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Standardised Water Pump

Etanorm PumpDrive 2 / Etanorm PumpDrive 2 Eco

Type Series Booklet



Legal information/Copyright

Type Series Booklet Etanorm PumpDrive 2 / Etanorm PumpDrive 2 Eco

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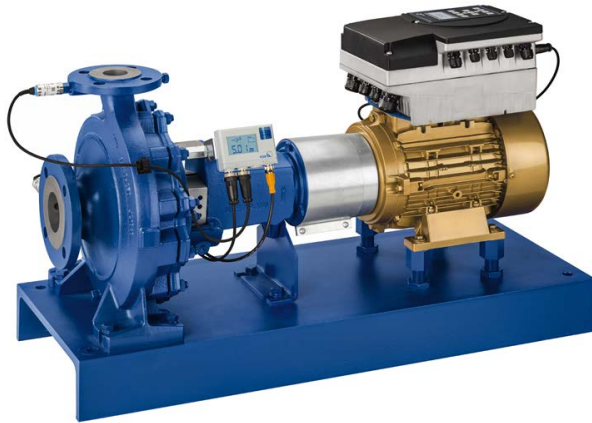
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Centrifugal Pumps with Shaft Seal

Standardised Water Pumps with Motor-mounted Variable Speed System

Etanorm PumpDrive 2 / Etanorm PumpDrive 2 Eco



Main applications

Pump for handling clean or aggressive fluids which are neither chemically nor mechanically aggressive to the pump materials.

- Water supply systems
- Cooling circuits
- Swimming pools
- Fire-fighting systems
- General irrigation systems
- Drainage systems
- Heating systems
- Air-conditioning systems
- Spray irrigation systems

Fluids handled

- Seawater
- Brackish water
- Drinking water
- Hot water
- Service water
- Fire-fighting water
- Brine
- Cleaning agents
- Condensate

- Oils

Operating data

Operating properties

Characteristic		Value
Flow rate	Q [m ³ /h]	≤ 740
Head	H [m]	≤ 160
Fluid temperature	T [°C]	-30 to +140
Operating pressure	p [bar]	≤ 16

Materials per country

- A = Europe, Middle East, North Africa
 - A1 = Default material variant
 - A2 = Optional material variant

Designation

Example: ETN 050-032-160 GBXAA10GD2 PD2E M

Designation key

Code	Description
ETN	Etanorm type series
050	Nominal suction nozzle diameter [mm]
032	Nominal discharge nozzle diameter [mm]
160	Nominal impeller diameter [mm]
G	Casing material
G	= cast iron
B	= bronze
S	= nodular cast iron
C	= stainless steel
B	Impeller material if different from casing material
G	= cast iron
C	= stainless steel
B, I	= bronze
X	Additional code
X	= special design
FX	= fire-fighting pump
A	Type of seal
A	= conical cover
C	= cylindrical cover
A	Operating mode
A	= conical cover without internal circulation
10	Shaft seal
10	= Q1 Q1 X4GG
G	Bearing bracket
G	= grease lubrication
D	Scope of supply
D	= pump, complete
2	Shaft unit
2	= shaft unit 25, LS standard bearing bracket
PD2E ¹⁾	Drive type series
M ¹⁾	PumpMeter

Further information on the designation

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¹⁾ Valid only for Etanorm with automation system

Design details

Design

- Volute casing pump
- Horizontal installation
- Back pull-out design
- Single-stage
- Dimensions and ratings to EN 733
- Requirements to 2009/125/EC Directive

Pump casing

- Radially split volute casing
- Volute casing with integrally cast pump feet²⁾
- Replaceable casing wear rings (optional for casing material C)

Impeller type

- Closed radial impeller with multiply curved vanes

Drive

KSB SuPremE motor:

- Magnetless synchronous reluctance motor
- Efficiency class IE4 in compliance with IEC/CD 60034-30 Ed. 2
- Pump operation on frequency inverter without rotor position sensors
- Rotor with air gaps (in accordance with US patent No. 5818140)
- Motor mounting points in accordance with EN 50347
- Envelope dimensions in accordance with DIN V 42673 (07-2011)

- Self-cooling (design: TEFC)
- Shaft centreline height 71 mm - 225 mm
- Rated power 0.55 kW - 45 kW
- Rated speed 1500 rpm or 3000 rpm

KSB SuPremE B1/C1:

- With terminal box for connecting to PumpDrive 2 or PumpDrive R for mounting on walls and in control cabinets

KSB SuPremE B2/C2:

- Equipped for being fitted with a motor-mounted PumpDrive 2

Asynchronous motor:

- KSB surface-cooled IEC frame three-phase current squirrel-cage motor
- Winding 220-240 V / 380-420 V ≤ 2.20 kW
- Winding 380-420 V / 660-725 V ≥ 3.00 kW
- Type of construction IM V1 ≤ 4.00 kW
- Type of construction IM V1 ≥ 5.50 kW
- IP55 enclosure
- Mode of operation: continuous operation S1
- Thermal class F with temperature sensor; 3 PTC thermistors
- Efficiency class IE3

PumpDrive:

PumpDrive 2 is a modular, self-cooling frequency inverter that enables continuously variable speed control of asynchronous and synchronous reluctance motors by means of analog standard signals, a field bus or the control panel.

Design variants

Size	P	Options	
	[kW]	PumpDrive 2	PumpDrive 2 Eco
A	0,37	<ul style="list-style-type: none"> ▪ M12 module ▪ Integrated master switch ▪ Modbus RTU ▪ LON ▪ Profibus DP ▪ App Bluetooth module ▪ I/O extension board On request: <ul style="list-style-type: none"> ▪ Profinet ▪ Ethernet ▪ BACnet MS / TP 	<ul style="list-style-type: none"> ▪ M12 module ▪ App Bluetooth module ▪ Modbus RTU³⁾
	0,55		
	0,75		
	1,1		
	1,5		
B	2,2		
	3		
	4		
C	5,5		
	7,5		
	11		
D	15		
	18,5		
	22		
	30		
E	37		
	45		
	55		

²⁾ Depending on the size, pumps with bearing pedestal have integrally cast pump feet.

³⁾ PumpDrive 2 Eco has just one slot into which the M12 module or the Modbus RTU module can be inserted.

Technical data

Characteristic	PumpDrive 2 Eco	PumpDrive 2
Mains supply		
Mains voltage ⁴⁾	3 ~ 380 V AC -10 % to 480 V AC +10 %	
Voltage difference between the three phases	±2 % of the supply voltage	
Mains frequency	50 - 60 Hz ± 2 %	
Mains types	TN-S, TN-CS, TN-C, TT and IT mains (to IEC/EN 60364)	
Output data		
Frequency inverter output frequency	0 - 70 Hz for asynchronous motors 0 - 140 Hz for KSB SuPremE	
PWM carrier frequency	Range: 2 - 8 kHz Sizes A, B and C: 4 kHz	
Phase rate of rise dv/dt ⁵⁾	5000 V/μs max. (depending on the size of the frequency inverter)	
Peak voltages	2×1.41×V _{eff} Lines with a high current-carrying capacity can cause the voltage to increase up to double the value.	
Frequency inverter data		
Efficiency	98 % - 95 % ⁶⁾	
Noise emissions	Sound pressure level of pump used + 2.5 dB ⁷⁾	
Environment		
Enclosure	IP55 (to EN 60529)	
In-service ambient temperature	-10 °C to +50 °C	
In-storage ambient temperature	-10 °C to +70 °C	
Relative humidity	Operation: 5 % to 85 %, non-condensing Storage: 5 % to 95 % Transport: 95 % max.	
Installation altitude	< 1000 m above MSL, or 1 % power derating per additional 100 m	
Vibration resistance	16.7 m/s ² max. (to EN 60068-2-64)	
Fluid temperature	-30 °C to +140 °C	
EMC		
Frequency inverter ≤ 11 kW	EN 61800-3 C1/ EN 55011 Class B/ cable length < 5 m	
Frequency inverter > 11 kW	EN 61800-3 C2/ EN 55011 Class A, Group 1/ cable length ≤ 50 m	
Mains feedback	Integrated line chokes	
Inputs and outputs		
Internal power supply unit	24 V ± 10 %	
Maximum load	600 mA DC max., short-circuit and overload-proof	
Residual ripple	< 1 %	
Analog inputs		
Number of parameterisable analog inputs	2 (configurable for current or voltage input)	
Input type	Not differential	Differential
Maximum voltage (with reference to GND)	+10 V	± 10 V
Current input	0/4 - 20 mA	
Input impedance	500 Ohm	
Accuracy	1 % of full-scale value	
Signal delay	< 10 ms	
Resolution	12 bit	
Voltage input	0/2 - 10 V	

4) If the mains voltage is low, the nominal torque of the motor will be lower.

5) The phase rate of rise (dv/dt) depends on the line capacity.

6) The efficiency at the nominal point of the frequency inverter varies between 98 percent for high power outputs and 95 percent for low outputs, depending on the inverter's nominal power.

7) The values are for orientation purposes only. The value refers to the nominal duty point (50 Hz) only. Also refer to the pump's noise characteristics. They, too, are documented for nominal duty operation. Other values may occur during variable speed operation.

Characteristic	PumpDrive 2 Eco	PumpDrive 2
Input impedance	circa 160 kOhm	circa 40 kOhm
Accuracy	1 % of full-scale value	
Signal delay	< 10 ms	
Resolution	12 bit	
Reverse polarity protection	Not provided	Positive and negative polarity reversal possible
Analog outputs		
Number of parameterisable analog outputs	1 (toggling 4 output values)	
Current output	4 - 20 mA	
Maximum external working resistance	850 Ohm	
Output	PNP transistor	
Accuracy	2 % of full-scale value	
Signal delay	< 10 ms	
Reverse polarity protection	Provided	
Short-circuit and overload protection	Provided	
Digital Inputs		
Number of digital inputs	4 in total, 3 of which can be parameterised	6 in total, 5 of which can be parameterised
ON level	15 - 30 V	
OFF level	0 - 3 V	
Input impedance	circa 2 kOhm	
Electrical isolation	Provided, insulation voltage: 500 V AC	
Delay	< 10 ms	
Reverse polarity protection	Provided	
Relay outputs		
Number of parameterisable relay outputs	1 NO contact	2 changeover contacts
Maximum contact rating	AC: Max. 250 V AC/0.25 A DC: Max. 30 V DC/2 A	

Shaft seal

Shaft seal

Shaft seal design	Region
Gland packing	A
Single mechanical seals to EN 12756	A
Double mechanical seals to EN 12756	A
Shaft equipped with replaceable shaft protecting sleeve in the shaft seal area	A

Bearings

Bearings

Bearing design	Region
Standard bearings	A

Bearing design	Region
– Floating bearings: deep groove ball bearings	A
Reinforced bearings	
– Floating bearings: deep groove ball bearings	

Example: WS_25_LS

Bearing bracket designation

Designation	Description	Region
WS	Bearing bracket, standardised water pump	A
25	Size code ⁸⁾	A
LS	Standard	A
LR	Reinforced	A

Bearings used

Standard bearings

Version	Bearing bracket	Rolling element bearing		
		Pump end	Drive end	Region
Standard bearings (grease lubrication)	WS_25_LS	6305 2Z C3	6305 2Z C3	A
	WS_35_LS	6307 2Z C3	6307 2Z C3	A
	WS_55_LS	6311 2Z C3	6311 2Z C3	A
Standard bearings (oil lubrication)	WS_25_LS	6305 C3	6305 C3	A
	WS_35_LS	6307 C3	6307 C3	A
	WS_55_LS	6311 C3	6311 C3	A
Reinforced bearings (grease lubrication)	WS_50_LR	6310 2Z C3	6310 2Z C3	A
	WS_60_LR	6312 2Z C3	6312 2Z C3	A

⁸⁾ Based on dimensions of seal chamber and shaft end

Version	Bearing bracket	Rolling element bearing		
		Pump end	Drive end	Region
Reinforced bearings (oil lubrication)	WS_50_LR	6310 C3	6310 C3	A
	WS_60_LR	6312 C3	6312 C3	A

Lubrication

Type of lubrication	Region
Grease lubrication	A
Oil lubrication	A

Coating and preservation

Coating and preservation

Version	Region
Coating and preservation to KSB standard	A

Product benefits

- Improved efficiency and NPSH_{req} by experimentally verified hydraulic design of impellers (vanes)
- Low energy costs through compliance with future requirements of Commission Regulation 547/2012 (minimum efficiency index MEI ≥ 0.4)
- Operating costs reduced by trimming the impeller diameter to match the specified duty point
- Little wear, low vibration levels and excellent smooth running characteristics thanks to good suction performance and virtually cavitation-free operation across a wide operating range
- Casing sealed reliably – even in varying operating conditions – by confined casing gasket
- Large variety of materials for perfectly matching the pump to the fluid handled. Large range of materials for many applications available as standard.
- Extended selection chart with additional pump sizes for small flow rates
- Maximum energy efficiency through demand-driven operation in combination with KSB SuPremE IE4 motor to IEC/CD 60034-30 Ed. 2
- PumpDrive perfectly matched to pump and motor by default factory parameter settings
- Space-saving owing to motor-mounted variable speed system up to 45 kW
- Pump operation made fully transparent with PumpMeter

- The efficiency of the motor also exceeds 95 percent of nominal efficiency when the motor is running at 25 percent of its nominal power on a quadratic torque-speed curve.
- Sustainable and environmentally friendly because no magnets based on "rare earth elements" such as NdFeB are used

Product information as per Regulation No. 547/2012 (for water pumps with a maximum shaft power of 150 kW) implementing "Ecodesign" Directive 2009/125/EC

- Minimum efficiency index: see data sheet
- The benchmark for the most efficient water pumps is MEI ≥ 0.70.
- Year of construction: see data sheet
- Manufacturer's name or trade mark, commercial registration number and place of manufacture: see data sheet or order documentation
- Product's type and size identifier: see data sheet
- Hydraulic pump efficiency (%) with trimmed impeller: see data sheet
- Pump performance curves, including efficiency characteristics: see documented characteristic curve
- The efficiency of a pump with a trimmed impeller is usually lower than that of a pump with full impeller diameter. Trimming of the impeller will adapt the pump to a fixed duty point, leading to reduced energy consumption. The minimum efficiency index (MEI) is based on the full impeller diameter.
- Operation of this water pump with variable duty points may be more efficient and economic when controlled, for example, by the use of a variable speed drive that matches the pump duty to the system.
- Information relevant for disassembly, recycling or disposal at end of life: see installation/operating manual
- Information on benchmark efficiency or benchmark efficiency graph for MEI = 0.70 (0.40) for the pump based on the model shown in the Figure are available at: <http://www.europump.org/efficiencycharts>

Acceptance tests / warranty

Overview of acceptance tests / warranty

Acceptance tests / warranty	Region
Materials testing	
▪ Test report 2.2 on request	A
Final inspection	
▪ Inspection certificate 3.1 to EN 10204 on request	A
Hydraulic test against surcharge	
▪ To ISO 9906/2B or ISO 9906/3B	A
▪ NPSH test	A
Other inspections/tests on request	A
Warranty	
▪ Warranties are given within the scope of the valid delivery conditions.	A

Project planning information

If a mains contactor is used in the power cable (before the frequency inverter), this must be configured for an AC1 duty rating; the rated current values of the frequency inverters used are added and the result is increased by 15 %.

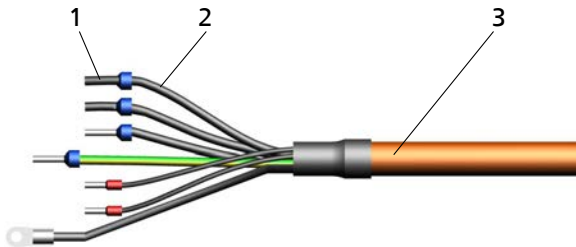
Selecting power/connection cables

Unshielded cables can be used as power cables.

The power cables must be designed with a cross-section suitable for the nominal mains current.

Power/connection cable properties

Size	Power [kW]	Cable gland for				Mains-side input current ⁹⁾ [A]	Maximum core cross-section [mm ²]	Cable cross-section KSB motor cable
		Mains power cable	Sensor cable	Motor cable	PTC thermistor			
A	.. 000K37 ..	M20	M16	M20	M16	1,4	2,5	2,5
	.. 000K55 ..					2,0		
	.. 000K75 ..					2,7		
	..001K10..					3,7		
B	.. 001K50 ..	M25	M16	M25	M16	5,2	2,5	
	.. 002K20 ..					6,3		
	.. 003K00 ..					8,4		
	.. 004K00 ..					10,4		
C	..005K500..	M32	M16	M32	M16	14,6	16	4
	..007K500..					18,7		
	..011K000..					25,9		
D	..15K000..	M40	M32	M20	M40	34,1	50	10
	..18K500..					43,3		16
	..22K00..					52,4		16
	..30K00..					67,7		25
E	..37K00..	M63	M32	M20	M63	83,4	95	35
	..45K00..					99		50
	..55K00..					122,4		70



Structure of electric cable

1	Wire end sleeve	2	Core
3	Cable		

Cable cross-section, control terminals

Control terminal	Core cross-section [mm ²]			Cable diameter ¹⁰⁾ [mm]
	Rigid cores	Flexible cores	Flexible cores with wire end sleeves	
Terminal strip A, B, C	0,2-1,5	0,2-1,0	0,25 - 0,75	M12: 3,5-7,0 M16: 5,0-10,0

⁹⁾ Observe the information on the use of line chokes provided in the Accessories and Optional Equipment section.

¹⁰⁾ Impairment of protection provided by enclosure when cable diameters other than those specified are used.

Length of motor connection cable

If the frequency inverter is not mounted on the motor to be controlled, longer motor connection cables may be required. The stray capacitance of the connection cables may result in high-frequency discharge currents flowing to ground. The sum of the discharge currents and motor current may exceed the output-side rated current of the frequency inverter. This will activate the frequency inverter's protection equipment and the motor will be stopped. The following motor connection cables are recommended depending on the power range:

Output filter

Output filters can only be used in conjunction with an asynchronous motor.

If longer connection cables than those listed above are required or the connection cable's stray capacitance value exceeds the above values, we recommend installing a suitable output filter between the frequency inverter and the motor to be controlled. These filters reduce the voltage ramp-up time of the frequency inverter output voltages and limit their peaks.

Electrical protection device

Back-up fuses

Provide three fast-acting fuses in the mains power supply line to the frequency inverter. The fuse size must be suitable for the nominal mains current supplied to the frequency inverter.

Motor protection switch

Separate motor protection is not required because the frequency inverter has its own safety devices (e.g. electronic overcurrent trip). Available motor protection switches must be dimensioned in accordance with the nominal motor current.

Residual current device

If fixed connections and appropriate supplementary earthing are used (cf. DIN VDE 0160), residual current devices (RCDs) are not mandatory for frequency inverters.

If residual current devices are used, three-phase frequency inverters must in accordance with DIN VDE 0160 be connected via universal AC/DC sensitive RCDs, as potential direct-current components may cause standard AC sensitive RCDs to either fail to respond or respond erroneously.

Residual current device to be selected

Size	Rated current [mA]
A, B and C	150
D and E	300

If you use a long shielded cable for the mains/motor connection, the residual-current monitoring device may be triggered by the discharge current that flows to earth (triggered by the carrier frequency). Remedies: Replace the RCD (residual current device) or lower the response limit.

Information on electromagnetic compatibility

Electromagnetic interference from other electrical devices can affect the frequency inverter. Interference can also be generated by the frequency inverter itself, however.

Interference emitted by the frequency inverter is generally conducted through the motor connection cables. The following measures are proposed for RFI suppression:

- Shielded motor connection cables for line lengths > 70 cm (especially recommended for frequency inverters with low power ratings)
- Made from a single piece of formed metal cable ducting with a minimum coverage of 80 % (if shielded connection cables cannot be used)

Use different earth bus bars for the control cable and mains power/motor connection cables.

The shield on the power cable/connection cable must consist of a single piece and be earthed at both ends either just on the appropriate earth terminal or on the earth bus bar (do not connect it to the earth bus bar in the control cabinet).

The shielded cable ensures that the high-frequency current, which normally flows as a discharge current from the motor housing to earth or between the individual conductors, flows through the shielding.

The shield for the control cable (connection on the frequency inverter side only) also serves as protection against radiated emission.

If using shielded cables, use a wide contact face for the different earth connections to ensure greater interference immunity.

In applications with long shielded motor cables, provide additional reactive resistors or output filters to compensate the capacitive stray current to earth and reduce the rate of voltage rise on the motor. These measures help reduce radio interference further. Using just ferrite rings or reactive resistors does not ensure compliance with the limit values defined in the EMC directive.

NOTE! If you are using shielded cables that are longer than 10 m, check the stray capacitance to ensure that the diffusion between the phases or to earth is not excessive, which could cause the frequency inverter to stop.

Route control cable and mains power/motor connection cables in separate cable ducts.

When routing the control cable observe a minimum distance of 0.3 metres between the control cable and the mains power/motor connection cables.

If you cannot avoid crossing control and mains power/motor connection cables, you should cross them at 90 degrees to each other.

Earth connection

The frequency inverter must be properly earthed.

To ensure greater interference immunity, a wide contact face is required for the different earth connections.

In the case of cabinet mounting, use two separate copper earth bus bars (mains power supply/motor connection and control connection bar) with a suitable size and cross-section for earthing the frequency inverter. All the earth connections are connected to these.

The bars are connected to the earthing system at one point only.

The control cabinet is then earthed via the mains earthing system.

Output filter



Installing line choke and output filter

	Transformer		Output filter (for asynchronous motors only)
	Line choke		Motor (asynchronous motor)

The maximum cable lengths must be observed in order to meet RFI suppression requirements to DIN 55011. Output filters are required if the maximum cable lengths are exceeded. Output filters can only be used in conjunction with an asynchronous motor.

IGBT switchgear is suitable for achieving high power. This, however, can result in faults due to the rapid switching operations, particularly if you are using long motor/drive control cables:

- Electromagnetic interference
- Damage to the motor winding insulation
- Voltage peaks due to high stray capacitance on the cable connections
- Damage to the short-circuit protective devices

Output filters can be used to remedy these situations:

When a filter is used, the peak voltage (V_{peak}) and its rate of rise (dv/dt) can be reduced. The peak voltages can also be seen as a function of the stray capacitance induced by the power circuits. The stray capacitance for frequency inverter sizes A, B, C and D must be below 5 nF. If long cables are required for installation reasons, for example, for wall or control cabinet mounting, and the stray capacitance value exceeds the maximum permissible value, a dv/dt limiting filter or sine filter must be installed. Connect the filter at the output of the frequency inverter. The filter protects the frequency inverter against excessive discharge currents and prevents the protective equipment from being deactivated as a result.

Line chokes

The line input currents indicated in the project planning information are for orientation purposes only; they refer to operation at nominal rating. These currents may vary depending on the actual line impedance. In low-impedance mains, higher currents may occur.

To limit the line input current, external line chokes can be used alongside the integrated line chokes (in the power range up to and including 45 kW). Line chokes also reduce mains feedback and improve the power factor.

The scope of DIN EN 61000-3-2 must be heeded.

Line chokes connected in series in the line to the consumer ensure that the typical requirement of a short circuit voltage of 4 % to the mains is complied with and reduce the mains feedback (in the form of harmonics) that may cause problems in the public power supply mains. Another benefit is the limitation of the charge currents of the DC link capacitors, which will increase the service life of these primary components. Line chokes also reduce the reactive power component and thus contribute to a significantly improved effective power factor.

The scope of DIN 1000-3-2 must be heeded.

Three-phase (3~) line choke:

- IP00 enclosure
- Thermal class F
- Max. ambient temperature 40 °C

Line chokes (overview)

Size	Power	Line choke inductance I_n	Nominal current $I_{Nominal\ motor\ current}$	Maximum current I_{Est}	L	B	H	Mat. No.	Weight
A	..000K37..	0,37	11	$1,5 I_n$	150	85	150	01093105	3.6
	..000K55..	0,55							
	..000K75..	0,75							
	..001K10..	1,1							
	..001K50..	1,5							
B	..002K20..	2,2	28	$1,5 I_n$	180	120	178	01093106	8.3
	..003K00..	3							
	..004K00..	4							
C	..005K50..	5,5	51	$1,5 I_n$	180	135	178	01093107	10.5
	..007K50..	7,5							
	..011K00..	11							
D	..015K00..	15	100	$1,5 I_n$	180	180	180	01093108	10.8
	..018K50..	18,5							
	..022K00..	22							
	..030K00..	30							
E	..037K00..	37	100	$1,5 I_n$	180	180	180	01093108	10.8
	..045K00..	45							

Programme overview / selection tables

Overview of fluids handled

Table of fluids handled and associated material combinations

X = standard

Fluid handled	Temperature [°C]	Casing/impeller materials							Shaft seal Mechanical seal						Variant code		Comments
		Grey cast iron/ grey cast iron	Grey cast iron/ tin bronze	Nodular cast iron/ grey cast iron	Tin bronze/ tin bronze	CrNiMo cast steel/ CrNiMo cast steel	RT-P	Pure graphite	U3BEGG	Q1Q1EGG	U3U3VGG	Q1Q1X4GG	BQ1EGG	Q12Q1M1GG	Gland packing ¹⁾	Mechanical seal	
Water																	
Brackish water ¹²⁾	≤ 25	-	-	-	X	-	X	-	-	-	-	X	-	-	1	10	CrNiMo cast steel can be used.
Fire-fighting water ¹³⁾	≤ 60	-	X	-	-	-	X	-	-	-	-	X	-	-	1	10	Contact KSB for supply to VdS guideline.
Heating water ¹⁴⁾	≤ 110	X	-	-	-	-	X	-	-	-	-	X	-	1	11	If used as a circulating pump to DIN 4752; p max. ≤ 10 bar. If ductile material has been specified: "S"	
Heating water	≤ 140	X	-	-	-	-	X	X	-	-	-	-	-	3	6		
Heating water	≥ 110	X	-	-	-	-	X	-	-	-	-	X	-	1	10		
Condensate	≤ 110	X	-	-	-	-	X	-	-	-	-	X	-	1	11	-	
Condensate, not conditioned	≤ 110	-	-	-	-	X	X	-	-	-	-	X	-	1	11	-	
Cooling water (without antifreeze)	≤ 60	X	-	-	-	-	X	-	-	-	-	X	-	1	10	Open loop: use GB 1 / GB 10	
Cooling water pH ≥ 7.5 (with antifreeze ¹⁵⁾)	≥ 30	X	-	-	-	-	X	-	-	-	-	X	-	1	11	Open loop: use GB	
Cooling water pH ≥ 7.5 (with antifreeze ¹⁵⁾)	≤ 60	X	-	-	-	-	X	-	-	X	-	-	-	1	7	Open loop: use GB	
Cooling water pH ≥ 7.5 (with antifreeze ¹⁵⁾)	≤ 110	X	-	-	-	-	X	-	-	X	-	-	-	1	7	Open loop: use GB	
Slightly contaminated water	≤ 60	X	-	-	-	-	X	-	-	-	-	X	-	1	10	-	
Seawater	≤ 25	-	-	-	X	-	X	-	-	-	-	X	-	1	10	CrNiMo cast steel can be used.	
Pure water ¹⁶⁾	≤ 60	X	-	-	-	-	X	-	-	-	-	X	-	1	11	-	
Raw water	≤ 60	X	-	-	-	-	X	-	-	-	-	X	-	1	10	-	
Swimming pool water (fresh water)	≤ 60	X	-	-	-	-	X	-	-	-	-	X	-	1	10	Also applies to requirements as per DIN 19643	
Swimming pool water ^{17):} filtration	≤ 40	-	X	-	-	-	-	-	-	-	-	X	-	1	10	Variant GB Shaft C45+N, shaft sleeve CrNiMo steel, nut A4/AISI 316, key A2, casing wear ring (suction and discharge side) grey cast iron JL 1040/ CI	
Swimming pool water ^{17):} water features; without turbulences and/or air content	≤ 40	-	X	-	-	-	-	-	-	-	-	X	-	1	10	Variant GB Shaft C45+N, shaft sleeve CrNiMo steel, nut A4/ AISI 316, key A2, casing wear ring (suction and discharge side) CC495K-GS	
Swimming pool water ^{17):} water features; with turbulences and/or air content	≤ 40	-	-	-	X	-	-	-	-	-	-	X	-	1	10	Variant B Shaft 1.4571, shaft sleeve CrNiMo steel, nut A4/ AISI 316, key A2, casing wear ring (suction and discharge side) CC495K-GS	
Swimming pool water (seawater)	≤ 40	-	-	-	X	-	X	-	-	-	-	X	-	1	10	CrNiMo cast steel for t ≤ 25 °C	
Dam water	≤ 60	-	X	-	-	-	X	-	-	-	-	X	-	1	10	If solids are contained, contact KSB.	
Drinking water ¹⁸⁾	≤ 60	-	X	-	-	-	X	-	-	-	-	X	-	1	11	-	
Partly desalinated water	≤ 110	X	-	-	-	-	X	-	-	-	-	X	-	1	11	-	
Fully desalinated water	≤ 110	-	-	-	-	X	X	-	-	-	-	X	-	1	11	Purity requirements cannot be met.	
Fully desalinated water as boiler feed water	≤ 110	X	-	-	-	-	X	-	-	-	-	X	-	1	11	-	
Refrigerants, cooling brines																	
Cooling brine; inorganic, pH value > 7.5, inhibited	≥ 30	X	-	-	-	-	X	-	-	-	-	X	-	1	11	-	
Cooling brine; inorganic, pH value > 7.5, inhibited	≤ 25	X	-	-	-	-	X	-	-	-	-	X	-	1	11	-	
Water with antifreeze, pH value ≥ 7.5	≥ 30	X	-	-	-	-	X	-	-	-	-	X	-	1	11	-	
Water with antifreeze, pH value ≥ 7.5	≤ 60	X	-	-	-	-	X	-	-	X	-	-	-	1	7	-	
Water with antifreeze, pH value ≥ 7.5	≥ 60	X	-	-	-	-	X	-	-	X	-	-	-	1	7	-	
Water with antifreeze, pH value ≥ 7.5	≤ 110	X	-	-	-	-	X	-	-	X	-	-	-	1	7	-	
Oils/emulsions																	
Diesel oil, extra light fuel oil	≤ 60	-	-	X	-	-	-	-	-	-	-	X	-	-	10	GG possible, unless specific standards have to be observed	

11) Na: p1 ≤ 0,5 bar; Nb: p1 > 0,5 bar
 12) For components made of bronze: ammonia (NH3) ≤ 5 mg/kg, free from hydrogen sulphide (H2S); no limitation of Cl content required in this case. Please contact KSB if limits are exceeded.
 13) General evaluation criteria for results of water analysis: pH value ≥ 7; chlorides content (Cl) ≤ 250 mg/kg. Chlorine (Cl2) ≤ 0.6 mg/kg.
 14) Treatment to VdTUV 1466; additional requirement: O2 < 0.02 mg/l
 15) Antifreeze on ethylene glycol basis with inhibitors. Content: > 20 % to 50 % (e.g. Antifrogen N)
 16) No ultra-pure water! Conductivity at 25 °C: ≤ 800 µS/cm, neutral with regard to chemical corrosion
 17) For France, observe the applicable rules as per ministerial order dated 18 January 2002.
 18) For France, ACS approval is required.

Fluid handled	Temperature [°C]	Casing/impeller materials							Shaft seal Mechanical seal							Variant code		Comments
		Grey cast iron/ grey cast iron	Grey cast iron/ tin bronze	Nodular cast iron/ grey cast iron	Tin bronze/ tin bronze	CrNiMo cast steel/ CrNiMo cast steel	RT-P	Pure graphite	U3BEGG	Q1Q1EGG	U3U3VGG	Q1Q1X4GG	BQ1EGG	Q12Q1M1GG	Gland packing ¹⁾	Mechanical seal		
		G	GB	SG	BB	C	1	3	6	7	9	10	11	12				
Lubricating oil, turbine oil, does not apply to SF-D oils (hardly flammable)	≤ 80	-	-	X	-	-	-	-	-	-	X	-	-	-	10	If specified "without internal primer" contact KSB. GG possible, unless specific standards have to be observed		
Drilling/grinding emulsion	≤ 60	X	-	-	-	-	-	-	-	X	-	-	-	1	9	-		
Oil-water emulsion	≤ 60	X	-	-	-	-	-	-	-	X	-	-	-	1	9	-		
Brewery applications																		
Beer mash	≤ 100	X	-	-	-	-	-	-	-	-	-	-	X	-	12	If there is a risk of the pump running dry due to excessive emptying of the tank, an Etanorm with double seal in tandem arrangement must be used.		
Beer wort	≤ 100	X	-	-	-	-	-	-	-	-	-	-	X	-	12			

11) Na: p1 ≤ 0,5 bar; Nb: p1 > 0,5 bar

Functions

Functions

Functions/firmware	PumpDrive 2 Eco	PumpDrive 2
Protective functions		
Thermal motor protection	X	X
Measuring and monitoring mains voltage	X	X
Phase failure, motor side	X	X
Short-circuit monitoring, motor side	X	X
Dynamic overload protection by speed limitation (i ² t control)	X	X
Suppression of resonant frequencies	X	X
Cable integrity monitoring (live zero)	X	X
Protection against dry running and hydraulic blockage (sensorless via learning function)	-	X
Dry running protection (external control signal)	X	X
Operating point estimation and characteristic curve control	X	X
Flow rate estimation	X	X
Open-loop control		
Open-loop control mode	X	X
Closed-loop control		
Closed-loop control mode via integrated PID controller	X	X
Pressure/differential pressure control (Δp const)	X	X
Pressure/differential pressure control with dynamic pressure compensation (Δp var)	X	X
Flow rate control	X	X
Sensorless differential pressure control (Δp const) in a single-pump configuration	X	X
Sensorless differential pressure control with dynamic pressure compensation (Δp var) in a single-pump configuration	X	X
Sensorless flow rate control	X	X
Level control	X	X
Temperature control	X	X
Alternative setpoint	-	X
Commissioning function: automatic setting of control parameters	-	X ¹⁹⁾
Operation and monitoring – Display		
Display of measured values such as pressure, head, speed, electric power, motor voltage, motor current, torque	X	X
Fault history	X	X
Operating hours counter	X	X
Fault reporting via relay	X	X
PumpDrive functions		
Programmable start and stop ramps	X	X
Field-oriented control (vector control), V/f control	X	X
Configurable motor control method (asynchronous motor, KSB SuPremE)	X	X
Automatic Motor Adaptation (AMA)	X	X
Motor standstill heater	X	X
Manual-0-Automatic mode	X	X
External OFF	X	X
External minimum speed	X	X
Sleep mode (stand-by mode)	X	X
Energy savings meter	-	X
Pump functions		
M12 module with PumpMeter bus connection	X	X
M12 module for dual pump configuration	X	X
M12 module for multiple pump configuration with up to 6 pumps	-	X
Functional check run	X	X
Integrated dual pump configuration (1×100 % with redundant pump or 2×50 % without redundant pump)	X	X
Multiple pump configuration with up to 6 pumps	-	X

¹⁹⁾ On request only

Functions/firmware	PumpDrive 2 Eco	PumpDrive 2
Waste water function: start-up at maximum speed	-	X
Waste water function: rinsing function	-	X
Operation		
Control panel	X ²⁰⁾	X
Commissioning wizard	-	X
Favourites list	-	X
Service interface	X	X

Protective functions

Sensorless protection against dry running and hydraulic blockage

Dry running of the pump is detected and the pump set is stopped before components are damaged.

Hydraulic blockage is also detected and initially a warning is displayed. If the blockage persists for a prolonged period of time, the pump set is stopped. These protective functions do not require sensors. They are based on an automatic learning function which needs to be run once during commissioning.

Dynamic overload protection by speed limitation (I²t control)

The frequency inverter is equipped with current sensors that record and limit the motor current. When the defined load or temperature limit is reached, the speed is lowered in order to reduce the power (I²t control). The frequency inverter then no longer operates in closed-loop control mode but maintains the operative function at a lower speed.

Characteristic curve control

The frequency inverter indicates continuous operation outside the permissible range, such as extremely low flow or extreme overload. The frequency inverter monitors the current operating point on the basis of the motor input power and the speed. In the case of extremely low flow or overload, a message is output and, depending on the settings, the pump set is switched off as required.

Open-loop and closed-loop control

Sensorless differential pressure control for single-pump configurations

The configurable differential pressure is kept almost constant over a broad operating range without the need for sensors. This can also be achieved using the dynamic pressure compensation function. The speed is adjusted as a function of the power input so that the required differential pressure is maintained.

Dynamic pressure/differential pressure compensation

The dynamic pressure/differential pressure compensation function compensates for pipe friction losses, which need to be considered if the pressure/differential pressure sensor is installed close to the pump or if sensorless differential pressure control is used. This ensures a virtually constant pressure/differential pressure at the consumer (e.g. heating) regardless of the flow. The dynamic pressure compensation function requires signals from two pressure sensors or one differential pressure sensor. Alternatively, sensorless dynamic differential pressure compensation can be used. The differential pressure setpoint is increased as a function of the (estimated or measured) flow rate or the speed.

Operation and monitoring

Display

Various physical data, such as the pressure, flow rate, speed, motor voltage, motor current, electric power, torque and others, can be displayed using the control panel or the service software.

Message history

The last 100 messages of the frequency inverter can be viewed. All messages are provided with a time stamp (real-time clock).

Statistics function

The frequency inverter generates utilisation statistics on the operating hours to date, runtime and number of starts.

Frequency inverter functions

Motor control method

The frequency inverter's motor control method can be set for either an asynchronous motor or the KSB SuPremE motor.

Automatic motor adaptation

Automatic motor adaptation (AMA) is a method for measuring the electric parameters of the motor with the motor at a standstill. The frequency inverter's motor control method is optimised to ensure optimum motor performance and efficiency.

Stand-by mode (sleep mode)

Sleep mode allows the single or multiple pump system to be started and stopped in line with demand. If sleep mode is activated, the frequency inverter stops the pump in the case of low flow rates, i.e. when the low flow limit or stop speed is reached. In pressure control applications, an accumulator can be filled during brief operation with an increased setpoint prior to stopping. If a drop in pressure and, thus, a flow rate requirement are detected, the pump restarts.

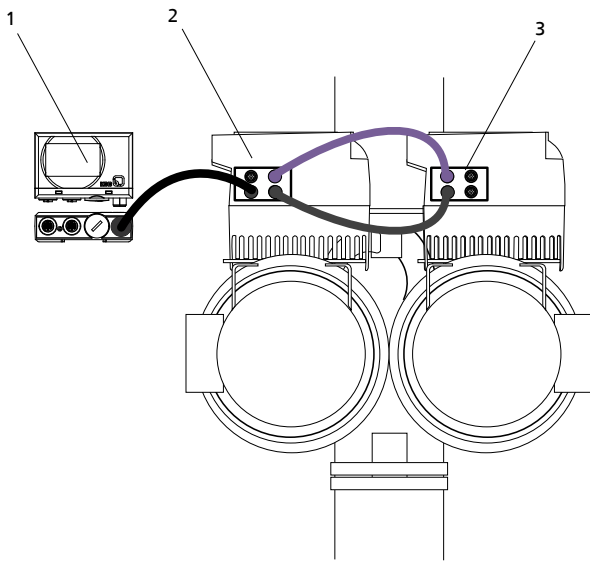
Pump functions

Direct connection to PumpMeter

PumpMeter can be connected to the M12 module of the frequency inverter via the Modbus interface using the M12 connector. Once they are connected, the frequency inverter and PumpMeter can automatically exchange all the data required for initialisation (pump characteristic curve, sensor data, etc.). This enables easy and straightforward commissioning, even in retrofit applications.

²⁰⁾ Some functions can only be parameterised or displayed using the Service Tool (see operating manual).

Dual pump configuration



Dual pump configuration

1	PumpMeter as Modbus master
2	Frequency inverter No. 1 as Modbus slave
3	Frequency inverter No. 2 as Modbus slave

Dual pump operation serves to control two pumps of identical design. Two operating modes can be set:

- In "1 pump" operating mode, the dual pump system is designed to achieve the setpoint with one pump operating at rated values (1 x 100 %).

- In "2 pumps" operating mode, the system's rated operating point is achieved with both pumps operating at rated values (2 x 50 %).

Both frequency inverters are quickly and easily connected to the respective M12 modules by way of pre-configured cables. The PumpMeter sensor signal can also be redundantly connected to the second frequency inverter as an option using a pre-configured "PumpMeter Crosslink" bus cable.

Multiple pump configuration

Up to six PumpDrives can be operated in parallel in a multiple pump configuration. One frequency inverter is used as master and controls all other available frequency inverters as slaves so that the operating point is as close as possible to the best efficiency point. If the master fails or malfunctions, the role of master can be assumed by one of the other frequency inverters. This requires, however, that the appropriate signals be made available in parallel at each frequency inverter. As with dual-pump operation, in a multiple pump configuration, the frequency inverters are quickly and easily connected to the M12 modules using pre-configured cables.

Energy-efficient pump starting and stopping

Pumps operated in a dual-pump or multiple-pump configuration are started and stopped with a view to optimal efficiency. Based on the current operating point and the pump characteristic curves, the frequency inverter automatically decides when an additional pump should be started or stopped to ensure that the multiple pump system is operated as efficiently as possible.

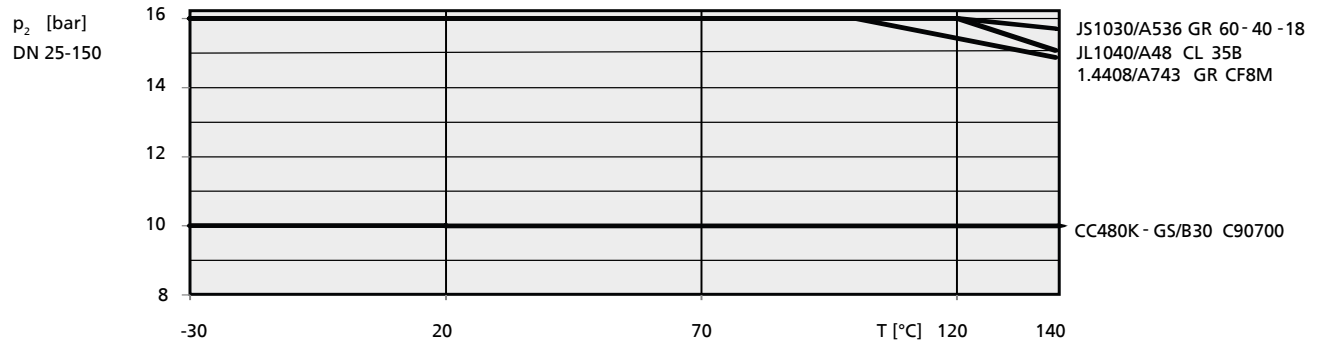
Pressure and temperature limits

Pressure and temperature limits of the pump

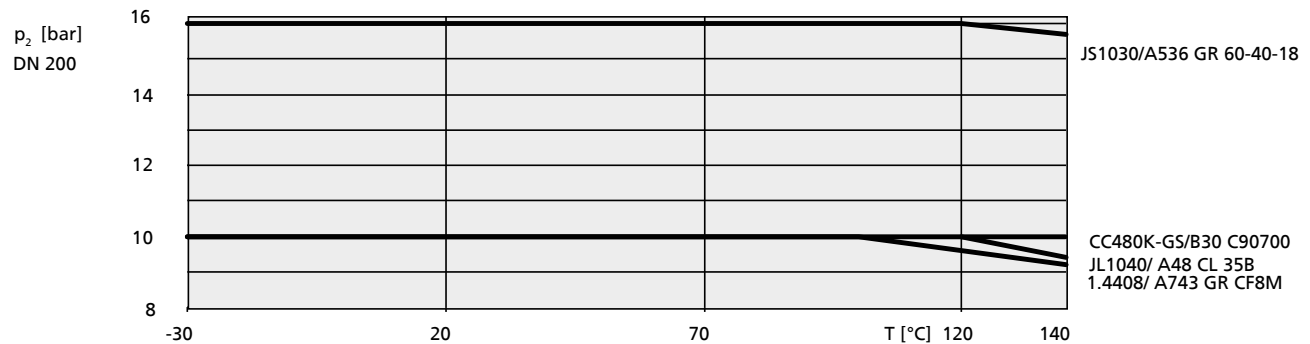
Pressure and temperature limits of the pump

Material variant	Fluid temperature ²¹⁾²²⁾	Discharge pressure p_2	Test pressure ²³⁾	Region
G	-30 °C to +140 °C	16 bar	Up to 21 bar	A
GB, GC	-30 °C to +140 °C	16 bar	Up to 21 bar	A
S, SB, SC	-30 °C to +140 °C	16 bar	Up to 25 bar	A
B	-30 °C to +140 °C	10 bar	Up to 13 bar	A
C	-30 °C to +140 °C	16 bar	Up to 21 bar	A

Pressure and temperature limits of pump with flanges to EN 1092-1, 1092-2 and 1092-3



Pump pressure and temperature limits DN 25 - DN 150



Pump pressure and temperature limits DN 200

²¹⁾ For hot water heating systems to DIN 4752, Section 4.5, application limits must be observed.

²²⁾ For fluid temperatures >140 °C use Etanorm SYT.

²³⁾ The casing components are checked for leakage by means of internal pressure tests to AN 1897/75-03D00 with water.

Materials

Overview of available materials for Europe

Part No.	Description		Material variant							
			GB	GC	GI	B	S	SB	SC	C
102	Volute casing	Grey cast iron JL1040 / A 48 CL 35B	A1	A1	-	-	-	-	-	-
		Bronze CC480K-GS / B30 C90700	-	-	-	A1	-	-	-	-
		Nodular cast iron JS1030 / A536 GR 60-40-18	-	-	-	-	A1	A1	A1	-
		Stainless steel 1.4408 / A743 Gr CF8 M	-	-	-	-	-	-	-	A1
161	Casing cover, conical	Grey cast iron JL1040 / A 48 CL 35B	A1	A1	-	-	-	-	-	-
		Bronze CC480K-GS / B30 C90700	-	-	-	A1	-	-	-	-
		Nodular cast iron JS1030 / A536 GR 60-40-18	-	-	-	-	A1	A1	A1	-
		Stainless steel 1.4408 / A743 Gr CF8 M	-	-	-	-	-	-	-	A1
161	Casing cover, cylindrical	Grey cast iron JL1040 / A 48 CL 35B	A2	A2	-	-	-	-	-	-
		Stainless steel 1.4408 / A743 Gr CF8 M	-	-	-	-	-	-	-	A2
		Bronze CC480K-GS / B30 C90700	-	-	-	A2	-	-	-	-
210	Shaft	Tempered steel C45+N	A1	A1	-	-	A1	A1	A1	-
		Chrome steel 1.4057+QT800	A2	A2	-	-	A2	A2	A2	-
		Duplex stainless steel 1.4462 / UNS S31803	A2	A2	-	A1	A2	A2	A2	A1
230	Impeller	Grey cast iron JL1040 / A 48 CL 35B	-	-	-	-	A1	-	-	-
		Bronze CC480K-GS / B30 C90700	A1	-	-	A1	-	A1	-	-
		Stainless steel 1.4408 / A743 Gr CF8 M	-	A1	-	-	-	-	A1	A1
330	Bearing bracket	Grey cast iron JL1040 / A 48 CL 35B	A1	A1	-	A1	A1	A1	A1	
400	Sealing elements	DPAF, asbestos-free	A1	A1	-	A1	A1	A1	A1	
502.01	Casing wear ring, suction side	Grey cast iron JL1040 / CI	A1	A1	-	-	A1	A1	A1	-
		Stainless steel (CrNiMoST) ²⁴⁾	-	A2	-	-	-	-	-	A2
		Bronze CC495K-GS	A2	-	-	A1	-	A2	-	-
502.02	Casing wear ring, discharge side	Grey cast iron JL1040 / CI ²⁴⁾	A1	A1	-	-	A1	A1	A1	-
		Stainless steel (CrNiMoST)	-	A2	-	-	-	-	-	A2
		Bronze CC495K-GS ²⁴⁾	A2	-	-	A1	-	A2	-	-
523	Shaft sleeve ²⁵⁾	Stainless steel (CrNiMoST)	A1	A1	-	A1	A1	A1	A1	
524	Shaft protecting sleeve ²⁶⁾	Stainless steel (CrNiMoST) ²⁴⁾	-	-	-	A1	-	-	-	A1
		Chrome steel 1.4122HV500+80	A1	A1	-	-	-	-	-	-
902	Studs	Steel 8.8	A1	A1	-	-	A1	A1	A1	-
		A4-70/ A193 Gr B8M CL2	A2	A2	-	A1	A2	A2	A2	A1
903	Plug	Steel	A1	A1	-	-	A1	A1	A1	-
		CC 493K-GS	-	-	-	A1	-	-	-	-
		A4/ AISI 316	A2	A2	-	-	A2	A2	A2	A1
920	Nut	8+A2A/ 8+B633 SC1 TP3	A1	A1	-	-	A1	A1	A1	-
		A4/ AISI 316	A2	A2	-	A1	A2	A2	A2	A1
920.95	Impeller nut	A4/ AISI 316	A1	A1	-	A1	A2	A1	A1	A1
		Steel 8	-	-	-	-	A1	-	-	-

²⁴⁾ Material group CRNIMO ST (WSZ 7605). Possible materials: 1.4401, 1.4404; 1.4408, 1.4571, AISI 316, AISI 316TI, A743 GR CF8M, A479 TYPE 316L

²⁵⁾ For pump sets with mechanical seal

²⁶⁾ Pump sets with gland packing

Availability of pump sizes per material variant

Available material variants

Size	GB	GC	GI	B	S	SB	SC	C
040-025-160	X	X	X	-	X	X	X	X
040-025-200	X	X	X	-	X	X	X	X
050-032-125.1	X	X	X	X	X	X	X	X
050-032-160.1	X	X	X	X	X	X	X	X
050-032-200.1	X	X	X	X	X	X	X	X
050-032-250.1	X	X	X	-	-	-	-	X
050-032-125	X	X	X	-	-	-	-	X
050-032-160	X	X	X	X	X	X	X	X
050-032-200	X	X	X	X	X	X	X	X
050-032-250	X	X	X	-	X	X	X	X
065-040-125	X	X	X	-	-	-	-	X
065-040-160	X	X	X	X	X	X	X	X
065-040-200	X	X	X	X	X	X	X	X
065-040-250	X	X	X	X	X	X	X	X
065-040-315	X	X	X	-	X	X	X	X
065-050-125	X	X	X	-	-	-	-	X
065-050-160	X	X	X	X	X	X	X	X
065-050-200	X	X	X	X	X	X	X	X
065-050-250	X	X	X	X	X	X	X	X
065-050-315	X	X	X	-	X	X	X	X
080-065-125	X	X	X	-	-	-	-	X
080-065-160	X	X	X	X	X	X	X	X
080-065-200	X	X	X	X	X	X	X	X
080-065-250	X	X	X	X	X	X	X	X
080-065-315	X	X	X	-	X	X	X	X
100-080-160	X	X	X	X	X	X	X	X
100-080-200	X	X	X	X	X	X	X	X
100-080-250	X	X	X	X	X	X	X	X
100-080-315	X	X	X	-	X	X	X	X
100-080-400	X	X	X	-	-	-	-	X
125-100-160	X	X	X	X	X	X	X	X
125-100-200	X	X	X	X	X	X	X	X
125-100-250	X	X	X	X	X	X	X	X
125-100-315	X	X	X	X	X	X	X	X
125-100-400	X	X	X	-	-	-	-	X
150-125-200	X	X	X	X	X	X	X	X
150-125-250	X	X	X	X	X	X	X	X
150-125-315	X	X	X	X	X	X	X	X
150-125-400	X	X	X	-	X	X	X	X
200-150-200	X	X	X	-	-	-	-	X
200-150-250	X	X	X	X	-	-	-	X
200-150-315	X	X	X	X	X	X	X	X
200-150-400	X	X	X	X	X	X	X	X

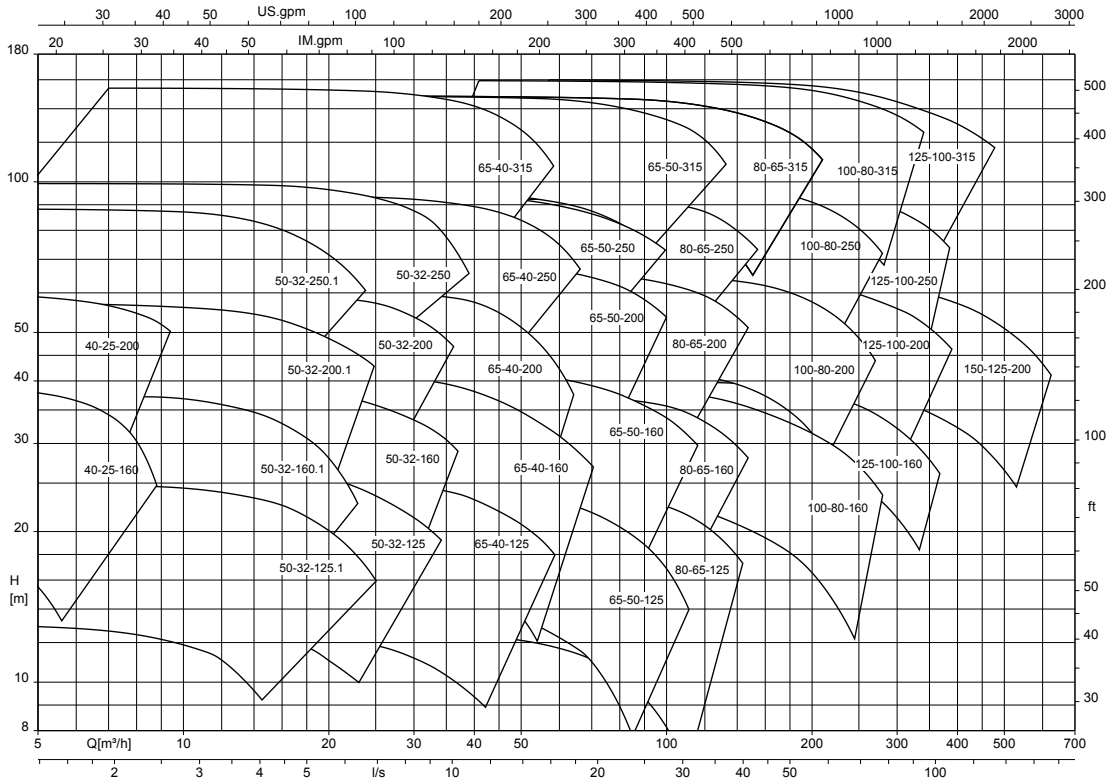
Technical data

Technical data

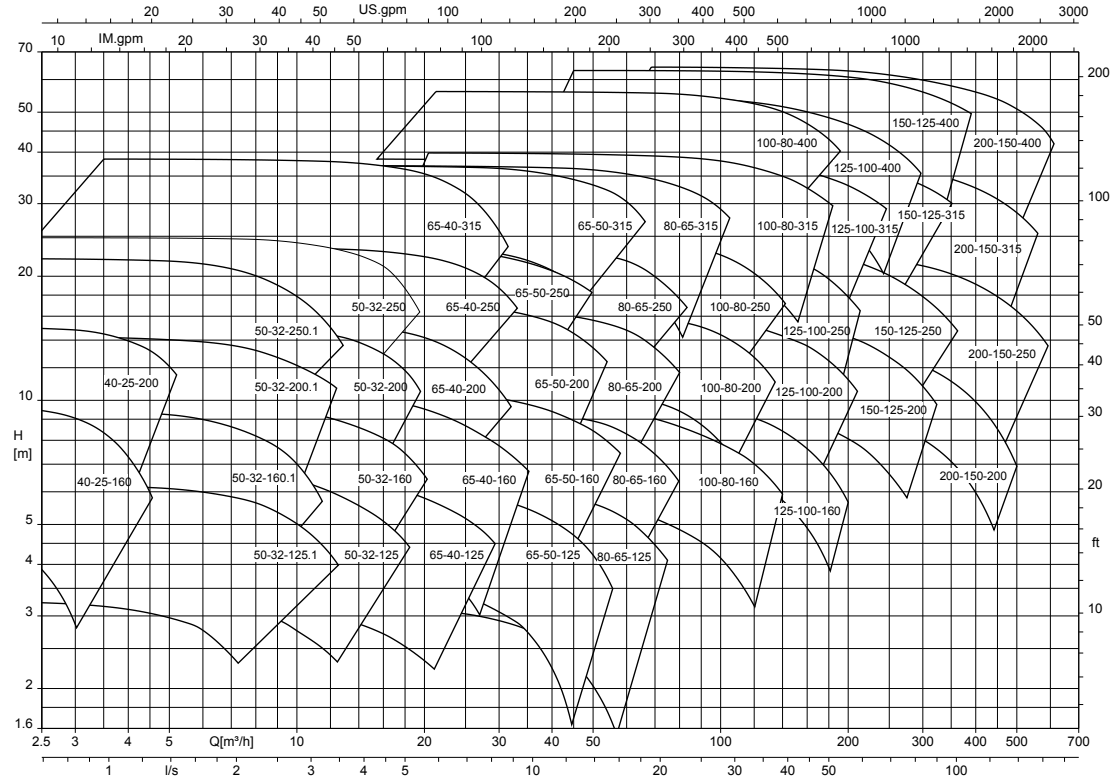
Sizes	Bearing bracket		Impeller					Speed limit	
	LS	LR	Impeller outlet width	Free passage diameter	Impeller inlet diameter	Impeller diameter		Maximum	Minimum
						Maximum	Minimum		
			[mm]	[mm]	[mm]	[mm]	[mm]	[rpm]	[rpm]
040-025-160	WS_25_LS	-	6,0	5,7	44,0	169	130	3500	500
040-025-200	WS_25_LS	-	6,0	5,7	44,0	209	160	3500	500
050-032-125.1	WS_25_LS	-	6,0	6,0	52,0	139	104	4300	500
050-032-160.1	WS_25_LS	-	10,0	5,4	63,0	170	136	4400	500
050-032-200.1	WS_25_LS	-	7,0	5,3	62,0	204	170	3800	500
050-032-250.1	WS_25_LS	-	13,0	5,2	70,0	254	200	3000	500
050-032-125	WS_25_LS	-	7,0	5,7	52,0	139	104	4200	500
050-032-160	WS_25_LS	-	6,0	5,8	54,0	174	136	3500	500
050-032-200	WS_25_LS	-	9,0	6,7	63,0	209	170	3700	500
050-032-250	WS_25_LS	-	14,0	7,1	74,0	261	209	3000	500
065-040-125	WS_25_LS	-	9,0	9,6	69,0	139	104	4000	500
065-040-160	WS_25_LS	-	20,0	11,5	88,0	174	128	4400	500
065-040-200	WS_25_LS	-	17,0	8,9	87,0	209	165	3700	500
065-040-250	WS_25_LS	-	14,0	8,0	83,0	260	200	3000	500
065-040-315	WS_35_LS	-	26,0	7,1	99,0	326	260	2300	500
065-040-315	-	WS_50_LR	26,0	7,1	99,0	326	260	3000	500
065-050-125	WS_25_LS	-	6,0	11,6	58,0	142	112	4500	500
065-050-160	WS_25_LS	-	8,0	11,6	63,0	174	128	4400	500
065-050-200	WS_25_LS	-	8,0	11,9	73,0	219	170	3400	500
065-050-250	WS_25_LS	-	8,0	10,0	75,0	260	215	3000	500
065-050-315	WS_35_LS	-	11,0	9,5	84,0	323	265	2400	500
065-050-315	-	WS_50_LR	11,0	9,5	84,0	323	265	3000	500
080-065-125	WS_25_LS	-	10,0	12,9	86,0	141	130	4000	500
080-065-160	WS_25_LS	-	21,0	12,2	92,0	174	132	3900	500
080-065-200	WS_25_LS	-	17,0	13,3	100	219	175	3000	500
080-065-250	WS_35_LS	-	15,0	14,3	101	260	215	3000	500
080-065-315	WS_35_LS	-	32,0	14,0	124	320	260	2400	500
080-065-315	-	WS_60_LR	32,0	14,0	124	320	260	3000	500
100-080-160	WS_25_LS	-	25,0	15,1	115	174	154	3500	500
100-080-200	WS_35_LS	-	19,0	15,2	115	219	180	3500	500
100-080-250	WS_35_LS	-	38,0	15,8	135	269	215	2900	500
100-080-315	WS_35_LS	-	33,0	17,8	142	334	269	1900	500
100-080-315	-	WS_60_LR	33,0	17,8	142	334	269	3000	500
100-080-400	WS_55_LS	-	14,0	14,3	107	398	330	1900	500
125-100-160	WS_35_LS	-	19,0	16,4	115	185	177	3600	500
125-100-200	WS_35_LS	-	15,0	17,9	129	219	179	3300	500
125-100-250	WS_35_LS	-	27,0	18,8	145	269	210	2500	500
125-100-315	WS_35_LS	-	23,0	19,9	142	334	270	1800	500
125-100-315	-	WS_60_LR	23,0	19,9	142	334	270	3000	500
125-100-400	WS_55_LS	-	18,0	17,1	142	401	329	1900	500
150-125-200	WS_35_LS	-	41,0	21,1	160	224	205	2600	500
150-125-250	WS_35_LS	-	37,0	22,4	162	269	218	2000	500
150-125-315	WS_55_LS	-	31,0	22,6	162	334	270	2300	500
150-125-400	WS_55_LS	-	26,0	20,9	162	419	330	1800	500
200-150-200	WS_35_LS	-	60,0	25,2	179	224	215	2300	500
200-150-250	WS_35_LS	-	49,0	23,0	191	269	220	1800	500
200-150-315	WS_55_LS	-	40,0	26,9	192	334	264	2100	500
200-150-400	WS_55_LS	-	33,0	23,8	191	419	330	1800	500

Selection charts

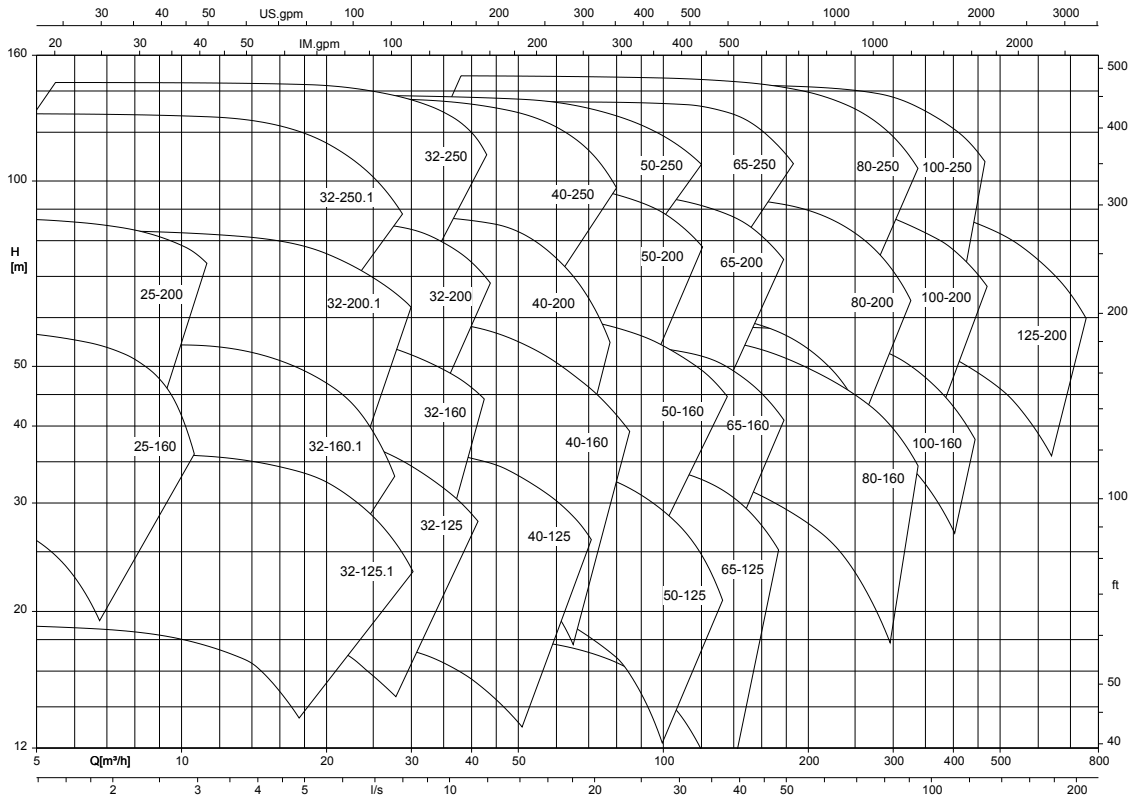
Etanorm, n = 2900 rpm



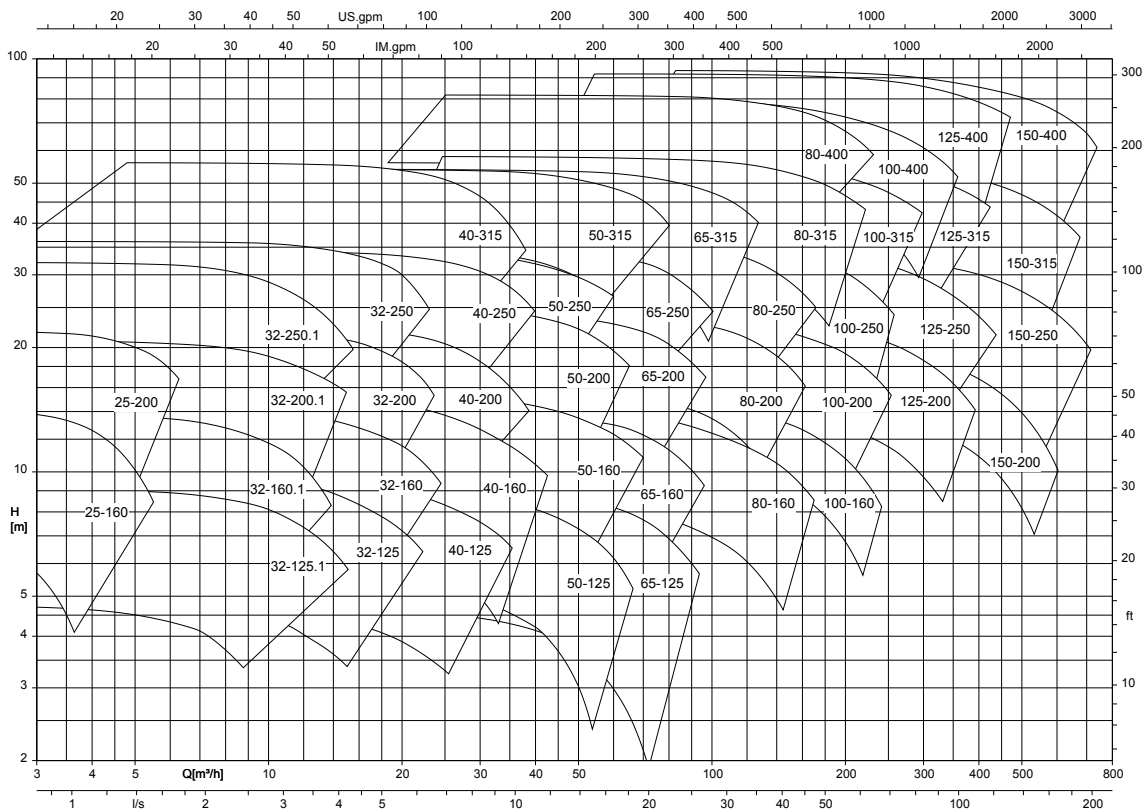
Etanorm, n = 1450 rpm



Etanorm, n = 3500 rpm

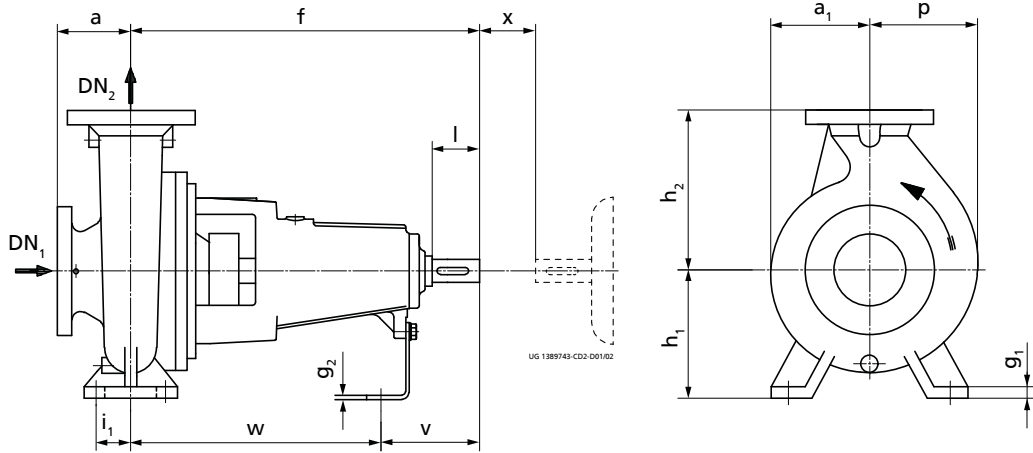


Etanorm, n = 1750 rpm

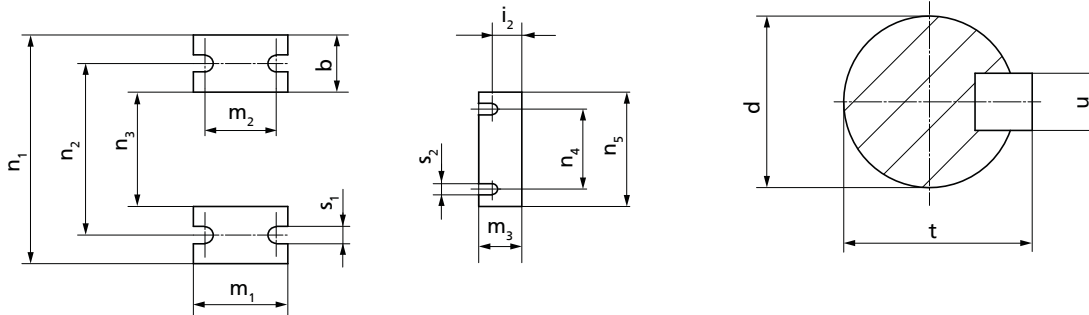


Dimensions

Pump with bearing bracket



Pump dimensions



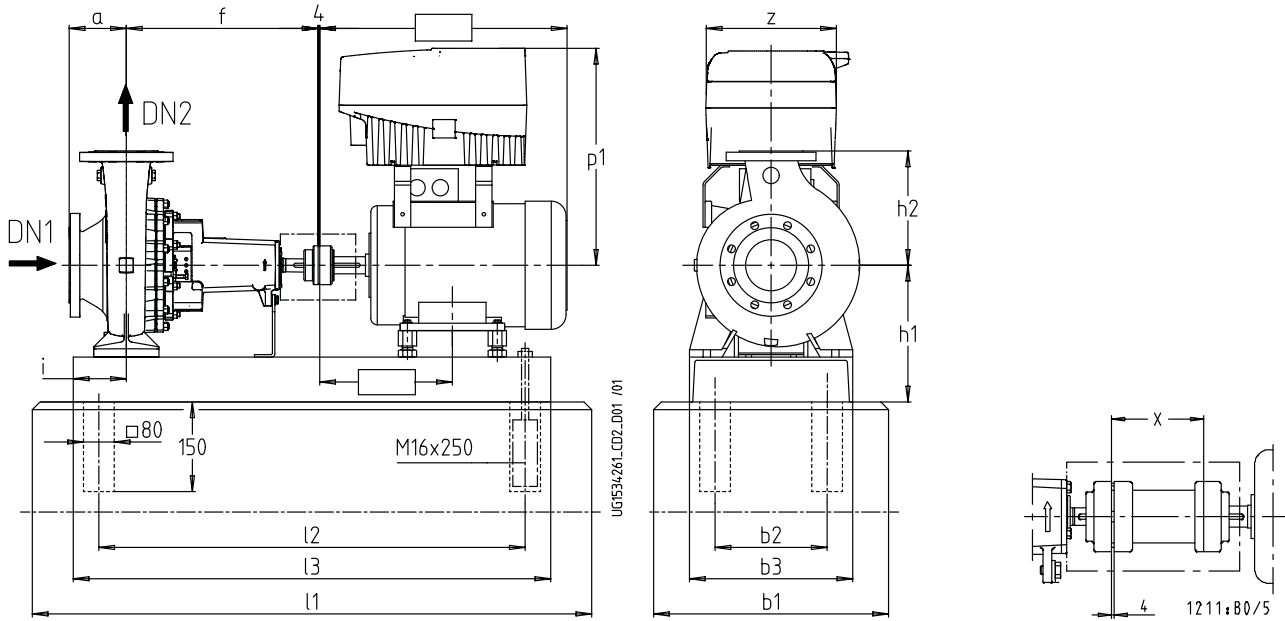
Dimensions of shaft end and pump feet

Dimensions of pump with bearing bracket [mm]

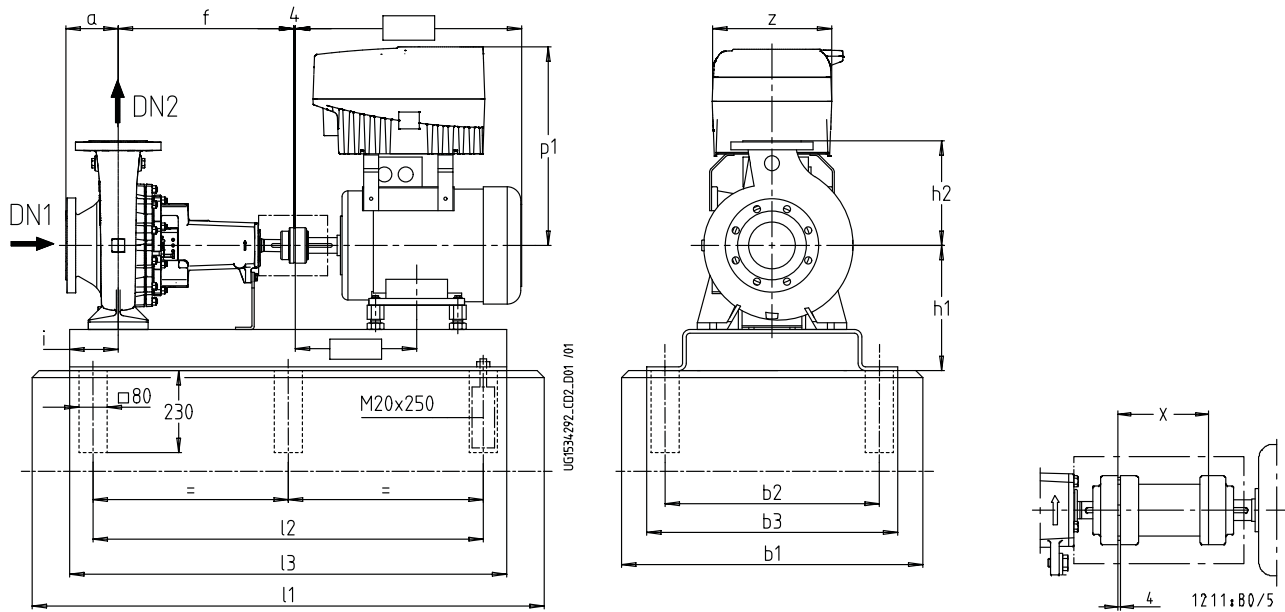
Size	Bearing bracket	Bearing bracket	DN ₁ ²⁷⁾	DN ₂ ²⁷⁾	a ²⁷⁾	a ₁	b ²⁷⁾	d ²⁷⁾	f ²⁷⁾	g ₁	g ₂	h ₁ ²⁷⁾	h ₂ ²⁷⁾	i ₁	i ₂	l ²⁷⁾	m ₁ ²⁷⁾	m ₂
040-025-160	WS_25_LS	-	40	25	80	118	50	24	360	15	4	132	160	35	23	50	100	70
040-025-200	WS_25_LS	-	40	25	80	142	50	24	360	15	4	160	180	35	23	50	100	70
050-032-125.1	WS_25_LS	-	50	32	80	116	50	24	360	15	4	112	140	35	23	50	100	70
050-032-160.1	WS_25_LS	-	50	32	80	116	50	24	360	15	4	132	160	35	23	50	100	70
050-032-200.1	WS_25_LS	-	50	32	80	142	50	24	360	18	4	160	180	35	23	50	100	70
050-032-250.1	WS_25_LS	-	50	32	100	168	65	24	360	18	6	180	225	47,5	25	50	125	95
050-032-125	WS_25_LS	-	50	32	80	115	50	24	360	15	4	112	140	35	23	50	100	70
050-032-160	WS_25_LS	-	50	32	80	118	50	24	360	15	4	132	160	35	23	50	100	70
050-032-200	WS_25_LS	-	50	32	80	142	50	24	360	18	4	160	180	35	23	50	100	70
050-032-250	WS_25_LS	-	50	32	100	169	65	24	360	18	6	180	225	47,5	25	50	125	95
065-040-125	WS_25_LS	-	65	40	80	117	50	24	360	15	4	112	140	35	23	50	100	70
065-040-160	WS_25_LS	-	65	40	80	119	50	24	360	15	4	132	160	35	23	50	100	70
065-040-200	WS_25_LS	-	65	40	100	142	50	24	360	18	4	160	180	35	23	50	100	70
065-040-250	WS_25_LS	-	65	40	100	169	65	24	360	18	6	180	225	47,5	25	50	125	95
065-040-315	WS_35_LS	-	65	40	125	207	65	32	470	18	6	225	250	47,5	24	80	125	95
065-040-315	-	WS_50_LR	65	40	125	207	65	32	500 ²⁸⁾	18	6	225	250	47,5	26	80	125	95
065-050-125	WS_25_LS	-	65	50	100	117	50	24	360	18	4	132	160	35	23	50	100	70
065-050-160	WS_25_LS	-	65	50	100	128	50	24	360	18	4	160	180	35	23	50	100	70
065-050-200	WS_25_LS	-	65	50	100	144	50	24	360	18	4	160	200	35	23	50	100	70
065-050-250	WS_25_LS	-	65	50	100	170	65	24	360	18	6	180	225	47,5	25	50	125	95
065-050-315	WS_35_LS	-	65	50	125	207	65	32	470	18	6	225	280	47,5	24	80	125	95
065-050-315	-	WS_50_LR	65	50	125	207	65	32	500 ²⁸⁾	18	6	225	280	47,5	26	80	125	95
080-065-125	WS_25_LS	-	80	65	100	117	65	24	360	18	4	160	180	47,5	23	50	125	95
080-065-160	WS_25_LS	-	80	65	100	132	65	24	360	18	4	160	200	47,5	23	50	125	95
080-065-200	WS_25_LS	-	80	65	100	155	65	24	360	18	6	180	225	47,5	25	50	125	95

²⁷⁾ Dimensions to EN 733
²⁸⁾ Dimensions differ from those specified in EN 733

Pump set



Dimensions of the pump set with coupling (Fig. A)



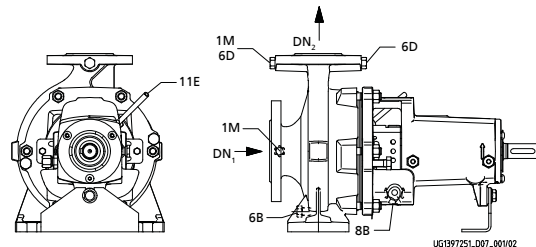
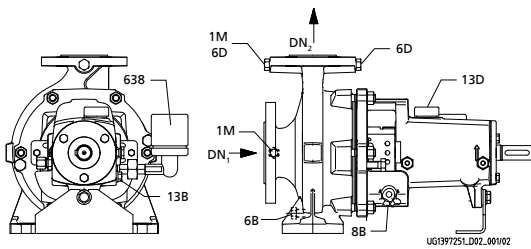
Dimensions of the pump set with spacer-type coupling (Fig. B)

Dimensions of the pump set [mm]

Size	Motor rating [kW]				Motor size Fig.	DN ₁	DN ₂	a	b1	b2	b3	f	h1	h2	i	p1	z	Coupling			Spacer-type coupling				
	1450 rpm	1750 rpm	2900 rpm	3500 rpm														l1	l2	l3	l1	l2	l3	x	
040-025-160	0,55	0,63	-	-	80M	A	40	25	80	450	240	300	360	232	160	100	294	190	860	650	710	950	740	800	100
	-	-	0,75	-	80M	A	40	25	80	450	240	300	360	232	160	100	294	190	860	650	710	950	740	800	100
	-	-	1,1	1,27	80M	A	40	25	80	450	240	300	360	232	160	100	294	190	860	650	710	950	740	800	100
	-	-	1,5	1,75	90S	A	40	25	80	450	240	300	360	232	160	100	299	190	860	650	710	950	740	800	100
	-	-	2,2	2,55	90L	A	40	25	80	450	240	300	360	232	160	100	299	211	950	740	800	1050	840	900	100
	-	-	3,45	4,55	100L	A	40	25	80	450	240	300	360	232	160	100	338	211	1050	840	900	1150	940	1000	100
040-025-200	-	-	-	4,55	112M	A	40	25	80	450	240	300	360	232	160	100	353	211	1050	840	900	1150	940	1000	100
	0,55	-	-	-	80M	A	40	25	80	450	240	300	360	260	180	100	294	190	860	650	710	950	740	800	100
	0,75	0,86	-	-	80M	A	40	25	80	450	240	300	360	260	180	100	294	190	860	650	710	950	740	800	100
	1,1	1,27	-	-	90S	A	40	25	80	450	240	300	360	260	180	100	299	190	860	650	710	950	740	800	100

Size	Motor rating [kW]				Motor size Fig.	DN ₁	DN ₂	a	b1	b2	b3	f	h1	h2	i	p1	z	Coupling			Spacer-type coupling				
	1450 rpm	1750 rpm	2900 rpm	3500 rpm														I1	I2	I3	I1	I2	I3	x	
		30,0	34,5	-														-	200L	B	200	150	160	810	600
	-	42,5	-	-	225S	B	200	150	160	810	600	650	470	420	400	112	699	455	1750	1060	1600	1750	1060	1600	140
	-	52,0	-	-	225M	B	200	150	160	810	600	650	470	420	400	112	699	455	1750	1060	1600	1750	1060	1600	140
	-	63,0	-	-	250M	B	200	150	160	810	600	650	470	420	400	112	760	455	1750	1060	1600	1750	1060	1600	140
	-	-	110,0	-	315S	B	200	150	160	940	730	780	530	455	400	130	-	-	1800	1100	1650	1800	1100	1650	140
	-	-	132,0	-	315M	B	200	150	160	940	730	780	530	455	400	130	-	-	1800	1100	1650	2150	1340	2000	140
	-	-	160,0	-	315L	B	200	150	160	940	730	780	530	455	400	130	-	-	1800	1100	1650	2150	1340	2000	140
	-	-	200,0	-	315L	B	200	150	160	940	730	780	530	455	400	130	-	-	1800	1100	1650	2150	1340	2000	140
200-150-315	22,0	-	-	-	180L	B	200	150	160	880	670	720	530	420	400	112	577	350	1750	1060	1600	1750	1060	1600	140
	30,0	-	-	-	200L	B	200	150	160	880	670	720	530	420	400	112	626	350	1750	1060	1600	1750	1060	1600	140
	37,0	42,5	-	-	225S	B	200	150	160	880	670	720	530	420	400	112	699	455	1750	1060	1600	1750	1060	1600	140
	45,0	52,0	-	-	225M	B	200	150	160	880	670	720	530	420	400	112	699	455	1750	1060	1600	1750	1060	1600	140
	-	63,0	-	-	250M	B	200	150	160	880	670	720	530	420	400	112	760	455	1750	1060	1600	1750	1060	1600	140
	-	86,0	-	-	280S	B	200	150	160	880	670	720	530	420	400	112	-	-	1750	1060	1600	1750	1060	1600	140
	-	104,0	-	-	280M	B	200	150	160	880	670	720	530	420	400	112	-	-	1750	1060	1600	1750	1060	1600	140
200-150-400	37,0	-	-	-	225S	B	200	150	160	880	670	720	530	455	450	112	699	455	1750	1060	1600	1750	1060	1600	140
	45,0	-	-	-	225M	B	200	150	160	880	670	720	530	455	450	112	699	455	1750	1060	1600	1750	1060	1600	140
	55,0	-	-	-	250M	B	200	150	160	880	670	720	530	455	450	112	760	455	1750	1060	1600	1750	1060	1600	140
	75,0	86,0	-	-	280S	B	200	150	160	880	670	720	530	455	450	112	-	-	1750	1060	1600	1750	1060	1600	140
	90,0	104,0	-	-	280M	B	200	150	160	880	670	720	530	455	450	112	-	-	1750	1060	1600	1750	1060	1600	140
	-	127,0	-	-	315S	B	200	150	160	940	730	780	530	455	450	112	-	-	1800	1100	1650	1800	1100	1650	140

Connection types

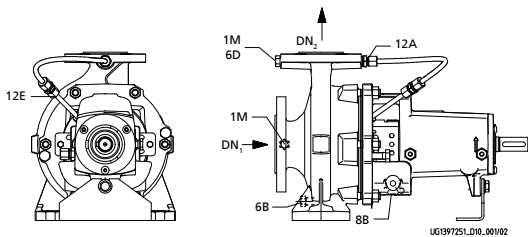


Grease-lubricated version

P4 VSH – Gland packing, external flushing liquid

Version with constant level oiler

P1	Na – Gland packing with internal barrier fluid
P2	Nb – Gland packing without barrier fluid
A	Single mechanical seal, A-type cover
IA	Single mechanical seal, A-type cover with internal circulation

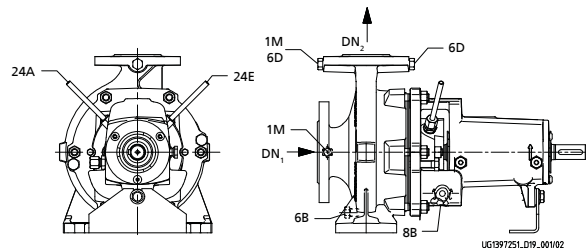


Grease-lubricated version

P3 Nc – Gland packing, external barrier fluid

Grease-lubricated version

EA External circulation, A-type cover

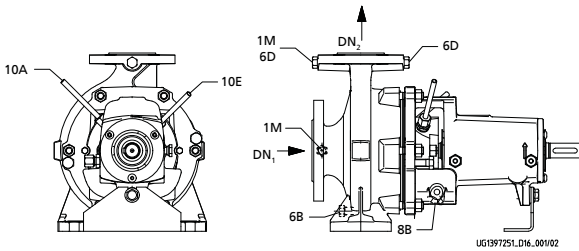


Grease-lubricated version

TI Double mechanical seal in tandem arrangement with internal circulation

Grease-lubricated version

FA External flushing, A-type cover



Grease-lubricated version

DB	Double mechanical seal in back-to-back arrangement
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Connection types

Connection	Description	Configuration	Position	Region
1M	Pressure gauge connection	On pump set with pressure sensor	DN ₂	A
6B	Fluid drain	Drilled and closed	-	A
6D	Fluid filling and venting	Drilled and closed	DN ₂ , suction side	A
8B	Leakage drain	Drilled and closed ²⁹⁾	-	A
1M optional	Pressure gauge connection	Drilled and closed or with pressure sensor	DN ₁	A
6D optional	Fluid filling and venting	Drilled and closed	DN ₂ , drive end	A
10A	External barrier fluid outlet	DN 8 pipe closed	-	A
10E	External barrier fluid inlet	DN 8 pipe closed	-	A
11E	Flushing liquid inlet	DN 8 pipe closed	-	A
12A	Circulation liquid outlet	Drilled and connected	-	A
12E	Circulation liquid inlet	Drilled and connected	-	A
13B	Oil drain	Drilled and closed	-	A
13D	Oil filling and venting	Drilled and closed	-	A
24A	Quench liquid outlet	DN 8 pipe closed	-	A
24E	Quench liquid inlet	DN 8 pipe closed	-	A

Connections for Europe

Size	Bearing bracket	Casing material											
		G, B	C, S	G, B, C, S	G, B, C, S	G, B, C, S	G, B	C, S	G, B, C, S	G, B, C, S	G, B, C, S	G, B, C, S	
		Connection											
		1M.1_6D / 1M.2 / 6B / 6D	8B	10A / 10E	11E	12A	12E	13B	13D	24A / 24E			
040-025-160	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
040-025-200	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
050-032-125.1	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
050-032-160.1	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
050-032-200.1	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
050-032-250.1	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
050-032-125	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
050-032-160	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
050-032-200	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
050-032-250	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
065-040-125	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
065-040-160	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
065-040-200	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
065-040-250	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
065-040-315	35	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
065-040-315	50	Rc 1/4	G 1/4	--	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 3/8	DN 20	DN 8	
065-050-125	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	
065-050-160	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8	

²⁹⁾ For bearing bracket LS only

Size	Bearing bracket	Casing material										
		G, B	C, S	G, B, C, S	G, B, C, S	G, B, C, S	G, B	C, S	G, B, C, S	G, B, C, S	G, B, C, S	G, B, C, S
		Connection										
		1M.1_6D / 1M.2 / 6B / 6D		8B	10A / 10E	11E	12A		12E	13B	13D	24A / 24E
065-050-200	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8
065-050-250	25	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8
065-050-315	35	Rc 1/4	G 1/4	G 1/2	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 1/4	DN 20	DN 8
065-050-315	50	Rc 1/4	G 1/4	--	DN 8	DN 8	Rc 1/4	G 1/4	DN 8	G 3/8	DN 20	DN 8
080-065-125	25	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
080-065-160	25	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
080-065-200	25	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
080-065-250	35	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
080-065-315	35	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
080-065-315	60	Rc 3/8	G 3/8	--	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 3/8	DN 20	DN 8
100-080-160	25	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
100-080-200	35	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
100-080-250	35	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
100-080-315	35	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
100-080-315	60	Rc 3/8	G 3/8	--	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 3/8	DN 20	DN 8
100-080-400	55	Rc 3/8	G 3/8	G 1/2	DN 8	DN 8	Rc 3/8	G 3/8	DN 8	G 1/4	DN 20	DN 8
125-100-160	35	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
125-100-200	35	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
125-100-250	35	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
125-100-315	35	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
125-100-315	60	Rc 1/2	G 1/2	--	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 3/8	DN 20	DN 8
125-100-400	55	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
150-125-200	35	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
150-125-250	35	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
150-125-250	60	Rc 1/2	G 1/2	--	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 3/8	DN 20	DN 8
150-125-315	55	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
150-125-400	55	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
200-150-200	35	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
200-150-250	35	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
200-150-250	60	Rc 1/2	G 1/2	--	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 3/8	DN 20	DN 8
200-150-315	55	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8
200-150-400	55	Rc 1/2	G 1/2	G 1/2	DN 8	DN 8	Rc 1/2	G 1/2	DN 8	G 1/4	DN 20	DN 8

Flange design

Flange material variants

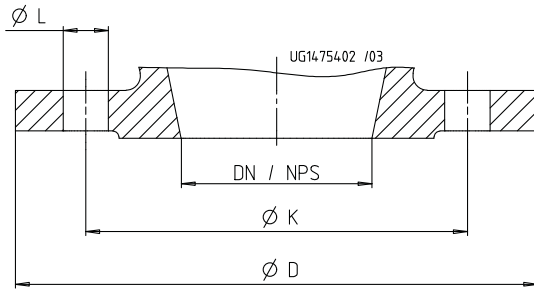
Material variant	Standard	Nominal diameter	Pressure class	Region
G, GB, GC	EN 1092-2	DN 25 - DN 150	PN 16	A
		DN 200	PN 10	
	Drilled to ASME B16.1 ³⁰⁾	DN 25 - DN 200	Class 125 ³¹⁾	A
S, SB, SC	EN 1092-2	DN 25 - DN 200	PN 16	A
		DN 25 - DN 200	Class 125 ³¹⁾	A
B	EN 1092-3	DN 25 - DN 200	PN 10	A
		DN 25 - DN 200	Class 125 ³²⁾	A
C	EN 1092-1	DN 25 - DN 150	PN 16	A
		DN 200	PN 10	
		Drilled to ASME B16.5 ³⁰⁾	DN 25 - DN 200	Class 150

³⁰⁾ Suction-side DN 80 machined like DN 100

³¹⁾ Nozzle drilled to Class 125 with pressure class PN 16.

³²⁾ Nozzle drilled to Class 125 with pressure class PN 10.

Flange dimensions



Flange dimensions

Flange dimensions to EN 1092-1, EN 1092-2, EN 1092-3

Flange dimensions [mm]

Nominal diameter	Standard																	
	EN 1092-3			EN 1092-1						EN 1092-2								
	Material variant																	
	B			C						G						S		
	PN 10			PN 10			PN 16			PN 10			PN 16			PN 16		
Ø K	Ø D	Number and Ø of holes (Ø L)	Ø K	Ø D	Number and Ø of holes (Ø L)	Ø K	Ø D	Number and Ø of holes (Ø L)	Ø K	Ø D	Number and Ø of holes (Ø L)	Ø K	Ø D	Number and Ø of holes (Ø L)	Ø K	Ø D	Number and Ø of holes (Ø L)	
25	85	115	4 × Ø14	-	115	-	85	115	4 × Ø14	-	115	-	85	115	4 × Ø14	85	115	4 × Ø14
32	100	140	4 × Ø18	-	140	-	100	140	4 × Ø18	-	140	-	100	140	4 × Ø19	100	140	4 × Ø19
40	110	150	4 × Ø18	-	150	-	110	150	4 × Ø18	-	150	-	110	150	4 × Ø19	110	150	4 × Ø19
50	125	165	4 × Ø18	-	165	-	125	165	4 × Ø18	-	165	-	125	165	4 × Ø19	125	165	4 × Ø19
65	145	185	4 × Ø18	-	185	-	145	185	4 × Ø18	-	185	-	145	185	4 × Ø19	145	185	4 × Ø19
80	160	200/ 229 ³³⁾	8 × Ø18	-	200/ 230 ³³⁾	-	160	200/ 230 ³³⁾	8 × Ø18	-	200/ 229 ³³⁾	-	160	200/ 229 ³³⁾	8 × Ø19	160	200/ 229 ³³⁾	8 × Ø19
100	180	229	8 × Ø18	-	230	-	180	230	8 × Ø18	-	229	-	180	229	8 × Ø19	180	229	8 × Ø19
125	210	254	8 × Ø18	-	255	-	210	255	8 × Ø18	-	254	-	210	254	8 × Ø19	210	254	8 × Ø19
150	240	285	8 × Ø22	-	285	-	240	285	8 × Ø22	-	285	-	240	285	8 × Ø23	240	285	8 × Ø23
200	295	343	8 × Ø22	295	345	8 × Ø22	-	345	-	295	343	8 × Ø23	-	343	-	295	343	12 × Ø23

Flange drilled to: ASME B 16.1, Class 125 or ASME B 16.5, Class 150

Flange dimensions [mm]

Nominal diameter	Standard					
	ASME B 16.1, Class 125 or ASME B 16.5, Class 150					
	Material variant					
	B, G, S			C		
Ø K	Ø D	Number and Ø of holes (Ø L)	Ø K	Ø D	Number and Ø of holes (Ø L)	
25/ NPS 1	79,2	115	4 × Ø15,7	79,2	115	4 × Ø15,7
32/ NPS 1 ¼	88,9	140	4 × Ø15,7	88,9	140	4 × Ø15,7
40/ NPS 1 ½	98,6	150	4 × Ø15,7	98,6	150	4 × Ø15,7
50/ NPS 2	120,7	165	4 × Ø19,1	120,7	165	4 × Ø19,1
65/ NPS 2 ½	139,7	185	4 × Ø19,1	139,7	185	4 × Ø19,1
80 ³⁴⁾ / NPS 3	152,4	200/229 ³³⁾	4 × Ø19,1	152,4	200/230 ³³⁾	4 × Ø19,1
100/ NPS 4	190,5	229	8 × Ø19,1	190,5	230	8 × Ø19,1

³³⁾ Flange DN 80 on suction side; applies to sizes 080-065-125; 080-065-160; 080-065-200; 080-065-250; 080-065-315. Also see the table on Equivalents.

³⁴⁾ On sizes 080-065-125, 080-065-160, 080-065-200, 080-065-250, 080-065-315 flanges DN 80 (NPS 3) are drilled to NPS 4. Also see the table on Equivalents.

Nominal diameter	Standard					
	ASME B 16.1, Class 125 or ASME B 16.5, Class 150					
	Material variant					
	B, G, S			C		
	Ø K	Ø D	Number and Ø of holes (Ø L)	Ø K	Ø D	Number and Ø of holes (Ø L)
125/ NPS 5	215,9	254	8 × Ø22,4	215,9	255	8 × Ø22,4
150/ NPS 6	241,3	285	8 × Ø22,4	241,3	285	8 × Ø22,4
200/ NPS 8	298,5	343	8 × Ø22,4	298,5	345	8 × Ø22,4

Equivalents of DN 80 for a flange drilled to ASME

Size	Bearing bracket	Material variant							
		G, GB, GC		B		S, SB, SC		C	
		DN 1 ASME 125	DN 2 ASME 125	DN 1 ASME 125	DN 2 ASME 125	DN 1 ASME 125	DN 2 ASME 125	DN 1 ASME 125	DN 2 ASME 125
080-065-125	25	NPS 4	NPS 2 1/2	-	-	-	-	NPS 4	NPS 2 1/2
080-065-160	25	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2
080-065-200	25	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2
080-065-250	35	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2
080-065-315	35	NPS 4	NPS 2 1/2	-	-	NPS 4	NPS 2 1/2	NPS 4	NPS 2 1/2

Accessories

Control unit/switchgear accessories

Further information

See PumpDrive 2, PumpDrive 2 Eco type series booklet

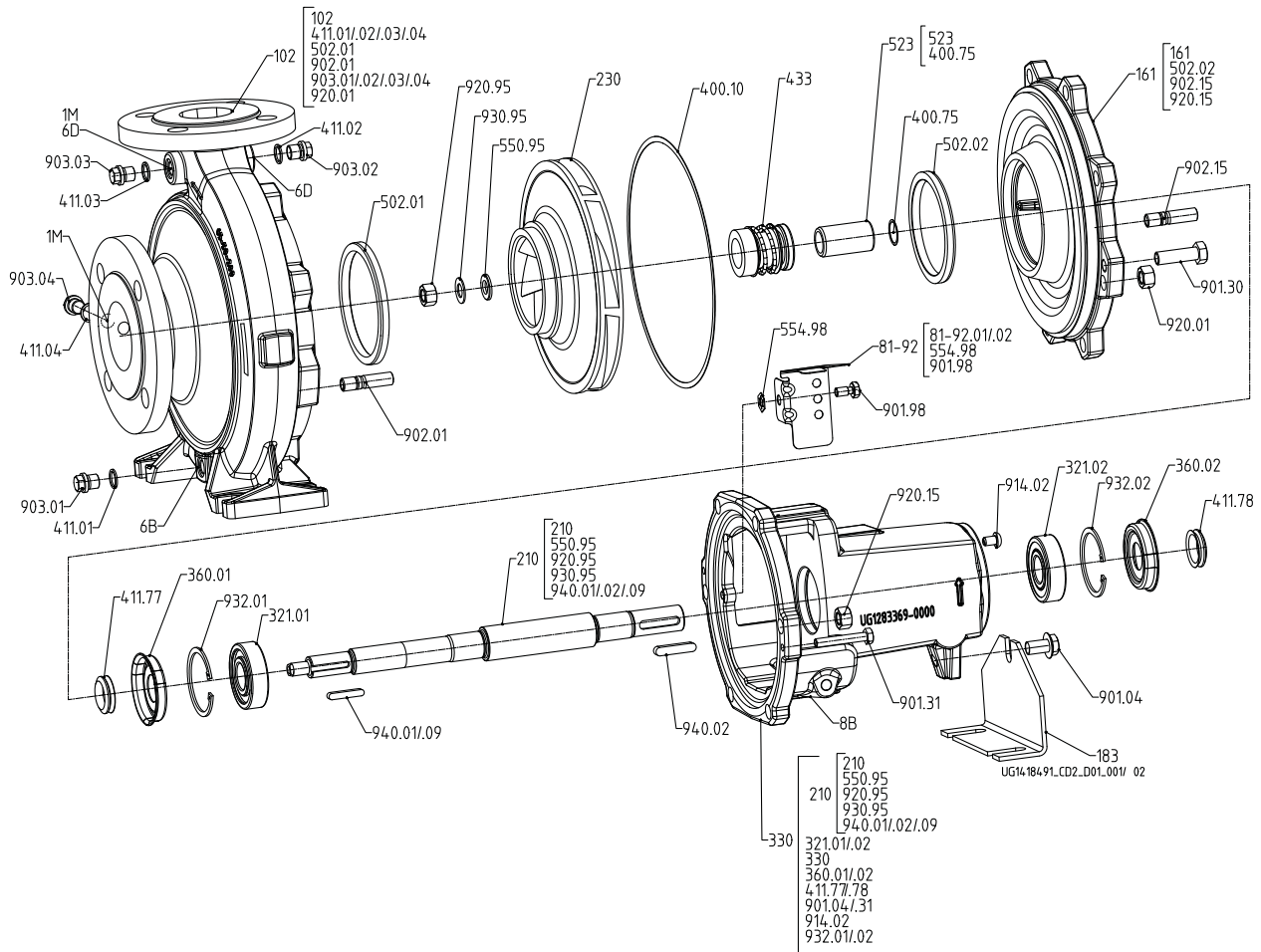
General assembly drawings

Standardised mechanical seal and bolted casing cover

This view applies to the following pump sizes:

040-025-200	050-32-200.1	065-040-200	065-050-200	080-065-200	100-080-250	125-100-250	150-125-250	200-150-250
	050-32-250.1	065-040-250	065-050-250	080-065-250	100-080-315	125-100-315	150-125-315	200-150-315
	050-32-200	065-040-315	065-050-315	080-065-315	100-080-400	125-100-400	150-125-400	200-150-400
	050-32-250							

[Supplied in packaging units only



Pump set with standardised mechanical seal and bolted casing cover

List of components

Part No.	Description	Part No.	Description
102	Volute casing	554.98	Lock washer
161	Casing cover	81-92.01/02	Cover plate
183	Support foot	901.04/.30/.31/.98	Hexagon head bolt
210	Shaft	902.01/.15	Stud
230	Impeller	903.01/.02/.03/.04	Screw plug
321.01/.02	Deep groove ball bearing	914.02	Round-head screw
330	Bearing bracket	920.01/.15/.95	Hexagon nut
360.01/.02	Bearing cover	930.95	Spring washer
400.10/.75	Gasket	932.01/.02	Circlip
411.01/.02/.03/.04	Joint ring ³⁵⁾	940.01/.02/.09 ³⁶⁾	Key

Part No.	Description	Part No.	Description
411.77/78	Axial seal ring	Connections:	
433	Mechanical seal	1M	Connection for pressure gauge
502.01/02	Casing wear ring ³⁷⁾	6B	Fluid drain
523	Shaft sleeve	6D	Fluid priming and venting
550.95 ³⁸⁾	Disc	8B	Leakage drain

³⁵⁾ For casing materials S and C only

³⁶⁾ For shaft units 55 and 60 only

³⁷⁾ Optional for casing material C

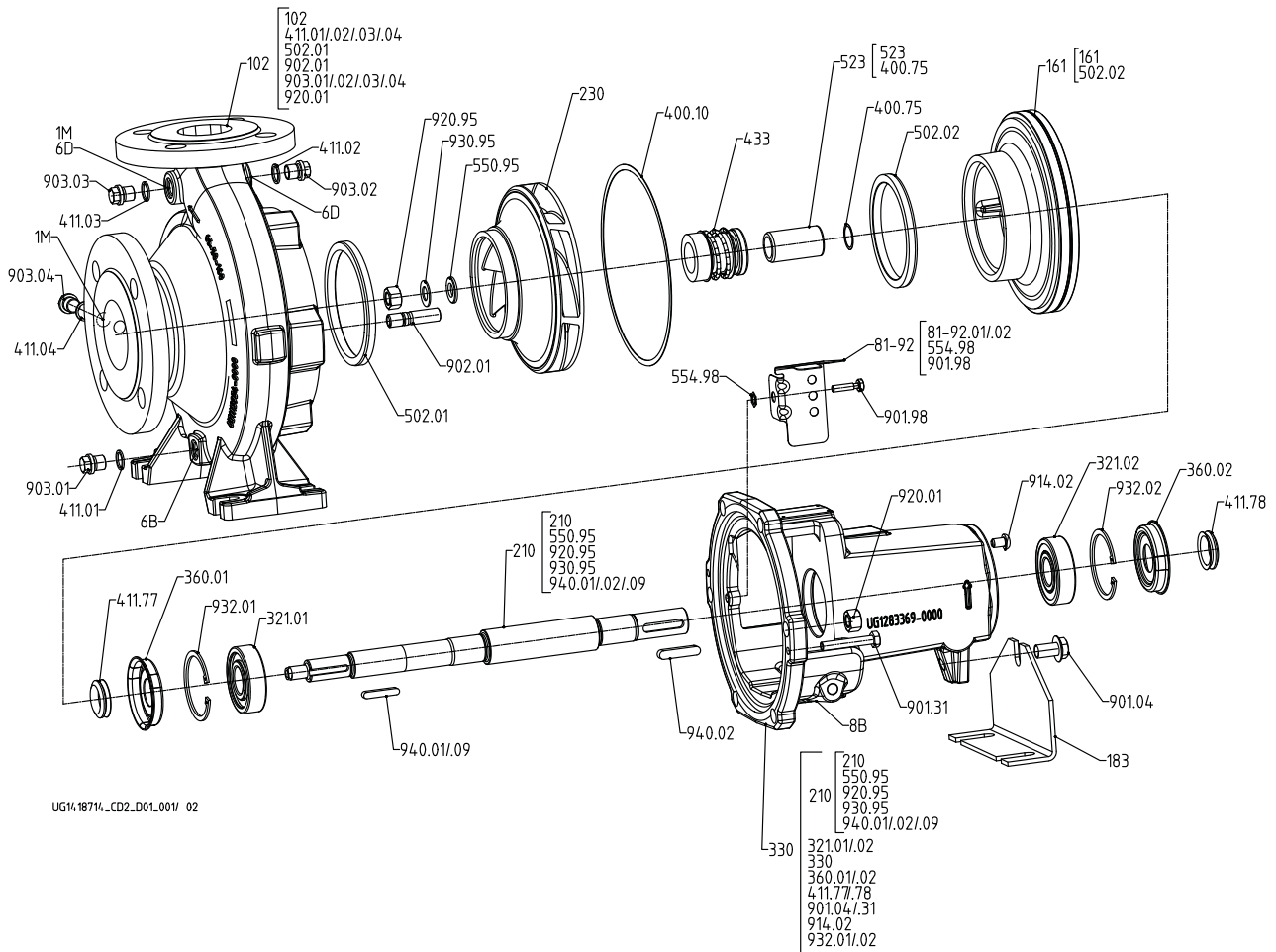
³⁸⁾ For shaft unit 25 only

Standardised mechanical seal and clamped casing cover

This view applies to the following pump sizes:

- | | | | | | | | | |
|-------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 040-025-160 | 050-32-125.1 | 065-040-125 | 065-050-125 | 080-065-125 | 100-080-160 | 125-100-160 | 150-125-200 | 200-150-200 |
| | 050-32-160.1 | 065-040-160 | 065-050-160 | 080-065-160 | 100-080-200 | 125-100-200 | | |
| | 050-32-125 | | | | | | | |
| | 050-32-160 | | | | | | | |

[Supplied in packaging units only



Pump set with standardised mechanical seal and clamped casing cover

List of components

Part No.	Description	Part No.	Description
102	Volute casing	554.98	Lock washer
161	Casing cover	81-92.01/02	Cover plate
183	Support foot	901.04/30/31/98	Hexagon head bolt
210	Shaft	902.01/15	Stud
230	Impeller	903.01/02/03/04	Screw plug
321.01/02	Deep groove ball bearing	914.02	Round-head screw
330	Bearing bracket	920.01/95	Hexagon nut
360.01/02	Bearing cover	930.95	Spring washer
400.10/75	Gasket	932.01/02	Circlip
411.01/02/03/04	Joint ring ³⁹⁾	940.01/02/09 ⁴⁰⁾	Key

³⁹⁾ For casing materials S and C only

Part No.	Description	Part No.	Description
411.77/78	Axial seal ring	Connections:	
433	Mechanical seal	1M	Connection for pressure gauge
502.01/02 ⁴¹⁾	Casing wear ring ⁴²⁾	6B	Fluid drain
523	Shaft sleeve	6D	Fluid priming and venting
550.95 ⁴³⁾	Disc	8B	Leakage drain

40) For shaft units 55 and 60 only

41) Not on sizes 040-025-160, 050-32-125.1, 050-32-160.1, 050-32-125, 050-32-160, 065-040-125

42) Optional for casing material C

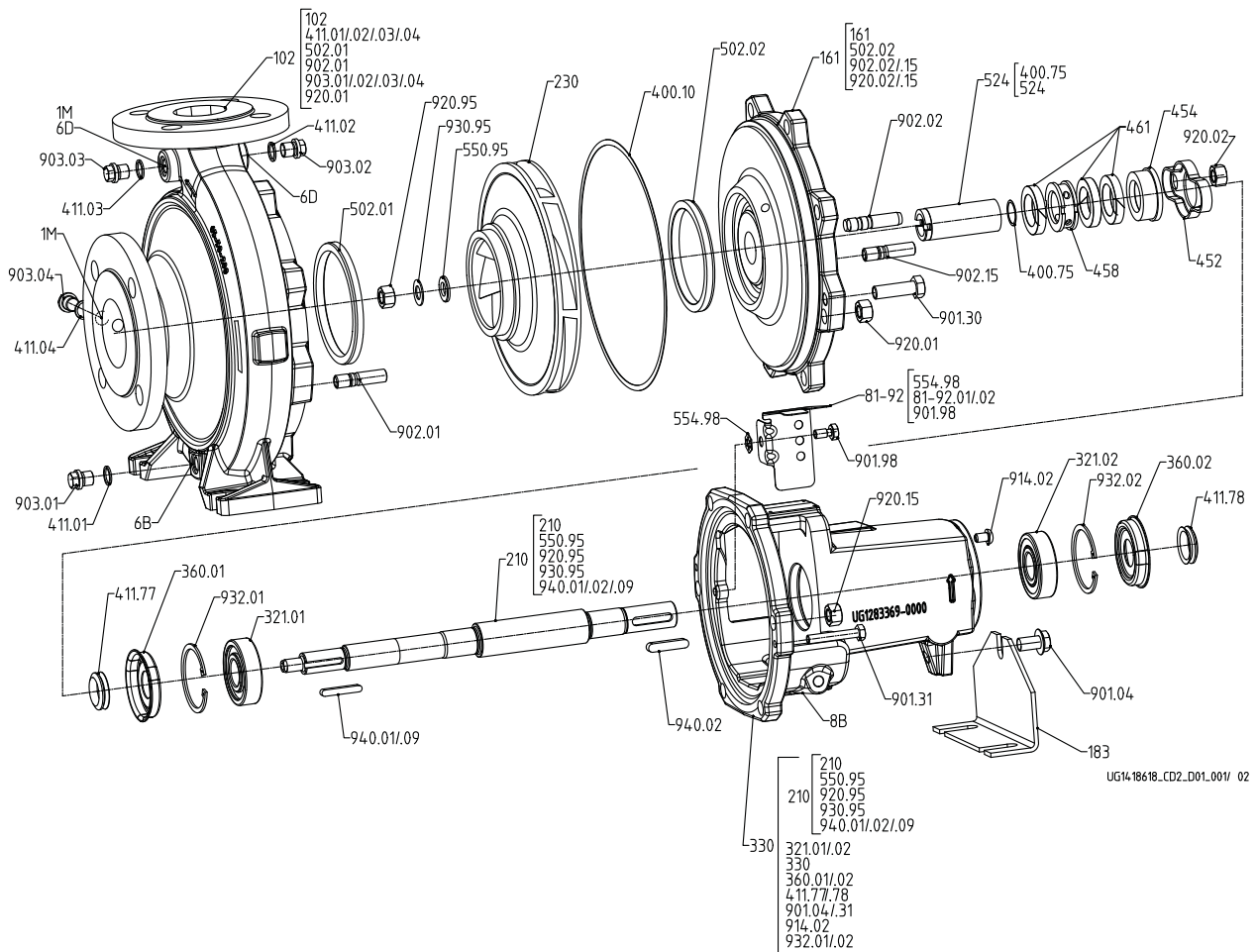
43) For shaft unit 25 only

Gland packing and bolted casing cover

This view applies to the following pump sizes:

040-025-200	050-32-200.1	065-040-200	065-050-200	080-065-200	100-080-250	125-100-250	150-125-250	200-150-250
	050-32-250.1	065-040-250	065-050-250	080-065-250	100-080-315	125-100-315	150-125-315	200-150-315
	050-32-200	065-040-315	065-050-315	080-065-315	100-080-400	125-100-400	150-125-400	200-150-400
	050-32-250							

[Supplied in packaging units only



Pump set with gland packing and bolted casing cover

List of components

Part No.	Description	Part No.	Description
102	Volute casing	550.95 ⁴⁴⁾	Disc
161	Casing cover	554.98	Lock washer
183	Support foot	81-92.01/02	Cover plate
210	Shaft	901.04/30/98	Hexagon head bolt
230	Impeller	902.01/02/15	Stud
321.01/02	Deep groove ball bearing	903.01/02/03/04	Screw plug
330	Bearing bracket	914.02	Round-head screw
360.01/02	Bearing cover	920.01/02/15/95	Hexagon nut
400.10/75	Gasket	930.95	Spring washer

44) For shaft unit 25 only

Part No.	Description	Part No.	Description
411.01/02/03/04	Joint ring ⁴⁵⁾	932.01/02	Circlip
411.77/78	Axial seal ring	940.01/02/09 ⁴⁶⁾	Key
452	Gland follower		
454	Stuffing box ring	Connections:	
458	Lantern ring	1M	Connection for pressure gauge
461	Gland packing	6B	Fluid drain
502.01/02	Casing wear ring ⁴⁷⁾	6D	Fluid priming and venting
524	Shaft protecting sleeve	8B	Leakage drain

⁴⁵⁾ For casing material C only

⁴⁶⁾ For shaft units 55 and 60 only

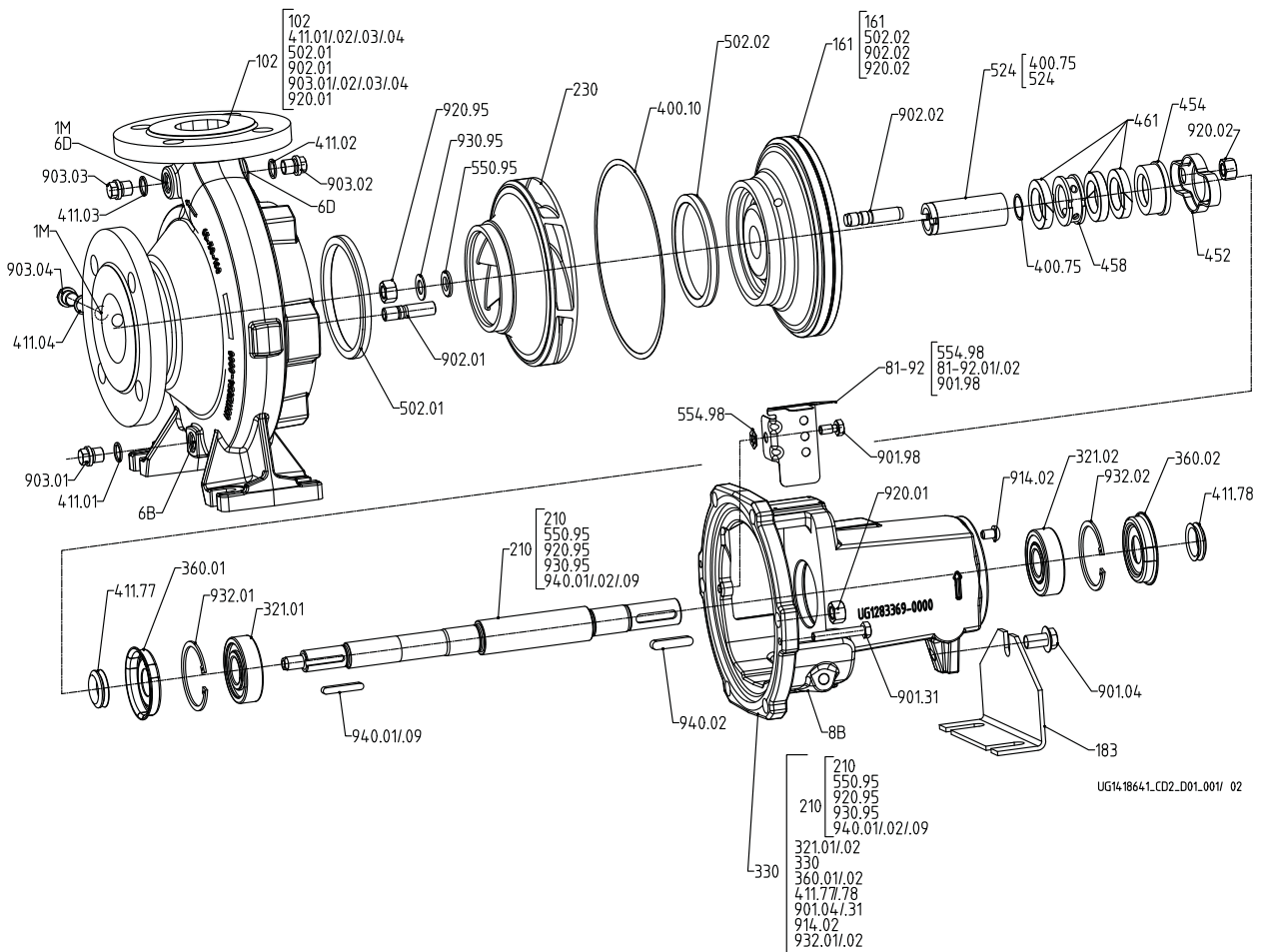
⁴⁷⁾ Optional for casing material C

Gland packing and clamped casing cover

This view applies to the following pump sizes:

- | | | | | | | | | |
|-------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 040-025-160 | 050-32-125.1 | 065-040-125 | 065-050-125 | 080-065-125 | 100-080-160 | 125-100-160 | 150-125-200 | 200-150-200 |
| | 050-32-160.1 | 065-040-160 | 065-050-160 | 080-065-160 | 100-080-200 | 125-100-200 | | |
| | 050-32-125 | | | | | | | |
| | 050-32-160 | | | | | | | |

[Supplied in packaging units only



Pump set with gland packing and clamped casing cover

List of components

Part No.	Description	Part No.	Description
102	Volute casing	550.95 ⁴⁸⁾	Disc
161	Casing cover	554.98	Lock washer
183	Support foot	81-92.01/02	Cover plate
210	Shaft	901.04/30/98	Hexagon head bolt
230	Impeller	902.01/02	Stud
321.01/02	Deep groove ball bearing	903.01/02/03/04	Screw plug
330	Bearing bracket	914.02	Round-head screw
360.01/02	Bearing cover	920.01/02/15/95	Hexagon nut
400.10/75	Gasket	930.95	Spring washer
411.01/02/03/04	Joint ring ⁴⁹⁾	932.01/02	Circlip

48) For shaft unit 25 only

Part No.	Description	Part No.	Description
411.77/78	Axial seal ring	940.01/02/09 ⁵⁰⁾	Key
452	Gland follower		
454	Stuffing box ring	Connections:	
458	Lantern ring	1M	Connection for pressure gauge
461	Gland packing	6B	Fluid drain
502.01/02 ⁵¹⁾	Casing wear ring ⁵²⁾	6D	Fluid priming and venting
524	Shaft protecting sleeve	8B	Leakage drain

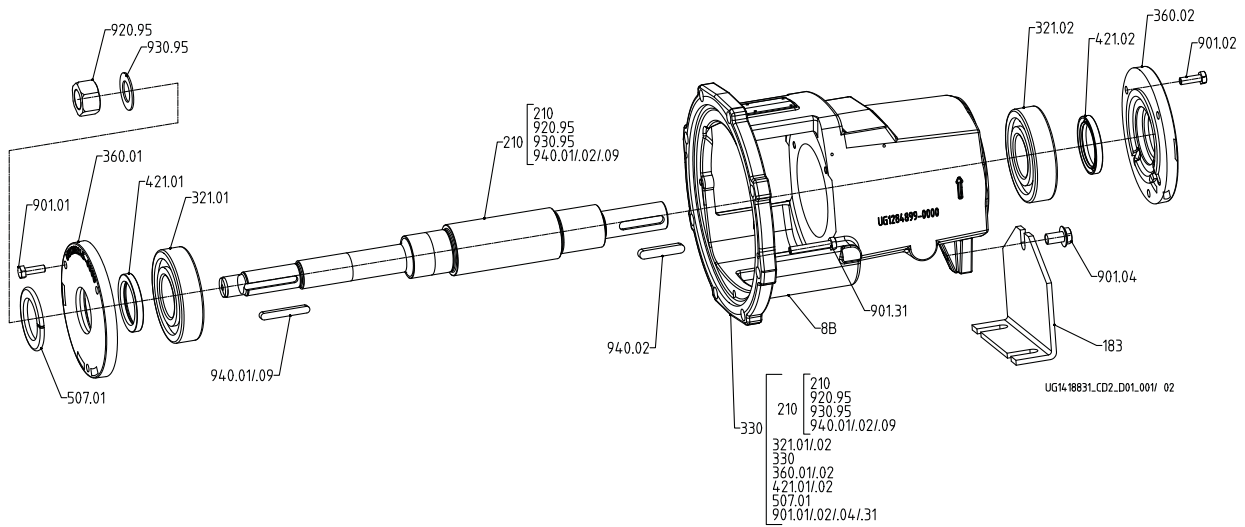
49) For casing material C only

50) For shaft units 55 and 60 only

51) Not on sizes 040-025-160, 050-32-125.1, 050-32-160.1, 050-32-125, 050-32-160, 065-040-125

52) Optional for casing material C

Reinforced bearings



Version with reinforced bearings (shaft units 50 and 60)

List of components⁵³⁾

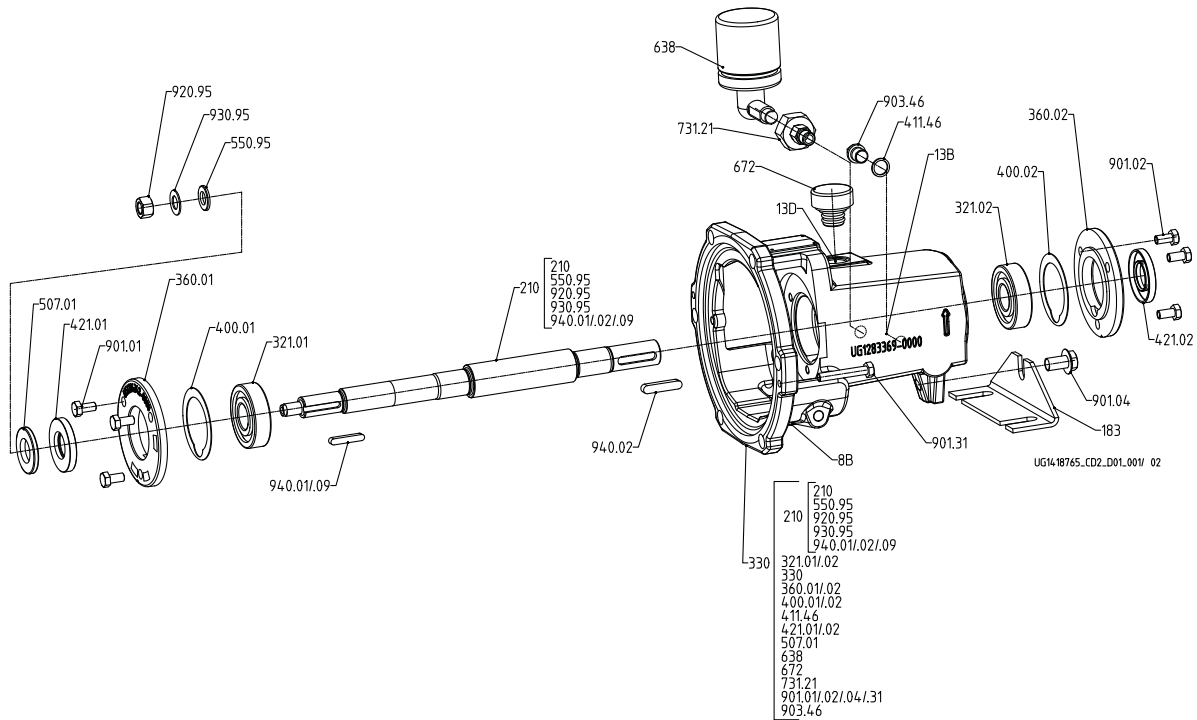
Part No.	Description	Part No.	Description
183	Support foot	901.01/.02/.04/.31	Hexagon head bolt
210	Shaft	920.95	Hexagon nut
330	Bearing bracket	930.95	Spring washer
321.01/.02	Deep groove ball bearing	940.01/.02/.09 ⁵⁴⁾	Key
360.01/.02	Bearing cover		
400 ⁵⁵⁾	Gasket		
421.01/.02	Lip seal	Connections:	
507.01	Thrower	8B	Leakage drain

⁵³⁾ Some individual components may not be applicable, depending on the size and material.

⁵⁴⁾ For shaft unit 60 only

⁵⁵⁾ For oil-lubricated pump sets only

Oil lubrication with constant level oiler



Version with oil lubrication and constant level oiler

List of components⁵⁶⁾

Part No.	Description	Part No.	Description
183	Support foot	672	Vent
210	Shaft	731.21	Pipe union
330	Bearing bracket	901.01/.02/.04/.31	Hexagon head bolt
321.01/.02	Deep groove ball bearing	903.46	Screw plug
360.01/.02	Bearing cover	920.95	Hexagon nut
400.01/.02	Gasket	930.95	Spring washer
411.46	Joint ring	940.01/.02/.09	Key
421.01/.02	Lip seal	Connections:	
507.01	Thrower	8B	Leakage drain
550.95 ⁵⁸⁾	Disc	13B	Oil drain
638	Constant level oiler	13D	Oil filling and venting
642 ⁵⁹⁾	Oil level sight glass		

⁵⁶⁾ Some individual components may not be applicable, depending on the size and material.

⁵⁷⁾ For shaft units 55 and 60 only

⁵⁸⁾ For shaft unit 25 only

⁵⁹⁾ Always supplied with constant level oiler and oil level sight glass for region B.

Complete product code

Designation example

Position																																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
E	T	N		0	4	0	-	0	2	5	-	2	0	0		S	G		A	A	1	1	G	B	2	1	3	2	0	2	B	P	2	E
See name plate and data sheet																							See data sheet											

Key to the designation

Position	Code	Description
1-4	Pump type	
	ETN	Etanorm
	ETNF	Etanorm fire-fighting pump
5-16	Size	
	040	Nominal suction nozzle diameter [mm]
	025	Nominal discharge nozzle diameter [mm]
17	Pump casing material	
	G	JL1040/A48CL35
	S	JS 1030
	C	1.4408/A743CF8M
18	Impeller material	
	G	JL1040/A48CL35
	C	1.4408/A743CF8M
	B	CC480K-GS/B30 C90700
19	Special design	
	Blank	Standard
	V	Fire-fighting variant to VDS
	A	Fire-fighting variant to APSAD
	M	Fire-fighting variant to FM
	X	Non-standard BT3D, BT3
20	Special design	
	A	Conical cover for single mechanical seal
	C	Cylindrical cover for version with gland packing or double mechanical seal
21	Seal code	
	P	Version with gland packing
	B	Dead-end arrangement (for Etanorm SYT only)
	I	Internal circulation (conical cover only)
	E	External circulation
	F	External flushing
	D	Back-to-back arrangement
	T	Tandem arrangement with internal circulation
A	Conical cover without internal circulation	
22-23	Seal code	
	1A	P1 gland packing variant with internal barrier fluid (Na), material RT/P ⁶¹⁾ (for hot water of up to 120 °C)
	1B	P2 gland packing variant without barrier fluid (Nb), material RT/P (for hot water of up to 120 °C) ⁶²⁾
	1C	P3 gland packing variant with external barrier fluid (Nc), material RT/P (for hot water of up to 110 °C)
	1D	P4 gland packing variant with external flushing liquid (VSH), material RT/P (for hot water of up to 110 °C)
	3B	P2 gland packing variant without barrier fluid (Nb), material BUP901/B5 (for hot water of up to 140 °C)
4A	P1 gland packing variant with internal barrier fluid (Na), material BU5426 (for drinking water to ACS)	

⁶⁰⁾ Blank

⁶¹⁾ For region B style 3116 is used instead.

⁶²⁾ For region B style 3116 is used instead (for hot water of up to 140 °C).

Position	Code	Description
	4B	P2 gland packing variant without barrier fluid (Nb), material BU5426 (for drinking water to ACS)
	5A	P1 gland packing variant with internal barrier fluid (Na), material HE1727 (surface treatment technology)
	5B	P2 gland packing variant without barrier fluid (Nb), material HE1727 (surface treatment technology)
	01	1 (ZN1181) Q1Q1VGG
	06	RMG13G606 U3BEGG (shaft unit 25, 35)
	07	1A (ZN1181) Q1Q1EGG
	08	M32N69 (SYT) AQ1VGG
	09	MG13G60 U3U3VGG
	10	1 (ZN1181) Q1Q1X4GG
	11	1 (ZN1181) BQ1EGG-WA (WA = drinking water)
	12	M37GN83 Q12Q1M1GG
	13	1 (ZN1181) BQ1VGG
	14	KMB13S2G9 Q1Q1KY7G
	15	M7G49 Q1Q1K9GG/G
	16	MG1S20 BVPGG
	17	M7N Q1BVGG
	18	MG12G6-E1 Q1Q1EGG/G MG12G6-E1 Q1Q1EGG/G
	19	HN400N Q1Q1M1GG MG12G6-E1 Q1Q1EGG/G
	20	M37GN85 Q12Q1M1GG1 MG12G6-E1 Q1Q1EGG/G
	23	M37GN92 Q12Q1M1GG1 MG12G6-E1 Q1Q1EGG/G
	21	M7G49 Q1Q1K9GG/G M7G49 Q1Q1K9GG/G
	24	M7G49 Q1Q1K9GG/G M7N Q1BVGG
	22	M32N69 AQ1EGG (shaft unit 55)
	25	M32N67 (SYT) AQ1VGG M32N67 AQ1VGG
24	Bearing bracket	
	G	Grease lubrication
	O	Oil lubrication
	Y	Version for heat transfer fluid
25	Scope of supply	
	A	Pump only (Fig. 0)
	B	Pump, baseplate
	C	Pump, baseplate, coupling, coupling guard
	D	Pump, baseplate, coupling, coupling guard, motor
26	Shaft unit	
	2	Shaft unit 25, bearing bracket LS standard
	3	Shaft unit 35, bearing bracket LS standard
	4	Shaft unit 50, bearing bracket LR reinforced
	5	Shaft unit 55, bearing bracket LS standard
	6	Shaft unit 60, bearing bracket LR reinforced
27-30	Motor rating	
	1 3 2 0	132 kW
	0 0 7 5	7.5 kW
	0 0 0 7	0.75 kW
31	Number of poles	
	2	2 poles
	4	4 poles
	6	6 poles
	8	8 poles
32	Product generation	
	B	Product generation Etanorm 2013
33-35	PumpDrive	
	P2	PumpDrive 2nd generation
	P2E	PumpDrive 2nd generation, Eco

PumpMeter



General description

The PumpMeter device is an intelligent pressure transmitter for pumps, with on-site display of measured values and operating data.

The device comprises two pressure sensors and a display unit. It records the load profile of the pump in order to indicate any potential for optimising energy efficiency and availability.

PumpMeter is supplied completely assembled and parameterised for the pump it is used with. It is ready for operation as soon as the M12 plug connector is plugged in.

Main applications

Industry:

- Air-conditioning systems
- Cooling circuits
- Heating systems
- Water treatment
- Cooling lubricant distribution
- Water extraction
- Service water supply

Water:

- Water supply systems
- Water treatment/conditioning
- Water distribution/transport

Building services:

- Air-conditioning systems
- Heat generation/distribution
- Water supply systems

Technical data

Technical data of the display unit

Characteristic	Value
Power supply	+24 V DC \pm 15 %
Power input	150 mA
Analog signal output	4 - 20 mA, 3-wire
Digital connection	RS485, Modbus RTU (Slave)
Enclosure	IP65 ⁶³⁾
Service interface	RS232
Storage temperature	-30 °C to +80 °C
Operating temperature	-10 °C to +60 °C

Technical data of the sensors

Characteristic	Value
Signal	4 - 20 mA
Enclosure	IP67 ⁶³⁾
Fluid temperature	-30 °C to +140 °C
Installation torque	10 Nm
Ambient temperature	-10 °C to +60 °C

Sensor pressure limits

Sensor measuring range [bar]		Overpressure range [bar]	Burst pressure [bar]
min	max		
-1	3	40	60
-1	10	40	60
-1	16	40	60
-1	25	50	75
-1	40	80	120
-1	65	130	195
-1	80	160	240

Materials

Overview of materials

Wetted components	Material
Pressure sensor measuring unit	1.4542
Pressure sensor process connection	1.4301
Adapter for fitting a sensor ⁶⁴⁾	1.0037 or 1.4571
Gasket	Centellen

Product benefits

- Transparent pump operation
Local output of the relevant operating data, especially the operating point of the pump.
- Identifies energy saving potentials
by recording and analysing the load profile and displaying the energy efficiency icon (EFF), if applicable.
- Saves time and money
The sensors are fitted to the pump at the factory, unlike conventional instruments used in systems.
- Helps increase pump availability by recognising and avoiding operation outside of the intended operating range.

⁶³⁾ Provided that the connectors are connected correctly

⁶⁴⁾ Depending on the basic material variant of the pump

Functions

Pressure transmitter function

The discharge pressure or differential pressure of the pump are transmitted as a 4-20 mA signal. Connection via the RS485 serial interface with Modbus protocol is also possible.

Operating data display

The device alternately displays the suction pressure and discharge pressure as well as the differential pressure or head.

Recording and analysing of the load profile



The operating hours of the pump in the different modes of operation are recorded in a load profile and saved in a non-volatile memory (protected against power failure). The energy efficiency symbol is displayed when a potential for optimisation is recognised.

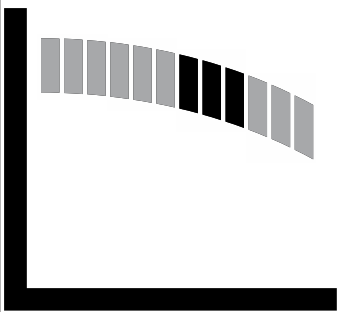
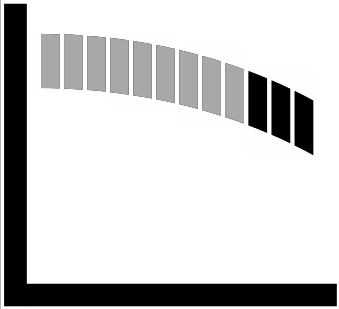
Qualitative indication of the pump's current operating point

The flashing segment indicates the position of the current operating point on the generalised characteristic curve.

Qualitative indication of the pump's current operating point

Operating range	Segment display	Description
Operation at extremely low flow ⁶⁵⁾ 	First quarter flashing (1)	<ul style="list-style-type: none"> Pump possibly not operated in accordance with its intended use Increased load on the components
Operation at moderately low flow ⁶⁵⁾ 	Second quarter flashing (2)	<ul style="list-style-type: none"> Operation with potential for optimising energy efficiency

⁶⁵⁾ For some pump characteristics, no differentiation is made between the low-flow operating conditions in the curve's first two quarters (both flashing simultaneously).

Operating range	Segment display	Description
Operation near the optimum 	Third quarter flashing (3)	<ul style="list-style-type: none"> Operation within intended operating range. Optimum energy efficiency
Operation in overload conditions 	Fourth quarter flashing (4)	<ul style="list-style-type: none"> Limit of the intended operating range Possibly overload of pump and/or motor

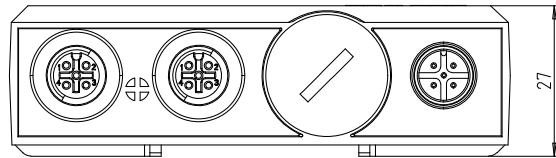
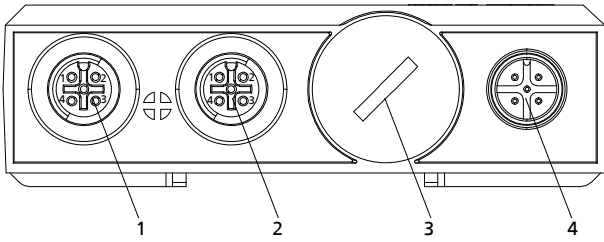
Design variants

- Adapter:**
 Depending on thread type and size of the pump's pressure gauge connections
- Cable length:**
 600 mm, 1200 mm or 1800 mm, depending on the pump size
- Measuring ranges of the pressure sensors:**
 The measuring ranges are selected as a function of the maximum pump inlet pressure specified (suction-side sensor) and the maximum pump discharge pressure at zero flow (discharge-side sensor). If no maximum inlet pressure is specified, calculation is based on a maximum inlet pressure of 5 bar.

Available measuring ranges

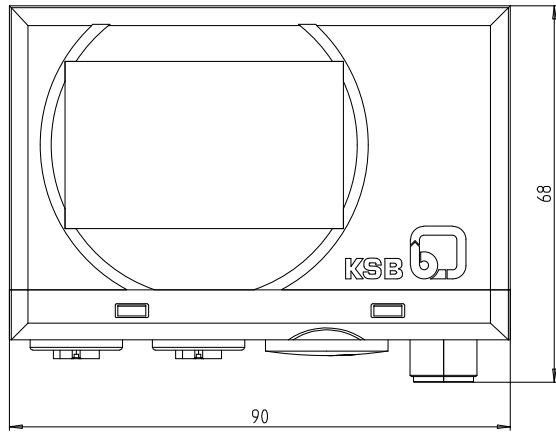
Label colour of sensor	Colour code	Measuring range [bar]	
		Minimum	Maximum
-	Red	-1	3
-	Blue	-1	10
-	Light grey	-1	16
-	Green	-1	25
-	Black	-1	40
Silver	None	-1	65
Yellow	None	-1	80

Electrical connections

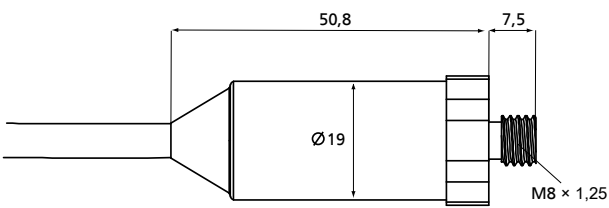


Connections at the device

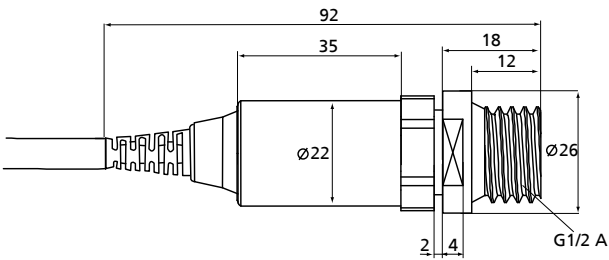
1	IN1 / port for the suction-side pressure sensor
2	IN2 / port for the discharge-side pressure sensor
3	Service interface
4	EXT / external port for energy supply and signal output



Dimensions



Dimensions of sensor, measuring range up to 40 bar



Dimensions of sensor, measuring range 65 bar and above

Dimensions of the display unit

motralec

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