

**DIVISION 23 – DIVISION 23 – HEATING, VENTILATING, AND AIR
CONDITIONING (HVAC)
23 21 00 HYDRONIC PIPING AND PUMPS**

PART 1 - GENERAL

1.01 DESIGN CONSIDERATIONS

A. General requirements:

1. Pumps shall be installed at floor level. No pumps installed above ceilings in plenum spaces.
2. Pumps shall be located where easily accessible for service, yet isolated to prevent pumping or vibration source noise from disturbing the occupied area.
3. Pump selection:
 - i. Shall be based on the highest efficiency products available.
 - ii. Piping system design shall be based upon ensuring lowest brake-horsepower per unit flow rate at maximum flow and head.
 - iii. When system selection requires evaluating all non-overloading applications such as primary secondary piping on chilled water service. In these applications motor selection shall be based upon the maximum flow condition at the minimum head possible in the system.
 - iv. The pump shall be equipped “non-overloading.”
4. Generally all pumps shall not operate at more than 1800 rpm.
 - i. The exception is when pump head requirements do not allow for selection in this rpm range. In this case, provide for control of noise and vibration at higher rpm.
 - ii. Pump design proposals to exceed 1800 rpm must be approved by WSU Project Manager and Engineering Services.
5. Pump head shall be calculated and included in system design computations. Pump NPSH (net positive suction head) selection shall subtract 4.2 feet from the head for the 2600 foot elevation at Pullman. Confirm NPSH at other WSU locations.
6. Wherever possible, pump inlet shall be located below the water supply level. Include suction and total head in design computations.
7. Stand-by pumps shall be provided only where a short duration shut-down for repair and maintenance cannot be tolerated.

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8. All equipment (including but not limited to: Air Handling Units, pumps, motors, water heaters, expansion tanks and the like) shall be installed according to manufacturer's instructions on 4" high concrete housekeeping pads. WSU is not interested in space frame type vibration isolation, as it is overkill.
 - i. Equipment shall be anchored to the housekeeping pad and the frames filled with grout to eliminate vibration.
 - ii. Housekeeping pad shall be minimum two inches larger around the perimeter of the equipment than the footprint of the equipment.
 - iii. Equipment pads that present a tripping hazard shall be marked with yellow painted edges.

B. Specific Requirements

1. Submittals and pump data plate shall include fluid, GPM, RPM, head, BHP, impeller diameter (if other than maximum), NPSH, and efficiency.
2. Vertical shaft pumps are generally preferred on the WSU campus. Base-mounted and unit-mounted pumps are also acceptable. In all cases, pump internals shall be serviceable without removal of the piping.
3. Vertical Shaft Inline, Horizontal-Split Case, and End Suction Pump characteristics:
 - i. Cast iron case, with integral cast bearing holders
 - ii. Rigid steel base mounted
 - iii. Centrifugal
 - iv. Stainless steel shafts
 - v. Guards
 - vi. Non-overloading motors
 - vii. Wear rings
 - viii. Bronze fitted
 - ix. Grease lubricated
 - x. Ball bearings and mechanical seals designed for 100,000 hours
4. Chilled and Condenser Water Pump characteristics:
 - i. Normally single stage
 - ii. Horizontal split case
 - iii. Double suction
 - iv. Stainless steel shafts
 - v. Bronze fitted with bronze wear rings and impeller
 - vi. Ball bearings and mechanical seals designed for 100,000 hours
 - vii. Flow meter shall be provided for each chilled and condenser water pump system

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viii. Variable Frequency Drive (VFD)

5. All heating water systems shall be parallel pump equipped for redundancy. The pumps shall operate with lead/lag through the BAS control system. Each pump will be sized to 100% capacity, and each pump shall be equipped with Variable Frequency Drive (VFD).
6. Duplex pump selections shall be non-overloading during single pump operation. Fixed speed pump selection should be based on 1800 RPM operation. Variable speed operation shall maximize pump hydraulic efficiency.
7. Variable capacity systems shall utilize Variable Frequency Drives (VFD). Exceptions require approval by WSU Engineering Services. VFD characteristics:
 - i. Shall be designed as an integral part of the pump/motor system to provide soft start up and stop of all motors 1 Hp and larger. VFD shall typically ramp into operation over 30 seconds and ramp off over 30 seconds to protect the system.
 - ii. Shall provide high efficiency and power factor; VFD shall limit horsepower load.
 - iii. Typical operating range: 20-60 Hz, as set by balancing.
 - iv. Impellor selection will usually fill the pump case.
 - v. Shall vary operating speed by differential pressure sensor adjusting to variable load conditions.
 - vi. Shall be a BAS node.
8. Pump Accessories:
 - i. Suction diffusers are not sufficient for removing debris from system; an additional strainer is required. Each system shall have an air and dirt separator
 - 1) Preferred Manufacturer: Spirodirt
 - ii. Inline pumps shall have removable seal and bearings. Impeller and motor shall be removable w/o disconnection of piping.
 - iii. Flex couplings:
 - 1) Preferred Manufacturer: SureFlex, Omega, Woods, and Lovejoy
 - iv. Pumps shall be supported by floor yoke or factory case support.
 - v. Mechanical seals shall be provided on all pumps.
 - 1) Mechanical seals for hot water heating pumps shall be certified by the pump manufacturer to be suitable for the maximum expected water temperature and chemical treatment used.

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- vi. Pump casings shall have tappings for gauges which shall be equipped with pipe extensions and shut-off valves for gauge installations. Provide a single gauge with isolation valves for each pump, rather than individual gauges on inlet and outlet.
- 9. Gate valve (each side), strainer (suction side), non-slam check and ball cock (discharge side), and pressure gauge (piped to each side) are required. Complete start-up, installation checkout by the manufacturer's agent is required.
- 10. Triple-duty valves are generally not used on the WSU campus. When required, triple-duty valves must be sized for flow, not for pipe size.
- 11. Flex hose connections are for pipe misalignment only and do not prevent vibration transfer to piping. Designed vibration couplings may be employed, but only those designed specifically for this purpose.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PUMP MANUFACTURERS

- A. Bell and Gossett
- B. TACO
- C. Armstrong
- D. PACO
- E. Weinman
- F. Other manufacturers require approval by WSU Project Manager and Engineering Services.

2.02 ACCEPTABLE MOTOR MANUFACTURERS

- A. Toshiba
- B. General Electric
- C. AO Smith
- D. Reliance

PART 3 - EXECUTION (NOT USED)

END OF SECTION