

JACKETED MOLTEN SULFUR PUMPS



For molten sulfur and other
fluids requiring pumping at
controlled temperatures.

INTRODUCTION

Tried and tested with over 50 years of operational experience, Hayward Gordon jacketed vertical and horizontal molten sulfur pumps provide reliable performance in both clean and dirty sulfur service.

For clean or slightly contaminated molten sulfur, the jacketed A-VBJ vertical lineshaft and A-J horizontal designs make use of the excellent lubricity of sulfur to provide effective lubrication to the specially designed lineshaft bearings and mechanical seals. These models feature high efficiency centrifugal process pump wet-ends.

For services with more severe solids contamination, such as sulfur reclaim, Hayward Gordon can provide model A-VCJ jacketed vertical cantilever pumps that eliminate submerged bearings or seals from exposure to the wearing action of the contaminate solids.

For handling molten sulfur with large solids or rocks, the open passages of our non-clogging recessed impeller wet-end make an excellent choice on either the horizontal or vertical pumps.

All Hayward Gordon molten sulfur pumps allow the required control of sulfur temperature by the passage of steam or water/glycol solution through a specially designed system of volute, seal housing, discharge and column jackets. Vertical pump column jackets are constructed with welded and flanged double walled pipe. Column cross-over pipes are designed to minimize thermal stresses.

In compliance with some local regulations, pump jackets can be welded to ASME Section IX and, if necessary, registered to the ASME Section VIII pressure vessel code.

MOLTEN SULFUR PUMPING

Understanding the temperature-viscosity relationship of sulfur is critical to ensuring proper pump operation. Sulfur melts at 119°C (246°F) and experiences a change of phase at a temperature of 158°C (317°F) beyond which its viscosity increases extremely rapidly over a small temperature range (see figure 1). This increase in viscosity or “caramelization” can quickly seize the submerged pump bearings and cause an overload trip of the motor.

Reliable molten sulfur pumping can be achieved by controlling the temperature below the phase change limit. Maintaining saturated steam in the pump jacketing at a pressure of 35 psi will keep the sulfur at a good pumping temperature in the range of 138°-148°C (280°- 300°F). This includes an allowance for a small frictional temperature rise that may occur when the sulfur passes through the pump. Steam pressure of 40 psi is recommended for cold weather, outdoor installations. Glycol is also often used as a heating medium in the pump jackets to control temperatures within the ranges specified above.

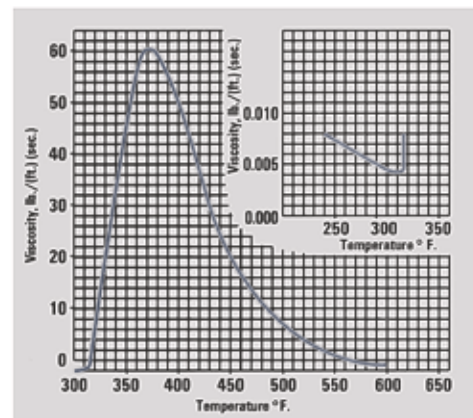
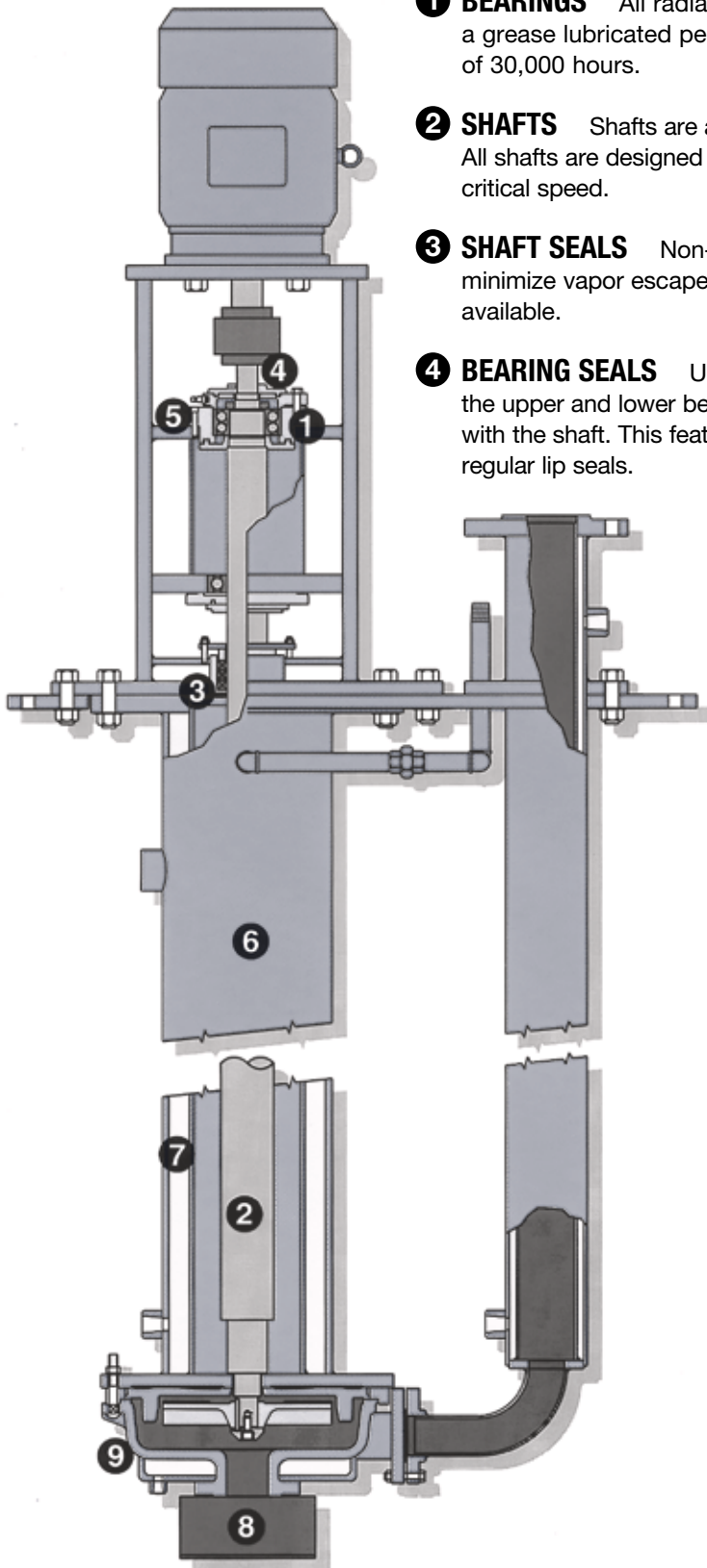


Figure 1

JACKETED VERTICAL CANTILEVER PUMPS For Contaminated Molten Sulfur

The Hayward Gordon vertical cantilever design does not require submerged bearings that would be subject to rapid wear in fluids containing abrasive solids. These low maintenance pumps can run dry and, therefore, can be operated without on-off level controls.



1 BEARINGS All radial and thrust bearings are located above the cover plate in a grease lubricated pedestal. Bearings are selected to provide L_{10} life in excess of 30,000 hours.

2 SHAFTS Shafts are available in diameters ranging from 3 to 7 inches. All shafts are designed to operate with minimal deflection well below the first critical speed.

3 SHAFT SEALS Non-metallic throttle bushings are included as standard to minimize vapor escape. Optional packed stuffing boxes and seal housings are available.

4 BEARING SEALS Unique, Hayward Gordon designed labyrinth seals protect the upper and lower bearings from contamination without any moving contact with the shaft. This feature provides a significant maintenance advantage over regular lip seals.

5 IMPELLER CLEARANCE ADJUSTMENT Convenient external impeller clearance adjustment can be achieved using shims and built-in jacking screws.

6 SUPPORT COLUMNS Pump support columns feature double walled construction and precision spigot mating to baseplate and casing to assure rigid and accurate alignment of rotating parts.

7 JACKETING Column, discharge pipe, and optional casing jackets provided to maintain close temperature control with low pressure steam or glycol.

8 STRAINERS Optional strainers are available for protection against large solids.

9 WET-ENDS ANSI process pump wet-ends with open impellers are offered for sulfur with mild contamination. For large solids handling and/or high abrasion resistance, an open channel recessed impeller design is available.

SERIES A-J HORIZONTAL JACKETED PUMPS

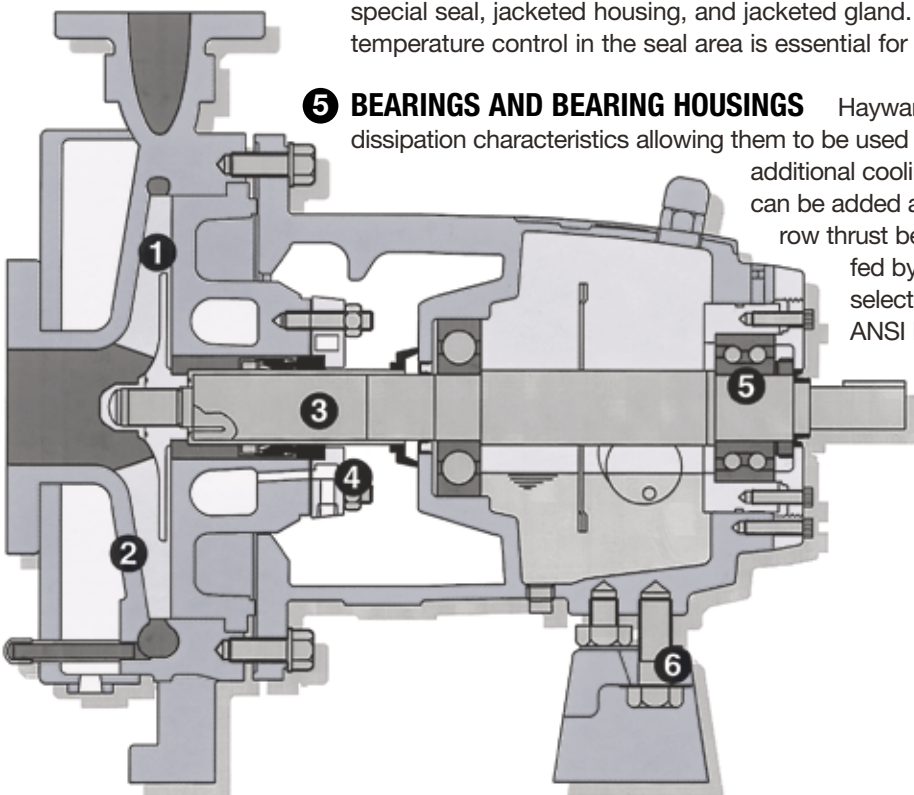
Series A process pumps and TORUS® recessed impeller pumps are also manufactured in a horizontal jacketed configuration. In addition to being used for transfer, loading and unloading applications, horizontal pumps can be used as boosters in series with vertical or other horizontal pumps for high head installations. As with the vertical pumps, a wide range of wet-ends, hydraulic performance, and materials of construction is available.

It is very important to ensure that bearing frames on jacketed pumps can withstand high temperatures. Hayward Gordon horizontal jacketed pumps incorporate an oversized, round-bodied, “bee-hive” frame designed to provide a large radiating surface and oil reservoir to carry away excess heat. Although optional cooling coils are available, they are not required for fluid temperatures below 204°C (400°F). Other features of the horizontal jacketed pumps are shown below.

- 1 IMPELLERS** Impellers are available in a variety of styles including fully open (with partial shrouds for rigidity), fully enclosed, or recessed (vortex pumps) depending on the requirements for abrasion resistance and solids handling. Open and recessed impellers feature back pumpout vanes that lower thrust on the bearings and reduce pressure in the sealing area. Impeller clearances are easily adjustable externally through shimming or a “micro-screw” mechanism.
- 2 CASINGS** All casings are supported with integral cast feet for minimum pipe distortion and a thick wall construction provides extra protection from corrosion and abrasion. Either 150 or 300 pound flat face or raised face flanges are available. Rugged front casing jackets are provided to maintain fluid temperatures with low pressure steam or glycol.
- 3 SHAFTS AND SLEEVES** Rigid, large diameter shafts are designed for minimum deflection under load and are manufactured to a surface finish of less than 32 micro inches through the sealing area. Hook type, positively driven shaft sleeves are available in various materials and hardness.
- 4 SEALS • GLANDS • SEAL HOUSINGS** Seals are the most vulnerable components of molten sulfur pumps. Hayward Gordon has worked with major mechanical seal manufacturers and customers for over 50 years to develop a reliable and field proven combination of special seal, jacketed housing, and jacketed gland. In molten sulfur service, a high degree of temperature control in the seal area is essential for proper pump operation and long seal life.

- 5 BEARINGS AND BEARING HOUSINGS** Hayward Gordon power-frames have excellent heat dissipation characteristics allowing them to be used on many high temperature services without additional cooling. However, bearing housing cooling coils can be added as an option. The heavily radial and double-row thrust bearings are lubricated by a large oil reservoir fed by a constant level oiler. Bearings are selected to provide L_{10} life that exceeds the ANSI B73.1M-1991 standards.

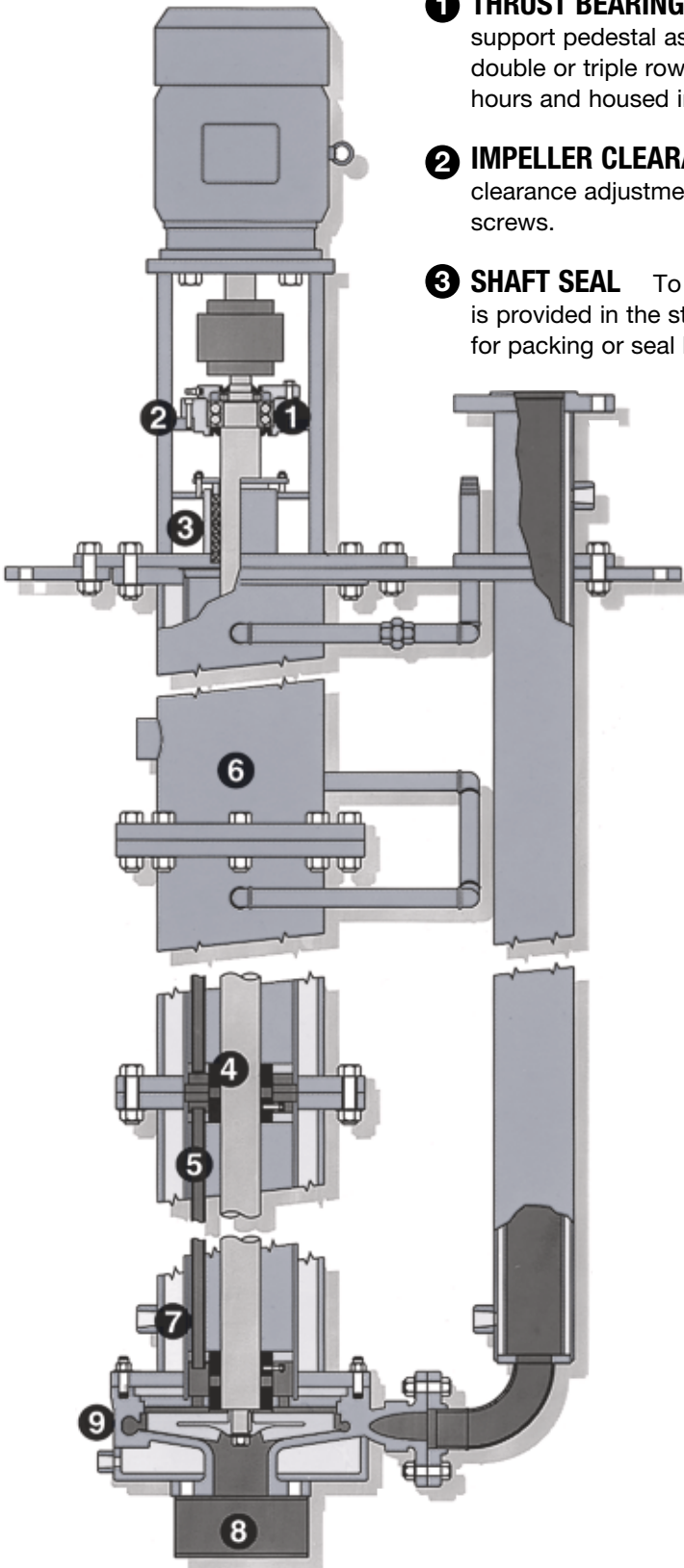
- 6 BACK PULL-OUT** All Hayward Gordon pumps feature back pull-out power frames for fast and low-cost maintenance. The complete rotating assembly can be removed without disturbing the suction or discharge piping.



SERIES A-VBJ

JACKETED VERTICAL LINESHAFT PUMPS For Clean Molten Sulfur

For clean or slightly contaminated sulfur, Hayward Gordon offers its proven vertical lineshaft design incorporating the features described below.



1 THRUST BEARINGS The upper bearing housing is integral with the motor support pedestal assuring accurate alignment. Bearings are regreaseable, double or triple row angular contact type selected for an L_{10} life of 30,000 hours and housed in a machined steel cartridge.

2 IMPELLER CLEARANCE ADJUSTMENT Convenient external impeller clearance adjustment can be achieved using shims and built-in jacking screws.

3 SHAFT SEAL To prevent the escape of vapors a minimum of six rings is provided in the stuffing box. Optional inlet and outlet connections allow for packing or seal lubrication.

4 SUBMERGED BEARINGS Specially designed ni-resist or carbon graphite grooved bearings provide radial support for the shaft and impeller assembly. Size and number of bearings are selected to provide long life and pump operation below first critical speed.

5 BEARING LUBRICATION SYSTEM An internally piped molten sulfur circulation system provides positive lubrication to each lineshaft bearing even during pump down.

6 SUPPORT COLUMNS Pump support columns feature double walled construction and precision spigot mating of the welded column flanges in order to assure rigid and accurate alignment of bearings.

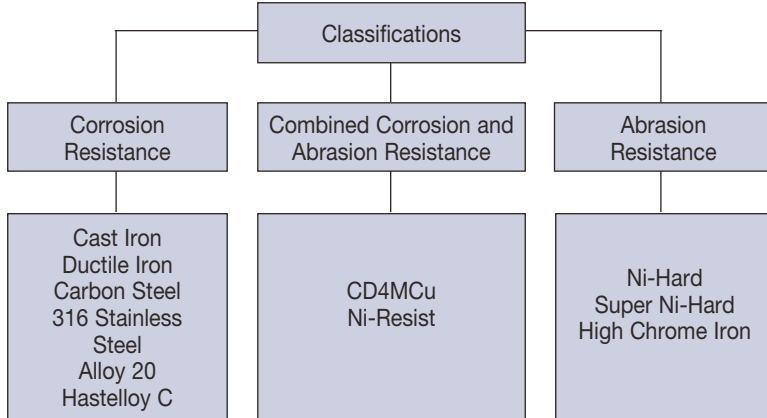
7 JACKETING Column, discharge pipe, and optional casing jackets are provided to maintain close temperature control with low pressure steam or glycol.

8 STRAINERS Optional strainers are available for protection against large solids.

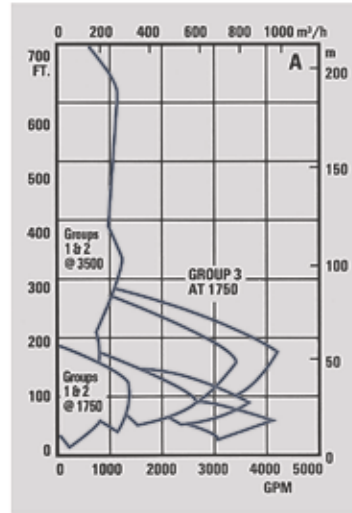
9 WET-ENDS ANSI process pump wet-ends with open impellers are offered as standard. Where hydraulic conditions preclude use of the standard, specially selected closed impeller designs are available.

MATERIALS OF CONSTRUCTION

Wet-end components are available in a wide range of materials to suit the application requirements. A partial list of material options is shown below.



PERFORMANCE RANGE



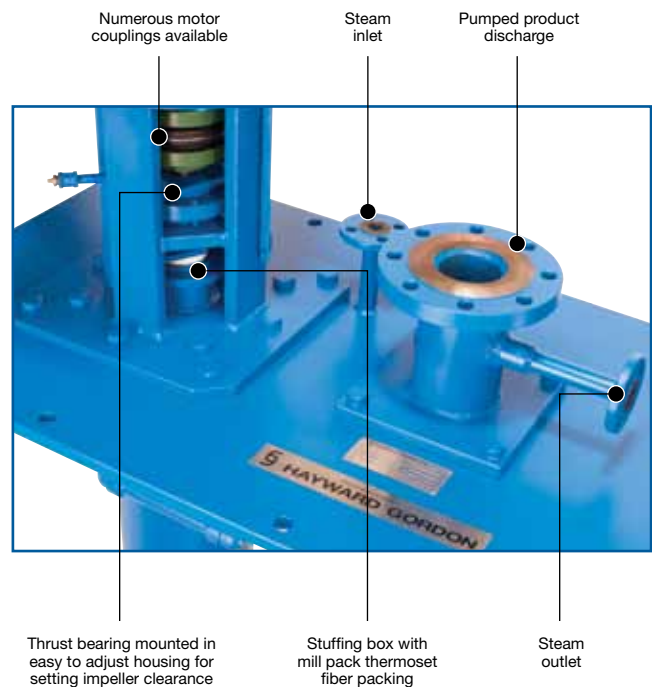
Standard models are available for capacities to 4000 GPM. Heads range from 250 feet on vertical pumps to 675 feet on horizontal pumps.

ACID & CORROSIVE LIQUID HANDLING PUMPS

For corrosive services, Hayward Gordon also produces non-jacketed versions of each of the horizontal and vertical pumps described in this bulletin. These pumps can be manufactured from most available metal and metal alloys to handle a wide range of corrosive and abrasive applications such as those found in acid plants, petrochemical facilities, metal refining operations, and FGD processes.

Non-jacketed vertical pumps can be produced with or without submerged bearings (i.e. lineshaft or cantilever) depending on the level of abrasion resistance required and the degree of solids contamination in the fluid. The full line of horizontal ANSI B73.1 chemical process pumps offers many of the same performance features as their jacketed counterparts including the unique alignment positioning back-foot and the micro-screw impeller clearance adjustment. Further bulletins and information on these pumps are available from the Hayward Gordon locations listed below.

VERTICAL LINESHAFT MODELS



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1051 Clinton Street
Buffalo, New York 14206
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