

QA/QC Checklist

PENNSYLVANIA STATE UNIVERSITY



Construction Services

DIVISION 23 – HVAC

23 21 23 – Hydronic Pumps

General Information	Programming/Design	Bidding/Preconstruction	Installation/Construction	Closeout/Warranty
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01 General

1. Verify that pumps are end suction, double suction, or in-line type for hydronic applications. Typically, pumps 10hp or greater shall be base mounted.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Verify that close coupled pumps are not specified or shown on drawings. OPP prefers not to use these types of pumps because it is difficult to repair their seals and sometimes require special order motors and/or frames.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

02 Motors

1. In general, pumps shall use 1750/1800 rpm motors unless design conditions necessitate alternative motor speeds.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Motors shall meet NEMA PREMIUM efficiency levels.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. Motors 3/4hp and larger shall be 3-phase. Motors greater than 1/2hp shall be ball bearing type. Refer to other motor requirements for HVAC equipment motors listed on the OPP Design and Construction Standards webpage under item 23 05 01.01A Motors and Drives section of the Mechanical General Requirements section.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4. On variable frequency drive (VFD) motors, shafts shall be grounded via a grounding ring through grounded brushes. OPP has noticed some bearing failures due to ungrounded shafts.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

03 Pumps/Bases

1. Verify that the pump seals meet the temperature and application requirements listed on the OPP Design and Construction Standards webpage under item 23 21 23.01B2 Seals section of the HVAC Pumps section.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Base mounted pumps installed slab-on grade shall typically be mounted on a concrete housekeeping pad with anchor bolts. In general, the housekeeping pad shall be at least 4” thick and 6” wider than the pump base plate on each side. Base mounted pumps installed on floors above grade (or anywhere that vibration may affect critical research or activities) shall be provided with concrete inertia bases with spring vibration isolators. Vibration type bases shall also include a minimum 2” pad underneath to prevent water from reaching and corroding vibration spring mountings.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. Unless specifically noted by the manufacturer, base-mounted pumps shall be grouted in place with non-shrink grout.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

04 Couplings					
1. Pump flexible couplings shall be the elastomer-in-shear toothed or donut element type. The coupling assembly shall have 4-way flexing action that can absorb torsional, angular parallel and axial shock, vibration and misalignment.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Couplings shall be center drop-out, spacer type to allow disassembly and removal without removing pump shaft or motor.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. "Jaw" type couplings shall not be permitted.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
05 Piping/Valves/Specialties					
1. All piping connections to pumps shall be independently supported so that no strain is imposed on the pump casing flanges.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Multipurpose/triple duty valves shall not be used. With the predominance of speed drives on pump systems, the balancing portion (and corresponding pressure drop) becomes unnecessary. In addition, the check valve portion cannot be repaired without draining the entire system.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. Vibration isolation flexible connectors (reinforced, double spherical, neoprene type) shall be used between the pump and both suction/discharge isolation valves. Flexible connectors are typically not required on in-line pumps (allowing pumps to be supported from adjacent piping). However, special noise or vibration requirements in sensitive applications may overrule and still require the isolators. Braided metal pipe connectors do not provide adequate vibration isolation and shall not be used.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4. Verify that there is a sufficient straight pipe length upstream/downstream of flow meter orifices.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5. A single pressure gauge with ¼" ball valves and interconnecting piping from the suction to the discharge sides of the pump and upstream of the strainer shall be provided on each pump in order that each pressure and/or pressure difference can be observed from a single gauge	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
06 Alignment/Startup/Balancing					
1. All base-mounted, flexible-coupled pumps shall have final alignment of motors, couplings and pump shafts performed by an independent HVAC Vibration Analyst, using precision laser equipment. IMPORTANT: Incorrect alignment causes rapid coupling and bearing failure. This work must be completed to the satisfaction of the University as part of the criteria determining Substantial Completion.	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2. On larger base-mounted pumps, contact Mike Hoy, Predictive Maintenance Leadman (rmh12@psu.edu ; (814) 777-4568) to review the installation for proper alignment by the contractor. This should be done BEFORE pumps are grouted in place.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3. Verify that the contractor removes any temporary fine mesh startup screens on strainers/suction diffusers after the system has been cleaned/flushed and before hydronic systems are balanced and commissioned. Verify that the "normal" screen remains in place to protect the pump and minimize the suction pressure drop in normal operation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses; then the pump impeller shall be trimmed or maximum pump speed shall be adjusted to meet design flow conditions at	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
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<p>actual minimum pressure required to satisfy critical zone(s). This is a significant issue to get coordinated and optimized and overseen by initial commissioning effort. Balancing and control vendors tend to set up the systems conservatively higher to achieve “design” conditions rather than fine tuning to actual project specific conditions. That translates to higher energy use.</p>					
<p>5. After startup and balancing, verify that insulation is installed on the pump bodies, valves, fittings, etc. Insulation must be removable on those areas that require periodic maintenance or testing.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<p>6. Insulation on pump systems operating below ambient dew point (such as chilled water) shall be insulated with closed cell foam with all joints and penetrations completely sealed to maintain vapor barrier.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>