HOT WATER CIRCULATION:
PICKING THE PERFECT PUMP

When an industrial process requires the circulation of a hot fluid, and you have decided hot water is going to be that fluid, you will want to specify the right pump to ensure the most efficient and safe circulation of water. Why is this important? The hotter that water gets, the higher its pressure will get. Water has low viscosity at higher temperatures and therefore cannot cool itself as it runs through a system.

Dickow’s hot water circulation pumps are made to be used with water only. They are not hot oil pumps that have been modified to use with water; rather, they are pumps that are made to be operated specifically with water—an important distinction when looking for long pump life. To determine if you require a pump that has a mechanical seal or if your application would be better served by a magnetic sealless pump, you need to know how hot your process will be.
Type NHL, HPL, HPR, and NHM have been developed for medium- and large-size heating plants, for heating calenders, presses, large buildings and similar applications that require temperatures greater than 356°F (180°C).

The NHL series is designed for pressures up to 45 bar at 464°F (238°C), maximum capacity is approximately 3960 gpm (900 m³/h), and differential head approximately 492 ft (150 mLC).

The HPL/HPR series is designed for pressures up to 80 bar at 536°F (280°C), maximum capacity is approximately 1320 gpm (300 m³/h), and differential head approximately 197 ft (60 mLC).

**PUMP DESIGN**

The pumps are single-stage volute casing pumps in a “back-pullout” design with end suction and a top centerline discharge flange. The back-pullout design allows disassembly of the rotating pump parts without removing the volute casing from the piping system.

To take full advantage of the back-pullout design, spacer-type couplings will allow the driver to remain bolted to the base plate.

Volute casings with rigid foot mounting are supplied as standard for the NHL/NHM pump types. The casing bolts are the heat-resistant expansion type. For applications with temperature swing, additional cup springs will help avoid leakage caused by thermal expansion.

The pumps are made with confined gaskets to avoid blow-out of the liquid. A centerline mounted design (according to API 610/ISO 5199) is available on request for higher operating temperatures. This minimizes thermal stress and misalignment of the coupling due to heat expansion of the casing during operation.

The pumps’ impellers are casted in one piece with solid hubs. To minimize thrust loads, the closed impellers are hydraulically balanced by wear rings and balance holes in the impeller hub. The impellers are keyed to the pump shaft and secured by cap screws with Heli-Coil inserts and are properly statically and dynamically balanced according to DIN ISO 1940 T1 Grade 6,3.

The volute casing and intermediate casing are fitted with renewable wear rings held in place by a press fit with locking screws. Additional impeller wear rings are available as an option. The running clearances are in accordance with API 610.

The pump shaft can transmit the full driver output and is accurately machined.
throughout its entire length and is properly finished at the bearing surfaces. To have satisfactory seal performance, the shaft diameter and overhang are sized to minimize shaft deflection at the seal faces. The shaft design guarantees a critical speed of more than 10 percent over the maximum operating speed. The connections “cap screw-hub” and “hub-shaft sleeve” are sealed by confined gaskets, and the pump shaft has no contact to the pump fluid. The pump shaft is carried by generously dimensioned antifriction bearings outside the pumped liquid. The bearings are oil-lubricated, and the oil level in the bearing bracket is regulated by a constant level oiler. The standard design has angular ball bearings on the coupling side fixed on the pump shaft in axial direction by circlips. The HPL pumps and NHL pumps in temperature swing applications are provided with shaft nuts.

Generally, all HPL/HPR pumps will be provided with centerline mounted casings. The roller bearings take the remaining hydraulic radial loads. The bearings proved a lifetime of more than 25,000 operating hours even under severe conditions. If required, bearing bracket cooling is available on request.
Application Limits

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*Once you know your temperatures, you will be ready to choose which model will be best for your application.*
**SHAFT SEAL COOLING**

Due to high vapor pressures of hot water, standard mechanical seals cannot be used for high temperatures. The following seals incorporate the cooling that is needed to ensure proper operating temperatures.

The “Re” design on the NHL model offers a water-cooled stationary seat and cooling jacket. There is no circulation available (dead end). A throttle separates the hot pumped liquid from the cooled liquid in the seal chamber. Cooling water consumption is 300-700 l/h with maximum allowable operating temperatures of 401°F (205°C) [NHL s] and 464°F (238°C) [NHL huh].

The “Gef” design with an air-cooled cooling loop on the NHL model offers a balanced, single mechanical seal with a pumping ring. Circulation is from the pumping ring at the seal through an external air cooler and back to the seal chamber. A throttle between impeller and seal chamber separates the pumped hot water from the cooled fluid in the seal chamber. This circulation minimizes heat load on the cooling loop by cooling only the small amount of liquid that is recirculated. This design is self-venting and offers an allowable operating temperature of 401°F (205°C) [NHL s] and 410°F (210°C) [NHL huh].
The “Ref” design with circulation through water-cooled heat exchanger (API-plan 23) is available on the NHL/HPL. Circulation leads from a pumping ring over the seal, through a water-cooled heat exchanger and back to the seal chamber. The cooling water goes through a cooling jacket in the intermediate casing and through the heat exchanger.

Cooling water consumption is 300-700 l/h with an allowable operating temperature of 536°F (280°C) [HPL/HPR] and 464°F (238°C) [NHL huh].

**WHEN TO GO SEALLESS**

When an application requires higher heat, a mechanical seal will not suffice as pressure will build and the seal can fail. To prevent the vaporization of liquids between seal faces, additional cooling is required when the media has vapor pressure greater than atmospheric pressure at operating temperatures. Additionally, when handling fluids that crystallize in the atmosphere, an appropriate quench connection or barrier fluid must be provided.

Various attempts have been made to improve the performance of mechanical seals to meet regulations pertaining to emissions. Examples include double-acting mechanical seals of tandem design, back-to-back design, and various gas seal types. All of these require auxiliary equipment, systems and controls.

For many applications, the cost of this equipment is not justifiable vs. the gains attained. It seems that the outer limits have been reached for improvements in mechanical seals with regard to reliability and emissions control. A realistic solution is a sealless pump with zero leakage—that is, without the connection of the media to the environment due to the absence of a seal.

Dickow's NHM pump design with magnetic coupling can be used with hot water. The termination of the main wear part (the mechanical seal) leads to considerably longer mean
time between failure and, therefore, higher availability.

Hot water spill-through seal failure is also excluded. Finally, the pump design is self-venting and does not require water cooling.

Although many of Dickow’s users have installed sealless magnet drive pumps for their zero-leakage feature, these installations have resulted in greatly improved mean times between failures, and down time due to seal replacement was eliminated.

Water is an economical fluid to use for your heat process, but it is important to remember to filter water before running it through your system to ensure the most efficient and longest-lasting operation. Unpurified, unfiltered water has minerals and other debris that can turn to scale and cause buildup within the system, shortening pump life.

**DICKOW’S MESSAGE**

If you are looking for a hot water circulation pump for your heat transfer application, there is a safe and reliable option out there. With Dickow, you’ll get equipment that has been performing in the industry for years. Dickow offers experience as well as references, access to parts 24/7, and top-notch customer service. If you want to invest in a pump that will serve you for the long haul, don’t cut corners with an inferior pump not designed for your application. That will cost money, time, and effort in the long run due to downtime, maintenance, and ultimately equipment failure. With a regularly scheduled maintenance program, which Dickow provides upon purchase, your Dickow pump can last for decades.

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