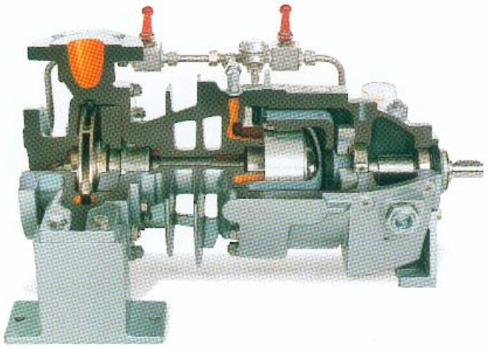
DICKOW PUMPEN



Sealless magnetic coupled Hot Oil Circulation Pumps

Series NMW / NMWR / PRMW

Issue 12/97

General

Magnetic coupled DICKOW-pumps of the series NMW/PRMW are of sealless design.
The containment shell forms a closed system with hermetically sealed liquid end.

Applications

The magnetic driven NMW/PRMW-pumps are designed for hot oil applications, to improve plant and personnel safety in industrial heating plants. Leakage of hot oil at high temperature reacts to the atmosphere and turns into koke or tar. If the vapour pressure at operating temperature is above the atmospheric pressure, leakage vaporizes. In these cases, double mechanical seals are required in conventional pumps.

The containment shell replaces any mechanical seal and saves maintenance costs because 90% of pump failures are caused by leaking seals. NMW/PRMW-pumps therefore offer exceptional benefits to the user and fulfill all environment protection rules. Maximum operating temperature without water cooling is 400°C (750°F).

Construction

NMW/PRMW-pumps are single stage volute casing pumps with closed impellers, back-pull-out design, with end suction and top centerline discharge flange. Foot mounted casings are provided as standard. Centerline mounted design is available as an option. Performance data and flange-to-flange dimensions comply with EN 22858 (ISO 2858).

DESIGN FEATURES

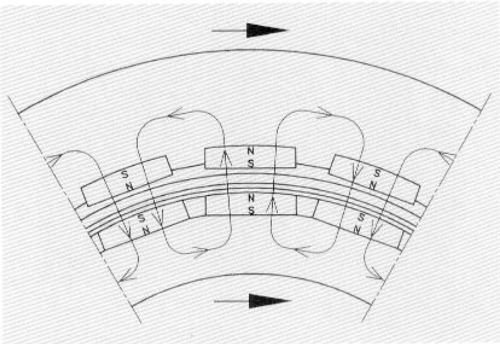
Containment shell, Disassembly

The containment shell is designed as a pressure vessel to separate the pumpage from the atmosphere only. The containment shell is not used as an additional bearing holder. No dynamic stress occurs. The containment shell is bolted to the bearing housing in a manner that allows removal of the bearing bracket including outer magnets and ball bearings without exposing the pumped liquid to the atmosphere.

Magnetic coupling

The single elements of the multipolar magnetic coupling are manufactured of a permanent magnet material "Cobalt-Samarium Rare Earth" with unlimited lifetime. The magnets in the internal rotor are completely encapsulated, no contact with liquid occurs.

Energy is transmitted to the hermetically sealed liquid end by the outer drive magnets, passing motive force through the containment shell to the internal drive magnets. Inner and outer magnets are locked together by the magnetic field lines and are working synchronously without any slip.



The inner magnet ring transmits the required torque direct to the impeller. Overload of the magnetic coupling and slipping will not effect demagnetization if a reliable monitoring device prevents overheating of the magnets. During operation, the rotating field lines cut the metallic containment shell and generate magnetic losses. The magnetic couplings are sized for direct-on-line starting of the electric motors. The transmissible power of a coupling depends on the axial magnet length. The couplings are sized for the maximum power consumption of the rated impeller at the end of performance curve.
The rated coupling power can be increased by mounting an additional series of magnets, required e.g. when installing a larger impeller respect. motor.

The maximum transmissible power is 132 kW at 2900 rpm (225 HP at 3500 rpm).

Internal clearances

The internal clearance between inner magnets and containment shell depends on the wall thickness of the containment shell. However, a minimum clearance of 1 to 2 mm (0.039 - 0.078") is provided in any case. This, together with wear resistant sleeve bearings, allows handling of fluid with solids.

Containment shell protection

The different clearances between the rotating outer magnets and stationary containment shell, and the rotating magnet holder and bearing bracket respectively adapter, prevent rubbing of the magnets on the containment shell in case of ball bearing failure. Ball bearing monitoring devices are available as an option.

Monitoring

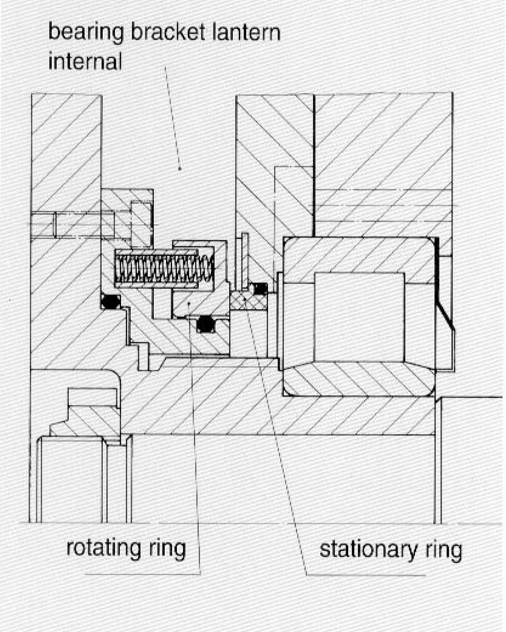
Temperature monitoring, power monitoring, dry running protection devices, leakage detection systems are available. Ask DICKOW engineers for further details.

Outer ball bearings

The drive shaft of the NMW-type is carried in generously dimensioned antifriction bearings, grease filled for life time and protected against environment by radial seal rings. The bearings are located behind the containment shell with C3-clearance and filled with high-temperature grease, type L12.
The NMWR/PRMW-pumps have the drive shaft carried in oil bath lubricated antifriction bearings. The bearings are L10 rated for more than 25000 hrs. The oil bath is protected against the atmosphere by labyrinth seal. The oil level is controlled by a constant level oiler and additionally by a bull's eye sight glass. Oil mist lubrication is available as an option.

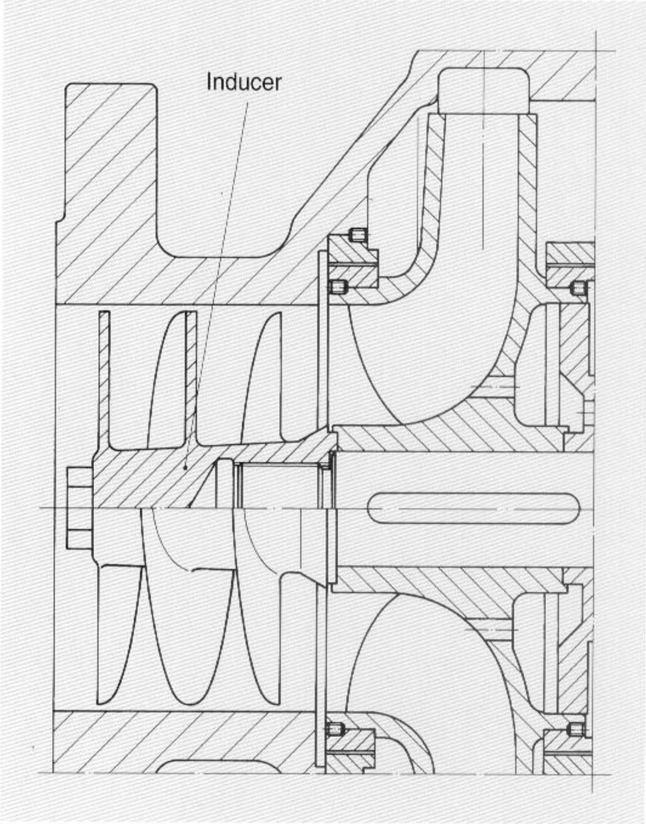
Secondary Containment

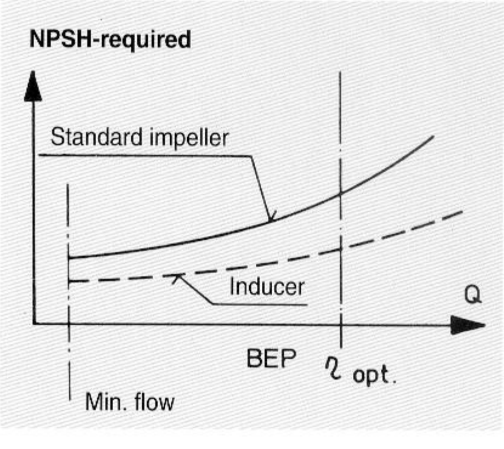
A mechanical stand-by seal can be supplied in lieu of the inboard labyrinth seal as an option. This mechanical seal separates the magnet area from the oilbath respectively the atmosphere and forms, together with the closed bearing bracket lantern, a secondary containment behind the containment shell.
The secondary seal complies to the rated working pressure of the pump. The seal is lubricated and cooled by the oilbath. Containment shell leakage monitoring is recommended in this case.
The secondary containment is standard in PRMW-types.



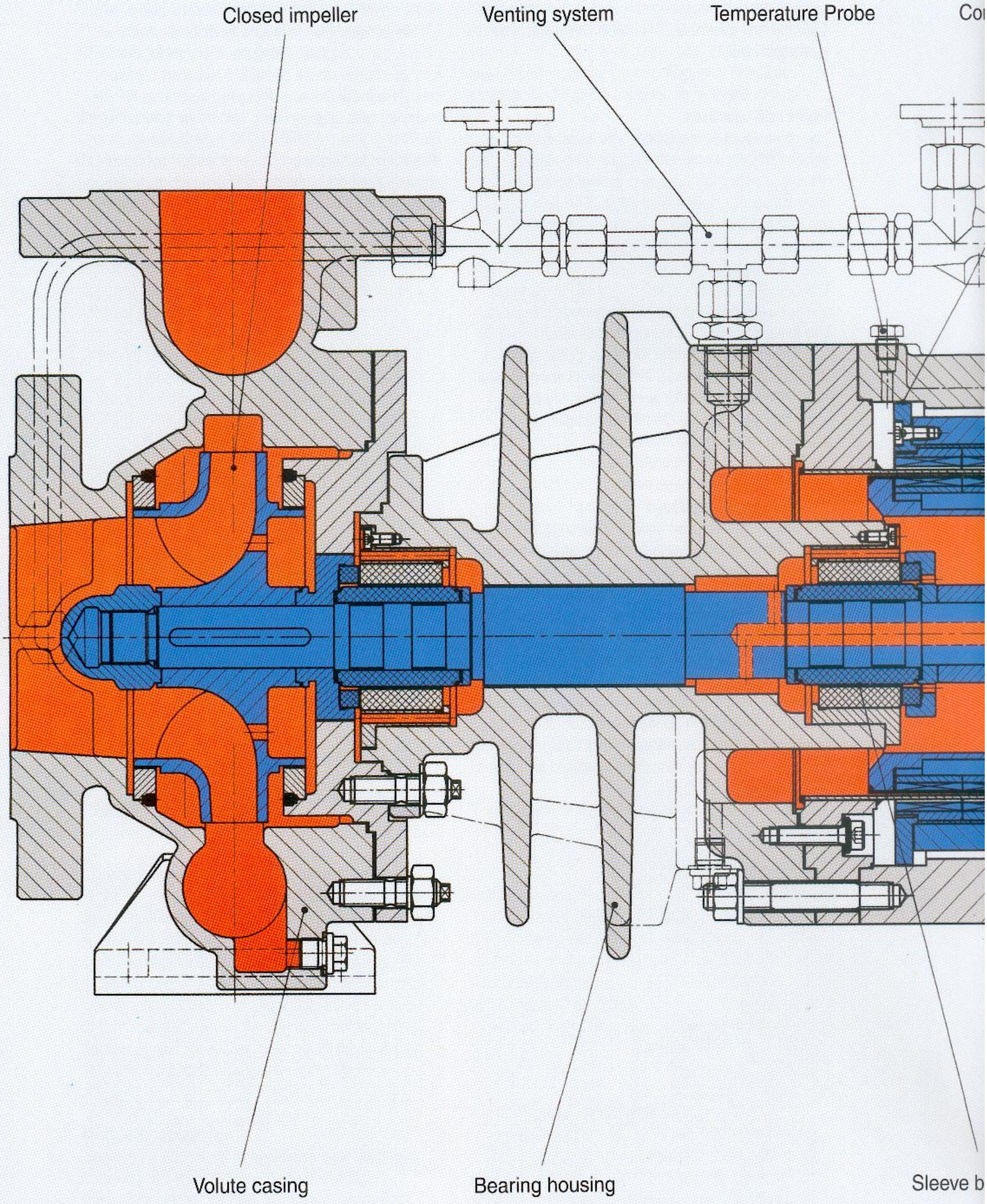
NPSH-Conditions, Inducer

To avoid cavitation, the impellers of the NMW/PRMW-pumps are designed to achieve low NPSH-values. For pumps with discharge above 50 mm (2"), additional inducers are available for further improvement of NPSH-required conditions. The inducers are designed such that NPSH-improvement is given from minimum flow up tp BEP.
Retrofit of inducers on site is possible by remachining the volute casing, without changing the suction pipe.

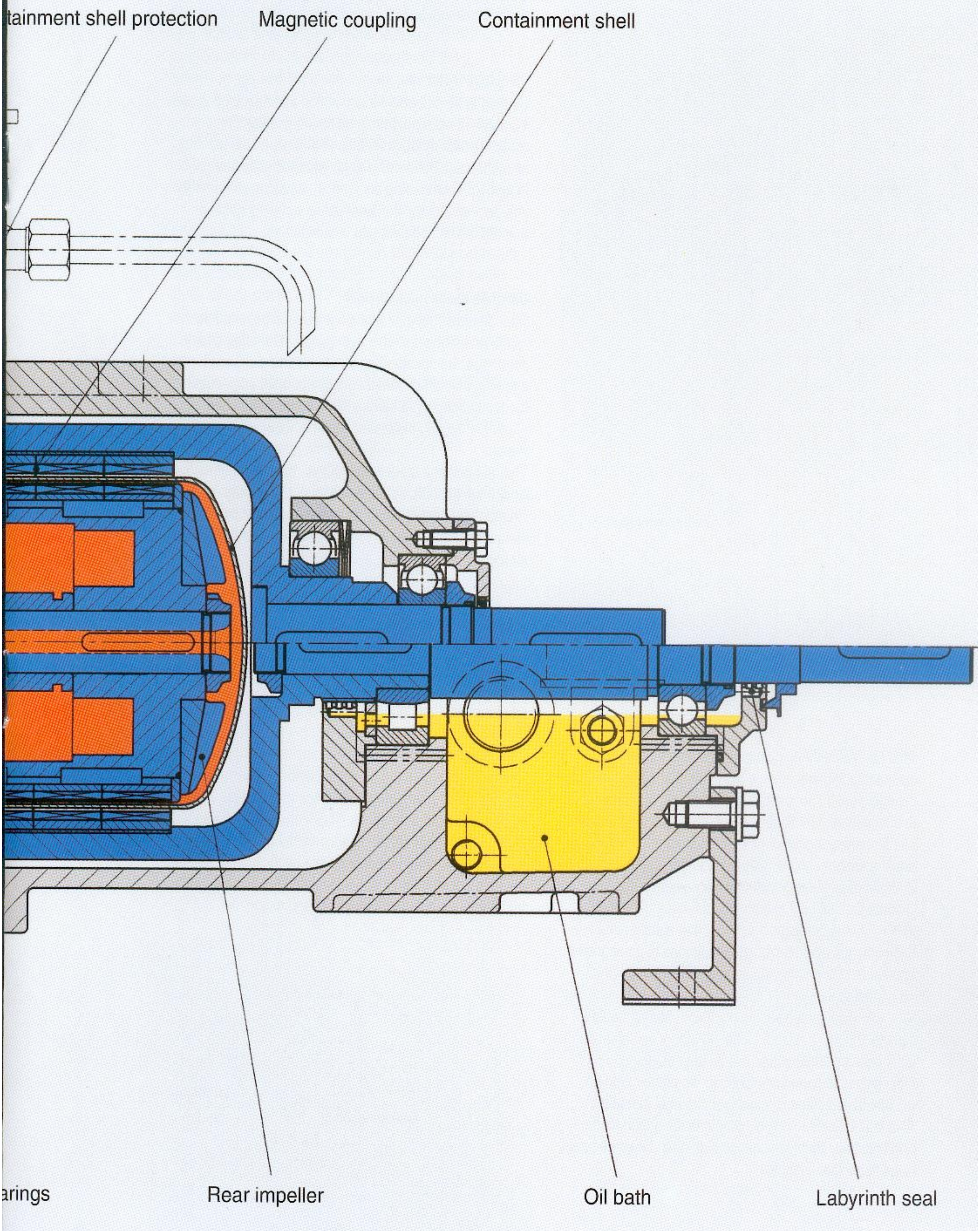




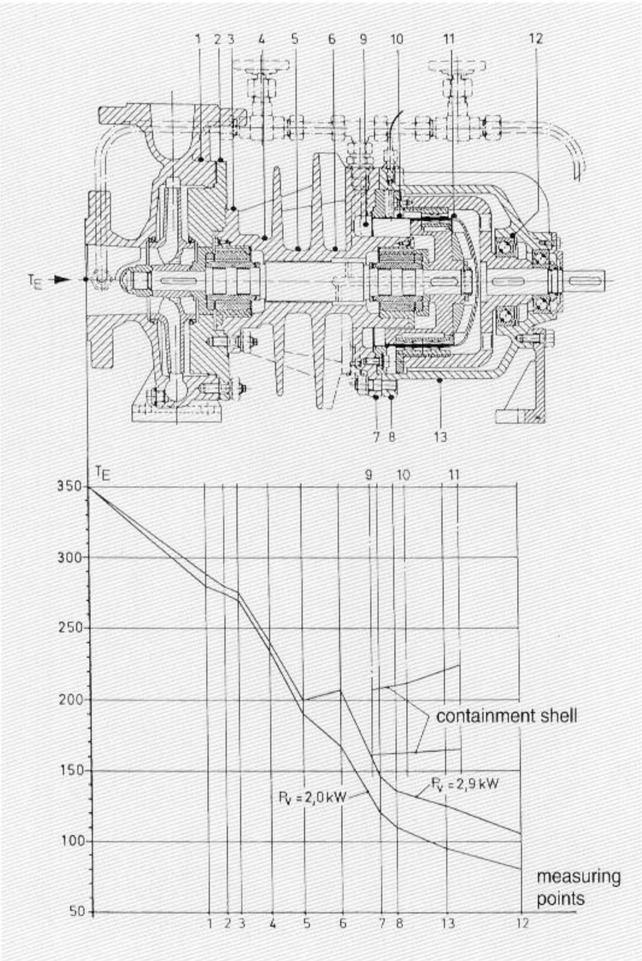
NMW - Design



NMWR - Design


tainment shell protection
Magnetic coupling
Containment shell
arings
Rear impeller
Oil bath
Labyrinth seal

Temperature - Magnet end



The NMW/PRMW-pumps are designed for operating temperatures up to 400°C. The bearing housing with the casted cooling fins separates the high temperature parts (volute casing, impeller) from the magnet end. This design creates such a temperature difference that 210°C (410°F) in the magnet area will not be exceeded. Cobalt-Samarium magnets can meet 250°C (480°F). As displayed above, the temperature in the magnet end depends also from the magnetic losses in the containment shell. Increase of losses from 2 to 2,9 kW at same pumping temperature creates a temperature rise in the shell from 160 to 210°C (410°F). The pumps can operate with dead ended magnets at losses up to 3 kW. For higher losses (depending on motor rating), an aircooled heat exchanger can be installed. The back vanes of the rotor create a constant cooling flow through the cooler and dissipate the heat from the magnets.

Drain Connections

Volute casing and magnet end have separate drain connections.

Venting System

During start-up and filling of the system with open suction valve, the pumped liquid enters the magnet end through holes in the sleeve bearings and the gap between pump shaft and bearing housing. Remaining air in the containment shell will be vented by the two valve venting system according to the manual instructions.

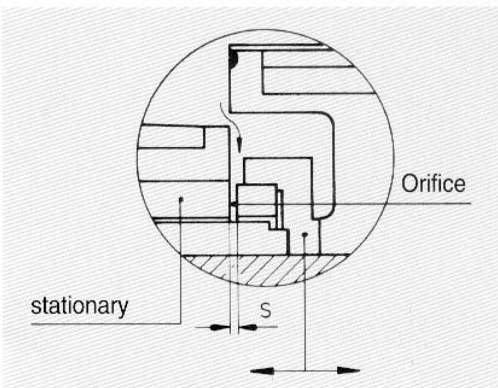
Double sleeve bearings

The double internal bearings are of the sleeve type, positioned in the pumpage. The stationary bearings are located centrally in the common bearing housing, which grants proper alignment for true running. Standard material is Silicon Carbide, highly resistant against corrosion and wear.

The stationary sleeve bearings, the shaft sleeves and also the start-up rings have elastically beared SiC-parts to avoid any thermal stress at operating temperature, they can meet any temperature swing.

Balanced thrust loads

The thrust loads of the closed impellers are balanced by wear rings, balance holes in the impeller hub and back vanes. Residual forces on the impeller are acting in suction flange direction. These forces will be balanced by the rotor design. The difference between the constant pressure at the rear rotor area and the variable pressure at the front side creates a counter force in direction to the containment shell. The value of this reaction force depends on the variable gap S. That means, the internal rotor floats until the forces at impeller and rotor are balanced. The thrust bearings work as start-up rings only.



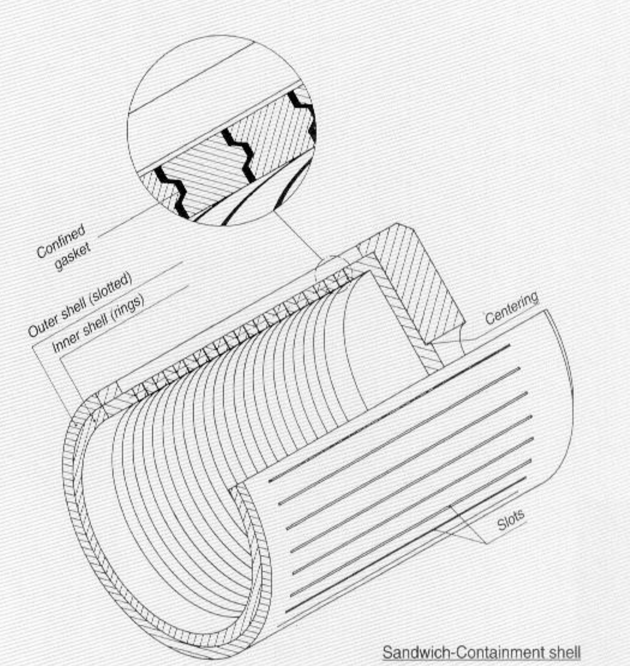
Measurement of thrust loads as a part of the performance test is possible.

Containment shell, PRMW-design
Different from the conventional design, the pressurized PRM-containment shell consists of two shells. The inner shell which accepts the radial loads, is consisting of centered ring. These rings are insulated from each other by confined Gore-Tex-PTFE gaskets and preloaded by a wave spring to avoid leakage. The outer shell consists of a slotted pipe with bottom and adapter flange welded to it. This shell accepts the axial loads.

This design, together with a special magnet assembly, reduces the magnetic losses by approx. 50%, compared to a Hastelloy C containment shell of 1,0 mm (0.039") thickness. The maximum allowable working pressure is 35 bar at 200°C (500 psi at 390°F).

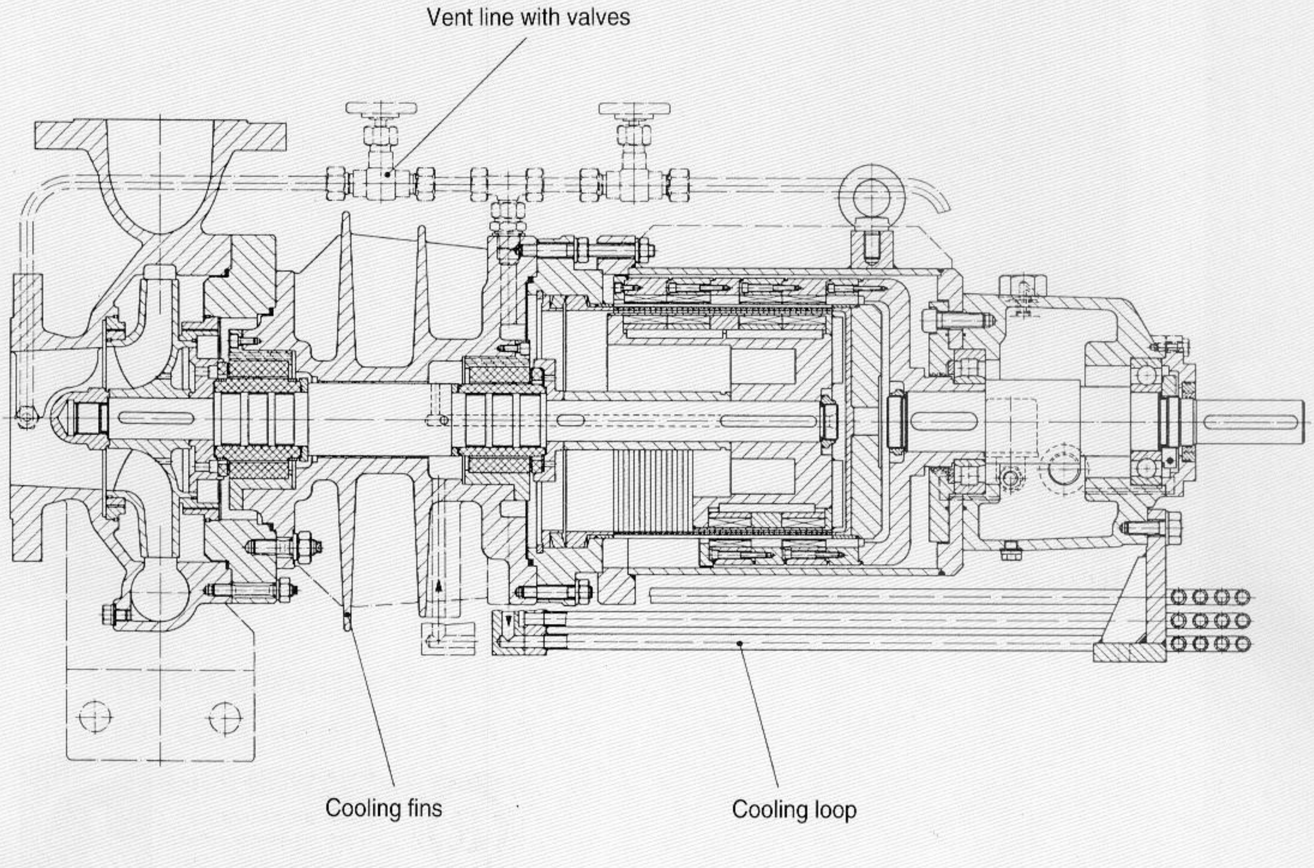
With the reduced magnetic losses, the PRMW-type can meet applications with rated motor power up to 132 kW at 2900 rpm (225 HP at 3500 rpm) without water cooling.

Aircooled cooling loop and vent line with thread connections are standard, flanged connections are available as an option.

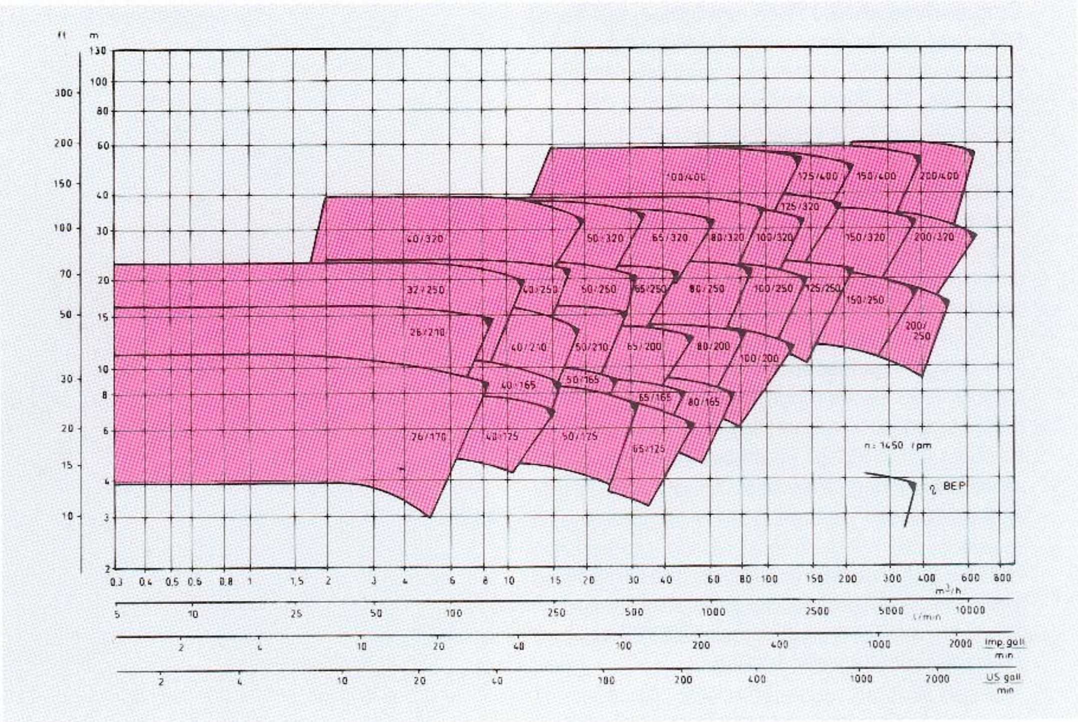


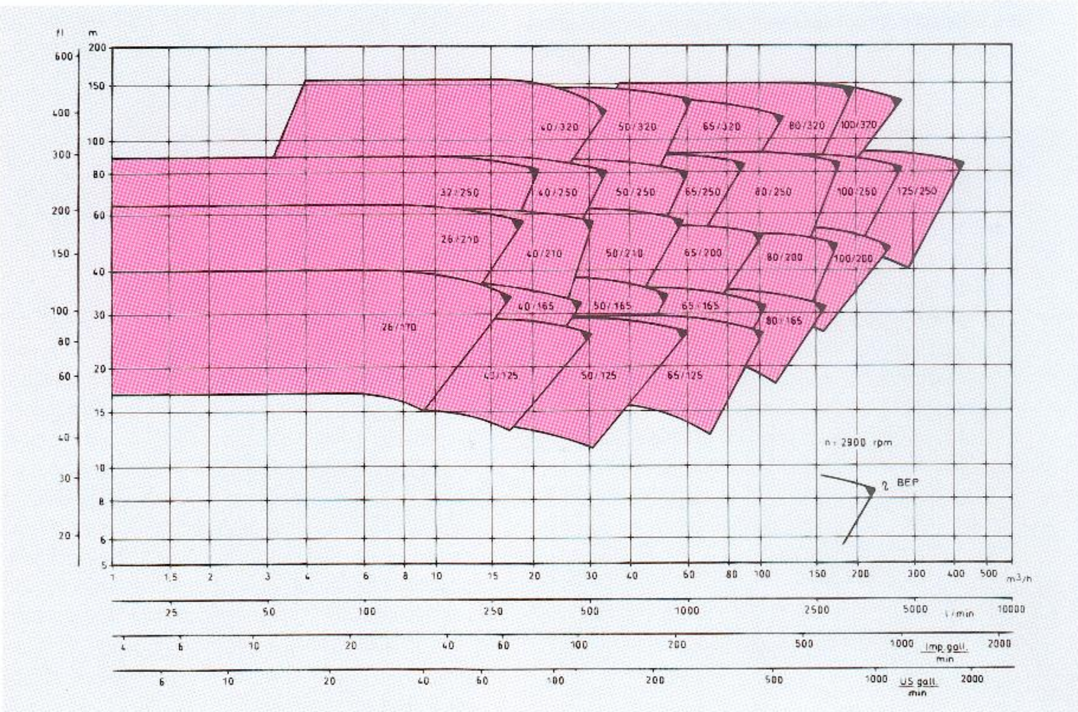
Sandwich-Containment shell

PRMW-Type



Performance table





Performance curves for the different pump sizes are available on request and are supplied with our technical offers in general.

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