DESIGN GUIDELINE 230041
PUMPS

Scope

Pump selection. Requirements for the following pump types:

- Domestic boosters
- Storm and sanitary sump pumps
- In-line circulators
- Base mounted end and double suction pumps
- Vacuum pumps
- Steam condensate pumps

Related Sections

Design Guideline Sections:
220000 – Plumbing Design
230040 – Hydronic Systems and Specialties
230050 – Chilled Water Systems

U-M Master Specification Sections:
220523 – Valves
221113 – Piping Materials and Methods
221123 – Domestic Water Booster Pumps
221333 – Packaged Submersible Storm And Sanitary Pumps
230593 – Testing, Adjusting, and Balancing
232123 – Plumbing and Hydronic Pumps

General:

U-M Master Specification Section 221123 shall be used as the basis for domestic water booster pump specifications on projects.

U-M Master Specification 221333 shall be used as the basis for packaged submersible storm and sanitary pump specifications on projects.

U-M Master Specification 232123 shall be used as the basis for plumbing recirculating pumps and hydronic pump specifications on projects.

The A/E shall edit the U-M specification to make it project specific. Turn on hidden text and read all spec. editor's notes when editing the specification.

A/E shall schedule all pump data on the drawings (not within project specifications).

Select pumps and motors to be non-overloading (not into the service factor), at pump run-out (right end of published curve).

Pump efficiency at design conditions should be close to, or left of, peak pump efficiency.

Mechanical seals shall be used on all pumps except fire pumps, where stuffing boxes shall be used.

In general, specify pumps with 1800 rpm motors, unless design condition necessitates alternate motor speed.

Where remote start-stop, or status monitoring is required, use combination magnetic starter or variable speed drive (not manual starter).

Provide variable speed control of pumps per the requirements indicated in the governing version of ASHRAE Standard 90.1. When variable speed control is required either per this Standard or per the requirements of the contract documents, ECM (electronically commutated motor) pumps are preferred in lieu of electronic VFD (variable frequency drive) for 7.5 horsepower and smaller inline pumps. VFDs shall be used for speed control of pumps larger than 7.5 horsepower. Discuss with U-M Design Manager the pump applications on a project that are appropriate for ECM speed control.

Sump Pumps

In general, design sump pumps based on a submersible, duplex pumping system. Include slide rail on all sanitary pumps and on storm water pumps with motors larger than 5 HP, or sumps deeper than 4 feet. Include lifting lugs on pumps, automatic pump alternator and non-mercury float switches. Specify one-point common alarm (indicating high level, pump failure, or seal failure), and connect to Building Automation System.

Base Mounted End Suction Circulating Pumps

Base mounted end suction circulating pumps shall be of the centrifugal single stage type, with back pull-out design. Pump and motor shall be connected through a flexible drive coupling, with safety guard.

Pump and motor shall be properly mounted and aligned on a common, welded, rigid structural steel or cast iron base, with an enclosed perimeter with opening for grouting in place. Base shall be grouted in place.

Base Mounted Double Suction Circulating Pumps

Base mounted double suction circulating pumps, shall be centrifugal, single-stage type with horizontal split case design for servicing the impeller without disruption of the piping. Vertical split case design is also acceptable, where floor space is at a premium.

Provide rigid steel grout base and grout as described for End Suction Pumps section above.

For pumps larger than 30HP, consider need for trimming impeller for improved energy efficiency, following initial testing and balancing. Consult U-M Design Manager.

In-Line Circulating Pumps

In-line circulating pumps shall be single stage; with cast iron body and bronze trim construction, unless special fluid handling dictates otherwise.

Vacuum Pump (Lab and Medical)

Vacuum pumps shall be bronze fitted, or all stainless steel, 1750 RPM and have mechanical seals. Vacuum pump package shall include tank with access hatch and all related controls and piping.

Coordinate equipment selection (rotary vane versus liquid ring) with U-M Design Manager.

System Application Requirements

Consider potential future expansion of pumped systems. Extent of expansion will be determined on a case-by-case basis. Consult with the U-M Design Manager for specific direction.

Domestic Water

Provide all bronze lead free construction or stainless steel construction for all domestic water pump applications.

Storm and Sanitary

Use submersible sump pumps as described in Sump Pumps, above.

Hydronic Systems (Chilled Water, Condenser Water, Hot Water Heating)

Use end suction, double suction or in-line pumps as described in Equipment Requirements above. Typically, use base mounted pumps for all applications over 10HP.

Install fully redundant (N-1) stand-by pumps for heating systems.

For chiller and cooling tower installations, refer to Design Guideline Section 230050.

Steam Condensate Pumps

Typically, use electric condensate pumps for steam condensate. Consider use of air operated condensate pumps (only with U-M Design Manager approval) in steam tunnels, or other spaces with high condensate temperatures.

Design of condensate pumping system must consider receiver size, location, NPSH, flash area, and receiver and flash tank venting (properly sized, routed to outside).

Installation Requirements

Install pumps and accessories in strict accordance with the manufacturer's requirements for maintaining satisfactory hydraulic performance.

Provide the following accessories for each pump (except sump pumps):

- Flexible connector, rated 2 times normal operating pressure, in suction and discharge lines. Refer to U-M Master Specification Section 221113. Flexible connectors are not typically required on in-line pumps (allowing pumps to be supported from adjacent piping).
- Isolation valving on both sides of the pumps. Not applicable for sump pumps. For condensate pumps, suction valve must comply with U-M Master Specification Section 220523.
- On pump discharge:
    - Triple duty valve and an isolation valve, or
    - Non-slam check valve, throttling valve, means of measuring flow, and isolation valve. Install flow measuring devices in strict accordance with manufacturer requirements to ensure proper performance. Throttling valve shall be eliminated on variable flow (VSD) pumping applications.
- Pressure gauges on suction (prior to and after strainer) and discharge. For small, in-line pumps, pressure-temperature plugs may be used in lieu of gauges. Typically, these three points should use manifolded ½" piping, with isolation ball valves and a single, common gauge.

Provide the following accessories for each sump pump:

- Flexible connectors are not typically required on sump pumps, except where vibration necessitates.
- Pressure gauge, check valve and isolation valve on pump discharge. Separate throttling valve is not typically required.

Provide vibration isolation as necessary to prevent excessive noise and vibration. In general, install large pumps located above grade on concrete inertia base with spring vibration isolators. Where an inertia base is used, support piping near pumps with spring hangers. Support suction diffusers and piping directly in contact with pump from inertia base.

Suction inlet pipe for all pumps should be a straight section of pipe of not less than 10 pipe diameters in direction of flow. Where space conditions will not permit suction inlet pipe of required length, provide a suction diffuser.

Base mounted pumps shall be laser aligned. Typically, this should be specified as part of factory service technician start-up services.

For vibration testing requirements, refer to U-M Master Specification Section 230593.