DICKOW PUMPEN

Heavy Duty Process Pumps according to API 610, 11th ed. Type NCR

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, 11th ed. / ISO 13709. This international standard specifies requirements for centrifugal pumps used in the above mentioned 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.

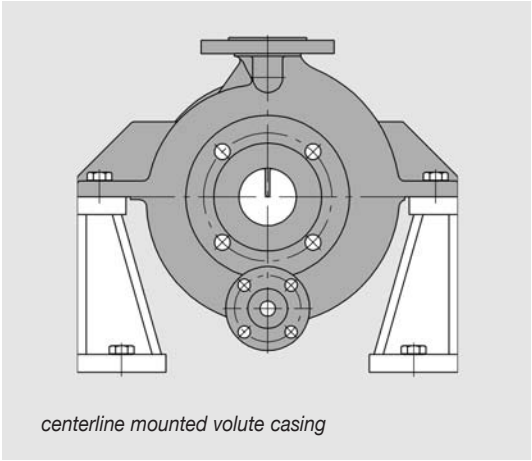
Design

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.

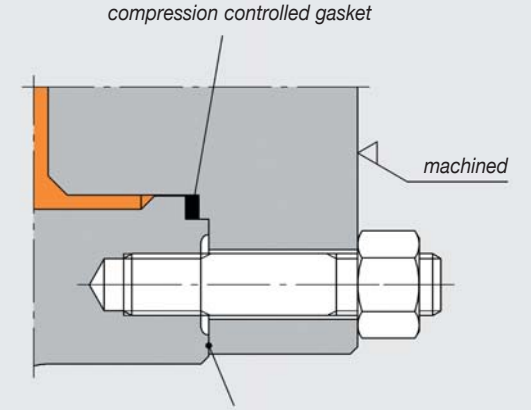


centerline mounted volute casing

The design gauge pressure rating for the standard materials is 4000 hPa (40 bar or 600 psi) at 38°C (100°F).

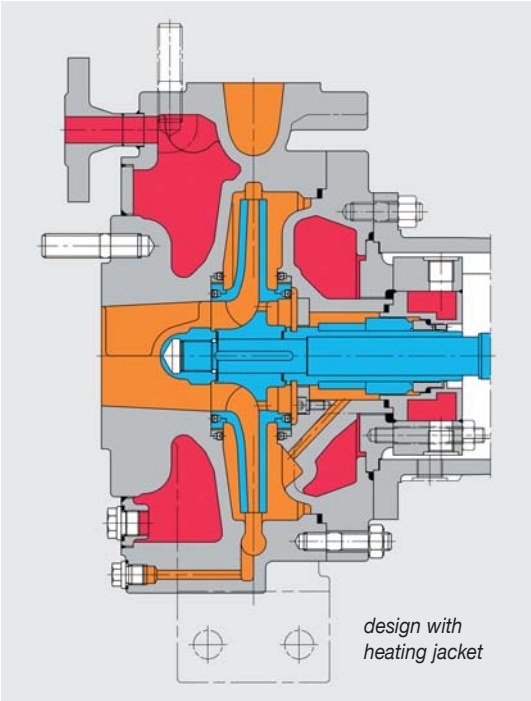
Pump flanges are full or spot faced on the back and designed for through bolting.

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.

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

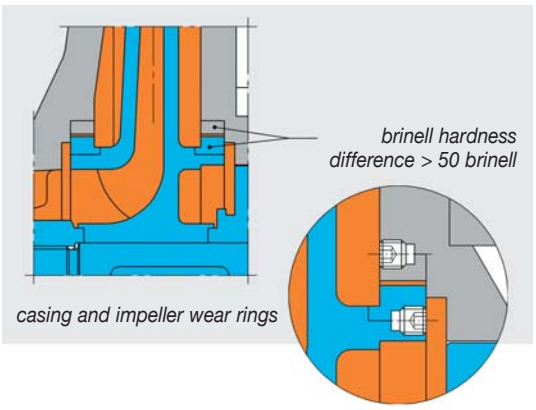
The standard pump impellers are closed, manufactured of single-piece castings with solid hubs. The impellers are keyed to the shaft and secured by a cap screw with Heli-Coil insert.

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 6.9.4 of the API 610, respectively ISO 1940-1, grade G2.5.

Wear rings

Renewable wear rings are provided at volute casing, intermediate casing and impeller. The wear rings are held in place by screws.

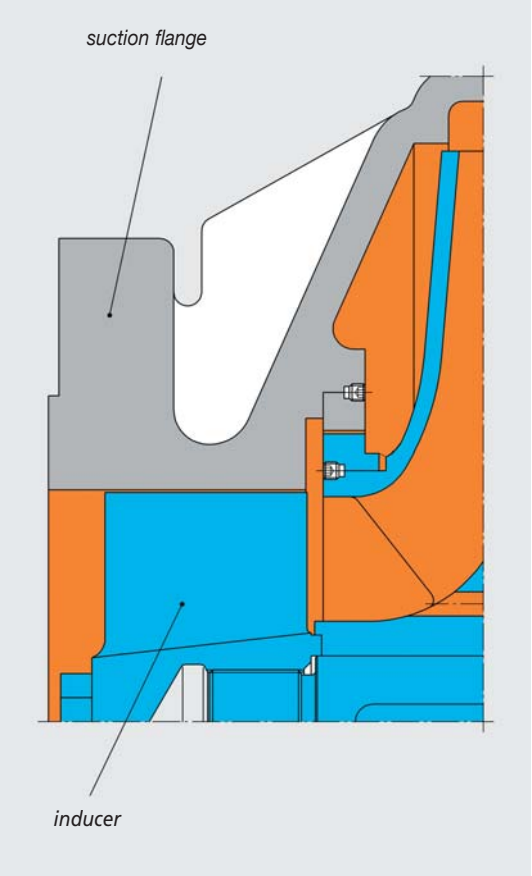


Running clearances meet the requirements of paragraph 6.7 (clearances are used to limit internal leakage and to balance axial thrust).

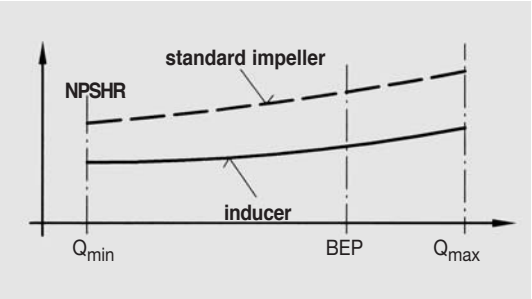
Mating surfaces of the wear rings have a difference in Brinell hardness of at least 50 HB.

Inducer

For certain applications with very low NPSHA-requirement, 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.

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 is 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

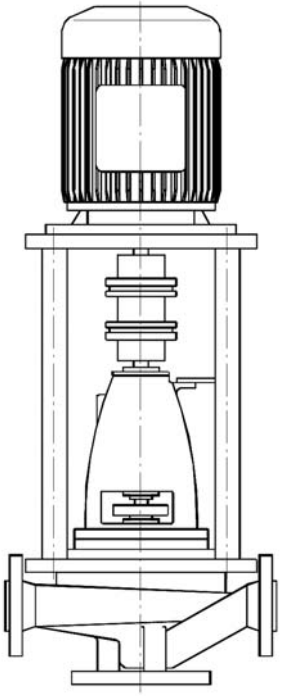
According to paragraph 6.10, the bearing housings are equipped with constant level sight feed oilers. A bulls eye is provided to check overfilling of the housing. The bearing housing is equipped with replaceable labyrinth seals with internal deflector to prevent contamination by moisture, dust and other 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. Cast steel bearing housings are standard.

Vibration monitoring

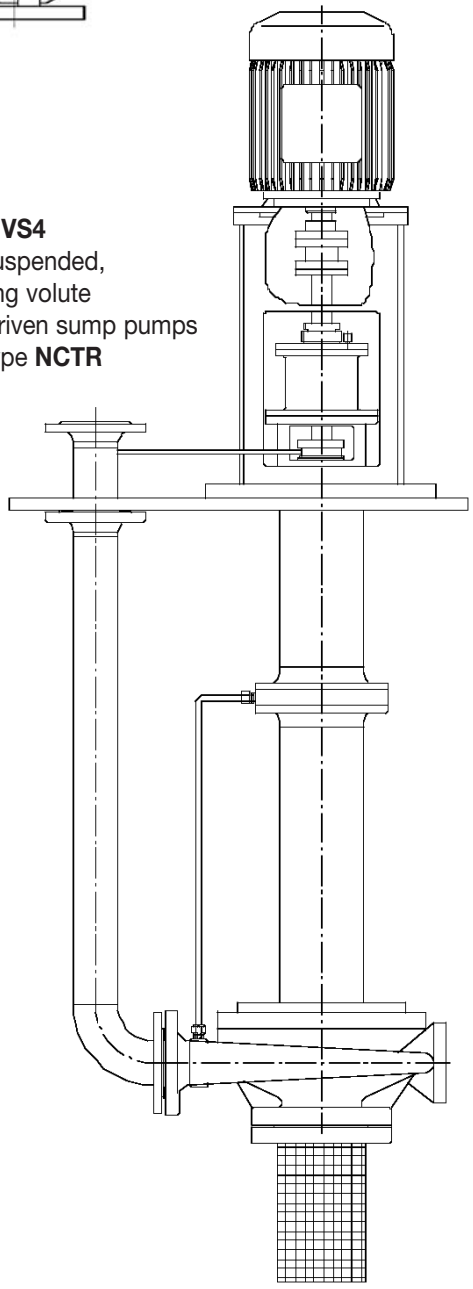
The bearing housings are dimpled to facilitate hand held vibration transducers.

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

Alternative pump designs acc. to API 610:



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**

Alternative pump designs acc. to API 610:

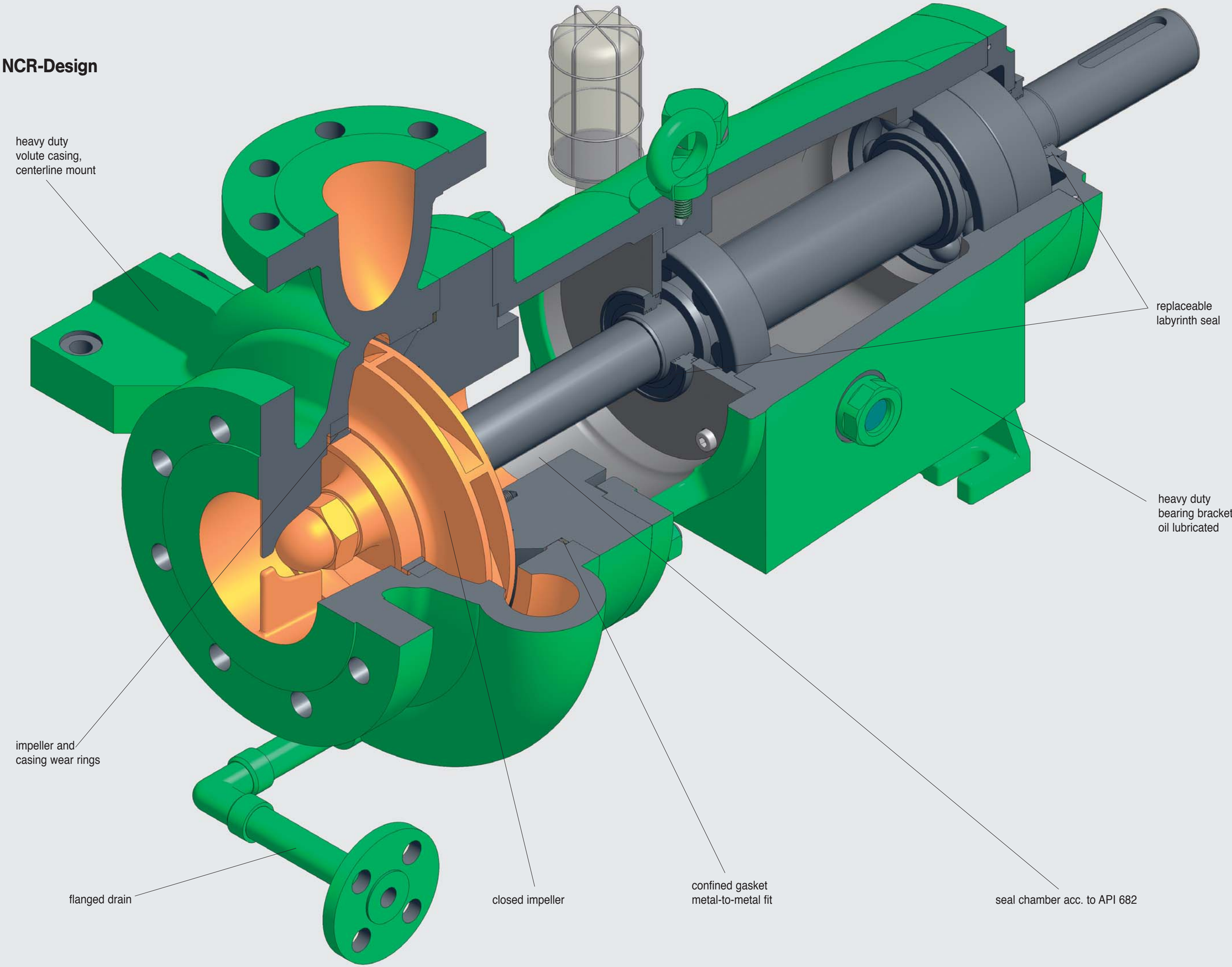
Pump type **VS1**
Verticallly suspended, single-casing diffuser pumps with discharge through the column
DICKOW type **HZVR**

Pump type **VS1**

Pump type **VS6**
Double casing, vertically suspended pumps (barrel type)
DICKOW type **HZVR**

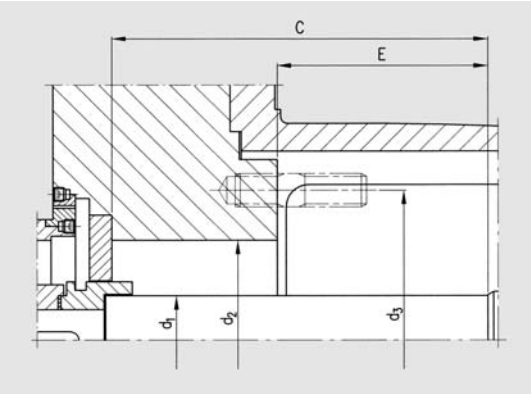
Pump type **VS6**

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

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 6.8 (Figure 25, Table 6) of API 610.

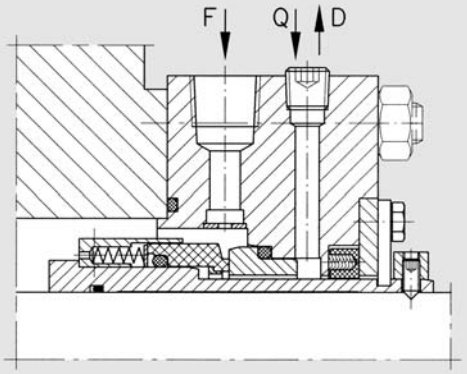


Frame size	d_1	d_2	d_3	C	E	Studs
I	30	80	115	155 *	100 *	4 x M12
II	40	90	125	160 *	100 *	4 x M12
III	50	100	140	174	110	4 x M16
IV6	60	120	160	175	110	4 x M16

dimensions in mm

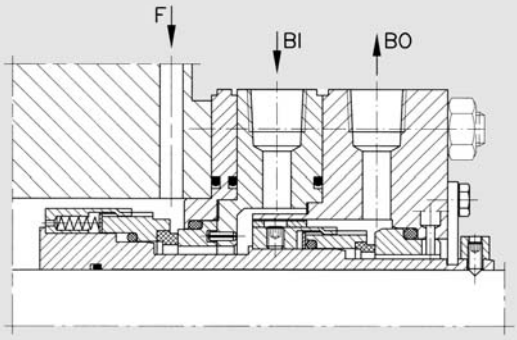
"Category 2" seals are standard, for temperatures from -40°C (-40°F) to +400°C (750°F) and pressures up to 42 bar (615 psig).
"Category 3" seals are available on request.

Single seal arrangement A1



API 682 Code: C2A1A1162

Double seal arrangement A2 / A3

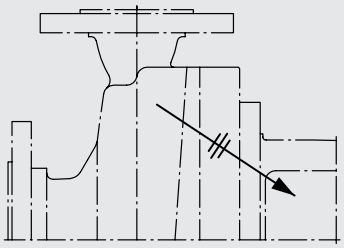


API 682 Code: C2A2A1152 / C2A3A1153

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

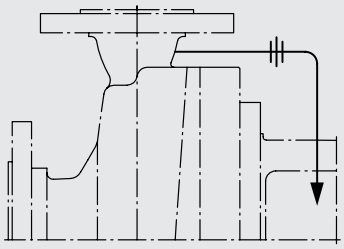
Seal flushing systems (examples)

API Plan 01



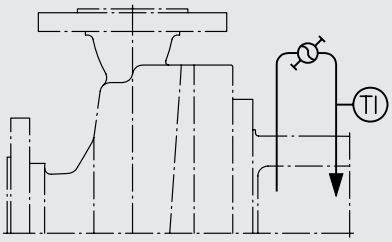
Internal recirculation from pump discharge to seal.
For clean liquids.

API Plan 11



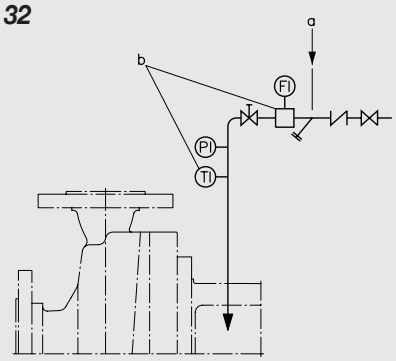
Recirculation from pump discharge through orifice (if necessary) to the seal.
For clean liquids.

API Plan 23



Recirculation from a pumping ring in the seal chamber through a cooler and back to seal chamber.
For hot applications (e.g. hot water, hot oil).

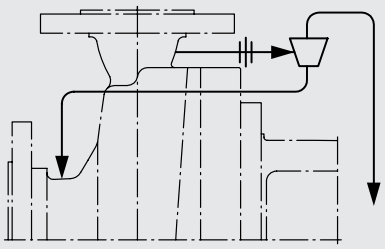
API Plan 32



Flush injected into the seal chamber from an external source.
For dirty liquids.

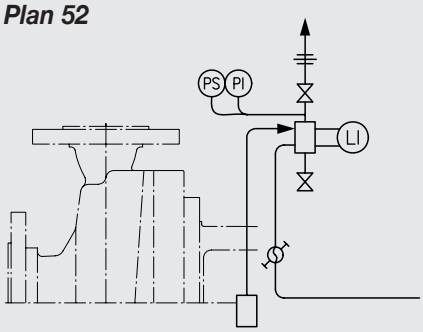
Seal flushing systems (examples)

API Plan 31



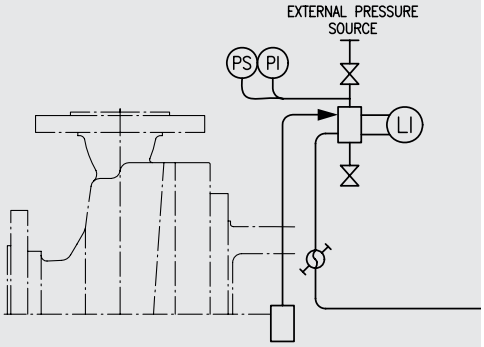
Recirculation from pump discharge through orifice, to cyclone separator.
For solid containing liquids.

API Plan 52



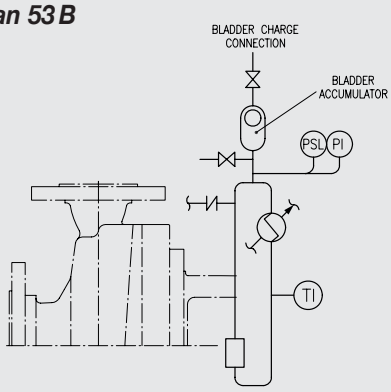
Unpressurized external reservoir to provide buffer fluid for the outer seal of an arrangement 2 dual seal.

API Plan 53 A



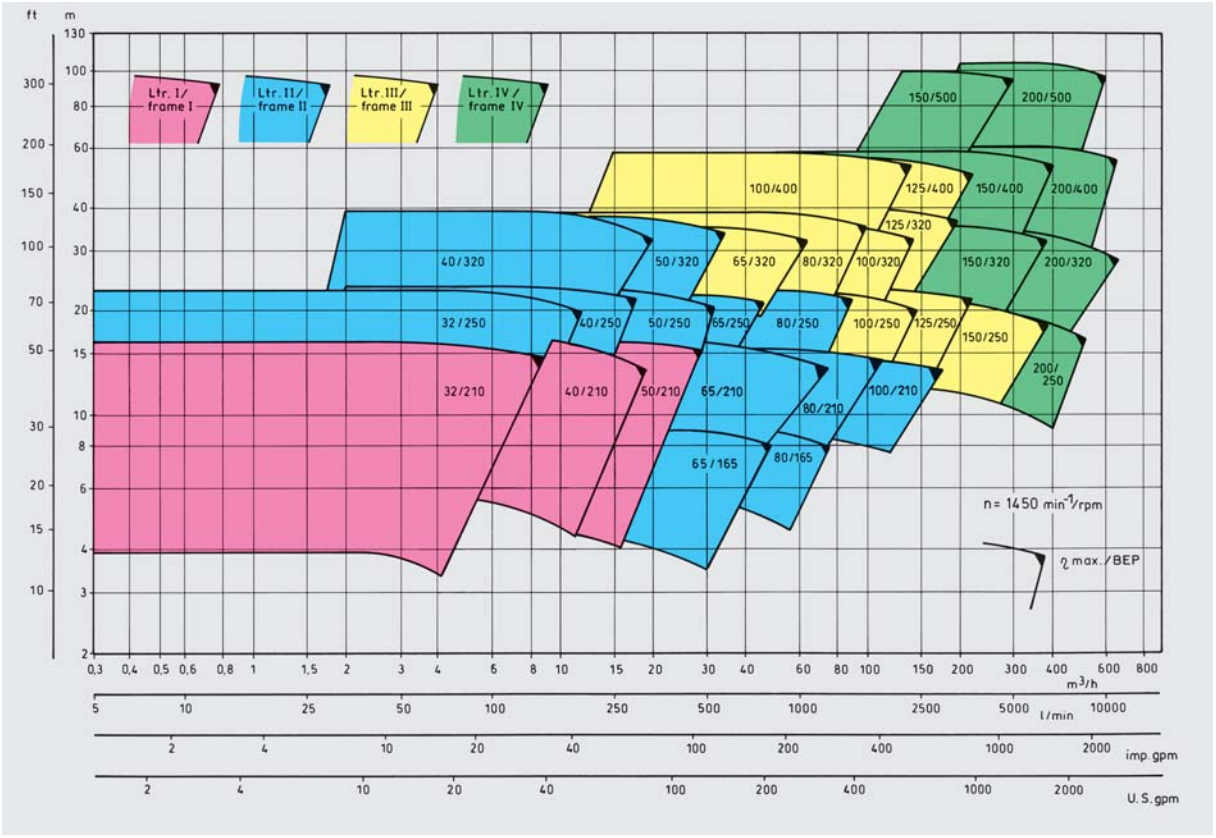
Pressurized external barrier fluid reservoir to supply clean fluid to the seal chamber.
For arrangement 3 dual seal.

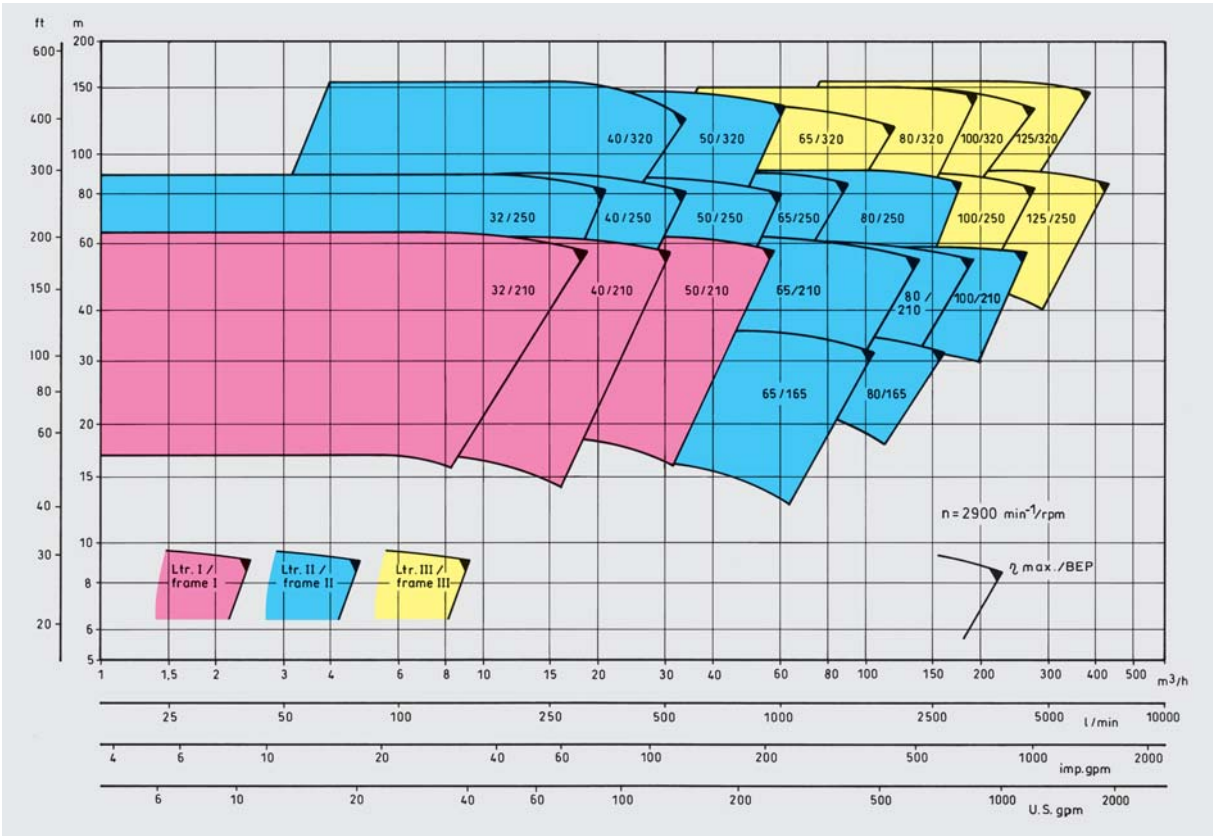
API Plan 53 B



Pre-pressurized bladder accumulator provides pressure to circulation system.
Heat is removed from system by air – or water – cooled heat exchanger.
For arrangement 3 dual seal.

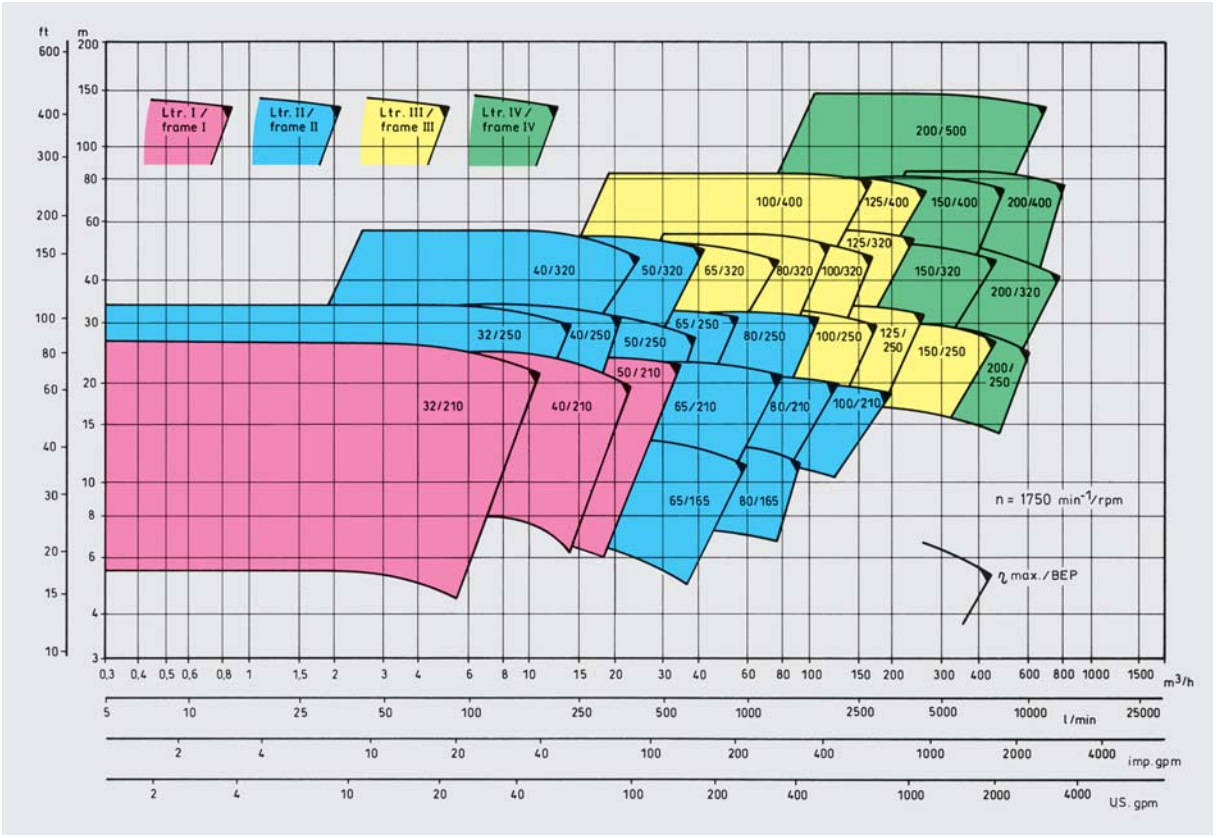
Performance range – 50 cycles

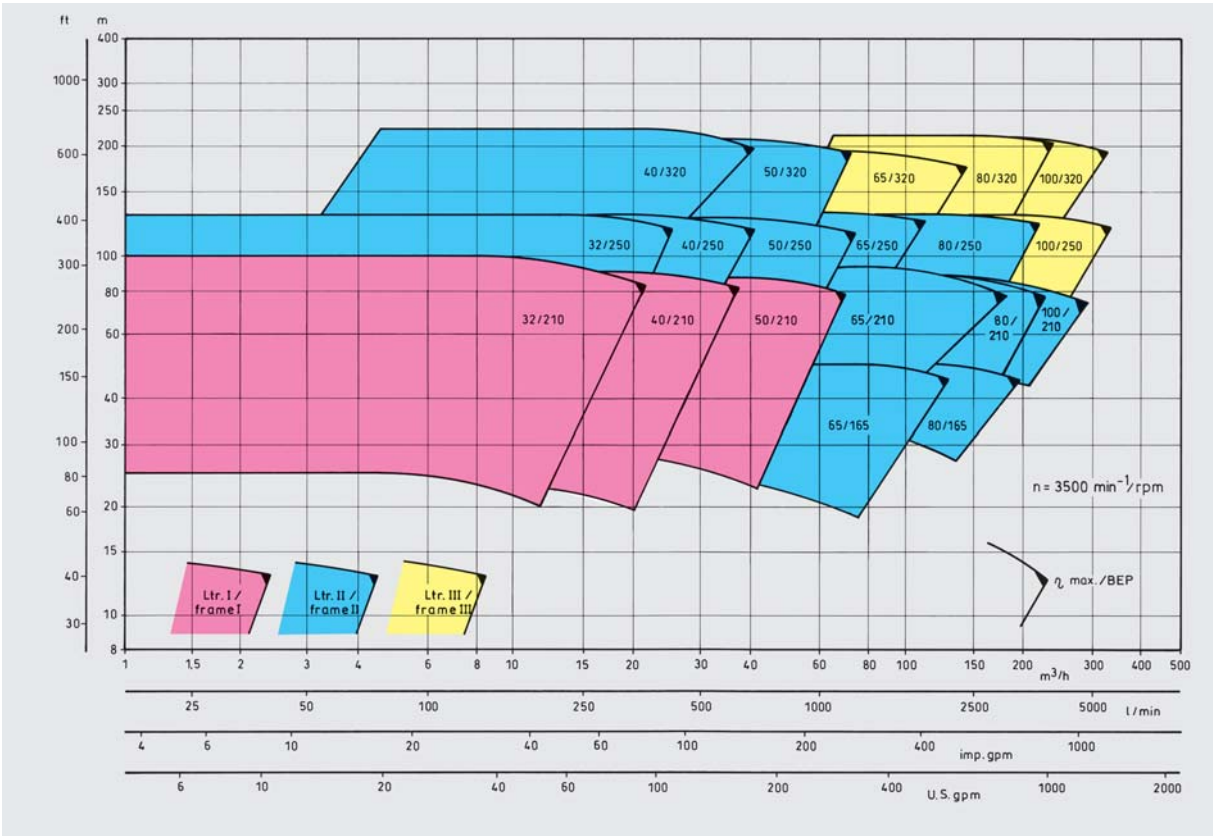




Performance curves for the different pump sizes are available on request.

Performance range – 60 cycles





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DICKOW PUMPEN KG
P.O. Box 1254
84465 Waldkraiburg · Germany
Phone ++ 49 86 38 6 02 0
Fax ++ 49 86 38 6 02 200 + 6 02 201
info@dickow.de / export@dickow.de
www.dickow.de

Issue 05.15