rated _____ Max _____ Min _____			Radial _____ Thrust _____		
Sump ☐ Vertical ☐			Impeller Mount:			Lubrication Type:		
Hydro Test Pressure (psig):____			☐ Between Bearings ☐ Overhung			☐ Grease ☐ Oil		
Field Testing: ☐ Not required			Packing:			Coupling:		
☒ Required, functional and performance			Manufacturer ____			Manufacturer ____		
			Type ____			Type _____ Model ____		
			Size/No. Rings__			Driver Half-Coupling Mounted by:		
			Mechanical Seal:			Driver Mfr. ☐ Pump Mfr. ☐		
			API Class Code __			☐ Purchaser		
			Manufacturer ____			Gland Type/Material:_		
			Model__			Gland Plate Taps Required:		
			Manufacturer Code_			☐ Quench ☐ Flush ☐ Drain ☐ Vent		
Remarks: _____ _____								
MATERIALS (manufacturer to supply missing data)								
Case:_____			Impeller:_____			Column:_____		
Case Wear Rings:_____			Impeller Wear Rings:_____			Shaft:_____		
Bearings: Bowl _____			Lineshaft:_____			Shaft Sleeve:_____		
Remarks: _____ _____						Mounting Plate: Type_____ Material_____		

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RW PUMPS DATA SHEET (CONTINUED)
ADDITIONAL REQUIREMENTS
Fully Open Impeller Design

☐ Vent and drain connections tapped and plugged
☐ Suction and discharge gauge connections tapped and plugged

RW PUMPS MOTOR DATA SHEET	
Equipment Names: <u>RW Pumps 1, 2, 3</u>	
Equipment Tag Numbers: <u>PMP-3320, PMP-3420, PMP-3520</u>	
Type: Squirrel-cage induction meeting requirements of NEMA MG 1	
Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer.	
Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.	
Motor Horsepower: 30	Guaranteed Minimum Efficiency at Full Load: _____ percent
Voltage: 480	Guaranteed Minimum Power Factor at Full Load: _____ percent
Phase: 3	Service Factor (@ rated max. amb. temp.): ☒ 1.0 ☐ 1.15
Frequency: 60	Enclosure Type: <u>TEFC</u>
Synchronous Speed: 3,600 rpm	☐ Multispeed, Two-Speed: _____ / _____ rpm
☒ Thermal Protection:	Winding: ☐ One ☐ Two
☒ Space Heater: 120 _____ volts, single-phase	Mounting Type: ☐ Horizontal ☒ Vertical
	☐ Vertical Shaft: ☐ Solid ☐ Hollow
	☐ Vertical Thrust Capacity (lb): Up _____ Down _____
	☒ Adjustable Speed Drive: See Section 26 29 23, Low-Voltage Adjustable Frequency Drive System.
	Operating Speed Range: _____ to _____ % of Rated Speed
	☐ Variable Torque
	☒ Constant Torque
Additional Motor Requirements: ☒ See Section 26 20 00, Low-Voltage AC Induction Motors.	
Special Features:	

