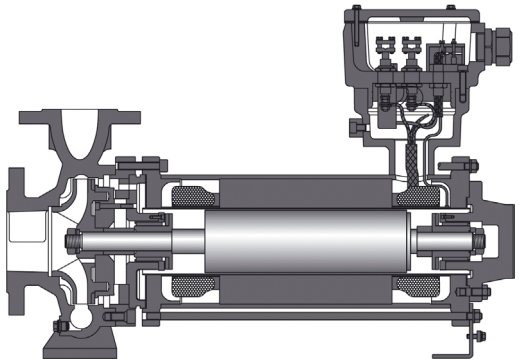
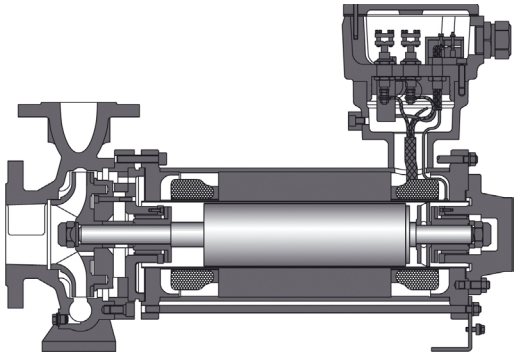
LEDERLE Hermetic

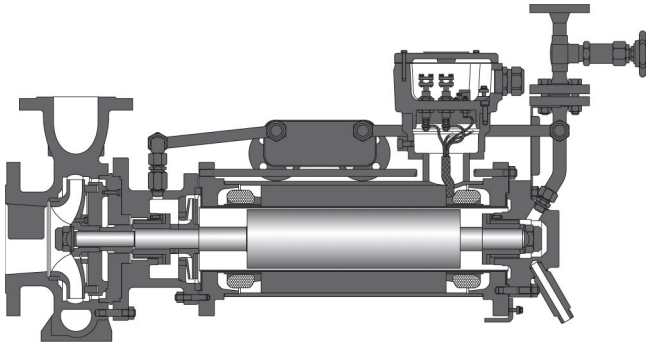
PRODUCT INFORMATION

CANNED MOTOR PUMP TYPE CN / CNF / CNK

HERMETIC *E-Line*







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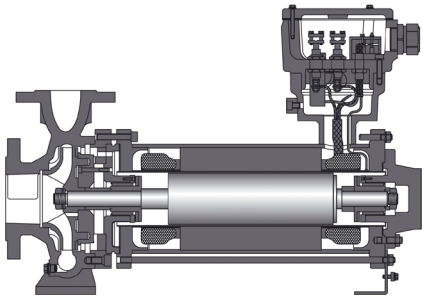

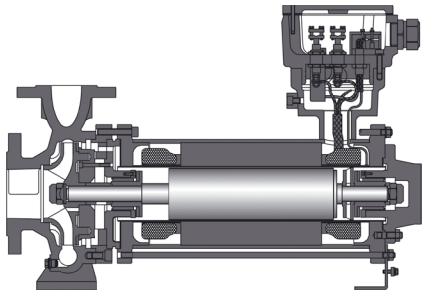

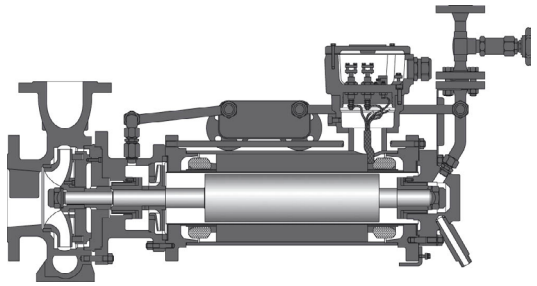

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Operational areas / applications
For the safe transport of aggressive, toxic, hot, explosive, valuable and flammable liquids and liquefied gases.

Model / design
Horizontal, sealless spiral housing pumps in process design with completely closed canned motor with radial impeller, single-stage, single-flow. The connection measurements of the housing comply with EN 22 858 / ISO 2858.

Canned motor pump type CN
The CN model is a standard design of the HERMETIC canned motor pump and is suitable for conveying all common liquids that are not close to steam pressure (not boiling media).

Canned motor pump type CNF
The CNF model is the version for liquefied gases, boiling media and condensate. With an integrated auxiliary impeller and internal fluid return, it is suitable for conveying liquids close to steam pressure.

Canned motor pump type CNK
The CNK model is the version for conveying hot organic heat transfer oils as well as heating bath liquids. Depending on the application, this version are equipped with plate heat exchanger or tubular coolers.

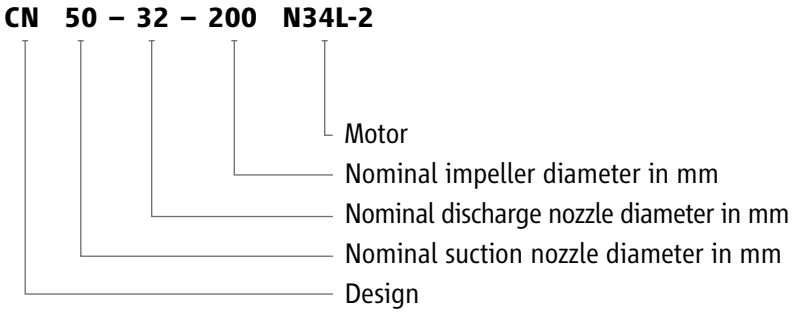
Drive
The rotor lining, one of our core competences, is manufactured using the compact extrusion method and as a nickel-base alloy, it is an essential component of the highly efficient canned motor. The pressure-resistant enclosed version of our canned motor complies with explosion protection according to Directive 2014 / 34 / EU. The canned motor filled with liquid accelerates to the operating speed in seconds. It is wear-free and maintenance-free during continuous operation due to the hydrodynamic sleeve bearings. The canned motor with low noise and vibration and offers double security to prevent leaks.

Operating data

Frequency:	50 Hz	60 Hz
Pump capacity [Q]:	max. 1700 m³/h	max. 1800 m³/h
Pumping head [H]:	max. 150 m	max. 220 m
Output power [P2]:	max. 520 kW	max. 622 kW
Conveyed material temperature [t] CN / CNF:	–120 °C to +360 °C	–120 °C to +360 °C
Conveyed material temperature [t] CNK:	max. +400 °C	max. +400 °C
Operating pressure:	16 / 25 bar	16 / 25 bar

(Extended rating scheme available on request)

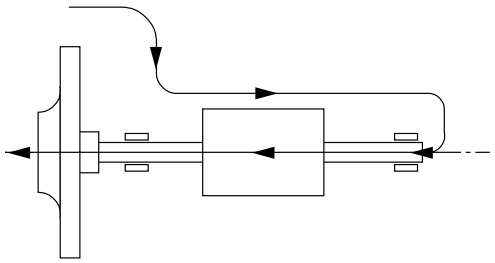
Pump and hydraulic denomination

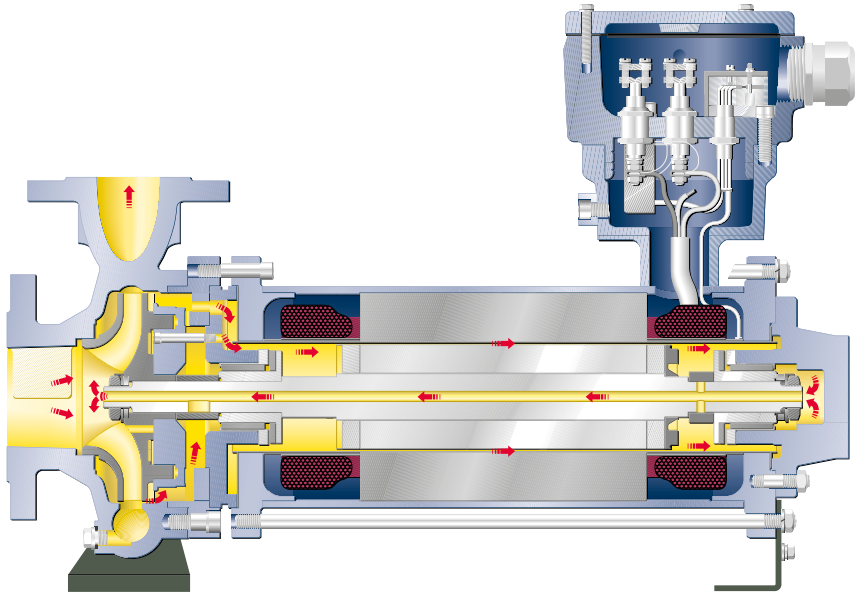


Functional principle CN

The partial flow for cooling the motor and lubricating the slide bearings will be deverted at the periphery of the impeller and, after having passed through the motor, is recirculated through the hollow shaft to the suction side of the impeller. This design is suitable for the delivery of uncritical liquids at low vapour pressures.

Recirculation of partial flow to suction side

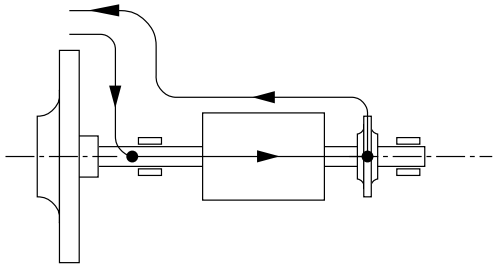


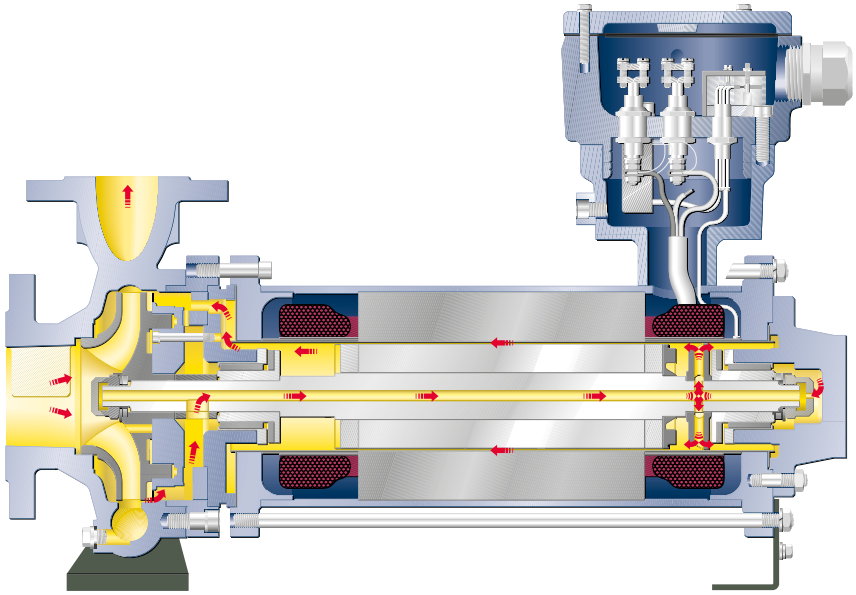


Functional principle CNF

The partial flow for cooling the motor and lubricating the slide bearings will be diverted at the periphery of the impeller and, after having passed through the motor, is recirculated to the discharge side. An auxiliary impeller is used to overcome the hydraulic losses encountered along the way. The recirculation of the partial flow towards discharge side ensures that the heated motor cooling flow has sufficient excess pressure above the boiling point of the pumped liquid during re-entry into the pump. This pump design can be used for liquefied gases with an extremely steep vapour pressure curve.

Recirculation of partial flow to discharge side

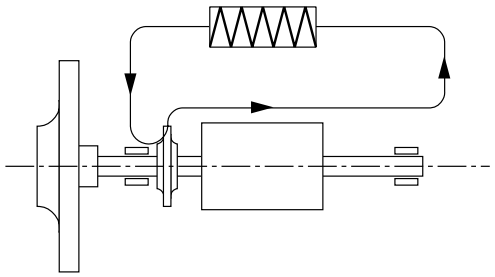


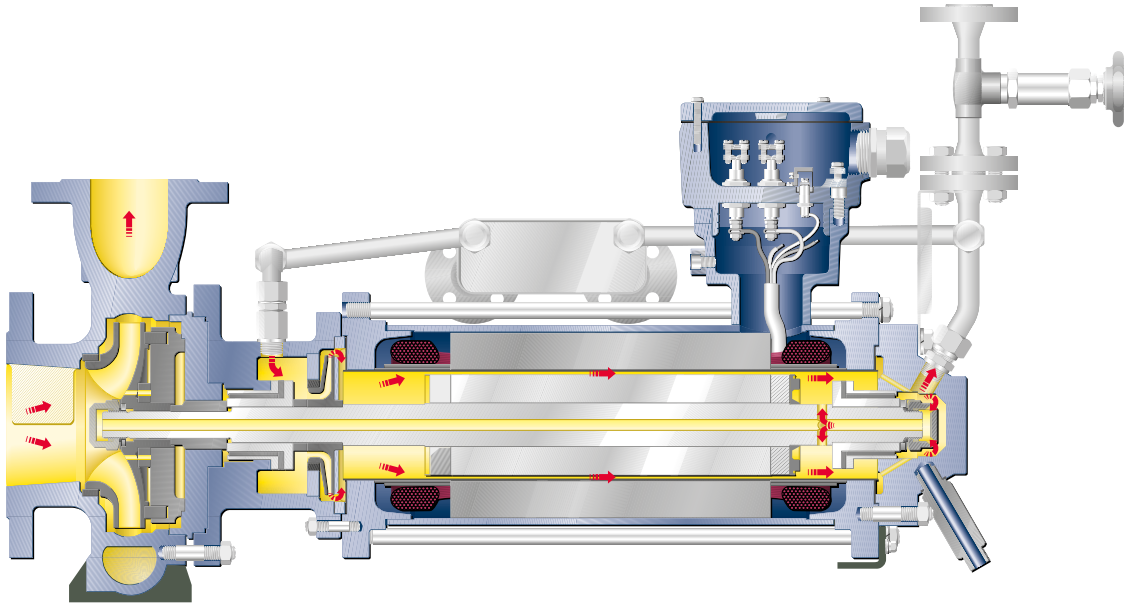


Functional principle CNK

The liquid is delivered from the suction side through the impeller to the discharge side. A thermal barrier avoids the direct heat transfer from the pump to the motor part. The motor heat losses are dissipated by a secondary cooling / lubricating circuit via a separate heat exchanger. This cooling / lubricating circuit also supplies the slide bearings. Thus the liquids at temperatures up to +400 °C can be conveyed while the secondary cooling cycle is at a lower temperature level. This construction is also suitable for conveying polluted or particle-containing liquids. If applicable, pure process liquid needs to be injected into the motor circuit.

Internal cooling / lubricating circuit

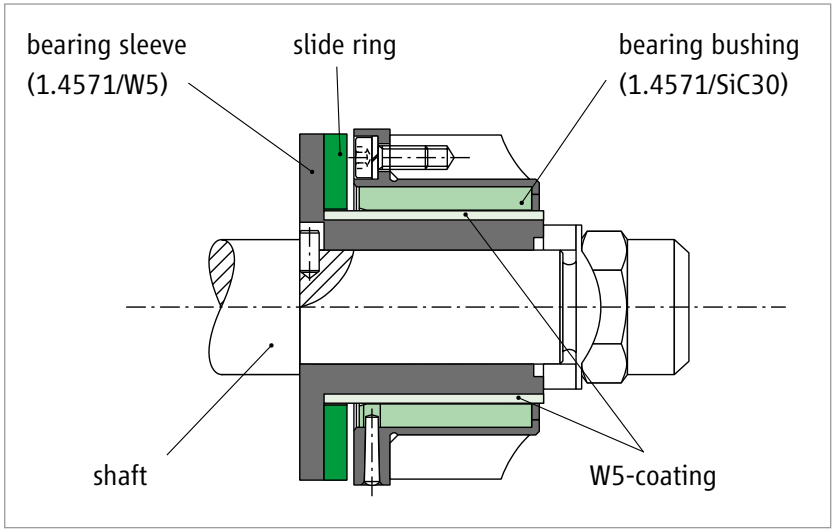




Bearings

The hermetically sealed design requires the arrangement of the bearings within the pumped liquid. Therefore, only hydrodynamic slide bearings are used in most cases. During normal operation slide bearings have the advantage that there is no contact between the sliding surfaces of the bearing. In continuous operation, they are wear- and maintenance-free. Service life of 8 to 10 years can be easily achieved by using hermetically sealed pumps.

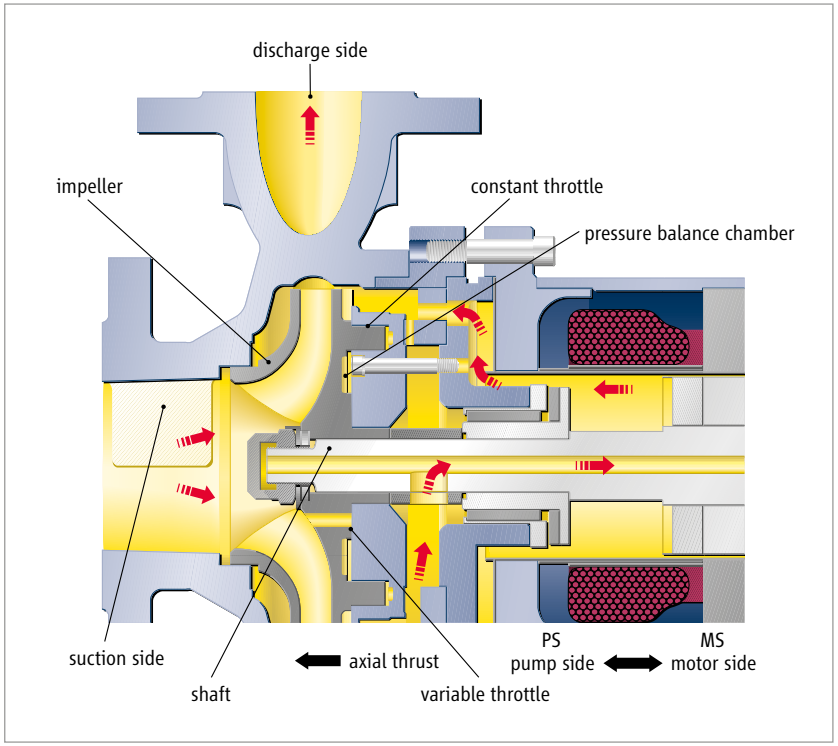
The almost universal bearing combination materials based on tungsten carbide (W5) and silicon carbide (SiC30) have proven to be the best choice. These combinations consist of a metallic shaft sleeve made of stainless steel (1.4571) coated with tungsten carbide by means of a “High Velocity Oxygen Fuel” process and a fixed bearing bushing made of ceramic material (SiC30) that is surrounded by a sleeve made of stainless steel. SiC30 is a mixed material of silicon carbide and graphite, combining the product advantages of both materials. Conditions of mixed friction, as they may arise for example during start-up and stopping of the pump, can be easily handled with SiC30. Moreover, this material is thermal shock resistant (high resistance against changes in temperature), as well as chemically inert, blister resistant (no formation of bubbles at material surface) and abrasion resistant.



Axial thrust balancing

The development of hermetically sealed pumps was dependent on the solution of a central problem, namely the elimination of axial forces of the rotor equipment. The various liquid properties exclude the possibility of using mechanical axial bearings. The only universal solution to this problem lay in hydraulic balancing of the rotor.

The functional principle of the hydraulic balancing device of series CN / CNF / CNK is based on the combination of a constant throttle (labyrinth gap) at the outer diameter of the impeller and a variable throttle near the impeller hub. If the rotor will be axially displaced from its balanced position, the pressure within the pressure balance chamber changes due to the valve effect of the variable throttle and thus counteracts the rotor displacement. Therefore, the axial position of the shaft is automatically controlled during operation in order that a balanced condition is reached and thus no axial forces act on the axial bearing collar.



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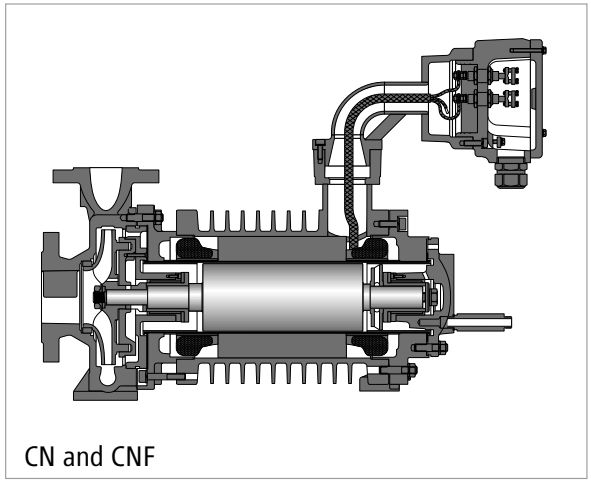
Design

Construction without cooling

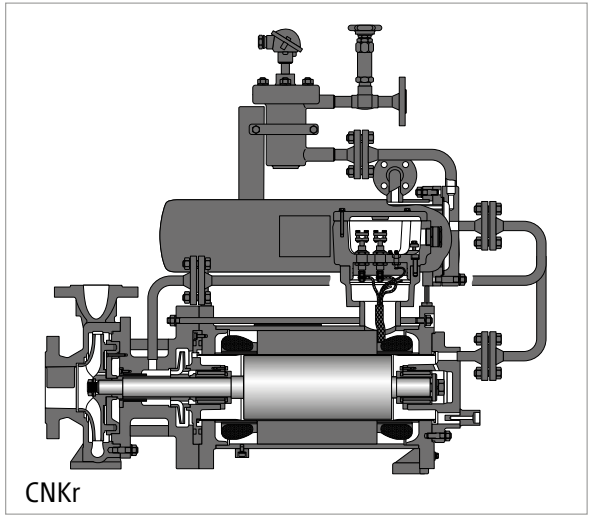
In the absence of cooling liquid, special windings of insulation class C-220 or C-400 can be used for conveying liquids with a temperature up to +360 °C. This design is characterised by fins used for convection cooling and by a terminal box extension.



CN and CNF

Cooled construction

As an option to the plate heat exchanger, also tubular coolers can be used. Cleaning and maintenance can be effected more easily.

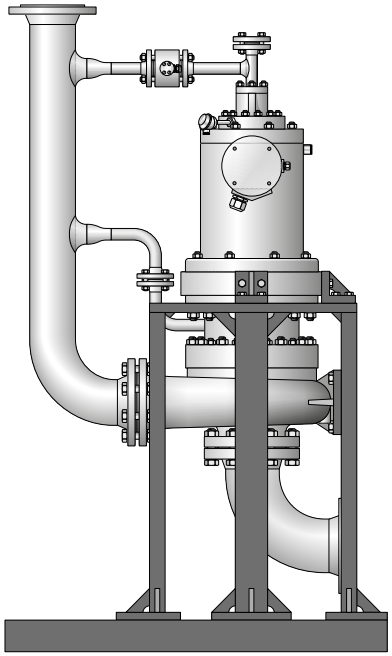


CNKr

Design

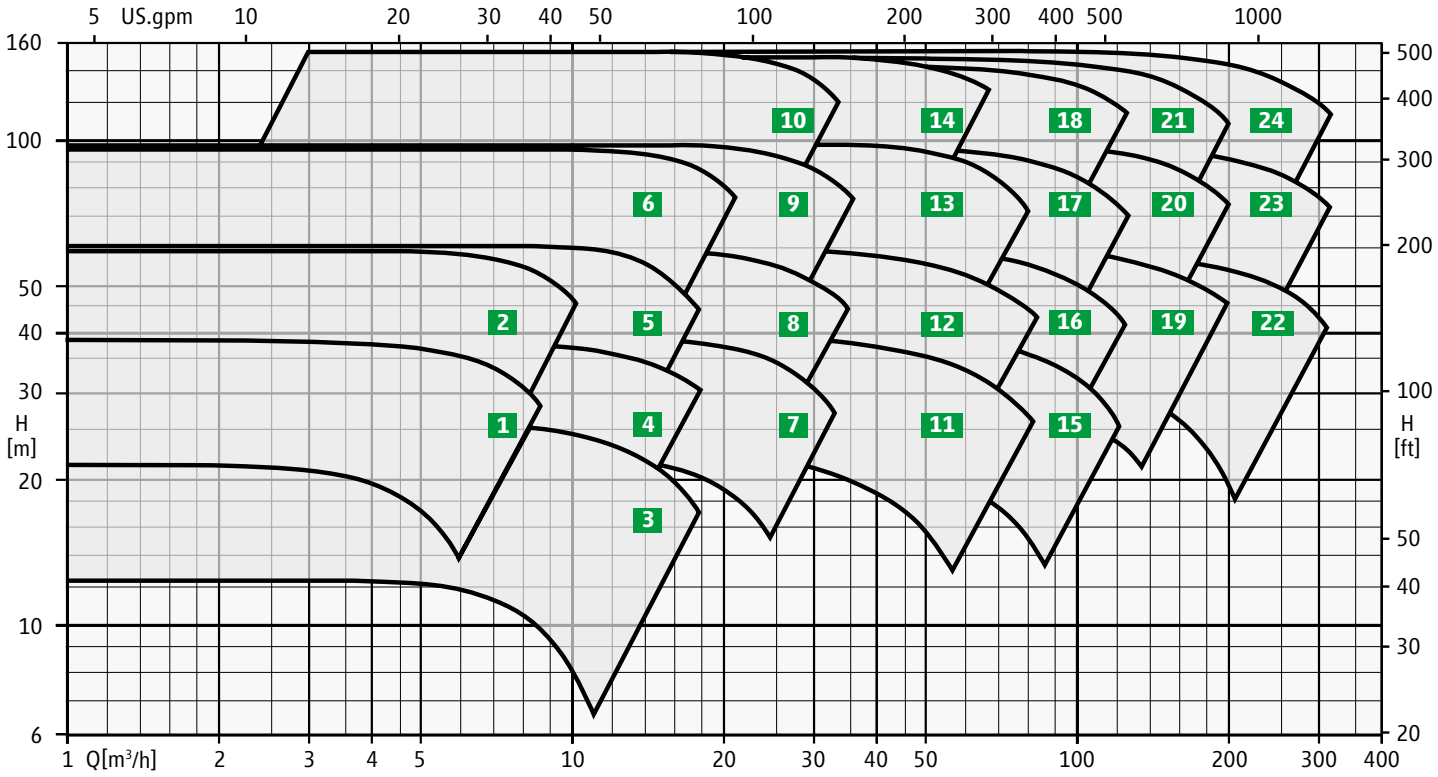
Pressure gases / liquefied gases

The vertical design of the pump can be necessary if the capacity of the slide bearings is too small due to a lower viscosity of the pumped liquid. In this case, the slide bearings do not have a supporting function in radial direction, but only a guiding function. In axial direction, the rotor weight is hydrostatically supported.



CNV and CNFV

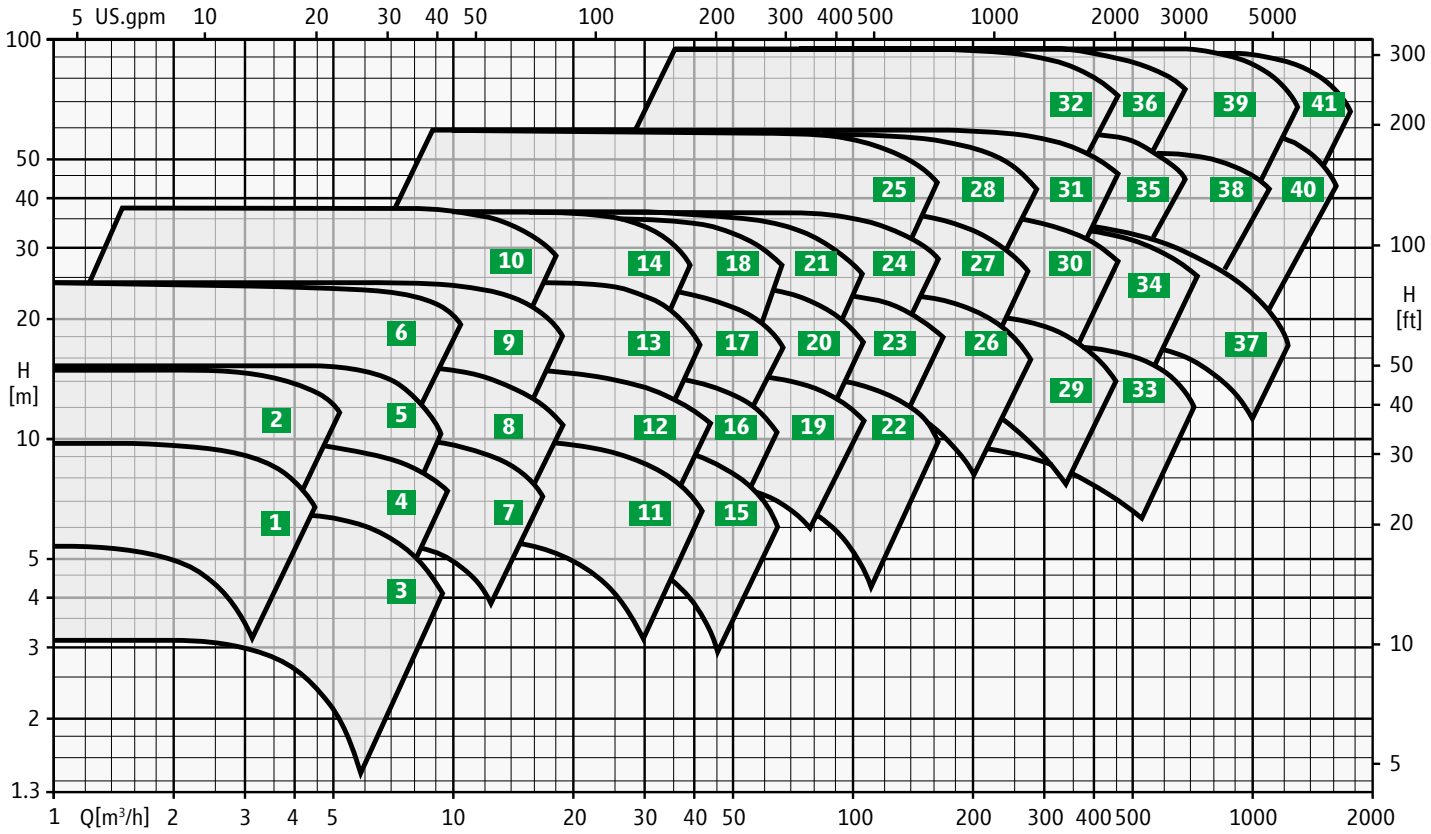
2900 rpm 50 Hz



Denomination of hydraulics shown in the characteristics maps

1	40-25-160	**7**	65-40-160	**13**	80-50-250	**19**	125-80-200
2	40-25-200	**8**	65-40-200	**14**	80-50-315	**20**	125-80-250
3	50-32-125	**9**	65-40-250	**15**	100-65-160	**21**	125-80-315
4	50-32-160	**10**	65-40-315	**16**	100-65-200	**22**	125-100-200
5	50-32-200	**11**	80-50-160	**17**	100-65-250	**23**	125-100-250
6	50-32-250	**12**	80-50-200	**18**	100-65-315	**24**	125-100-315

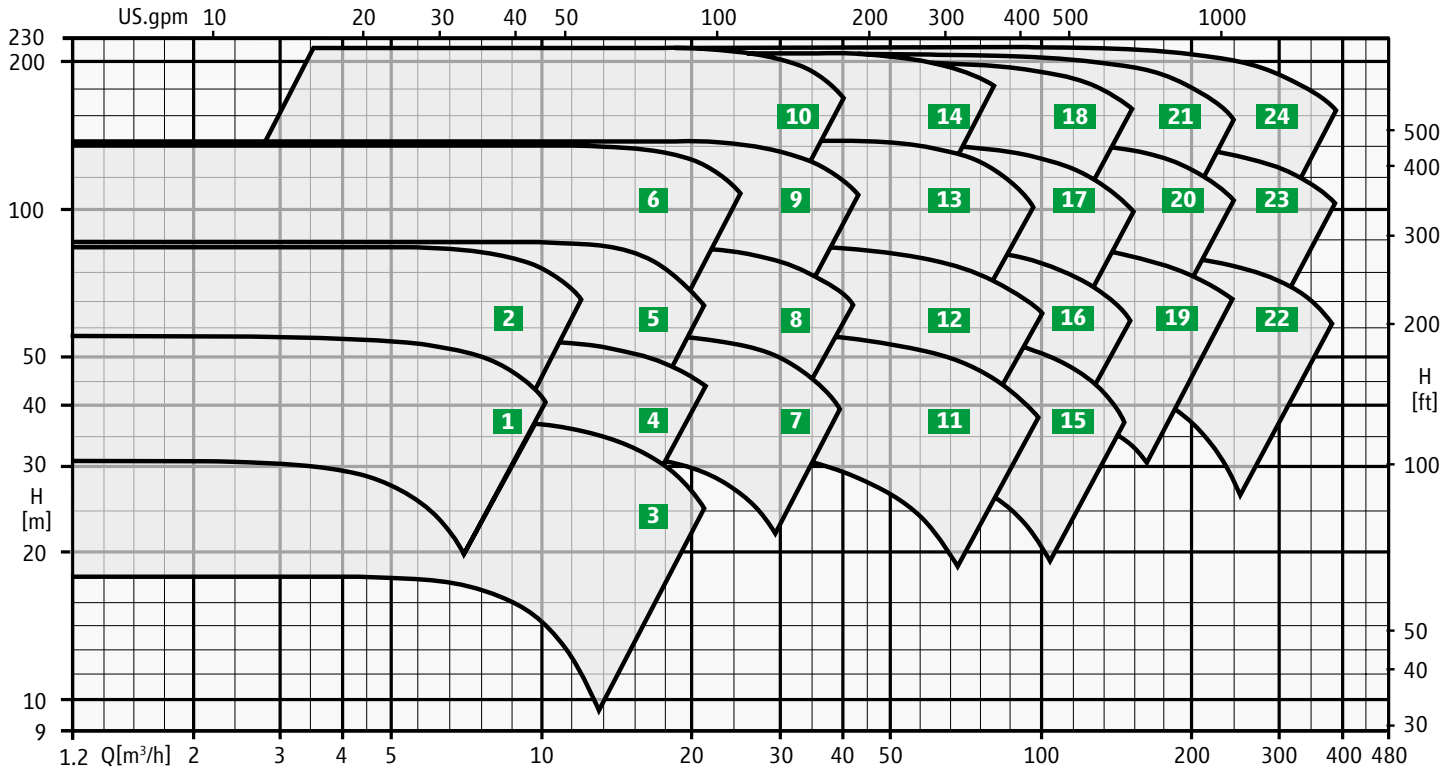
1450 rpm 50 Hz



Denomination of hydraulics shown in the characteristics maps

1	40-25-160	**6**	50-32-250	**11**	80-50-160	**16**	100-65-200	**21**	125-80-315	**26**	125-250	**31**	150-400	**36**	200-500	**41**	300-500
2	40-25-200	**7**	65-40-160	**12**	80-50-200	**17**	100-65-250	**22**	125-100-200	**27**	125-315	**32**	150-500	**37**	250-315		
3	50-32-125	**8**	65-40-200	**13**	80-50-250	**18**	100-65-315	**23**	125-100-250	**28**	125-400	**33**	200-250	**38**	250-400		
4	50-32-160	**9**	65-40-250	**14**	80-50-315	**19**	125-80-200	**24**	125-100-315	**29**	150-250	**34**	200-315	**39**	250-500		
5	50-32-200	**10**	65-40-315	**15**	100-65-160	**20**	125-80-250	**25**	100-400	**30**	150-315	**35**	200-400	**40**	300-400		

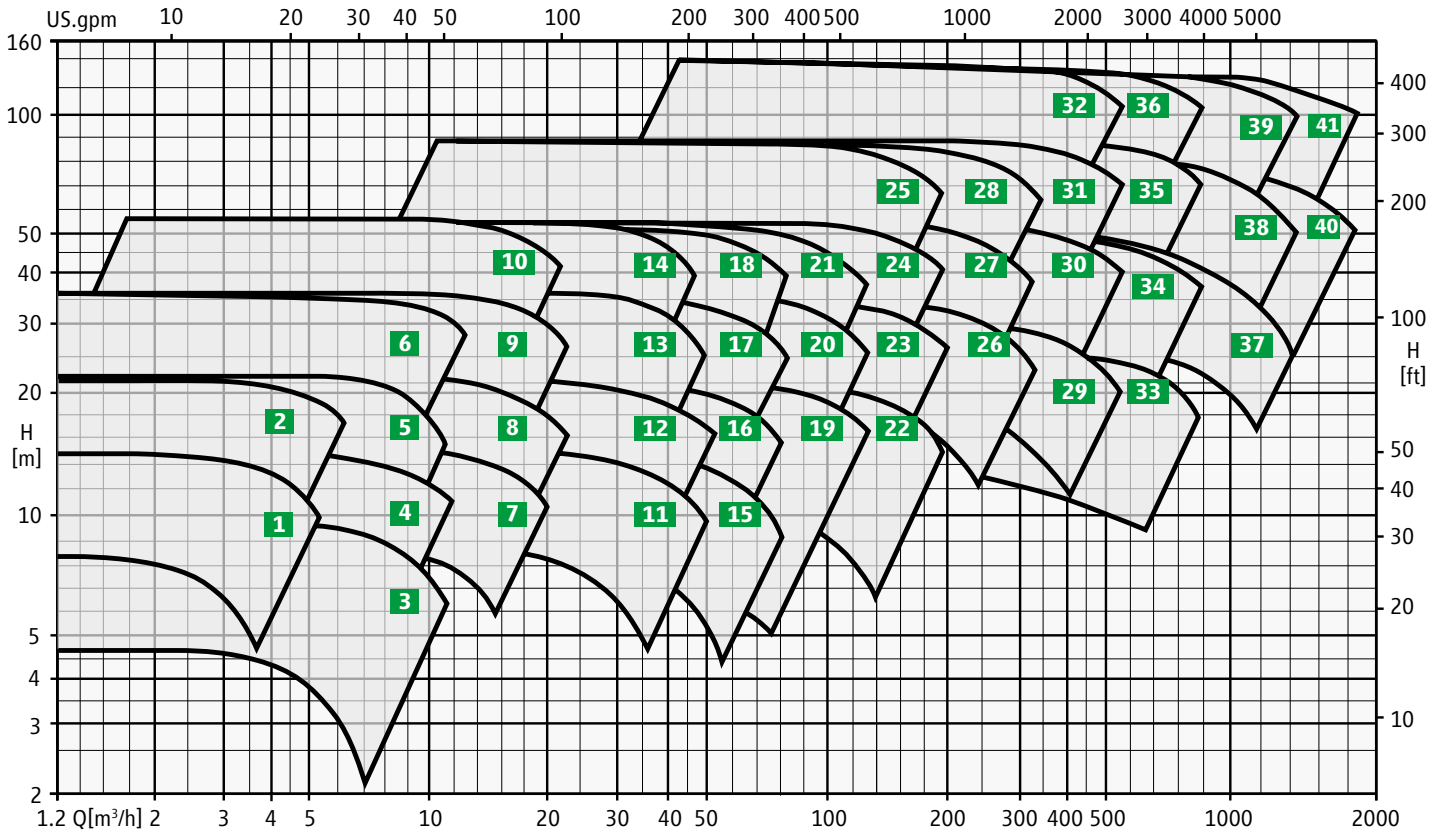
3500 rpm 60 Hz



Denomination of hydraulics shown in the characteristics maps

1	40-25-160	**7**	65-40-160	**13**	80-50-250	**19**	125-80-200
2	40-25-200	**8**	65-40-200	**14**	80-50-315	**20**	125-80-250
3	50-32-125	**9**	65-40-250	**15**	100-65-160	**21**	125-80-315
4	50-32-160	**10**	65-40-315	**16**	100-65-200	**22**	125-100-200
5	50-32-200	**11**	80-50-160	**17**	100-65-250	**23**	125-100-250
6	50-32-250	**12**	80-50-200	**18**	100-65-315	**24**	125-100-315

1750 rpm 60 Hz



Denomination of hydraulics shown in the characteristics maps

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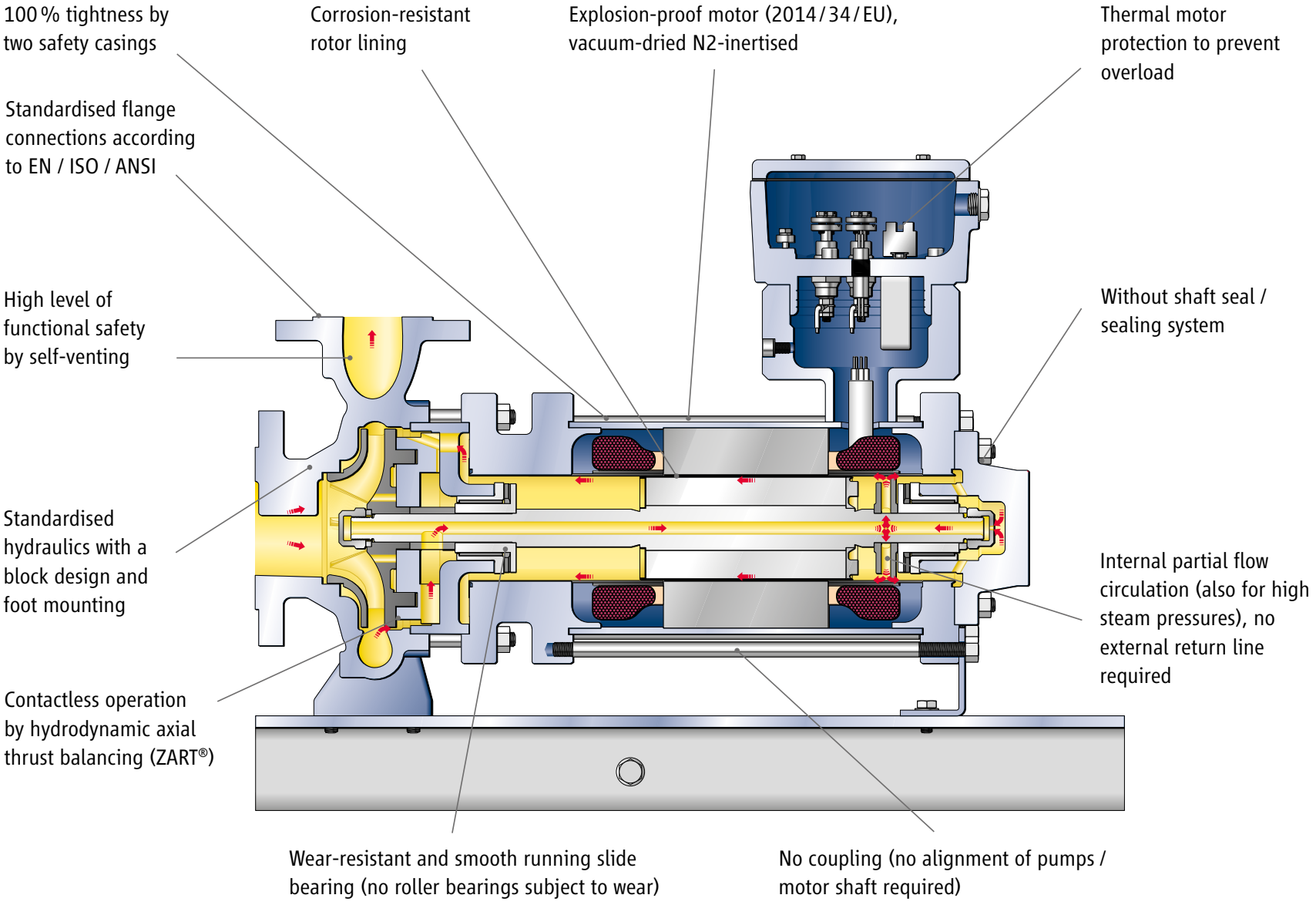
2	40-25-200	**7**	65-40-160	**12**	80-50-200	**17**	100-65-250	**22**	125-100-200	**27**	125-315	**32**	150-500	**37**	250-315		
3	50-32-125	**8**	65-40-200	**13**	80-50-250	**18**	100-65-315	**23**	125-100-250	**28**	125-400	**33**	200-250	**38**	250-400		
4	50-32-160	**9**	65-40-250	**14**	80-50-315	**19**	125-80-200	**24**	125-100-315	**29**	150-250	**34**	200-315	**39**	250-500		
5	50-32-200	**10**	65-40-315	**15**	100-65-160	**20**	125-80-250	**25**	100-400	**30**	150-315	**35**	200-400	**40**	300-400		

Advantages of the canned motor pump

- Best Available Pump Technology according to IPCC / TA-LUFT
- Leakage-free, long-lasting operation: protection of personnel and environment
- No shaft seals
- Low space requirement
- High level of reliability
- Low expenditure for repairs / spare parts
- Simple assembly and installation
- Long service life of pump and motor
- Low life cycle costs
- Very smooth running

Advantages of the canned motor pump

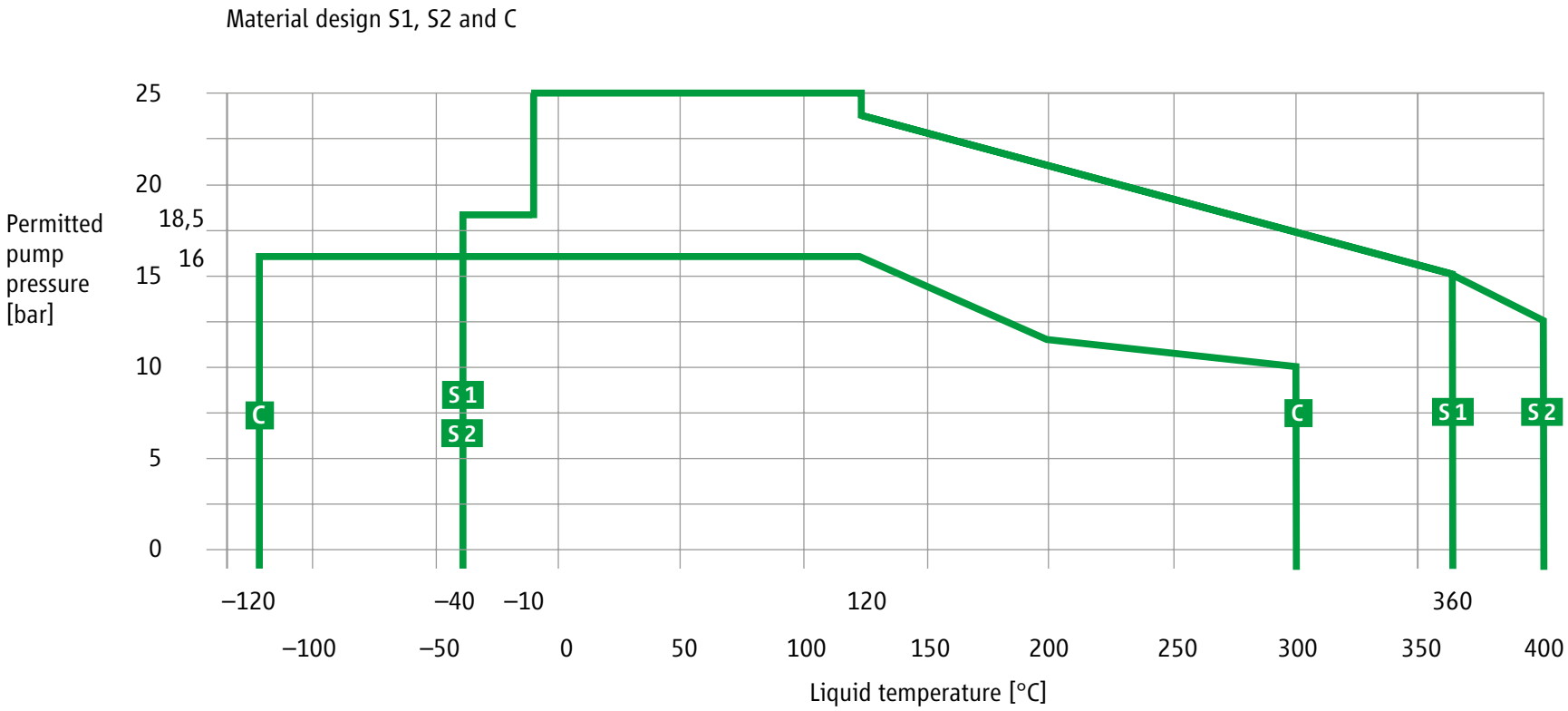


Materials

VDMA No.	Parts designation	Model CN / CNF / CNK		
		Material design S1	Material design S2	Material design C
		Pressure rating PN 25	Pressure rating PN 25	Pressure rating PN 16
Parts coming into contact with conveying fluid				
102	Volute casing	JS 1025	1.0619+N	1.4408
161	Casing cover	1.0570 / 1.0460	1.0570 / 1.0460	1.4571
230	Impeller	JL 1040 / JS 1025	JL 1040 / JS 1025	1.4408
230	Auxiliary impeller(1)	JL 1030	JL 1030	1.4581
344	Bearing support lantern	1.0570 / 1.0460	1.0570 / 1.0460	1.4571
360	Bearing cover	1.0570 / 1.0460	1.0570 / 1.0460	1.4571
472	Slide ring	PTFE / K	PTFE / K	PTFE / K
513	Wear ring insert	JL 1030	JL 1030	1.4571
529	Bearing sleeve	1.4571 / W5 (2)	1.4571 / W5 (2)	1.4571 / W5 (2)
545	Bearing bush	1.4571 / SiC30	1.4571 / SiC30	1.4571 / SiC30
816	Stator liner	Hastelloy C4	Hastelloy C4	Hastelloy C4
817	Rotor liner	1.4571	1.4571	1.4571
819	Motor shaft	1.4571 / 1.4021	1.4571 / 1.4021	1.4571
Parts that do not come into contact with conveying liquid				
811	Motor casing	1.0254	1.0254	1.0254

special materials / higher pressure ratings are possible on demand
(1) parts only for CNF and CNK
(2) tungsten carbide coating

Pressure and temperature limits



Canned motors

Canned motor data

Output power P2:	max. 520 kW (50 Hz) / max. 622 kW (60 Hz)
Voltage (±10 %) / frequency / circuit:	400V / 50 Hz / delta 480V / 60 Hz / delta 500V / 50 Hz / delta 600V / 60 Hz / delta 690V / 50 Hz / star (all canned motors are suitable for inverter operation)
Insulation class:	H-180 / C-220 / C-400
Operating mode:	S1 according to EN 60034-1
Protection class:	IP 67 (stator), IP 55 (terminal box)
Motor protection in winding:	Thermistor KL180 (for H-180 winding), Thermistor KL210 (for C-220 winding), alternative PT100 Thermometer (for all windings) / PT100 for C-400 winding (inclusive)
Rotation monitoring:	ROMi (from motor size N34 / T34)

Explosion protection according to Directive 2014 / 34 / EU
Incl. EC type-examination certificate
Marking: Ⓔx II 2 G Ex de IIC T1 to T6*

(*) Based on the requirements of the non-electrical explosion protection, the gas groups are classified as follows:
Thickness of coating > 200 µm – gas group IIB
Thickness of coating ≤ 200 µm – gas group IIC

Noise expectancy values [examples of different motor sizes]

Motors	N34L-2	N34XL-2	N54XL-2	N64XL-2
Output power [P2 at 50 Hz]	8.0 kW	14.8 kW	24.0 kW	41.0 kW
max. expected sound pressure level dB(A) at 50 Hz	57	59	61	64
Output power [P2 at 60 Hz]	10.5 kW	17.2 kW	27.0 kW	48.0 kW
max. expected sound pressure level dB(A) at 60 Hz	58	60	62	64

Documentation and tests

Documentation according to HERMETIC Standard, consisting of:

- Operating manual for the HERMETIC pump
- Technical specifications
- Sectional drawings with position numbers
- Dimensional drawing
- Cable connection diagram
- Acceptance report and pump characteristic curve
- Electric test report
- Slip ring report / gap size report, slide bearing clearancies
- EC type-examination certificate PTB 99 ATEX
- EU Declaration of Conformity

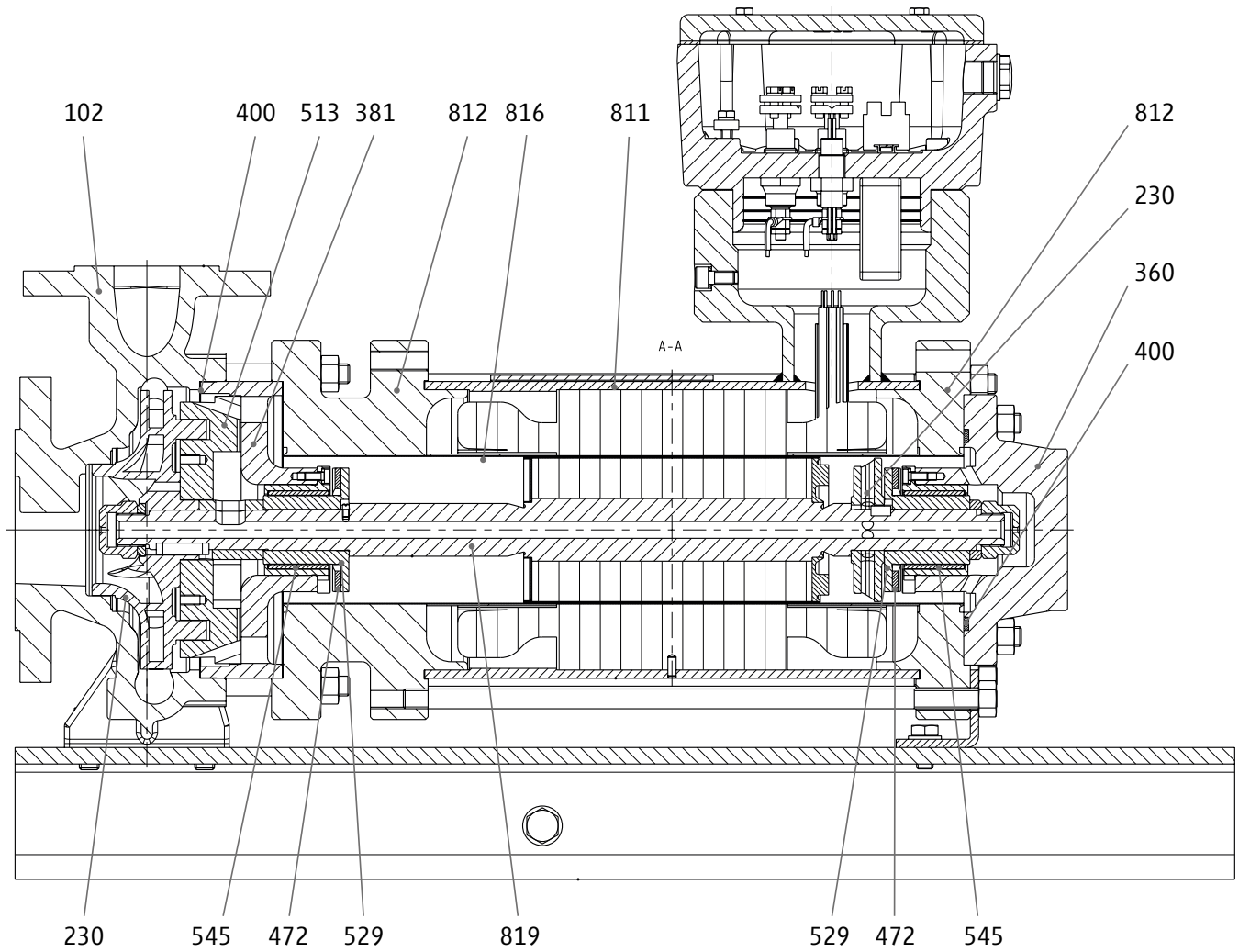
Standard tests

- Hydrostatic pressure test with 1.5x nominal pressure
- Test run according to DIN EN ISO9906, Class 2 B (5 measuring points)
- Balancing of the shaft and impeller according to DIN ISO 1940, 6.3 [without report]
- Axial thrust measurement
- Leak test for the complete pump with N_2 at 6 bar

Additional testing possible on request, e.g.:

- NPSH-test / Helium leakage test / vibration test
- ultrasonic test / PMI-test

Reduced part list / example for pump type CNF



Reduced part list

VDMA Pos.	Name
102	Volute casing
513	Wear ring insert
381	Bearing support
545	Bearing bush
400	Gasket
816	Stator liner
812	Motor casing cover, front
812	Motor casing cover
811	Motor casing
360	Bearing cover
545	Bearing bush

VDMA Pos.	Name
819	Motor shaft
230	Impeller
529	Bearing sleeve
230	Auxiliary impeller (*)
472	Slide ring

(*) only CNF and CNK

Refer to the relevant assembly drawing for the full list of the complete parts. These from part of the standard documentation.

Recommended spare parts stock

For two-year operation: **none**
For overhaul: **for each pump**

4 pcs. Pos. 400 gasket
2 pcs. Pos 529 bearing sleeve
2 pcs. Pos. 545 bearing bush
2 pcs. Pos. 472 slide ring

Overview of the safety- and function-related monitoring equipment

Hermetically sealed centrifugal pumps are principally manufactured for use in potentially explosive atmospheres.
For this reason the pumps comply with electrical as well as non-electrical explosion protection requirements.

Level monitoring of the pumped liquid for detecting and avoiding dry run

The pump's interior and rotor chamber must be always filled with the pumped liquid for reasons of safety. HERMETIC provides suitable level monitoring equipment for each pump complying with the explosion protection requirements according to directive 2014 /34 / EU. Level monitoring can be recommended principally for application cases which do not mandatory comply with explosion protection requirements. Level monitoring prevents the pump from running dry and to be affected by major damages such as by destruction of the slide bearings or by exceeding inadmissible high temperatures caused by missing cooling and lubricating flow.

Temperature monitoring for detecting and avoiding inadmissible high temperatures in the pump and the motor

Temperature monitoring ensures that the pump is switched off when achieving inadmissible high temperatures. HERMETIC provides suitable temperature monitoring equipment for each pump complying with explosion protection requirements according to directive 2014 / 34 / EU. Monitoring of the liquid temperature allows a reliable control to ensure the operation of the pump within the admissible range and to ensure the internal motor cooling of a canned motor pump. For liquids with a pour point that is higher than the ambient temperature, the liquid temperature monitoring can also be used to prevent the start-up of the pump as long as the maximum admissible viscosity of the liquid is reached.

In order to protect canned motors against inadmissible high temperatures, the winding is equipped either with PTC thermistors or PT100 resistance thermometers.

Rotor position monitoring for detecting and avoiding axial wear

Axial thrust balancing is mainly influenced by the operating method of the pump, plant conditions and various physical properties of the pumped liquid. For an early detection of an imminent malfunction it is recommended to install a rotor position monitoring device. This electronic protection equipment monitors the axial shaft position of the rotor during operation in a hermetically sealed and contact-free way. Combined with the level and temperature monitoring an efficient detection of imminent failures is possible.

Rotation monitoring for detecting and avoiding incorrect phase sequence

The correct rotating direction of hermetically sealed centrifugal pumps with canned motor cannot be checked visually from the outside. Due to a wrong phase sequence in the power line the pump is operated with an incorrect rotating direction without being noticed what might result in considerable damages to the pump. By default, hermetically sealed centrifugal pumps with canned motor are equipped with an electronic rotation monitor in the form of a phase sequence relay.

Overview of the safety- and function-related monitoring equipment

Level monitoring of the pumped liquid for detecting and avoiding dry running

Level monitoring by / with:
- KSR magnetic float switch [LS]
- Vibration limit switch [LS]
- Optoelectronic liquid level limit transducer [LS]

Temperature monitoring for detecting and avoiding inadmissible high temperatures in the pump and the motor

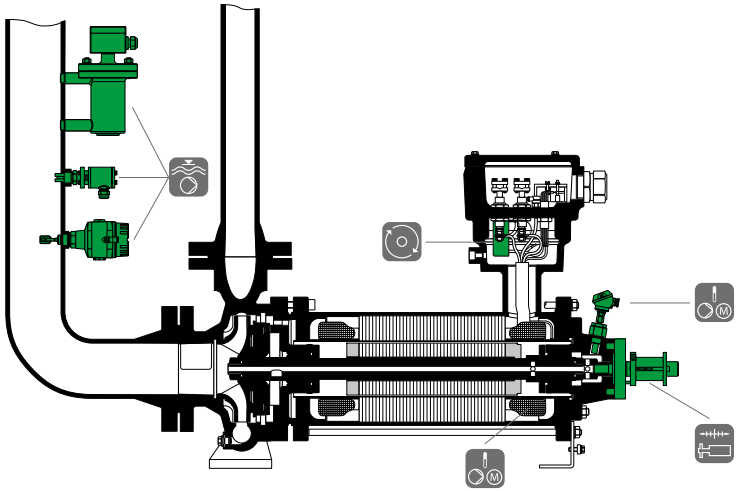
Temperature monitoring by / with:
- Resistance thermometer PT100 [TI]
- Thermistor [TS]

Rotor position monitoring for detecting and avoiding axial wear

Rotor position monitoring by / with:
MAP [GI]

Rotation monitoring for detecting and avoiding incorrect phase sequence

Rotation monitoring by / with:
ROMi [GS]



Example shown

PRODUCT INFORMATION

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All information given in this document corresponds to the state of the art at the time of print.
We reserve the right to make technical improvements and changes at any time.

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