



DESIGN CONSIDERATIONS for Maintaining Peak Pump System Performance

When selecting the proper pump design for your specific application, it is important to consider upfront cost, reliability, safety, operational cost and maintenance cost.

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High temperature liquids can wreak havoc on industrial operations if properly specified and installed pumping systems are not in place. Industrial process pumps are often the workhorses that keep operations moving reliably and safely. Typically, some of the most demanding high temperature processing applications are found in industries such as chemical processing, petroleum refining, pulp-and-paper and industrial manufacturing. It is more important than ever for site engineers to have a thorough understanding of the demands and their effects on pump design. Being armed with this knowledge helps to prioritize, identify and select the right industrial pump to reliably keep operations online and uninterrupted.

This article will discuss three design considerations to evaluate when selecting the right pump for any industrial process heating application.

Centerline-Mounted vs. Foot-Mounted Designs

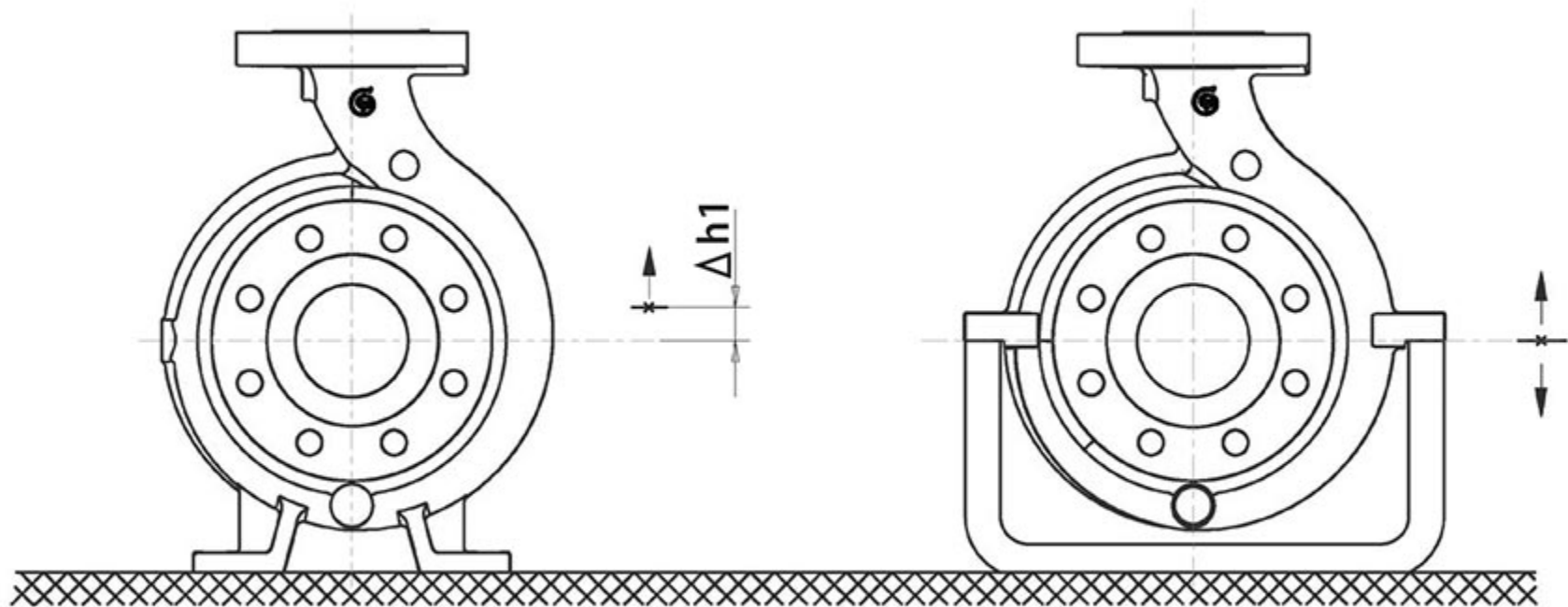
Many existing pump designs on the market have foot-mounted designs. While this design is reliable, it can pose some challenges when trying to decide on the best option for a specific application.

Foot-mounted pumps are more common and readily available. Many are designed for lower temperature applications but can be used in systems up to 700°F (371°C).

The alternative is to use a pump with a centerline-mounted casing. The advantage of the centerline-mounted design is that the thermal growth of the casing is bilateral the centerline of the pump. It does not disturb the location of the suction flange or the shaft of the pump. Also, the centerline-mounted casing will keep the suction flange in the proper position, more effectively distributing any additional piping loads while maintaining shaft position.

By contrast, the movement of the shaft of a foot-mounted design requires additional hot-alignment steps to ensure proper coupling and bearing life. Also, with the foot-mounted casing, the movement of the suction flange can cause undesired flange loading on the suction of the pump.

Site operational leaders seeking an alternative should consider the benefits of a centerline-mounted design. Table 1 summarizes some of the pros and cons associated with foot-mounted casings and centerline-mounted casings.



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ANSI Standard Guidelines

The ANSI standard — published by the American National Standards Institute — specifies the basic requirements for chemical process pumps in specification number ASME B73.1-2012. This specification has detailed requirements for dimensional interchangeability and technical requirements for optimized reliability. ANSI B73.1 centrifugal pumps have standard features across their design platform, including materials, bearing life, seal envelope, acceptable testing and other specifications to be used in the design and manufacturing of these pumps. ANSI B73.1 process pumps are respected and trusted to provide standardized pumps that are approved for the rigors typically found in demanding high temperature applications up to 500°F (260°C).

Two significant benefits should be considered when selecting an ANSI B73.1 pump for demanding applications. First, utilizing ANSI B73.1-compliant pumps can reduce inventories. ANSI B73.1 pumps designed for high temperatures (above 500°F) typically share many components with ambient-temperature designs. They also are dimensionally interchangeable, so the pumps can be modified or exchanged easily when process temperatures change.

High Temperature Oils and Heat Transfer Fluids

The use of synthetic heat transfer liquids continues to expand as these liquids offer chemical stability and efficient heat transfer properties. In addition, the use of these liquids allows system pressures to be reduced for added safety and lower design costs. Hot natural oils and synthetic oils are used in heat transfer, food processing, oil refining and petrochemical mining applications. Some applications for hot oils and heat transfer fluids include computer and power supply, energy storage, transformer cooling, recirculating chillers, train traction rectifiers, reflow soldering, industrial processing, pharmaceutical processing and semiconductor processing.

Second, with an ANSI centerline-mounted pump, operators do not have to perform time-consuming hot-alignment steps and can maximize uptime. Another area where centerline-mounted ANSI B73.1 pumps provide gains is in worker safety. Avoiding hot-alignment activities directly results in a safety benefit by removing exposure of staff working with high temperature systems that can often be as high as 700°F.

Another design advantage is that it allows for better cooling capability of the bearings. This is done utilizing a finned-tube cooler and using materials with lower heat transfer coefficients such as stainless-steel shafts. By using cooling and reducing the amount of heat that is transferred to the bearings, an ANSI B73.1 pump can maintain high bearing life under severe operating conditions.

Recognizing and planning for these pump system design features set plant operators up for success. When plant managers plan for maximum interchangeability across many pump types, a reduction in training and downtime can be realized along with a positive influence on safety.

Table 1.	Foot-Mounted	Centerline-Mounted
Pros	<ul style="list-style-type: none">• Low cost• Interchangeability with other products• Availability	<ul style="list-style-type: none">• Maintains alignment as temperatures change• Reduced piping loads
Cons	<ul style="list-style-type: none">• Requires a hot alignment step• More susceptible to high piping loads	<ul style="list-style-type: none">• Longer lead times• Higher upfront purchase price

API Pump Details

Finally, the third consideration is an intimate understanding of API 610 pump details and incorporating them into the evaluation. The American Petroleum Institute (API) is a major force in determining petrochemical equipment and operating standards. Centrifugal pumps used in petrochemical, gas and petroleum applications must meet the requirements of the API Standard 610. API standards are focused on both the design and the materials used in pump construction. API pumps are considered more robust than ANSI pumps due to the design of the casings, bearing housings, mounting feet and more. The design and materials used will directly impact the pump's ability to handle high temperature applications.

Modern API centrifugal pump designs provide robust high temperature features, allowing the pumps to go as high as 800°F (426°C). In facilities that have a number of API 610-compliant pumps, interchangeability can be maximized. Training efforts on different styles of pumps can be minimized when applying these products to high temperature applications.

When selecting the proper pump design for your specific application, it is important to consider upfront cost, reliability, safety, operational cost and maintenance cost. While foot-mounted pumps that do not meet any industrial standards are least expensive, they lack in other areas that encompass additional maintenance and operational issues like interchangeability. Using a centerline-mounted ANSI B73.1-compliant pump will allow for maximum interchangeability using a reliable pump design at a reasonable cost. A full upgrade to an API 610-compliant pump will support interchangeability in plants that use this style of pump and will be the most robust pump design in this group. A proper design selection can provide for the best solution while taking all these criteria into account.