

PUMPS - HYDRONIC

DESIGN & INSTALLATION

1. Summary

- a. Separately coupled, base-mounted, end-suction centrifugal pumps are preferred.
- b. Location of equipment and what it serves determines quality of associated motor, bearings, etc.
- c. All pumps to get VFD's to eliminate the possibility of trimming of impellers after installation.
- d. Pumps to have 100% back-up.
- e. Select pumps for highest efficiency as possible.

2. Design Requirements

- a. Piping at pumps shall be arranged to facilitate pump maintenance. Piping shall be arranged so that the service valves can be closed and the piping and specialties between the service valves and pump removed for servicing and to allow clear access to the pump for removal as required. Where pump connection sizes are smaller than the line sizes associated with the suction and discharge piping, reducer/increaser shall be installed immediately at the pump flange to adapt to the indicated line size. All specialties and service valves associated with the pump such as strainers, check valves, etc., shall be line size, and not pump connection size.
- b. In general 100% stand-by pumps shall not be used. Parallel pumps shall be used where added reliability is needed.
- c. Parallel pumps shall be selected at $\frac{1}{2}$ - $\frac{3}{4}$ the system flow at system head.
- d. Pumps selections shall meet the following criteria:
 - High Pump Efficiency.
 - Mid-range impeller size in the pump body.
 - Non-overloading motor size for the impeller size.
 - Parallel pumps shall not be off of the manufacturer's published curve when operating on a single pump.
 - The preference is 1750 RPM, then J 150 RPM, and then 3500 RPM.
- e. Pumps installed at slab on grade shall not have inertia isolation bases. Inertia isolation bases shall only be used where the designer demonstrates the need.
- f. Accurate pump head calculation and selection is required. The DESIGNER will pay to have the impeller trimmed for pumps that operate at design flow with a head 10' less than scheduled, or pay the cost to install a larger impeller where the pump flow is less than design flow.
- g. Pump motors shall be NEMA Premium efficiency.
- h. Pump coupling shall be rated for inverter use.
- i. Install either Brass or Stainless Steel nipples with quarter turn ball valves to drain and vent pumps.

3. Existing Systems

- a. Where existing systems are modified, specify that the Contractor install “start-up strainers” for existing pumps. Start-up strainers shall be removed after 72 hours of operation.
- b. Specify that the start-up strainers shall be attached to the pump service valve after removal to show that the start-up strainer was removed.

4. Submittals

- a. Provide certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- b. Show pump layout and connections.
- c. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
- d. Include diagrams for power, signal, and control wiring.
- e. Include emergency, operation, and maintenance manuals.

EQUIPMENT and PRODUCT REQUIREMENTS

1. Approved Manufacturer

- a. Bell and Gossett.

2. Separately Coupled, Base-Mounted, End-Suction Centrifugal Pumps

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - ITT Corporation; Bell & Gossett.
- b. Description: Factory-assembled and tested, centrifugal, overhung-impeller, separately coupled, end-suction pump' as defined in HI 1.1-1.2 and HI1.3; designed for base mounting, with pump and motor shafts horizontal.
- c. Pump Construction:
 - Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and flanged connections. Provide integral mount on volute to support the casing, and provide attached piping to allow removal and replacement of impeller without disconnecting piping or requiring the realignment of pump and motor shaft.
 - 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.
 - Pump Shaft: Steel, SAE 1144 with aluminum bronze ASTM Bill shaft sleeve.
 - Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.
 - Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings.

- d. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor. EPDM coupling sleeve for variable-speed applications.
 - e. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.
 - f. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.
 - g. Motor: Single speed, secured to mounting frame, with adjustable alignment.
 - Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Pump Specialty Fittings
 - a. Suction Diffuser:
 - Angle pattern.
 - 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting.
 - Bronze startup and bronze or stainless-steel permanent strainers.
 - Bronze or stainless-steel straightening vanes.
 - Drain plug.
 - Factory-fabricated support.
4. Examination
 - a. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - b. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
 - c. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.
 - d. Proceed with installation only after unsatisfactory conditions have been corrected.
5. Pump Installation
 - a. Comply with HI 1.4.
 - b. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
 - c. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
 - d. Equipment Mounting: Install base-mounted pumps on cast-in-place concrete equipment pads.

- Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
- Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of concrete base.
- For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
- Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- Install anchor bolts to elevations required for proper attachment to supported equipment.
- Install pump on 4 inch high concrete base designed to withstand, without damage to equipment, seismic force required by code.
- Grout pump base solid using non-shrink, non-metallic grout after mounting but prior to pump alignment.

6. Alignment

- a. Engage a factory-authorized service representative to perform alignment service.
- b. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
- c. Comply with pump and coupling manufacturers' written instructions.

7. Connections

- a. Comply with requirements for piping specified in Section Piping and valves. Drawings indicate general arrangement of piping, fittings, and specialties.
- b. Where installing piping adjacent to pump, allow space for service and maintenance.
- c. Connect piping to pumps. Where pump connection sizes are smaller than the line sizes associated with the suction and discharge piping, concentric reducers or increasers shall be installed immediately at the pump flanges to adapt to the indicated line size. All specialties and service valves associated with the pump such as strainers, check valves, etc. shall be line size and not pump connection sizes.
- d. Install check and shutoff valves or check valve, throttling valve and shutoff valves as indicated on drawings on discharge side of pumps. Triple duty valves not necessary where pumps have variable frequency drives.
- e. Install suction diffuser and shutoff valve on suction side of pumps.
- f. Flexible connections required at pumps. Victaulic type mechanical couplings on suction and discharge sides of base-mounted pumps between pump casing and valves may be installed in lieu of flex connections for vibration isolation.
- g. Install individual valved pressure taps on pump suction, pump discharge and suction diffuser housing with sensing tubes to a single pressure gauge.
- h. Ground equipment according to Grounding and Bonding in Electrical standards.

- i. Connect wiring according to Building Wire and Cable in Electrical standards.
8. Start-Up Service
- a. Perform startup service.
 - b. Complete installation and startup checks according to manufacturer's written instructions.
 - c. Check piping connections for tightness.
 - d. Clean strainers on suction piping.
 - e. Perform the following startup checks for each pump before starting:
 - Verify bearing lubrication.
 - Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - Verify that pump is rotating in the correct direction.
 - f. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - g. Start motor.
 - h. Open discharge valve slowly.

END OF SECTION

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