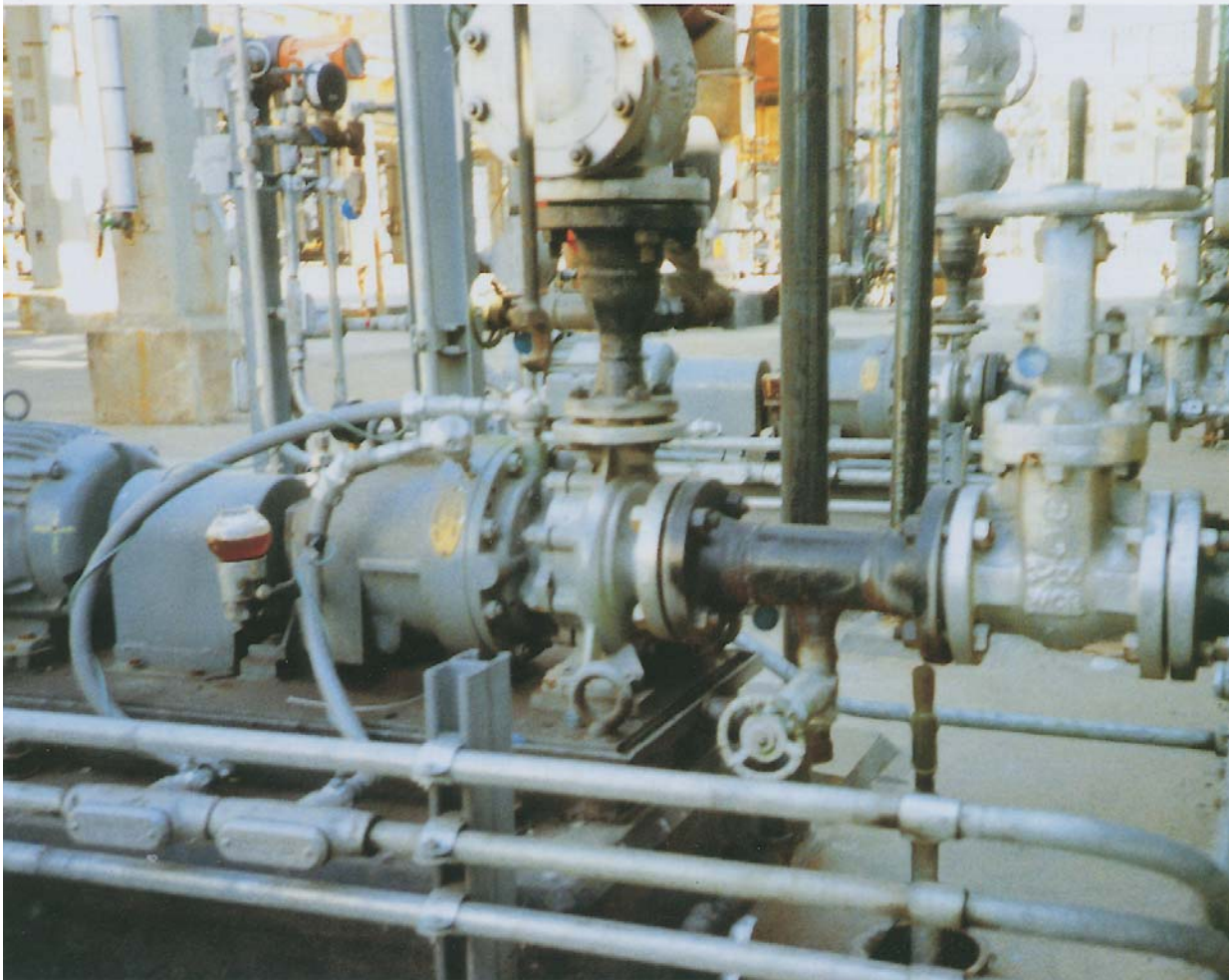
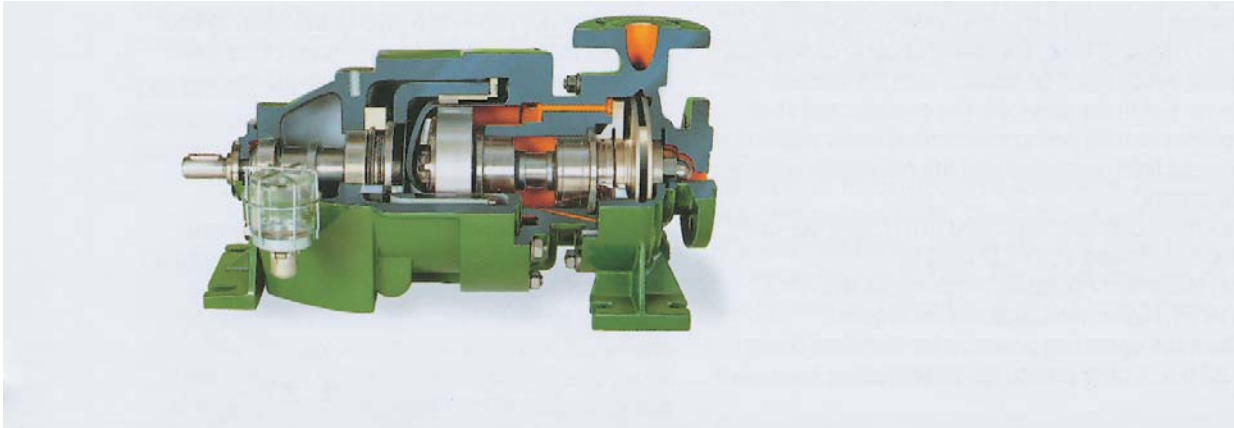




**DICKOW  
PUMPEN**



## Sealless magnetic coupled centrifugal pump

**Type NMR**

Design with heavy duty oil lubricated bearing bracket

*our  
contribution  
for  
environmental  
protection*

## GENERAL

DICKOW-pumps of series NMR 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

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

Maximum capacity appr. 900 m<sup>3</sup>/h (3960 US-gpm), differential head 150 mLC (490 ft).

The maximum operating temperature is 270°C (518°F), higher temperatures on request.

Maximum operating pressure for standard design is 23 bar, higher pressures on request.

### Construction

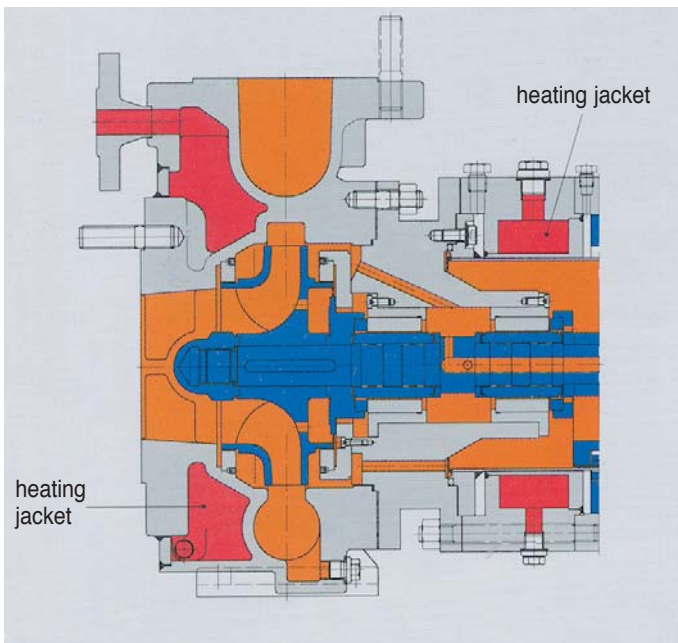
NMR-pumps are single stage, single flow volute casing pumps with closed impellers, back-pull-out design, with end suction and top centerline discharge flange.

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.

The pump can be drained completely through the volute casing, a separate draining of the magnet chamber is not necessary.

### Design with heating jacket, Type NMRb

For pumpage with melting temperature above ambient temperature. Maximum allowable temperature of heating fluid 270°C (518°F).



## 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. Static load on the containment shell by internal pressure only, no dynamic stress occurs.

The containment 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

### 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 165 kW at 2900 rpm (260 HP at 3500 rpm).

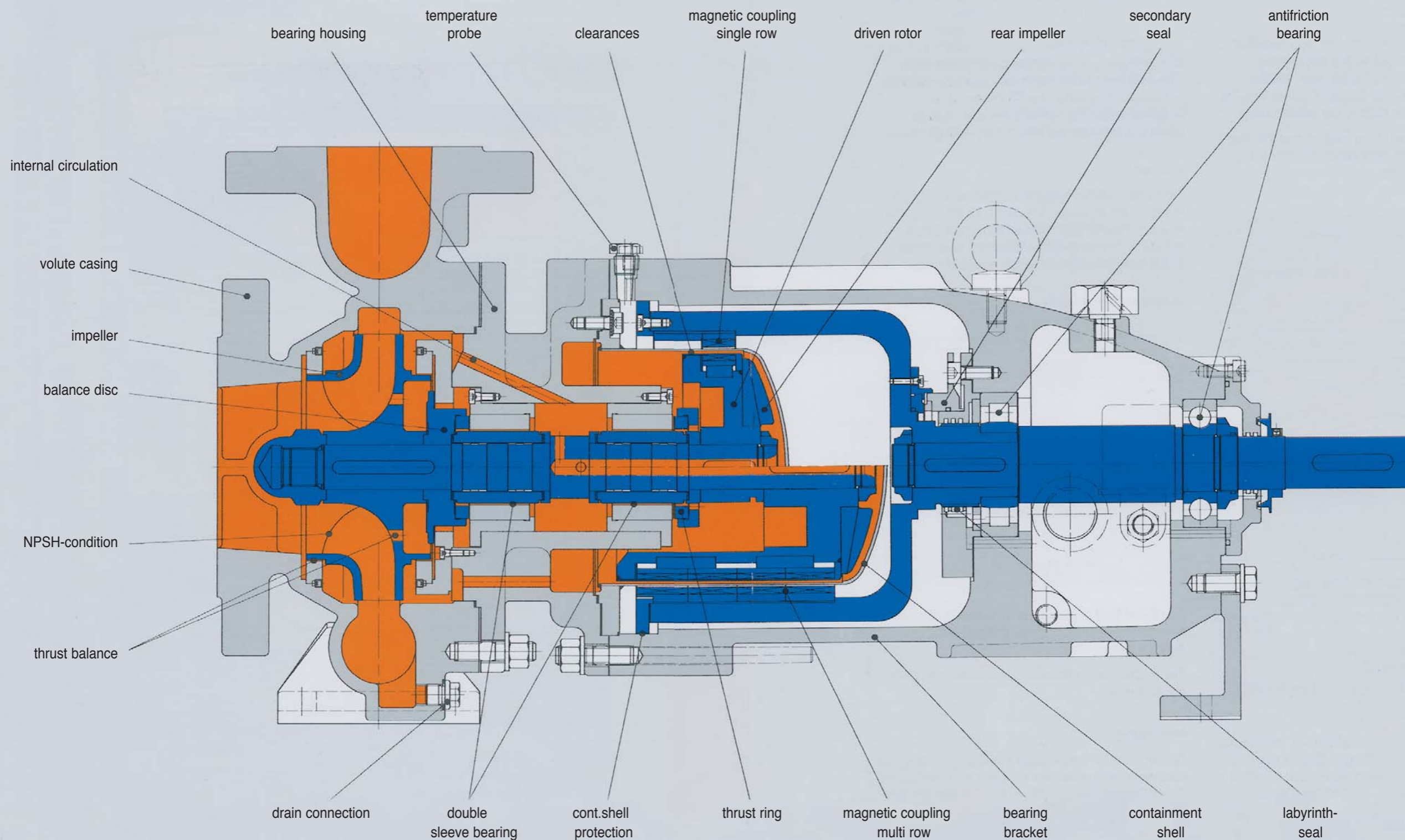
### Outer ball bearings / Containment shell Protection

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.



Standard design with heavy duty oil lubricated bearing bracket



Standard materials:

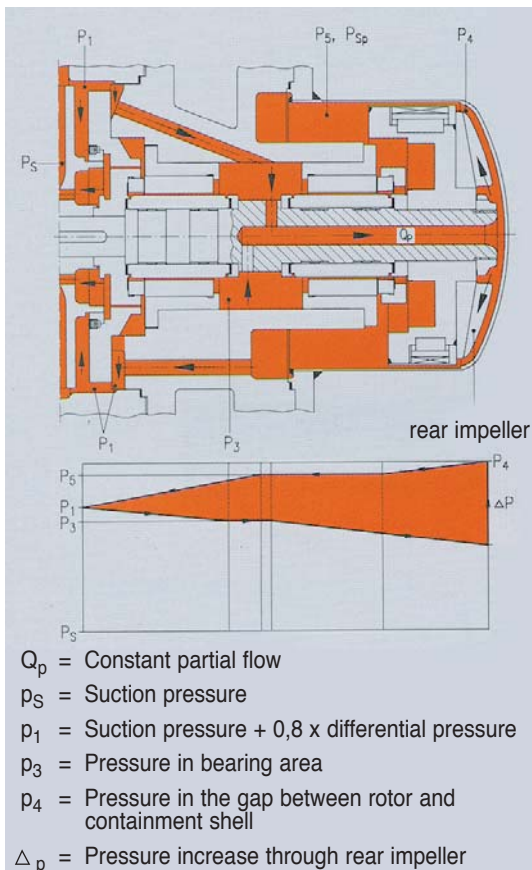
Pump type	NMRs	NMRhu / NMRbhu	NMRh	NMRbh
Volute-/bearing casing	GGG40.3 / A356 60-40-18	GS-C25 / A216 Gr.WCB	1.4408 / A743 CF8M	1.4581 / A351 CF10MC
Impeller	max 260Ø: GGG25 / A278 Class 30; >260Ø: GGG40.3 / A356 60-40-18		1.4408 / A743 CF8M	
Wear rings	St52-3 / A572 Gr.50		1.4571 / A276 316Ti	
Pump shaft	1.4021 / A276 420		1.4571 / A276 316Ti	

	all Pump types
Sleeve bearings/Start-up rings	SiC/SiC – "dry safe" / 1.4462 / A276 Cr.XM-26
Containment shell	1.4571 / 2.4610 or zirconium oxide
Magnetic coupling	Cobalt Samarium $Sm_2C_{017}$
Driven rotor	Cobalt Samarium $Sm_2C_{017}$ / 1.4571 / A276 316 Ti

## Internal circulation / NPSH-Condition

Pumps in operation generate eddy currents in the metallic containment shell which heat up the product in the gap between rotor and containment shell. This heat is dissipated through an internal circulation. The internal circulation flows from discharge, direct behind the impeller, through the pump shaft to the rear impeller. The pressure increase through the rear impeller allows a circulation back to the volute casing.

This pressurization of the magnet end and the sleeve bearing prevents vaporization of the pumpage in this area.



The heated partial flow is led through the internal circulation back to discharge side and has therefore no influence on the NPSH-value. Handling of boiling liquids is possible without problems.

## 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.

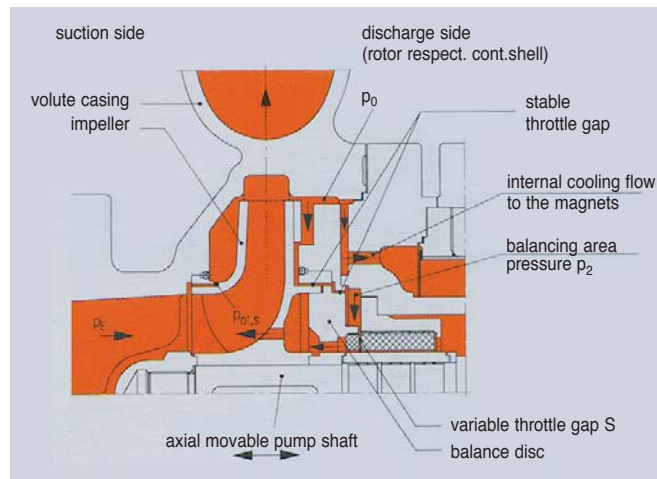
## Secondary seal

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.

## Inducer

To improve NPSH-required conditions, additional inducers are available. The inducers are designed in a way that NPSH-improvement is given from minimum flow up to BEP. Retrofit of inducers on site is possible without change of suction pipe.

## Balanced thrust loads



The thrust load of the closed impellers is hydraulically balanced by wear rings, balance holes and balance discs.

The available thrust bearings are working as start-up rings only.

## Monitoring

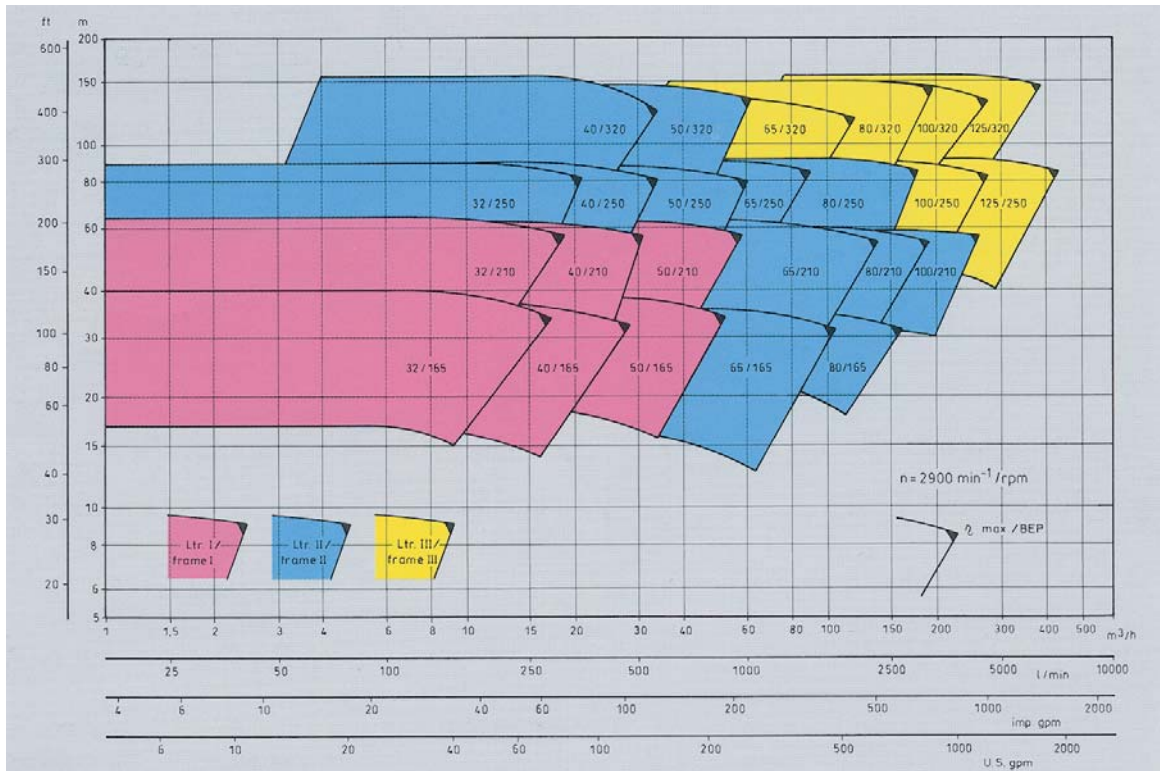
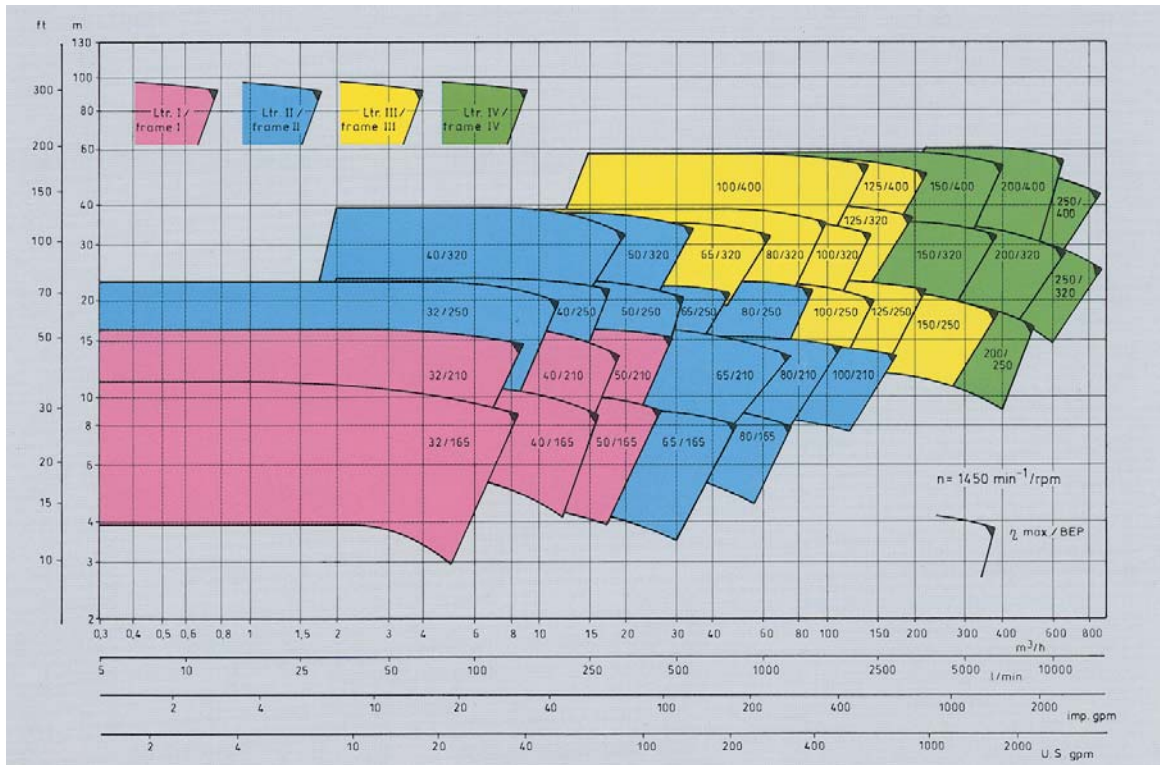
Connections for temperature monitoring of the containment shell surface are available as standard. For critical service conditions, e.g. dry running, ball bearing and containment shell temperature, the MAG-SAFE monitoring device is highly recommended.

## 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 Machinery Directive 98/37 EC and are suitable for plants with increased safety requirement.



## Performance range



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