



**DICKOW  
PUMPEN**



**Sealless Magnetic Coupled  
Centrifugal Pumps acc. to  
EN 22858 / ISO 2858  
Type NMR**

**(Design with heavy duty oil lubricated bearing bracket)**

*our  
contribution  
for  
environmental  
protection*

## General

Magnetic coupled DICKOW-pumps of the series NMR are sealless pumps. The static containment shell forms a closed system with hermetically sealed liquid end.

## Applications

Magnetic coupled NMR-pumps are designed to improve plant and personnel safety, especially when handling toxic, explosive or other dangerous liquids which react on contact with the atmosphere. For all these services the containment shell replaces the double acting mechanical seal with external fluid reservoirs and the necessary control equipment. NMR-pumps therefore offer exceptional benefits to the chemical, petrochemical and allied industries, and protect the environment.

Max. capacity and differential head:  
50 Hz - appr. 900 m<sup>3</sup>/h and appr. 150 m  
60 Hz - appr. 1000 m<sup>3</sup>/h and appr. 220 m  
(appr. 4400 gpm and 720 ft)

The maximum operating temperature is 270°C. Higher operating temperatures are available on request.

## Hazardous area

Together with the required Ex-drive motors, the NMR-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 are suitable for plants with increased safety requirement.

## Design / Pump casing

NMR-pumps are single stage volute casing pumps with closed impellers, back-pull-out design, with end suction and top discharge flange. Sturdy feet are provided as standard for mounting on the base plate. Centerline mounted design is available on request.

Capacity and outer casing dimensions comply with DIN EN 22858 resp. ISO 2858.

## Containment shell

The containment shell is a pressure vessel to separate the pumped liquid from the atmosphere only. The shell is not used as an additional bearing holder. Therefore, no dynamic stress occurs.

The standard containment shell is a one piece deep-draw design without additional welds made of 2.4610 (Hastelloy C).



Containment shell 2.4610

Other available material options are:

- Zirconium oxide (industrial ceramic) without eddy current losses.
- PEEK composite (carbon fibre reinforced Polyetheretherketon) without eddy current losses.
- Titanium for high pressure applications.

The containment shell is bolted to the bearing housing in a manner that allows removal of the bearing bracket together with the drive rotor without draining the pump.

## Magnet coupling

The single elements of the multipolar magnet coupling are manufactured of permanent magnet material "Cobalt Samarium" with unlimited life-time. The magnets in the driven rotor are completely encapsulated, not in contact with liquid. Power is transmitted to the hermetically sealed liquid end by a bank of external magnets. Inner and outer magnet rings are locked together by magnet forces and work as a synchronous coupling. The inner magnet ring transmits the required torque direct to the impeller. Overload of the magnet coupling and slipping will not cause demagnetization if temperature monitoring is available. The magnet couplings are designed for electric motors, direct on line starting.

Should a increase of motor power be required, i.e. when installing a larger impeller, the nominal power of coupling can be increased with additional magnets.

The maximum drive power of NMR-pumps is approx. 197 kW @ 50 Hz (238 kW resp. 319 hp @ 60 Hz).

### Internal clearances

The internal clearance between rotor and containment shell is appr. 1,0 mm for standard containment shells. This allows - together with the wear resistant SiC sleeve bearings - handling of solid containing fluids.

### Containment shell protection

The clearances between drive rotor and bearing bracket respectively between bearing bracket and containment shell are arranged such that rubbing of the magnets on the containment shell will be avoided, even in the case of worn out ball bearings.

### Casing drain

Complete drainage of casing and magnet end is possible through casing drain. No additional drain is required.

### Outer ball bearings

The drive shaft is carried by 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.

### Double sleeve bearings

The pump shaft is carried by 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 shrinkfitted or elastically beared by tolerance rings and therefore protected against shock and thermal stress. Both sleeve bearings are bolted in one common bearing housing to grant correct alignment.

### NPSH-conditions / Inducer

Due to the internal circulation from discharge to discharge, there is no temperature elevation in the impeller eye. Handling of boiling liquids is therefore possible and there is no increase of NPSH-required.

Inducers to improve NPSHR are available on request.

### Balanced thrust loads

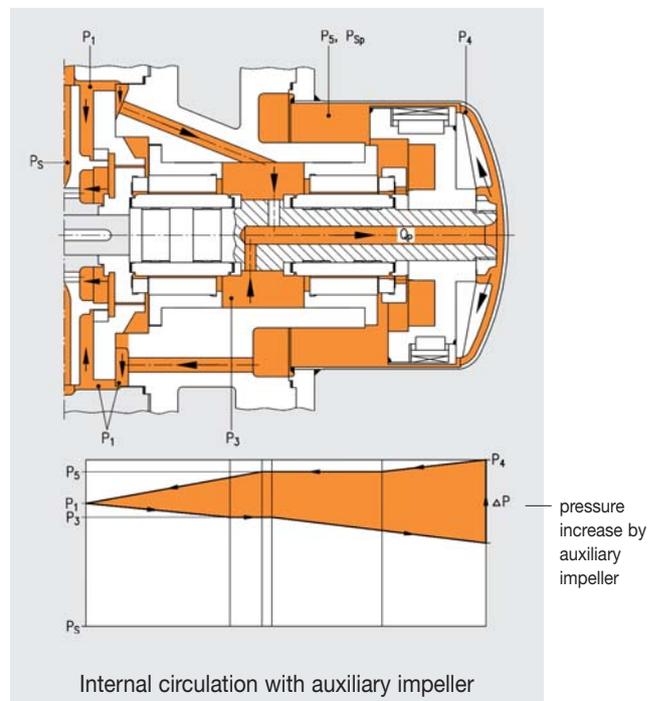
The thrust loads of the closed impellers are hydraulically balanced by wear rings, balance holes, back vanes and / or auxiliary impeller. The pump shaft connected to the impeller is floating.

### Monitoring

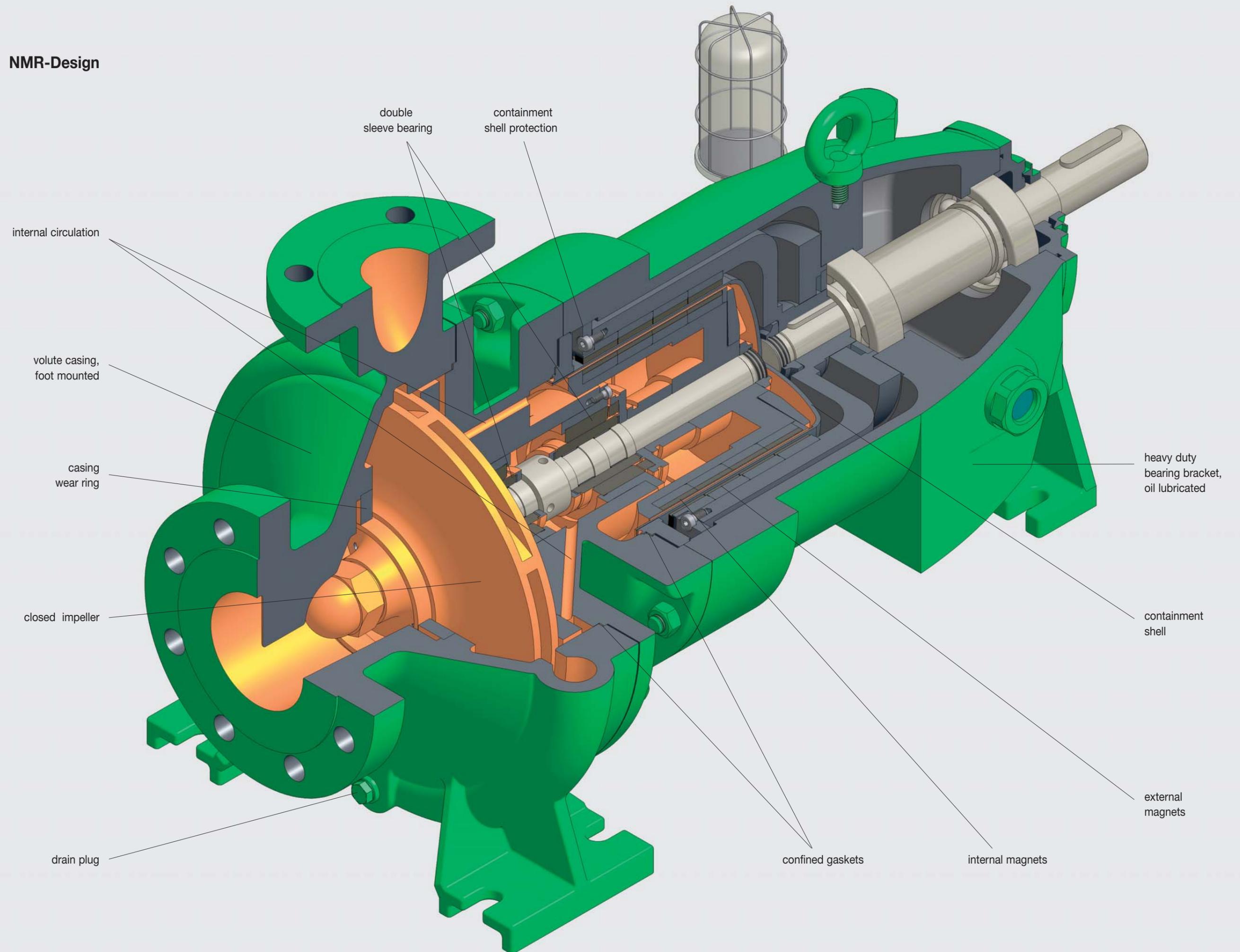
Connection for temperature sensor for containment shell surface is available as standard. Dry running protection, monitoring of ball bearings and pump protection with the patented "mag-safe" system is recommended.

### Internal circulation, pressurized magnet end

When pump is in operation it generates eddy currents which heat up the containment shell and the pumpage in the magnet area. This heat is dissipated by internal circulation with auxiliary impeller:



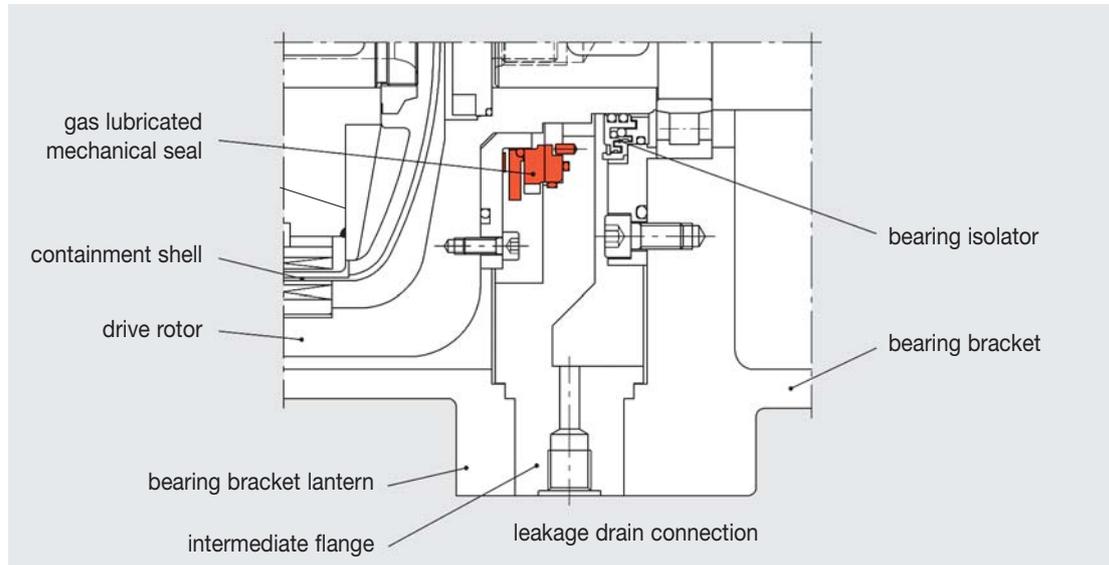
# NMR-Design



## Secondary control / containment

### Secondary control design

Minimization of release of pumped liquid in the event of failure of the containment shell.  
Gas lubricated stand-by mechanical seal, design "CGS":

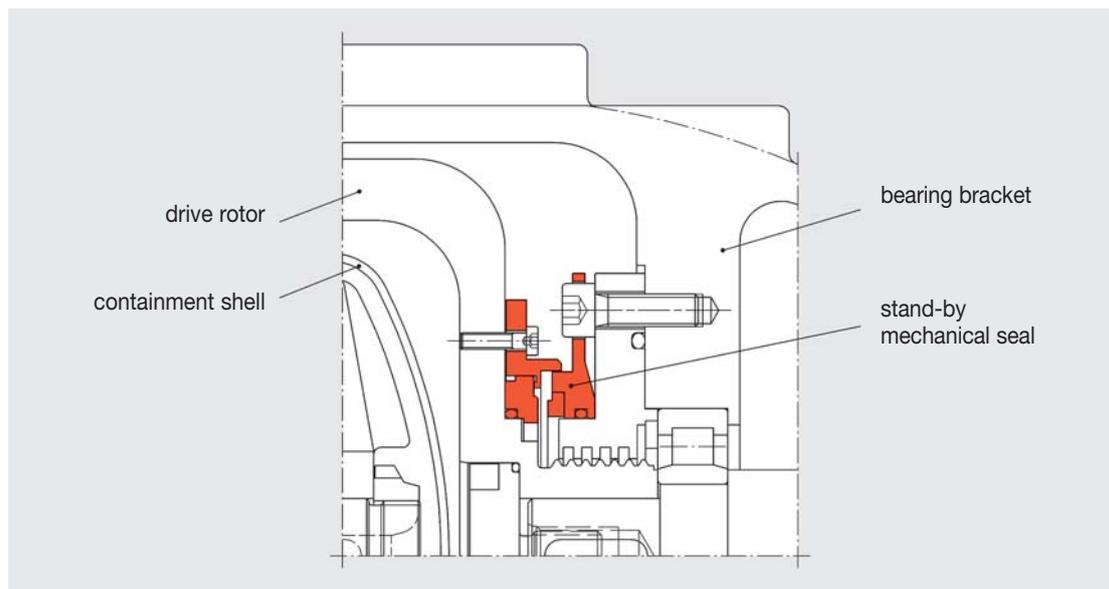


- Gas seal can operate up to 24 hours in case of failure.
- Occuring leakage in case of failure must be drained externally.
- Leakage monitor is required.

### Secondary containment design

Confinement of the pumped liquid within a secondary pressure casing in the event of failure of the primary containment shell.

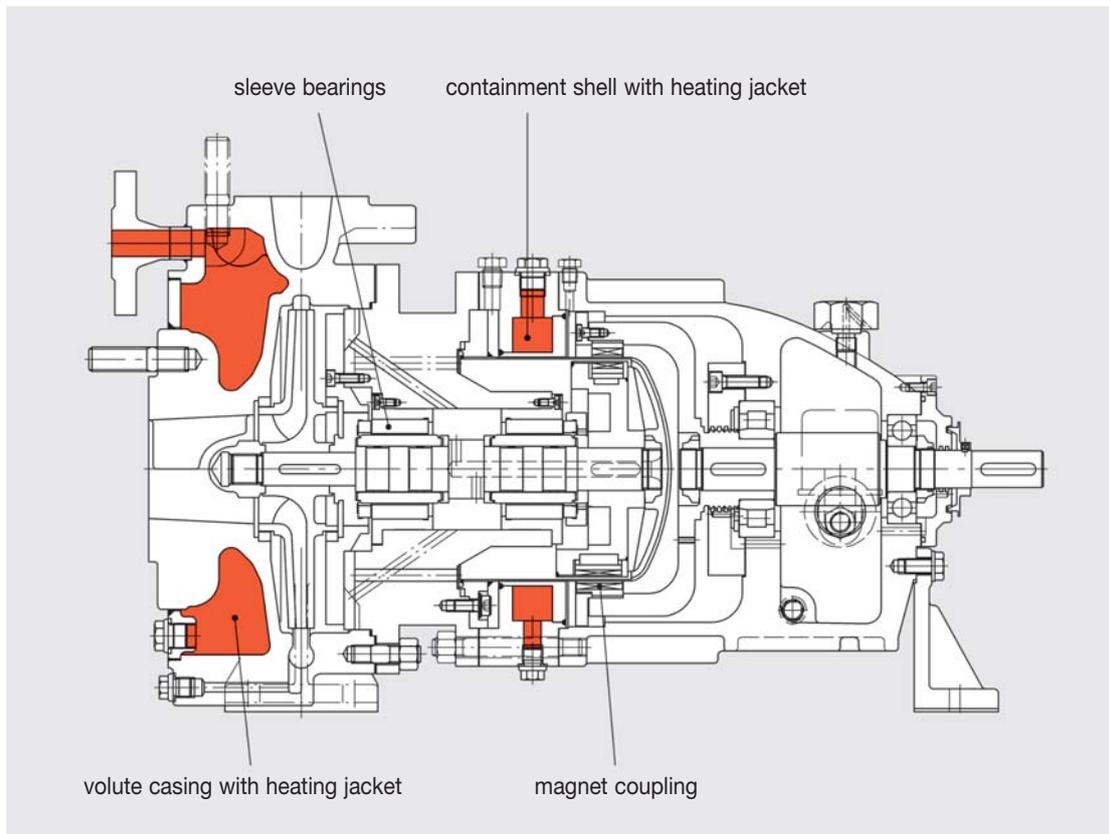
Dry running stand-by mechanical seal, design "Ge":



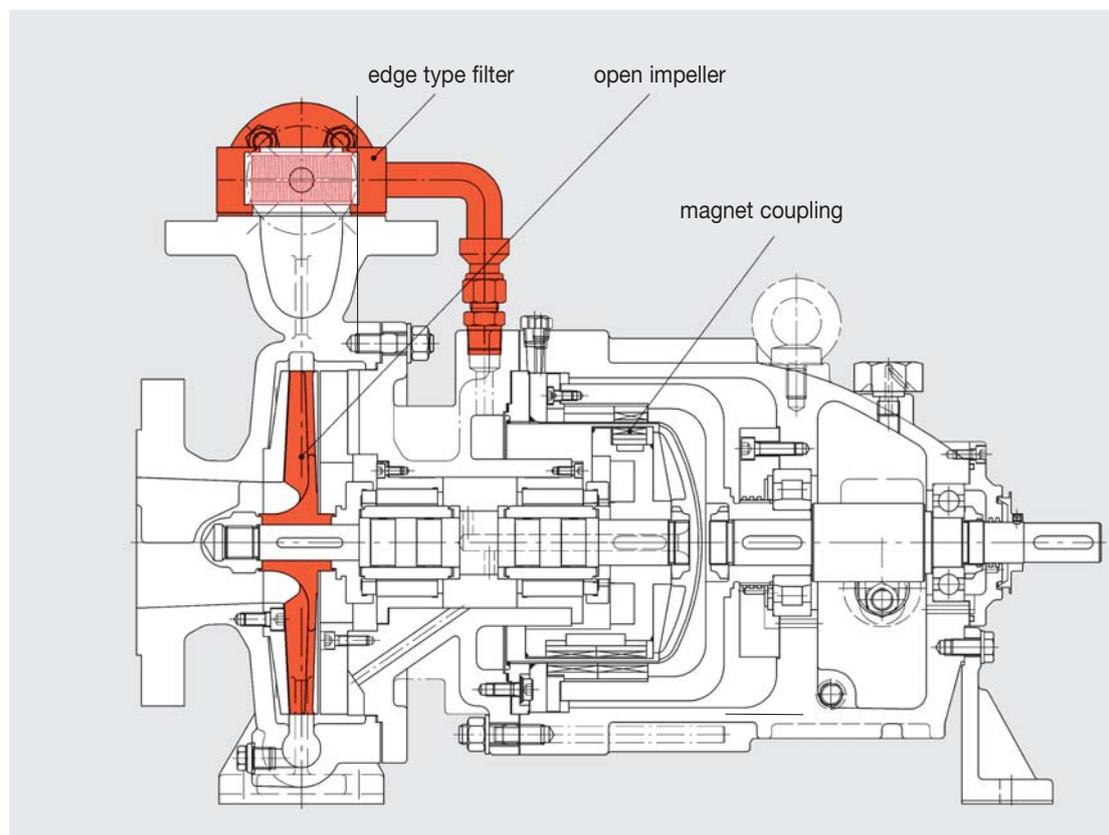
- In case of pressure increase by 50 kPa seal faces will close.
- Pump must shut down immediately in case of failure.
- Leakage monitor is required.

**Optional designs**

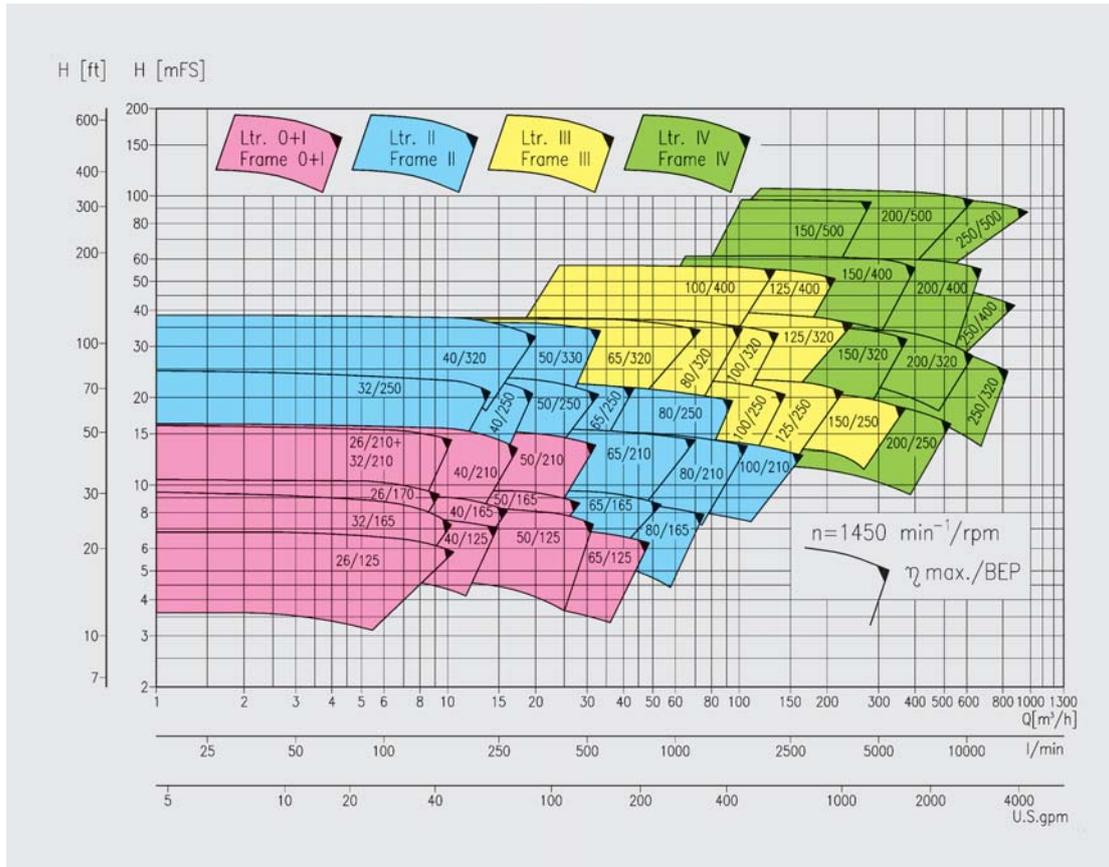
**Type NMR b - with heating jacket**



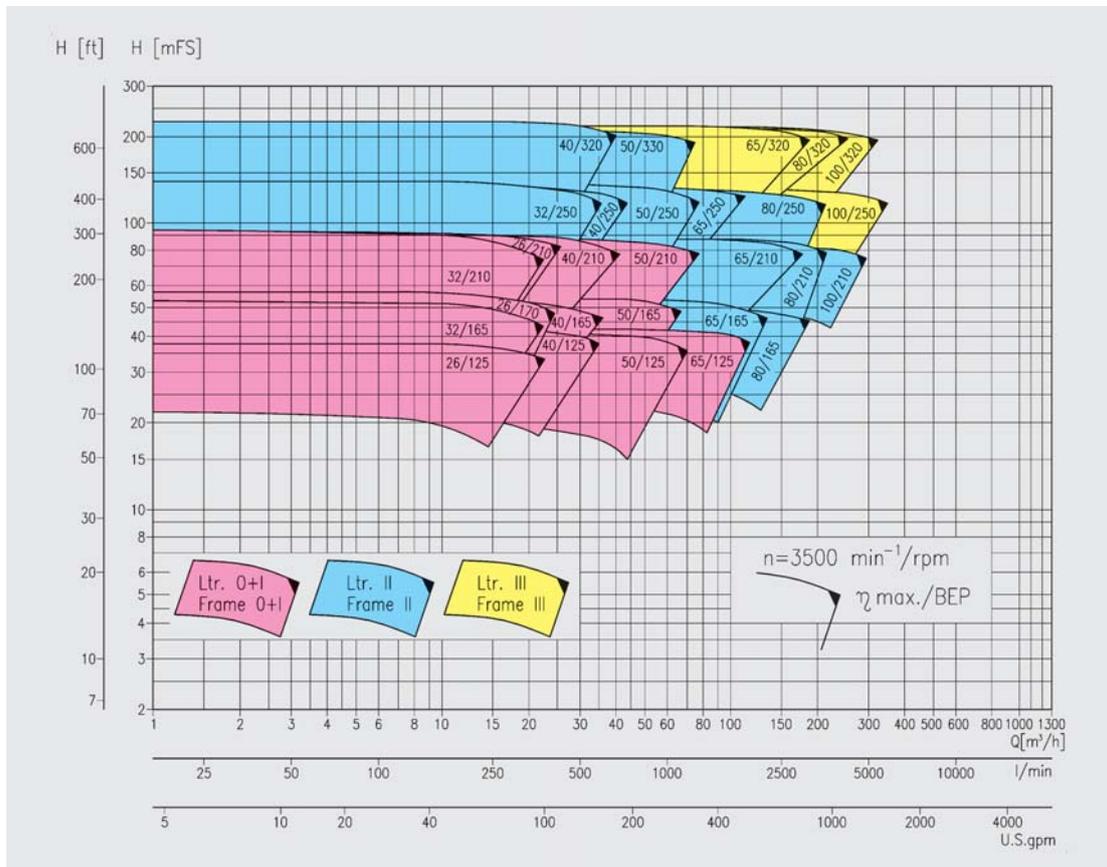
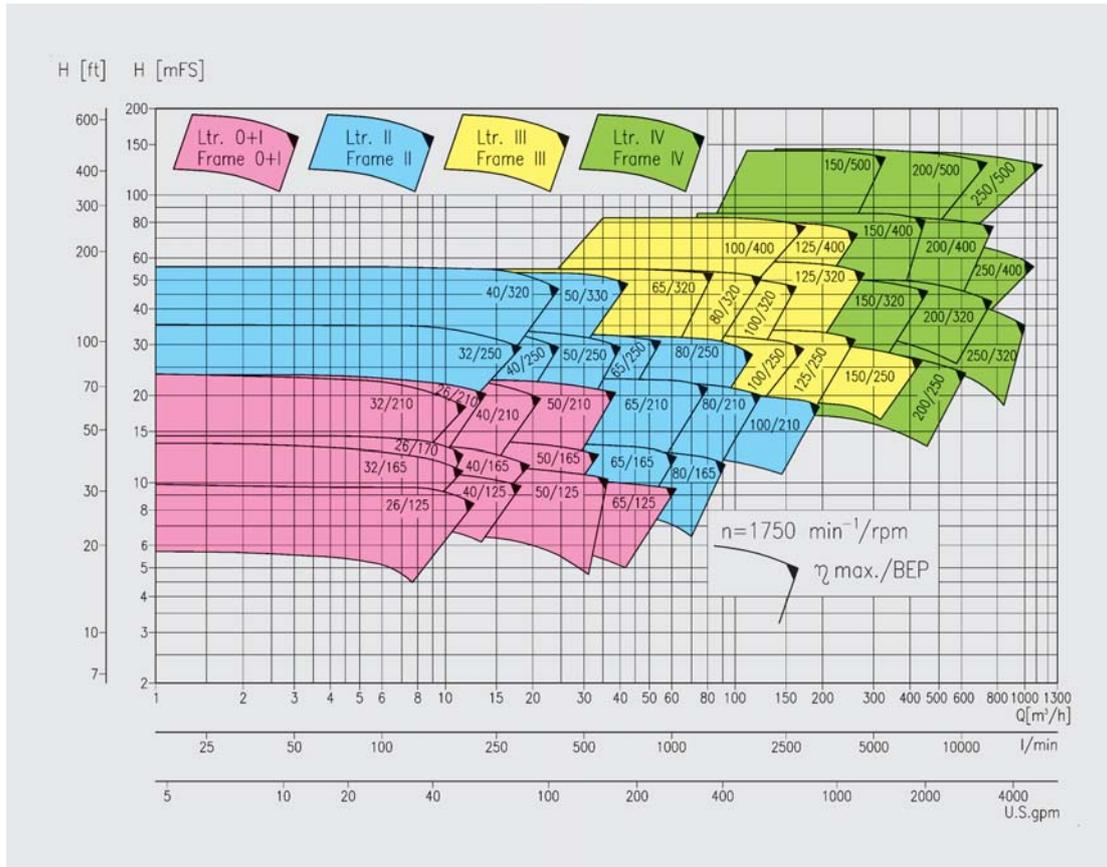
**Type NMR o - with open impeller and edge type filter**



Performance range – 50 cycles



## Performance range – 60 cycles



Performance curves for the different pump sizes are available on request.



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