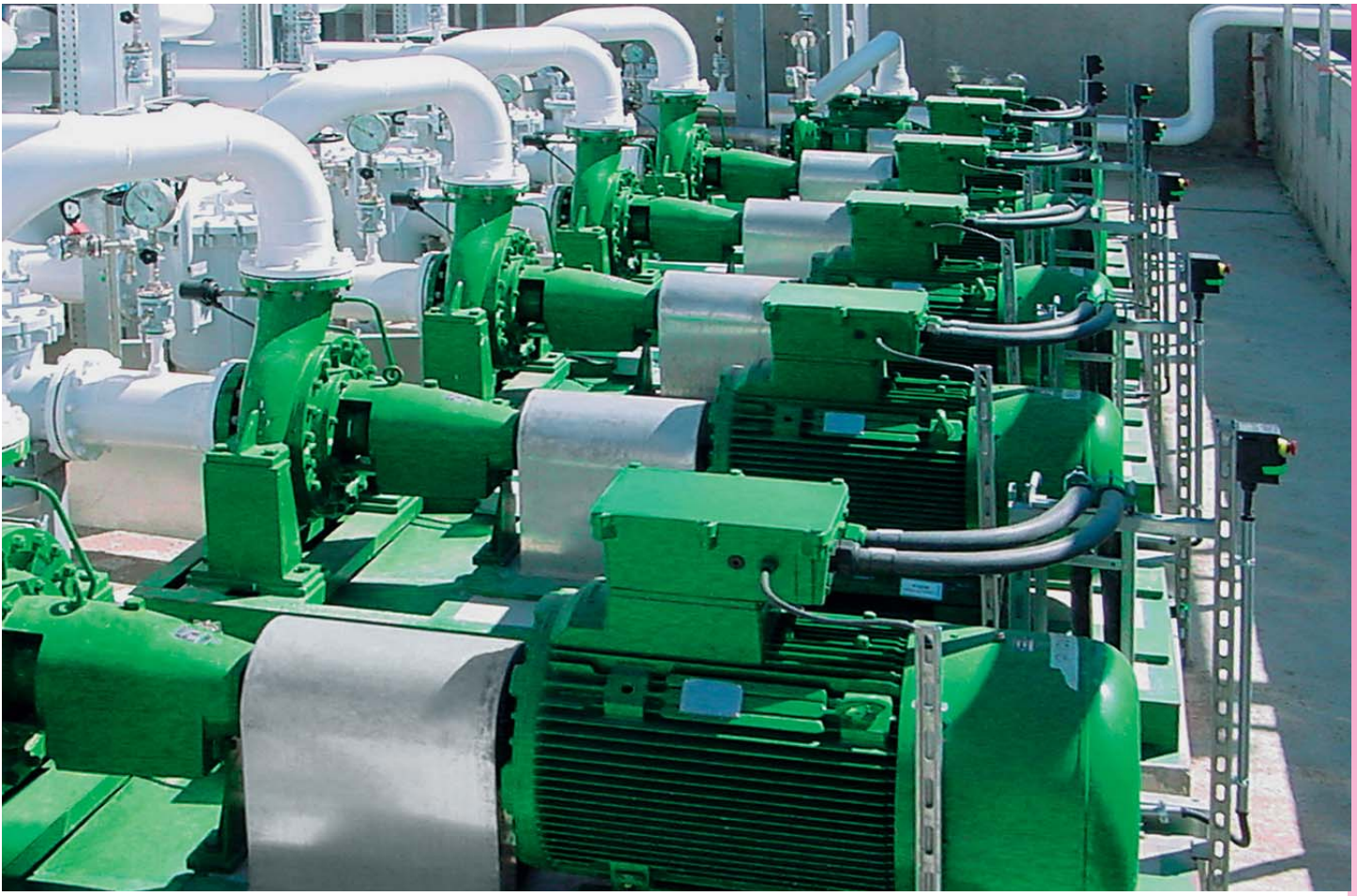
DICKOW PUMPEN



Heavy Duty Process Pump according to API 610, 10th ed. series NCR

Issue 05/08

GENERAL

The DICKOW-pumps, type NCR, are heavy duty centrifugal pumps for petroleum, petrochemical and natural gas industries. The pumps are designed and manufactured according to API 610, 10th ed. / ISO 13709. This international standard specifies requirements for centrifugal pumps used in the above industries.
The standard does not refer to any outline dimensions of the pumps.

APPLICATIONS

The performance range of the NCR-pumps is subdivided such that acceptable efficiencies can be achieved for all service conditions.
The maximum capacity goes up to 700 m^3/h (3100 USgpm). Differential head up to 145 mLC (480 ft) at 2900 rpm and 220 mLC (660 ft) at 3500 rpm.

With a wide selection of materials and the possibility to install all shaft sealing systems according to API 682, DICKOW-NCR-pumps are suitable to convey nearly all kinds of liquids which are usual in the above mentioned industries. E.g. acids, lyes, chlorinated hydrocarbons, heat transfer media (HTM), all kinds of hydrocarbon fuels, liquid sulphur, melted plastics, bitumen etc.

If the application requires sealless pumps, consider also our magnetic coupled PRM-pumps according to API 685.

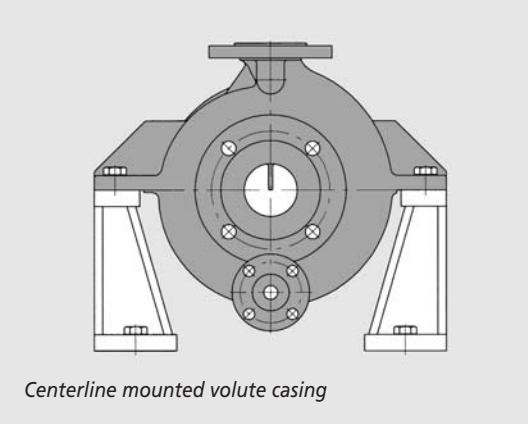
DESIGN

The NCR-pumps are centerline mounted single stage overhung pumps (designated pump type OH2). They have a heavy duty bearing bracket to accept all forces imposed upon the pump shaft and maintain rotor position during operation.
The pumps are mounted to a API baseplate and direct coupled to the drivers.

The pump is of back-pull-out design. That means rotating pump unit (including bearing bracket, intermediate casing, shaft sealing and impeller) can be removed without disassembly of the volute casing. Suction and discharge pipe remain connected.

Volute casing

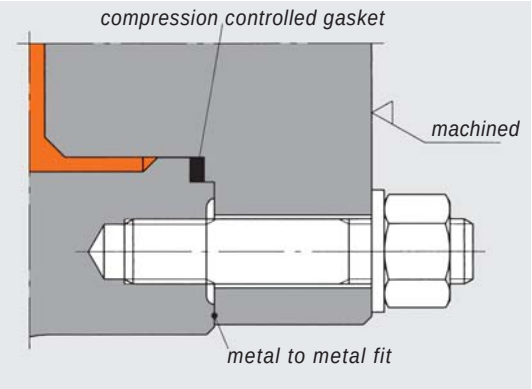
The single or double volute casings of standard design are cast en bloc and centerline mounted. The design gauge pressure rating for the standard materials is 4000 hPa (40 bar or 600 psi) at 38°C (100°F).



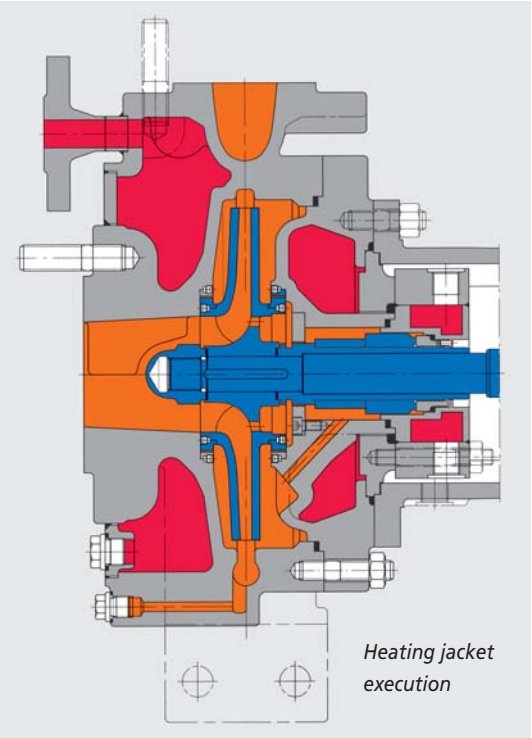
Centerline mounted volute casing

Pump flanges are full or spot faced on the back and designed for through bolting.

Drain connection is available at the bottom.
No vent connection required because of the self-venting configuration.
The radially split casings have metal-to-metal fits, with confined compression controlled gaskets to avoid blow outs.



Fully jacketed volute casings are available as an option. Pumps can be heated or cooled with water, steam or oil. Maximum allowable heating temperature 330°C (620°F), maximum pressure 24 bar (350 psig). Flanged connections for heating fluid are standard.



Heating jacket execution

Pumps with jacketed casings may be required if the melting or cristallization temperature of the pumped fluid is higher than the pump's ambient temperature.

Impeller

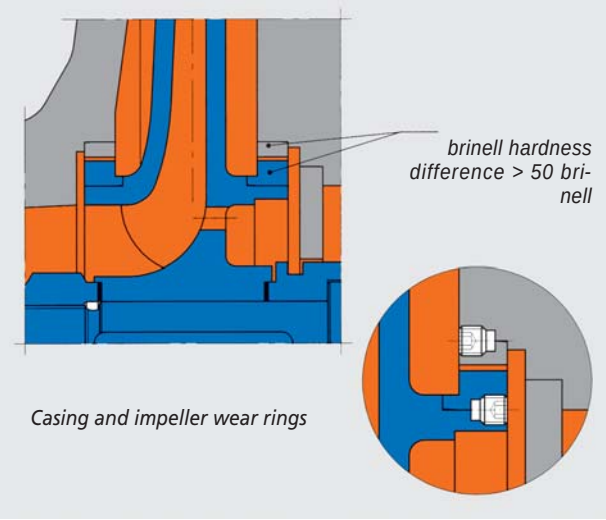
The standard pump impellers are closed, manufactured of single-piece castings with solid hubs. The impellers are keyed to the shaft and secured by a cap screw with Heli-Coil insert.

The impeller thrust loads are hydraulically balanced by wear rings and balancing holes to the suction side. Special care was taken when designing the impeller eye to achieve low NPSH-values.

The impellers are properly statically and dynamically balanced according to paragraph 5.9.4 of the API 610, respectively ISO 1940-1, grade G 2,5.

Wear rings

Renewable wear rings are provided at volute casing, intermediate casing and impeller. The wear rings are held in place by screws. Running clearances meet the requirements of paragraph 5.7.4. (clearances are used to limit internal leakage and to balance axial thrust).

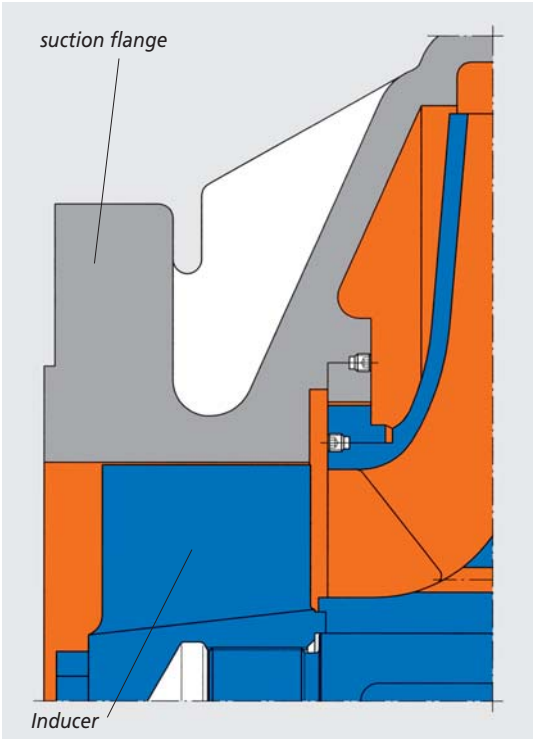


Casing and impeller wear rings

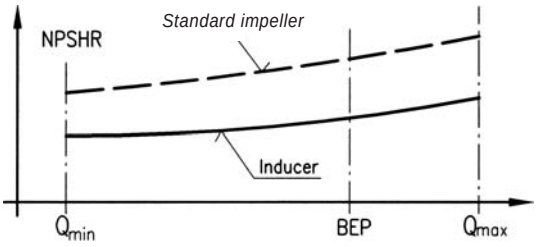
Mating surfaces of the wear rings have a difference in Brinell hardness of at least 50 HB.

Inducer

For certain applications with very low NPSHA-requirement, installation of inducers can be provided.

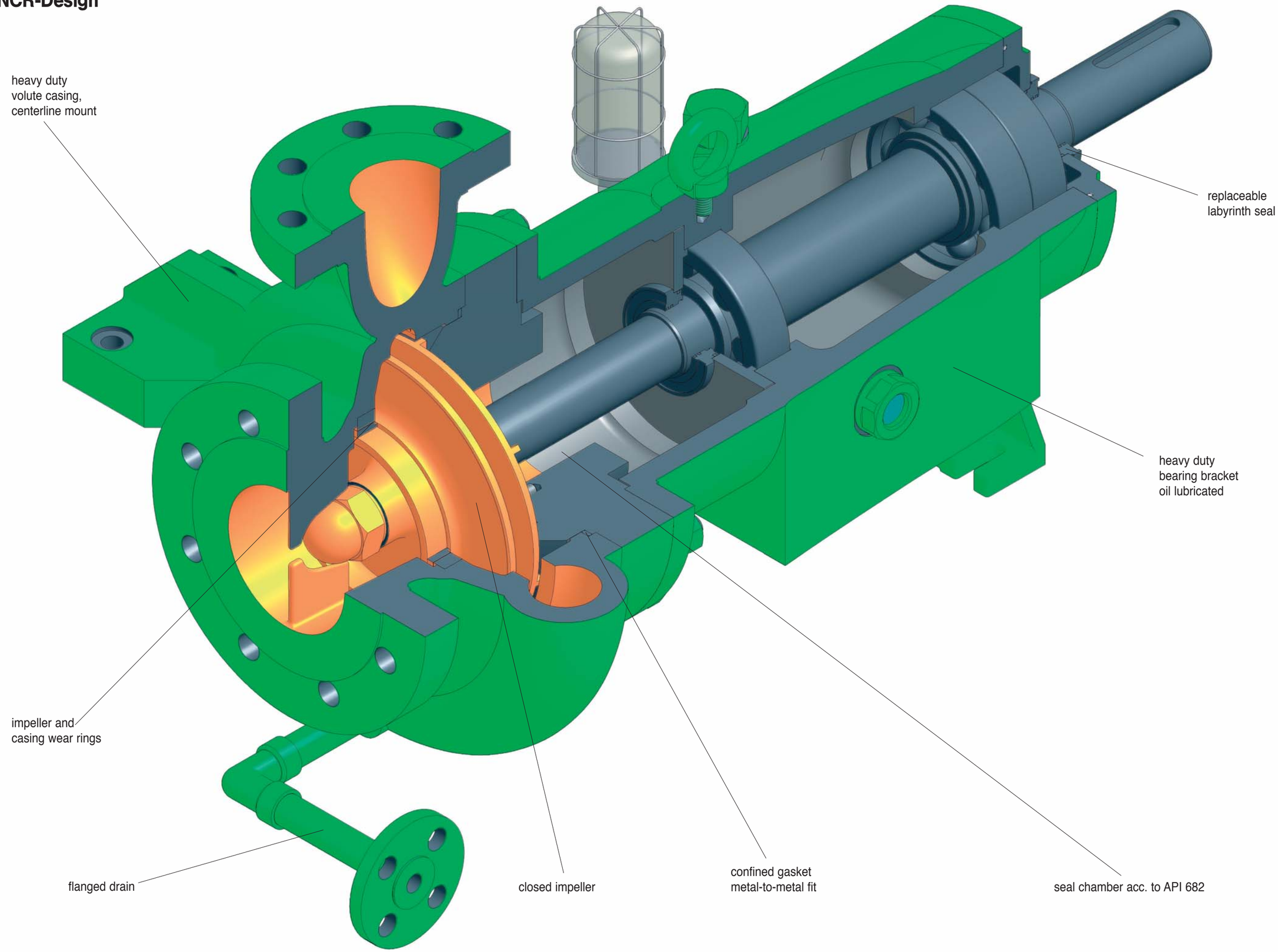


Contrary to former inducer designs, this inducer offers NPSH-improvement from minimum flow to maximum flow.



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

NCR-Design


heavy duty
volute casing,
centerline mount
replaceable
labyrinth seal
heavy duty
bearing bracket
oil lubricated
impeller and
casing wear rings
flanged drain
closed impeller
confined gasket
metal-to-metal fit
seal chamber acc. to API 682

Pump shaft

The pump shaft is sized to transmit the full driver output and is accurately machined thoughout his entire length and has a proper finish on bearing mating surfaces. All shaft keyways have fillet radii conforming to ASME B17.1.
To obtain satisfactory seal performance, the shaft stiffness limits the total deflection. This limit is achieved by the combination of shaft diameter, shaft span or overhang and casing design.
The shaft design guarantees that the first try bending critical speed is at least 20% above the pump's maximum continuous operating speed.

Bearings

The pump shaft is supported by one radial roller bearing at impeller side and two combined radial thrust bearings at coupling side. Bearings are mounted directly to the shaft by means of shoulders. The thrust bearings are locked to the shaft by a nut with a tongue-type lock washer.
Bearings are arranged for ringoil lubrication.
Oil mist lubrication available as an option.

The bearings offer L10 rating life of more than 25000 hrs (three years) at continuous operation under rated conditions.

Bearing housing

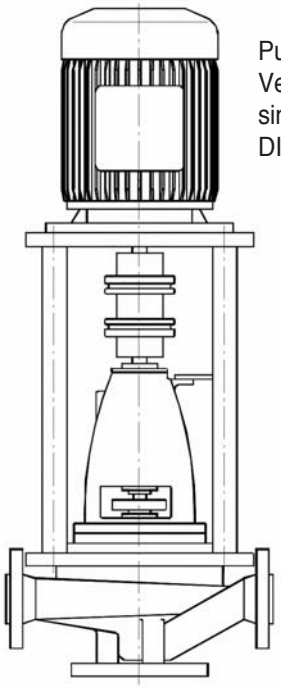
According to paragraph 5.10.2.2, the bearing housings are equipped with constant level sight feed oilers. A bulls eye is provided to check overfilling of the housing. The bearing housing is equipped with replaceable labyrinth seals with internal deflector to prevent contamination by moisture, dust and other foreign matters.
The design effectively retains oil in the housing. Water jacket to cool the oil sump is available as an option. A drain plug is provided at the bottom and a vent plug at the top of the bearing housing. For flammable or hazardous liquids, cast steel bearing housings are available.

Vibration monitoring

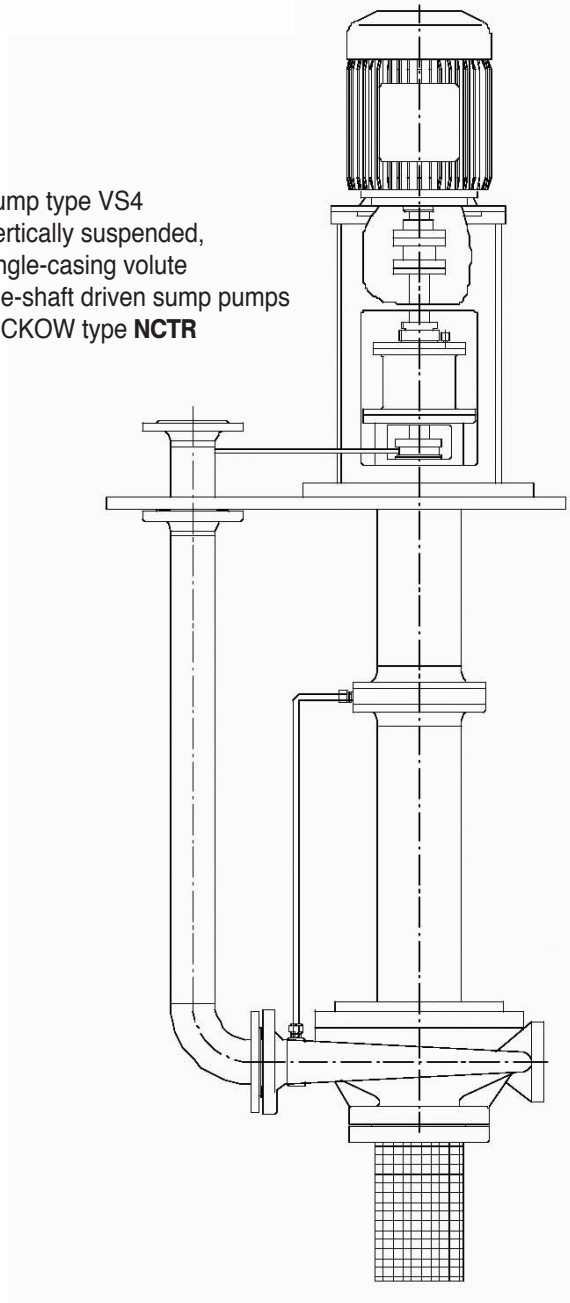
The bearing housings are dimpled to facilitate hand held vibration transducers.

Threaded connections for permanently mounted transducers or flat surfaces for magnetic based vibration measurement equipment is available on request.

Alternative pump designs



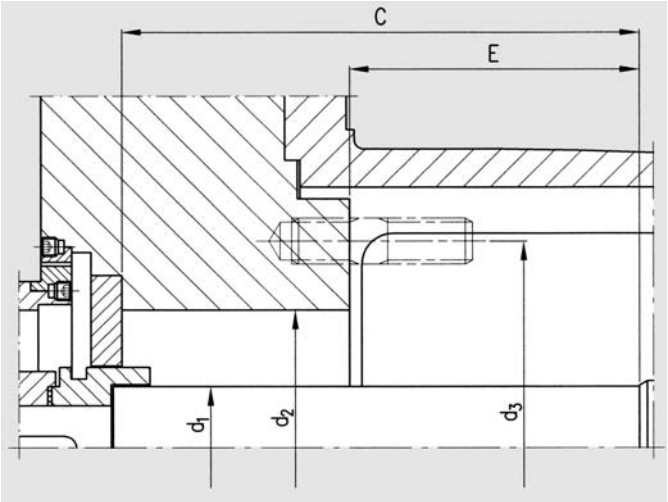
Pump type OH3
Vertical in-line,
single stage overhung pumps
DICKOW type **NCVLR**



Pump type VS4
Vertically suspended,
single-casing volute
line-shaft driven sump pumps
DICKOW type **NCTR**

Mechanical shaft seals

The NCR-pumps will be equipped with mechanical seals and sealing systems in accordance with ISO 21049 (equivalent to API 682, category 2/3). The seal chamber dimensions conform with paragraph 5.8.3 (Figure 25, Table 6) of API 610.



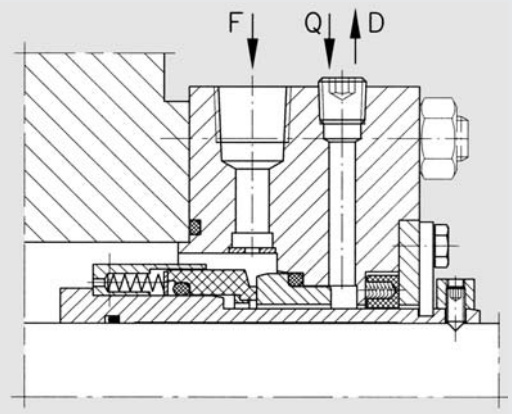
Frame size	d_1	d_2	d_3	C	E	Studs
I	30	80	115	155 *	100 *	4 x M12
II	40	90	125	160 *	100 *	4 x M12
III	50	100	140	174	110	4 x M16
IV6	60	120	160	175	110	4 x M16

dimensions in mm

"Category 2" seals are standard, for temperatures from –40°C (-40°F) to +400°C (750°F) and pressures up to 42 bar (615 psig).

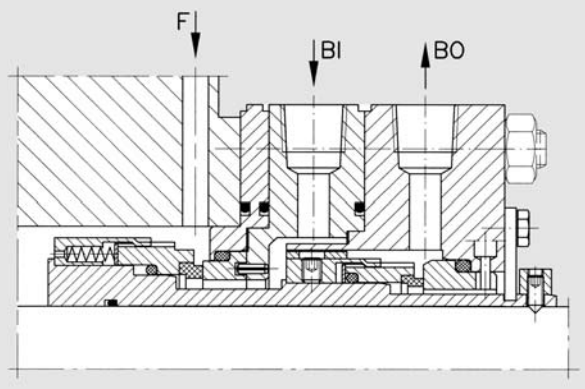
"Category 3" seals are available on request.

Single seal arrangement A1



API 682 Code: C2A1A1162

Double seal arrangement A2 / A3



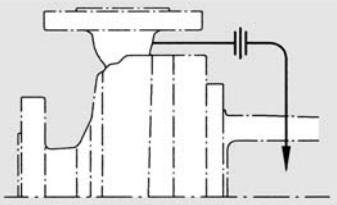
API 682 Code: C2A2A1152 / C2A3A1153

F: Flushing acc. to plan 01, 02, 11, 13, 14, 21, 23, 31, 32, 41
Q: Quench acc. to plan 61 / 62
D: Drain BI / B0: Buffer fluid connection plan 52 / 53

Seal flushing systems

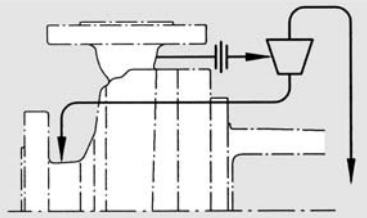
For single seal arrangement A1

API Plan 11



Recirculation from pump discharge through orifice, if necessary to the seal. For clean liquids.

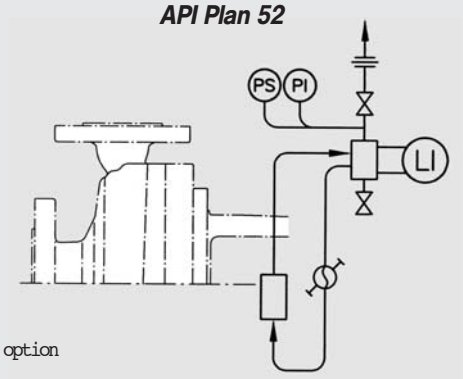
API Plan 31



Recirculation from pump discharge through orifice, to cyclone separator. For solid containing liquids.

For double seal arrangements A2 / A3

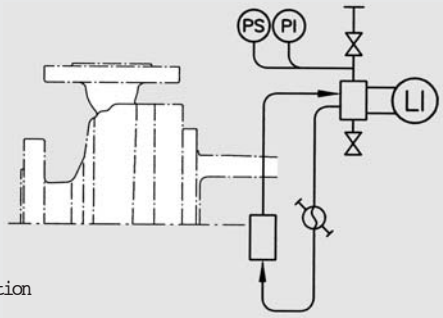
API Plan 52



*) as option

Uses an external reservoir to provide buffer fluid for the outer seal of an unpressurized dual seal arrangement.

API Plan 53 A



*) as option

Uses a pressurized fluid reservoir to supply clean fluid to the seal chamber.

Pump material

The following specified materials for the main pump parts are standard materials according to API 610, Annex H, Table H1, provided by DICKOW. Further materials are available on request.

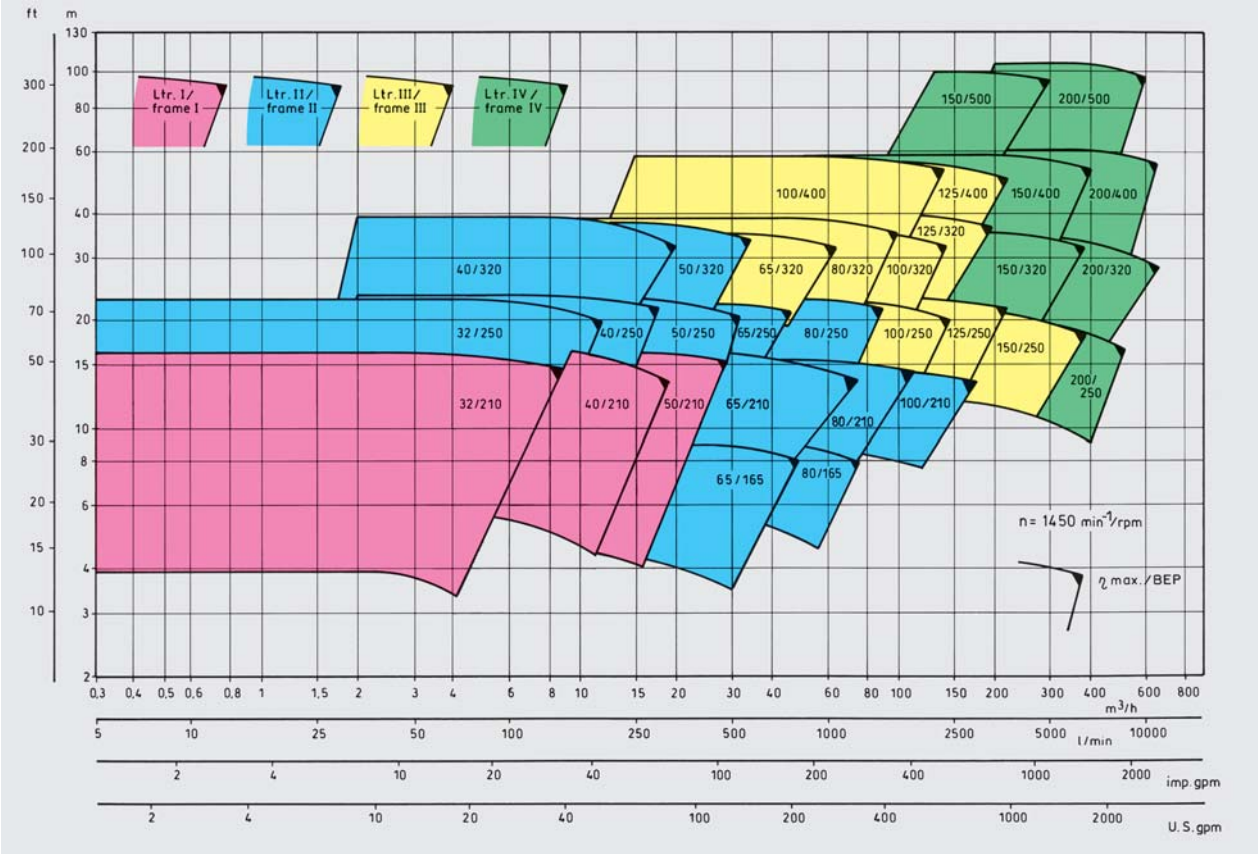
Pump type / API material class	NCRhuh / S-1	NCRhuh / S-6	NCRhx / A-8	NCRhd / D-1
Pressure casing	C.S. 1.7706	C.S. 1.7706	D.S. 1.4517	D.S. 1.4517
Impeller	C.I. GG25/GGG40	Cr.S. 1.4027	S.S. 1.4408	D.S. 1.4517
Wear rings	S.S. 1.4571/1.4418	S.S. 1.4571/1.4418	S.S. 1.4571/1.4418	D.S. 1.4462
Shaft	C.S. 1.4021	C.S. 1.4021	S.S. 1.4571	D.S. 1.4462
Case, gland studs	8.8	8.8	A4-70	D.S. 1.4462
Case gaskets	Non asbestos compositions according to the pumped fluid			
Bearing bracket	GGG40.3 (GS-C25 for flammable and hazardous liquids)			

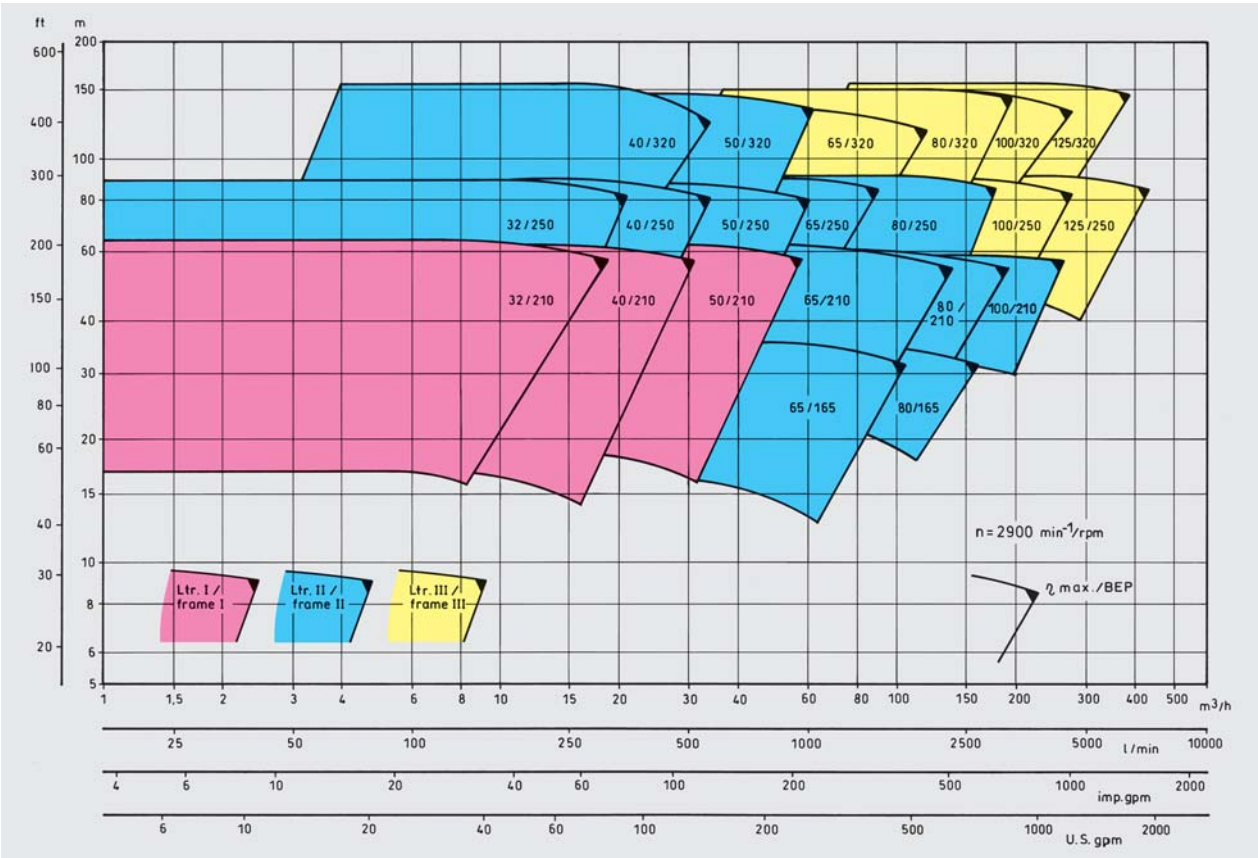
Material Composition:

GG25	EN-GJL-250	A278 Class 30
GGG40.3	Ductile iron	A536 60-40-18
GS-C25	Cast steel	A216 GrWCB
1.4021	X20 Cr 13	A276 420
1.4027	G-X20 Cr 14	A743 Gr. CA-40
1.4408	G-X6 CrNiMo 18-10	A743 CF8M

1.4418	X4 CrNiMo 16-5-1	-
1.4462	X2 CrNiMoN 22-5-3	A276 Gr.XM-26
1.4517	G-X2 CrNiMoCuN 25-6-3-3	A351 Gr.CD4 M Cu
1.4571	X6 CrNiMoTi 17-12-2	A276 316 Ti
1.7706	GS-17 CrMoV 5-11	A356 Gr.9

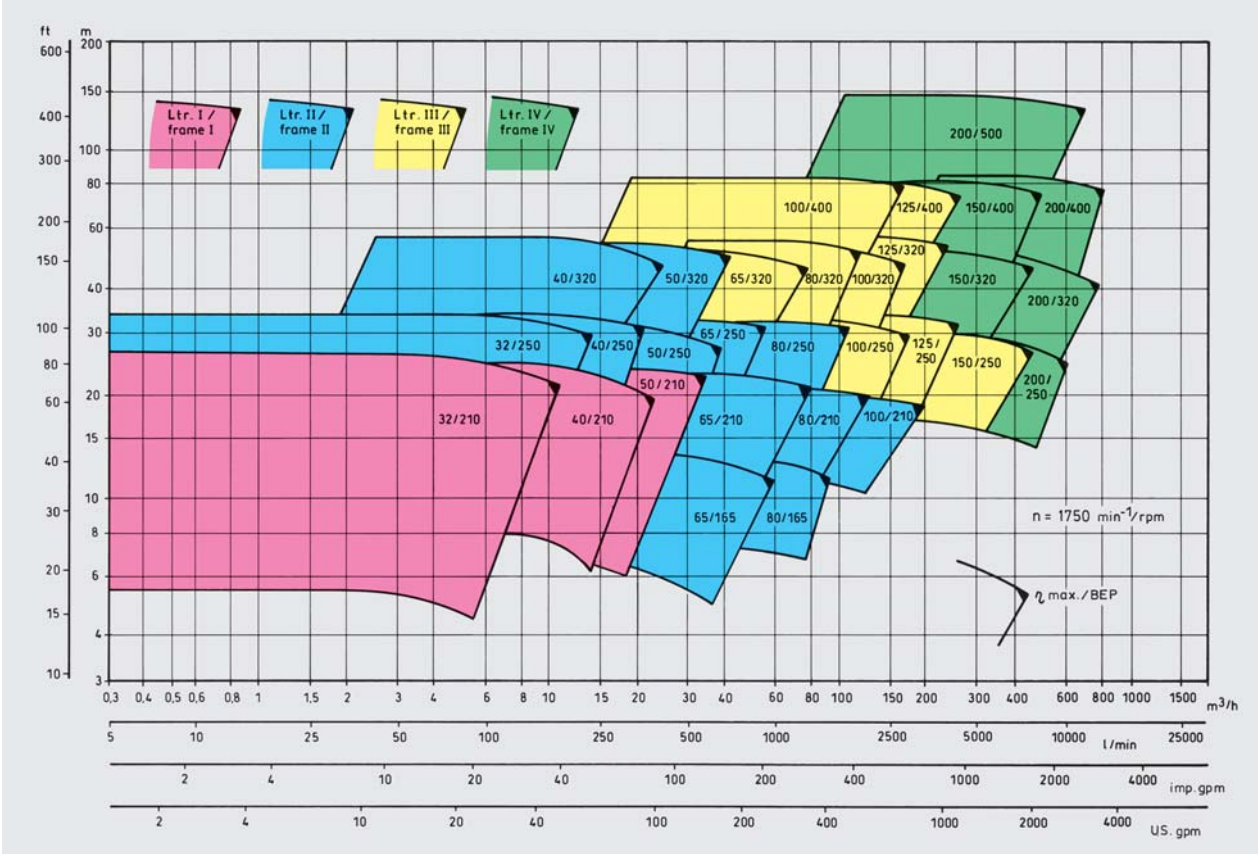
Performance view – 50 cycles

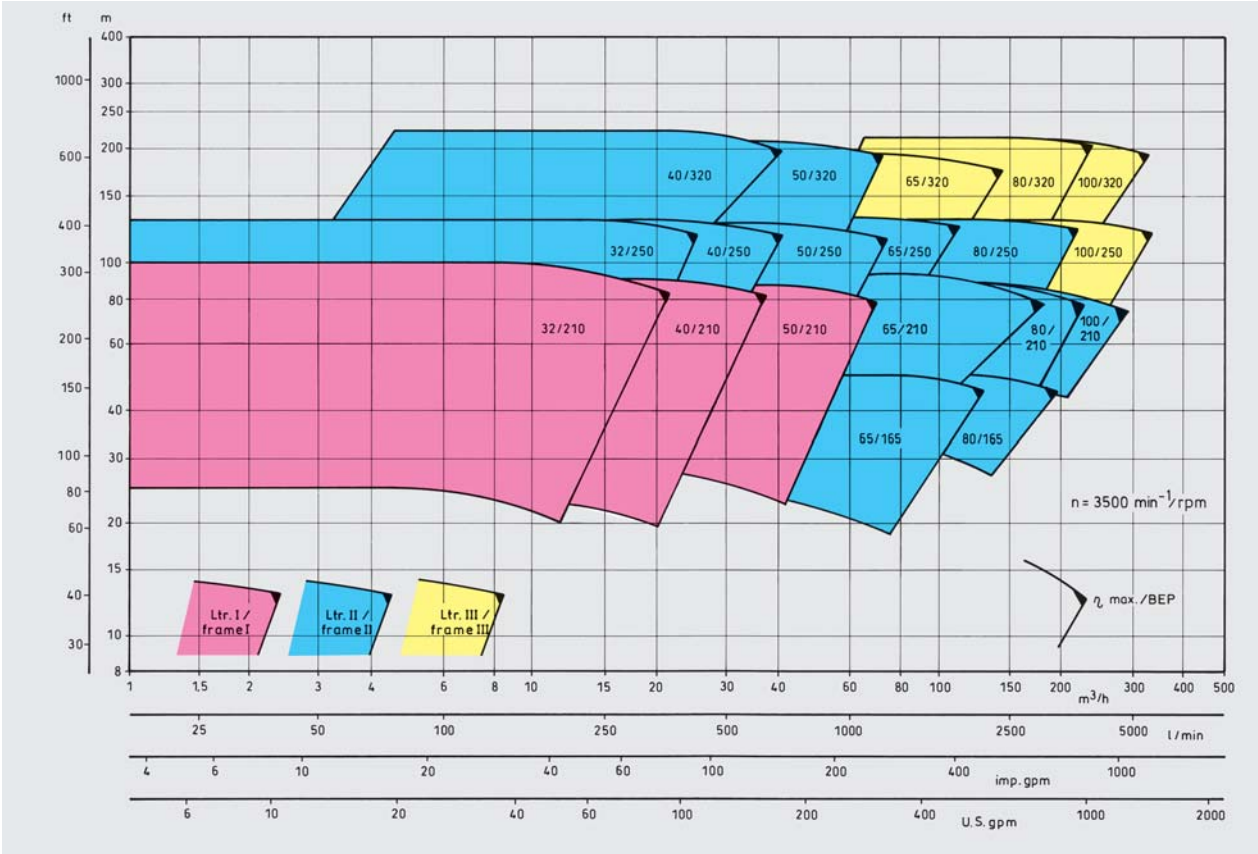




Performance curves for the different pump sizes are available on request.

Performance view – 60 cycles





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

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