

**SECTION 232000 - HVAC PUMPS**

- 1.0 ASHRAE 90.1 Compliance: University of Pennsylvania buildings shall comply with the Commercial Energy Efficiency Requirements of ASHRAE Standard 90.1-2016. The ASHRAE 90.1-2016 compliance paths shall be followed instead of the International Energy Conservation Code (IECC) requirements as permitted by 2018 IECC Section 401.2 Application.
- 2.0 Refer to section 230100 for general requirements, alignment procedures and vibration isolation requirements for pumps and section 230500 for Testing, Balancing and Adjusting.
- 3.0 Pump submittals shall include certified performance curves, rated capacities, operating characteristics, materials of construction, impeller dimensions and all accessories being provided. Pump curves shall include system curve, brake horsepower curve and efficiency curves. Operating point shall be indicated. Variable speed pumps shall include multiple speed operating curves and clearly indicate the minimum permissible operating speed. Open systems shall include the NPSH curve and indicate the minimum NPSH required at the operating point. Parallel and series pump arrangements shall include combined pump curve.

ASHRAE 90.1-2016 Compliance Requirements: Variable flow hydronic systems shall be provided in accordance with the requirements of Section 6.5.4.2 of ASHRAE 90.1-2016, including all exceptions.

Pumps greater than 100 HP shall be warranted for a minimum of 2 years.

- 4.0 Pump Selection: Select pumps to operate at or near their point of peak efficiency. Select impeller diameter such that the design capacity of the pump (GPM and TDH) does not exceed 90% of the capacity obtainable with maximum impeller diameter at the design speed for that model.
- 5.0 All pumps shall be base-mounted, bronze fitted, flexible coupled and rated for 175 psi. Pumps shall be constructed with the following components:
- A. Bronze shaft sleeve.
  - B. Alloy steel shaft.
  - C. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
  - D. Cast iron casting and companion flanges.
  - D. Regreaseable lubricated ball-bearings rated for an average life of L-10 200,000 hours.
  - E. Extended grease fittings and bottom relief plugs. Grease fittings shall extend to the exterior of the insulation boxes on chilled water pumps.
- 6.0 Motors supplied with pumps shall meet Section 220500, and be selected so that the motor cannot become overloaded at any point on the pump curve.
- 7.0 The use of ECM (Electronically Commutated Motor) is prohibited and shall only be used upon the approval of the University's Engineering Department.
- 8.0 Provide all split case pumps with self-aligning, cartridge type, split ring seals, or in end suction pumps, ethylene propylene, silicon carbide, or tungsten carbide seals.
- 9.0 Use horizontal pumps in all locations. Vertical in-line pumps are prohibited.

- 10.0 Split case (vertical) double inlet pumps are preferred to end suction and must be used on all systems having a flow rate in excess of 500 GPM.
- 11.0 Maximum speed of all pumps shall be 1750 RPM.
- 12.0 Mount pumps on minimum 4 inch high concrete equipment pads. Provide inertia bases on pumps over 5 horsepower mounted above grade. Pumps shall be re-aligned after installation and alignment reports shall be provided to the UE.
- 13.0 Consider adding option for in-line for low flows/heads: In-line circulators (horizontal, pipemounted, split-coupled) may be used for small pumps with motor horsepowers 5 HP or below.
- 14.0 Install pumps with access for periodic maintenance including removal of motors, impellers, couplings and accessories. Pumps that are not base-mounted shall be mounted no higher than 8' above floor.
- 15.0 General - Design end suction pumps with suction diffusers or minimum of 5 pipe diameters of straight pipe at the inlet to the pump. Require that the pump manufacturer or his authorized representative provide start-up services for pumps greater than 75 HP which include the following:
- A. Checking of alignment, absence of pipe strain, lubrication, rotation and vibration (axially, horizontally and vertically). All pumps shall conform to the manufacturer's standards for proper installation / alignment / mounting.
  - B. All pumps 10-HP or larger must be aligned using the laser methods. Details on this method can be found in the "Millwrights and Mechanical Guide." Provide UE a report of the final alignment settings.
  - C. All pumps 50-hp or larger shall be aligned by a certified Millwright. Alignment shall comply with the manufacturer's requirements and shall exceed the requirements as specified in the "API recommended practices 686, Section 7."
  - D. Take suction and discharge pressure gauge readings and compare such with pump nameplate data.
  - E. Submit five (5) copies of a full report to the University Engineering Department.
  - F. Split case horizontal pumps are preferred to end suction pumps in all primary pumping applications and are required in all applications requiring flow rates in excess of 750 GPM.
  - G. All pumps shall be mounted as indicated on the standard University details contained in the Appendices and per vibration isolation guidelines in this Section.
  - H. Mechanical Shaft Seals: Parts and wear surfaces to suit the temperature, pressure and liquid pumped as scheduled. Mechanical seal shall include seal flushing line or be internally-flushed type.
  - I. Couplings: Provide pump with flexible drive coupling, and coupling guard meeting the requirements of Subpart O (Machinery and Machine Guarding) of referenced OSHA Standards.