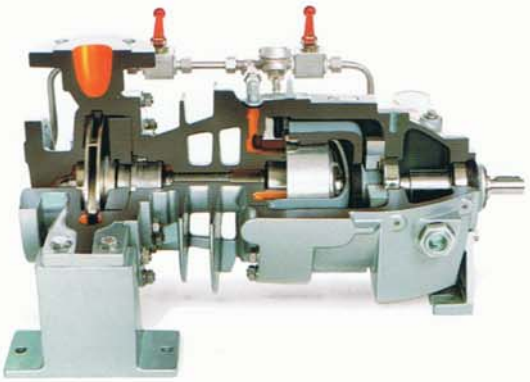
®DICKOW PUMPEN



Hot Oil Circulation Pump with magnetic coupling

Type NMWR / PRMW

our contribution for environmental protection

GENERAL

DICKOW pumps of series NMWR/PRMW are sealless centrifugal pumps with magnetic coupling and no shaft duct to the atmosphere.
The containment shell forms a closed system with hermetically sealed liquid end.

Applications

The leakage free NMWR-pumps are designed for handling thermal oil with a temperature range from 270 to 400°C (518 to 752°F) without water cooling.

The containment shell replaces double acting mechanical seals with external fluid reservoirs and the necessary control equipment.

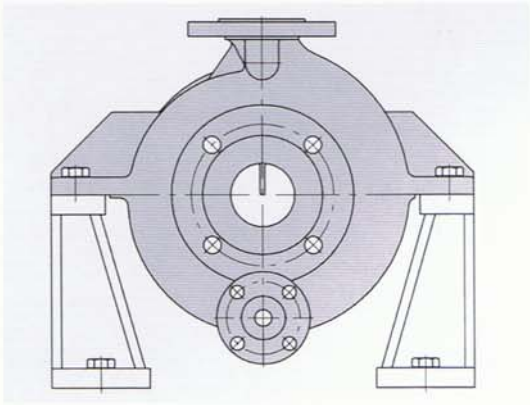
Maximum capacity appr. 900 m³/h (3960 US-gpm), differential head 150 mLC (490 ft).

Maximum operating pressure for standard design is 20 bar, higher pressures on request.

Construction

NMWR-pumps are single stage, single flow volute casing pumps with closed impellers, back-pull-out design, with end suction and top centerline discharge flange.

Casing with rigid foot mounting is supplied as standard.



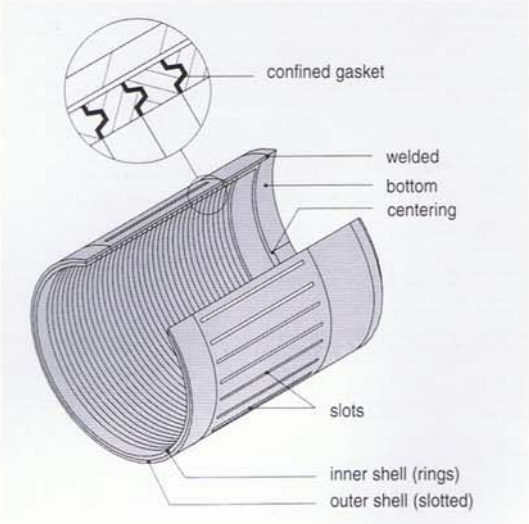
Centerline mounted design is available on request. Capacity and flange to flange dimensions comply with DIN EN 22858.

DESIGN FEATURES

Containment shell

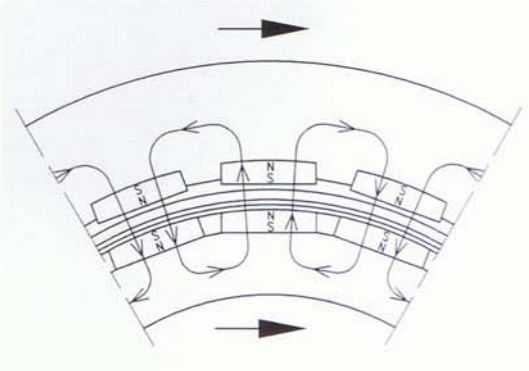
The containment shell is designed as a pressure vessel to separate the pumpage from the atmosphere only. With the arrangement of the complete sleeve bearing in the bearing housing, no additional sleeve bearing in the containment shell is required. The contaiment shell is bolted to the bearing housing in a manner that allows removal of the bearing bracket and the drive rotor without draining the pump.

Besides the standard containment shells of single-wall design, a containment shell of "sandwich design" is also available (pump type PRMW). These shells are reducing the magnet losses at a motor rating >75 kW (100 HP) and a pump speed of 2900 resp. 3500 rpm. Different from the conventional design, this sandwich containment shell consists of two shells. The inner shell which accepts the radial loads is formed by several centered rings. These rings are insulated from each other by nonconducting confined gaskets. The outer shell consists of a slotted pipe accepting the thrust loads. This design – together with a special magnet assembly – reduces the eddy current losses by approx. 50%.



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 driven rotor are completely encapsulated, no contact with liquid. Energy is transmitted to the hermetically sealed liquid end by a bank of external magnets. Inner and outer magnet rings are locked together by magnetic forces and work as a synchronous coupling.

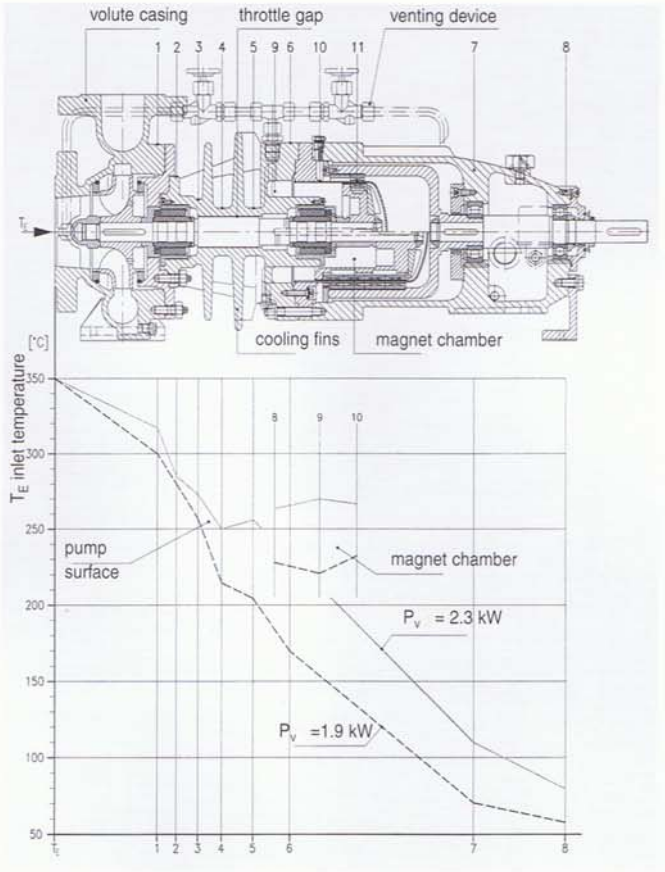


The inner magnet ring transmits the required torque direct to the impeller.Overload of the magnetic coupling and slipping will not affect demagnetization if a reliable monitoring device prevents overheating of the magnets.

The magnetic drives are designed for electric motors, direct on line starting. Should a subsequent increase of motor power be required, i.e. when installing a larger impeller, the nominal power of coupling can be increased accordingly by an additional bank of magnets.

The maximum drive power is approximately 140 kW at 2900 rpm (220 HP at 3500 rpm).

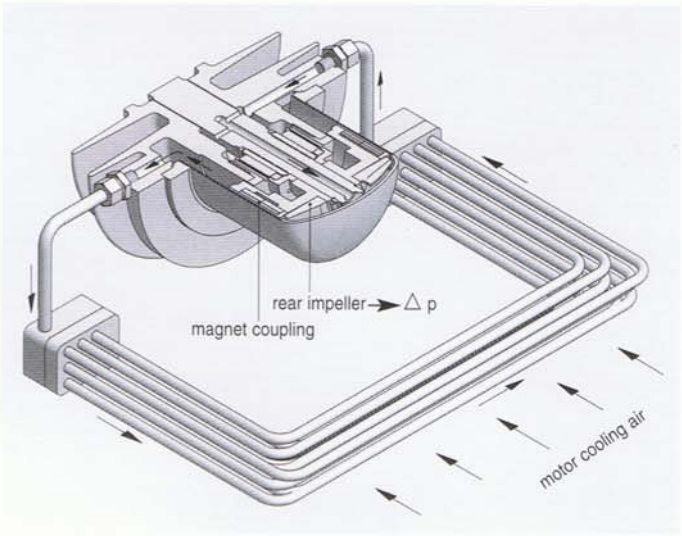
Bearing housing with cooling fins



The transmissible power of the Cobalt Samarium coupling depends on the operating temperature of the magnets which should not exceed 250°C (482°F). For applying the pumps also at flow temperatures between 270 and 400°C (518 and 752°F), the bearing housing is designed as a cooling device with cast-on fins. The heat dissipation to the atmosphere keeps the temperature in the containment shell well below the flow temperature in the volute casing. The magnet temperature depends on the magnetic losses. The containment shell temperature with a loss of 1,1 kW is appr. 160°C (320°F) and increases with a loss of 1,9 kW to appr. 230°C (446°F). That means, the magnetic losses of pumps with "dead end" design should not exceed 2,0 kW.

Another advantage of this design is the separation of magnet chamber and volute casing. There is no internal circulation and the sleeve bearing on impeller side and the throttle gap prevents exchange of dirty product with clean liquid in the magnet area. Penetration of ferritic solids such as welding beads, pipe scale and rust sediments is therefore excluded.

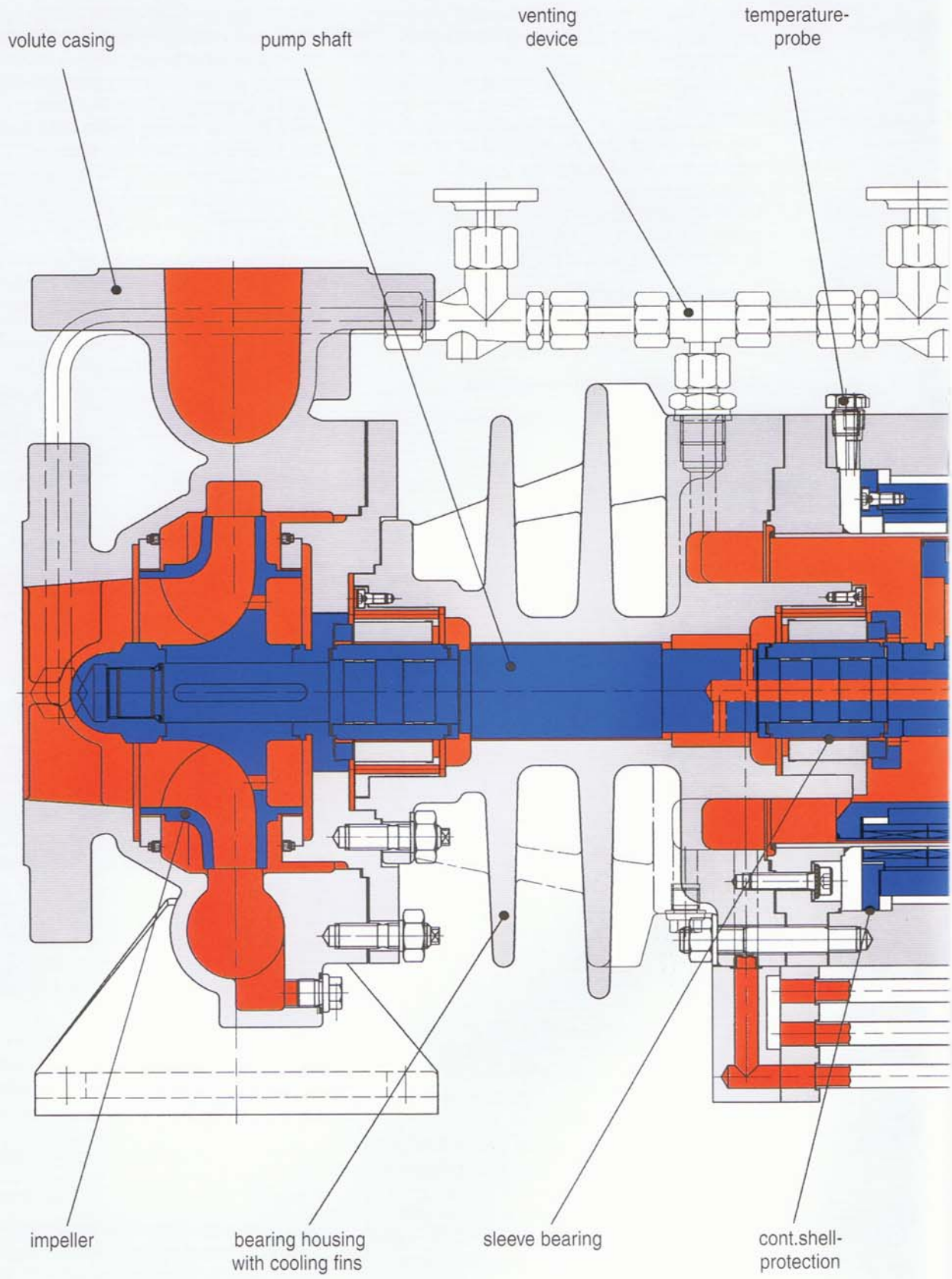
External Cooler

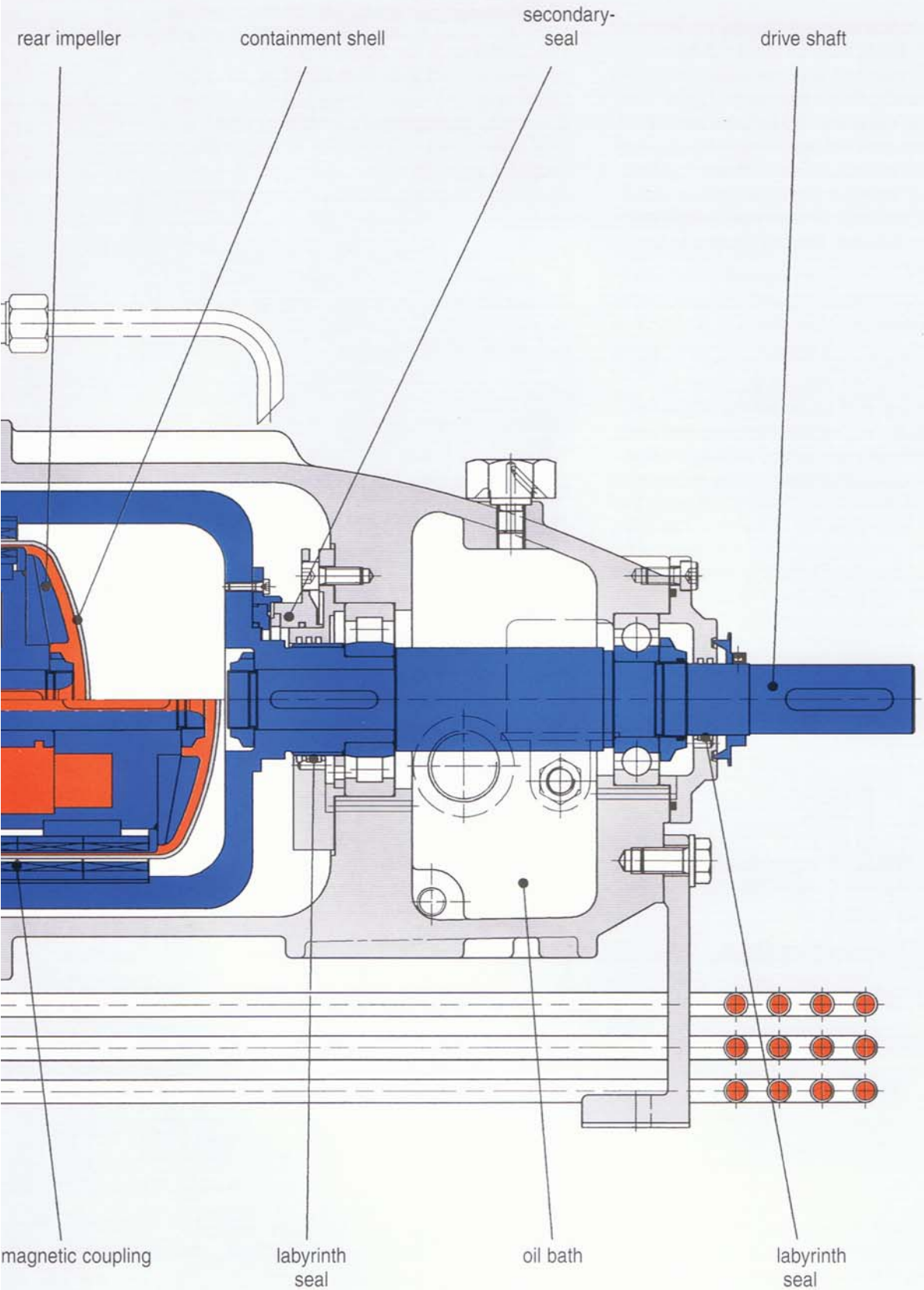


For a drive power higher than 22 kW and magnetic losses above 2,0 kW, an additional external cooling loop is required. The rear impeller on the rotor creates a circulation which cools down the heated liquid (by the containment shell) trough the external cooler by dissipation to the atmosphere.

The pumps with external cooling loop are suitable for magnet losses up to 10 kW. For higher losses, an additional cooling fan, mounted on the eleastic coupling, is required to improve the cooling effect.

Standard design NMWR with external cooling circulation



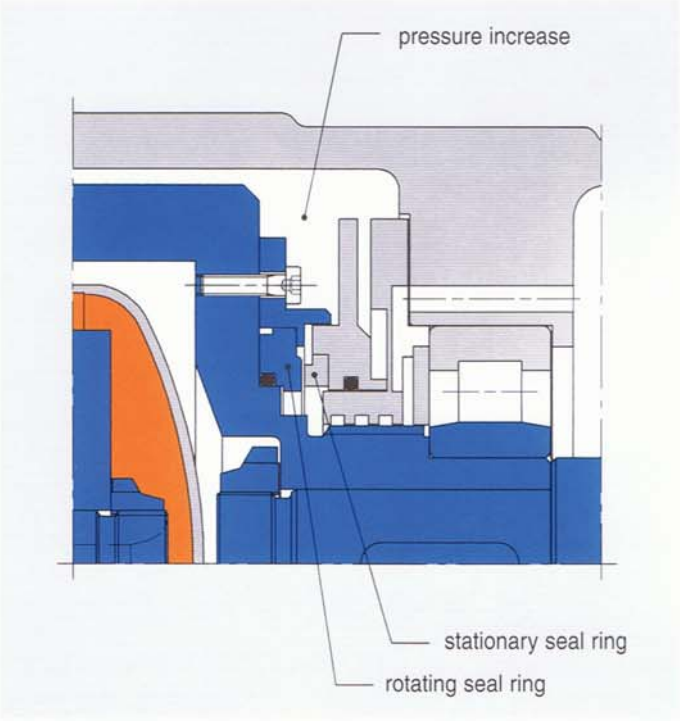

rear impeller
containment shell
secondary-
seal
drive shaft
magnetic coupling
labyrinth
seal
oil bath
labyrinth
seal

Double sleeve bearings

The pump shaft is carried in wetted sleeve bearings. Standard material is pure Silicon Carbide with diamond layer, providing limited dry-run capability. SiC is highly resistant to corrosion and wear and can be used for all kind of liquids, also for solid containing products. The SiC-components are shrink-fitted or elastic mounted and therefore protected against shock and thermal stress. Both sleeve bearings are bolted in one common bearing housing to grant a correct alignment.

Secondary seal

If desired, a mechanical stand-by seal can be supplied in lieu of the inboard labyrinth seal. This mechanical seal separates the magnet area from the oilbath respectively the atmosphere and forms, together with the closed bearing bracket, a secondary containment behind the containment shell.



The slide rings of the secondary seal operate without contact and wear free. The seal will be activated only if the containment shell leakage leads to a pressure increase in the bearing bracket.

Outer ball bearings / Containment shell Protection

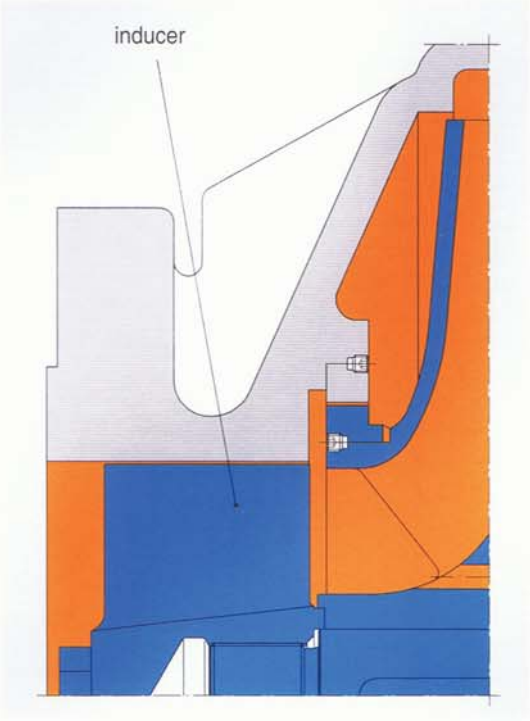
The drive shaft is carried in generously dimensioned oil lubricated antifriction bearings, rated for 25000 operating hours. The oil bath is protected against the atmosphere by a labyrinth seal. Oil level is controlled by a constant level oiler and an additional sight glass. The oil chamber is sealed against the magnetic coupling also by a labyrinth seal.

The clearances between the outer magnetic coupling and the bearing bracket respectively the containment shell are sized to exclude rubbing of the magnetic coupling on the containment shell, even when ball bearing fails.

NPSH-Conditions / Inducer

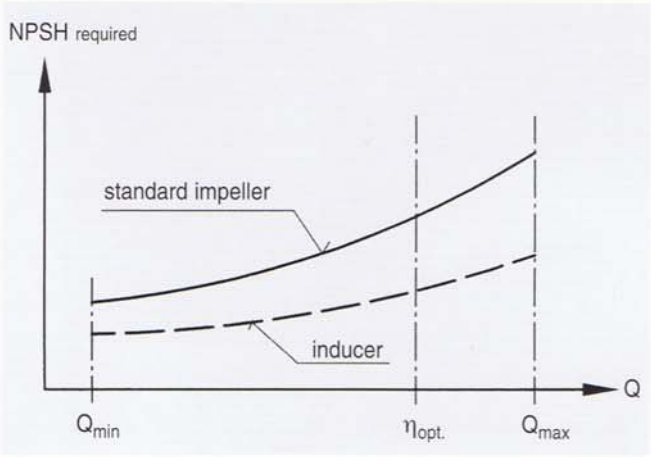
The impellers of NMWR/PRMW-pumps are designed to achieve low NPSH-values.

To improve NPSH-required conditions, additional inducers are available.



Retrofit of inducers on site is possible without change of suction pipe.

The inducers are designed in a way that NPSH-improvement is given from minimum flow up to BEP



Draining

The magnet chamber and the volute casing are provided with separate drain connections.

Venting

NMWR-pumps are not selfventing. They must be vented with open suction valve through the venting device under consideration of the operating instructions before start-up.

Monitoring

Connections for temperature monitoring of the containment shell surface are available as standard.
Since the dry safe coated sleeve bearings tolerate a short time dry running, motor monitoring (P_{min}) for dry run protection is sufficient.

Hazardous Area

Together with the required Ex-drive motors, the NMWR and PRMW-pumps can be applied in hazardous area Group II, Category 2. The pumps meet the basic safety and health requirements of Explosion-proof Directive 94/9 EC and Machinery Directive 98/37 EC and are suitable for plants with increased safety requirement.

Since the expected surface temperature is not depending on the ignition sources but on the temperature of the pumped liquid, no temperature class will appear on the pump. The temperature class is stated in the pump data sheet according to the liquid temperature. For example, a pump with an operating temperature of 360°C (680°F) will be certified with T1 (03 ATEX D092) and the user must ensure that no explosive atmosphere with an inflammation temperature of below 450°C (842°F) exists on site.

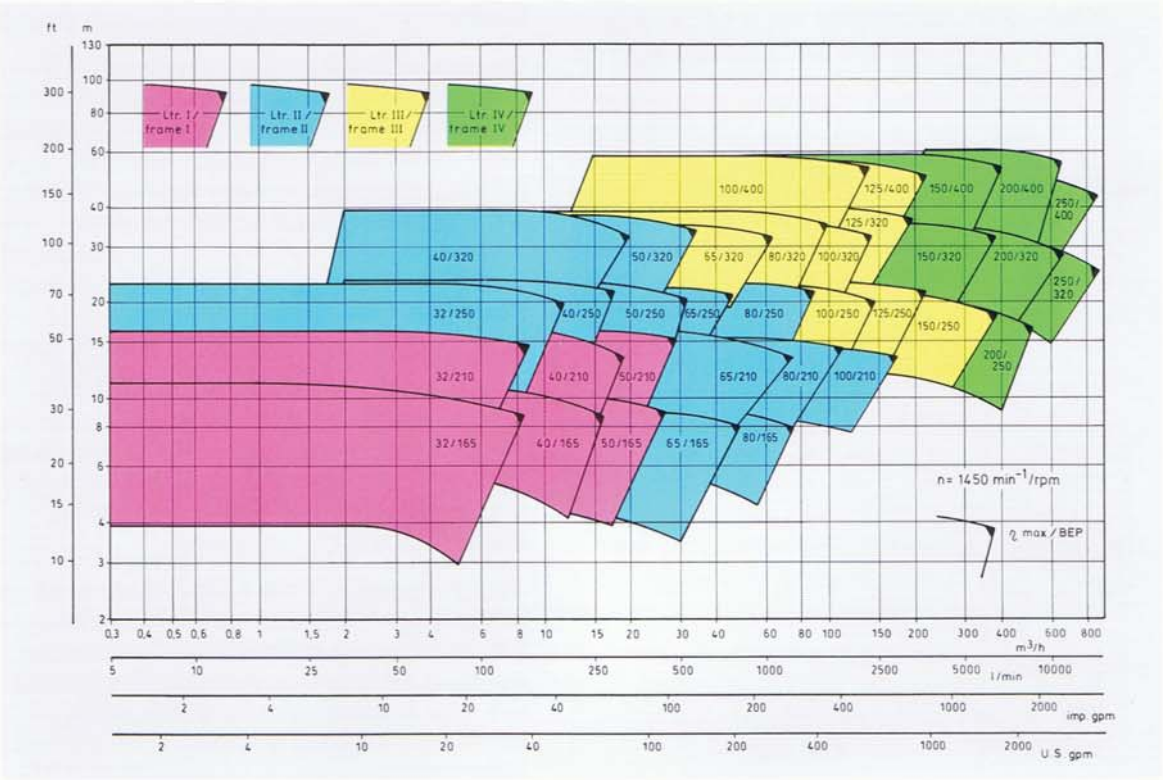
Standard materials:

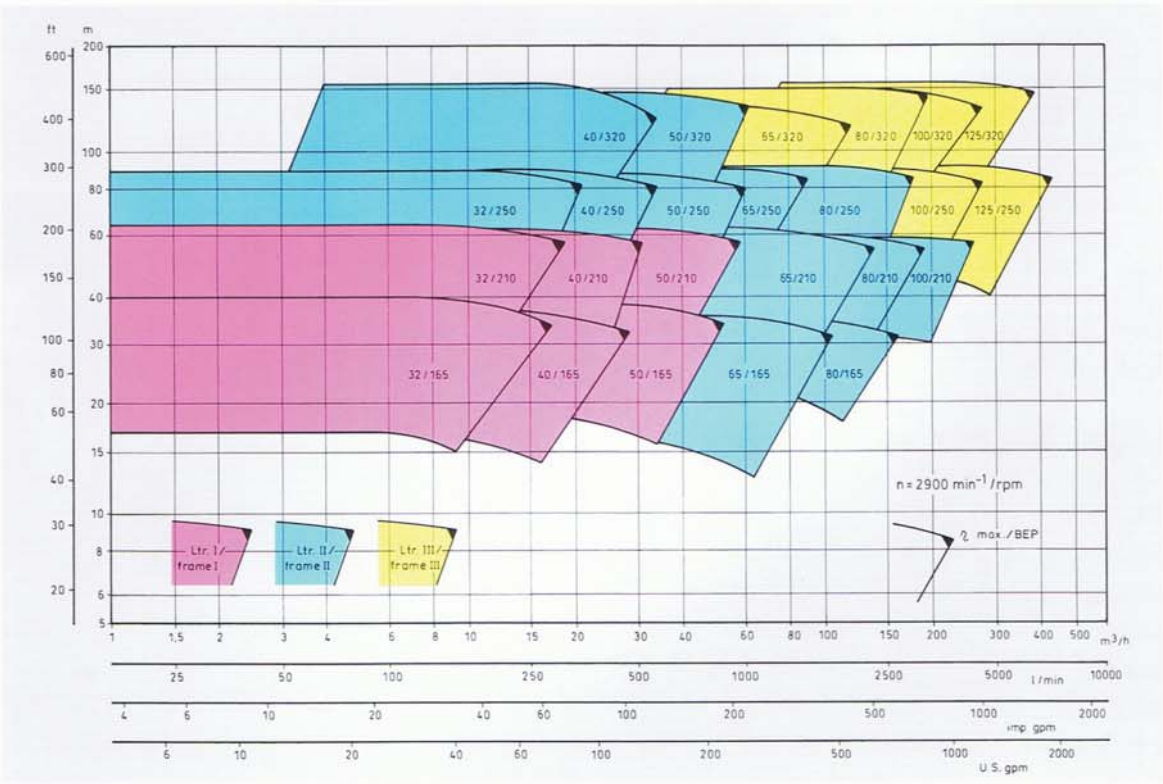
Pump type	NMWRs	NMWRhu	NMWRh
Volute casing	GGG40.3	GS-C25	1.4408
Impeller	GG25 / GGG40.3		1.4408
Wear rings	GG25 / St 52.3		1.4571
Pump shaft	1.4021		1.4571
Drive shaft	1.4021		
Shaft sleeve	SiC-dry safe		
Sleeve bearing, Start-up rings	1.4462 / SiC-dry safe		
Containment shell	Hastelloy C4		
Magnetic coupling	Cobalt samarium S_{m2} C_{O17}		
Casing gasket	pure Graphite NOVAFIT VS		

Material specification:

GGG40.3	Ductile iron	A536 60-49-18	1.4571	X6 CrNiMo 17.12.2	A276 316 Ti
GG25	Cast iron	A278 Class 30	1.4021	X20 Cr.13	A276 420
GS-C25	Cast steel	A216 Gr.WCB	1.4462	X2 CrNiMo 22.5.3	A276 Gr.XM-26
1.4408	G-X6 CrNi 18.10	A743 CF8M			

Performance table NMWR / PRMWR





Performance curves of the individual pump sizes, also for 1750 / 3500 rpm, with NPSH-values and power consumption, are available on request.

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