NK, NKG

Installation and operating instructions

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GRUNDFOS

NK, NKG

Original installation and operating instructions

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1. General information

Read this document before you install the product. Installation and operation must comply with local regulations and accepted codes of good practice.

1.1 Hazard statements

The symbols and hazard statements below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious personal injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious personal injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate personal injury.

The hazard statements are structured in the following way:

SIGNAL WORD

Description of the hazard

Consequence of ignoring the warning

- Action to avoid the hazard.

1.2 Notes

The symbols and notes below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

Observe these instructions for explosion-proof products.

A blue or grey circle with a white graphical symbol indicates that an action must be taken.

A red or grey circle with a diagonal bar, possibly with a black graphical symbol, indicates that an action must not be taken or must be stopped.

If these instructions are not observed, it may result in malfunction or damage to the equipment.

Tips and advice that make the work easier.

2. Product introduction

2.1 Product description

NK, NKG are non-self-priming, single stage, centrifugal volute pumps with axial inlet port and radial outlet port.

NK pumps comply with EN 733.

NKG pumps comply with ISO 2858.

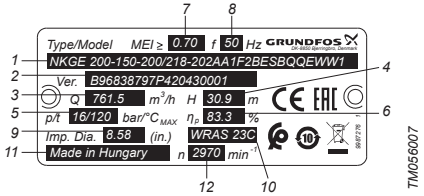
2.1.1 Pumped liquids

NK, NKG pumps are suitable for clean, thin, non-explosive liquids without solid particles or fibres. The pumped liquid must not attack the pump materials chemically.

2.2 Identification

2.2.1 Nameplate

Example of NK, NKG nameplate



Legend

Pos.	Description	
1	Type designation	
2	Identification code	
	B	Service model
	96838797	Product number
	P4	Production site code
	2015	Production year and week (YYWW)
	0001	Serial number
3	Nominal flow rate	
4	Nominal pump head	
5	Pressure rating and maximum temperature	
6	Hydraulic efficiency at best efficiency point	
7	Minimum efficiency index	
8	Frequency	
9	Actual impeller diameter	
10	Drinking water approval or Pump Energy Index (PEI) PEI_{CL}: constant load PEI_{VL}: variable load	
11	Country of origin	
12	Rated pump speed	

2.2.2 Type key

Example 1: NKGE 125-100-160/160-140BSA1F2AESBAQERW1
Example 2: NKGE 200-150-315.2/317ACA1F3AESDAQFYW4
Example 3: NKG 100-65-200/219SAZ1F2KESBQQEXX4
Example 4: NK 32-125/97AA1F1AESBQQEHX2
Example 5: NK 80-200/222VAXEF1BESBQQEWX2

Pos.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Example 1	NKGE	125	-100	-160	/160-140		B	S	A1	F	2	A	E	S	BAQE	R	W	1
Example 2	NKGE	200	-150	-315.2	/317		A	C	A1	F	3	A	E	S	DAQF	Y	W	4
Example 3	NKG	100	-65	-200	/219	S	A		Z1	F	2	K	E	S	BQQE	X	X	4
Example 4	NK		32	-125	/97		A		A1	F	1	A	E	S	BQQE	H	X	2
Example 5	NK		80	-200	/222	V	A		XE	F	1	B	E	S	BQQE	W	X	2

Pos.	Explanation
1	Type range
2	Nominal diameter of inlet port (DN)
3	Nominal diameter of outlet port (DN)
4	Nominal impeller diameter [mm]
5	Actual impeller diameter [mm]
6	**Impeller type** 'blank': Closed impeller, cylindrical trim. If one dimension is shown, the impeller has a cylindrical trim, for example 317 'blank': Closed impeller, conical trim. If two dimensions are shown, the impeller has a conical trim, for example 160-140 S: Semi-open impeller V: Super vortex impeller
7	**Hydraulic version** A: 1st version B: 2nd version C: 3rd version D: 4th version
8	**Sensor version** 'blank': Pump without sensor C: Without built-in sensor, one cable and one pressure sensor are supplied with the pump. S: Pump with built-in differential-pressure sensor, Series 2000

Pos.	Explanation
9	**Code for pump version; the codes may be combined** A1: Basic version, grease-lubricated standard bearing design, standard coupling A2: Basic version, grease-lubricated standard bearing design, spacer coupling B: Oversize motor (+E): With ATEX approval, certificate or test report, the second character of the pump version code is an E G1: Grease-lubricated heavy-duty bearing design, standard coupling G2: Grease-lubricated heavy-duty bearing design, spacer coupling H1: Oil-lubricated heavy-duty bearing design, standard coupling H2: Oil-lubricated heavy-duty bearing design, spacer coupling I1: Pump without motor, grease-lubricated standard bearing design, standard coupling I2: Pump without motor, grease-lubricated standard bearing design, spacer coupling J1: Pump without motor, grease-lubricated heavy-duty bearing design, standard coupling J2: Pump without motor, grease-lubricated heavy-duty bearing design, spacer coupling K1: Pump without motor, oil-lubricated heavy-duty bearing design, standard coupling K2: Pump without motor, oil-lubricated heavy-duty bearing design, spacer coupling Y1: Bare shaft pump, grease-lubricated standard bearing design W1: Bare shaft pump, grease-lubricated heavy-duty bearing design Z1: Bare shaft pump, oil-lubricated heavy-duty bearing design X: Special version; used in case of further customisation than already listed
10	**Pipe connection** E: Table E flange F: DIN flange G: ANSI flange J: JIS flange
11	**Flange pressure rating (PN - rated pressure)** 1: 10 bar 2: 16 bar 3: 25 bar 4: 40 bar 5: Other pressure rating

Pos.	Explanation				
	Code for materials				
	Code	**Pump housing**	**Impeller**	**Wear ring**	**Shaft**
	A	EN-GJL-250	EN-GJL-200	Bronze/brass	1.4021/1.4034
	B	EN-GJL-250	Bronze CuSn10	Bronze/brass	1.4021/1.4034
	C	EN-GJL-250	EN-GJL-200	Bronze/brass	1.4401
	D	EN-GJL-250	Bronze CuSn10	Bronze/brass	1.4401
	E	EN-GJL-250	EN-GJL-200	EN-GJL-250	1.4021/1.4034
	F	EN-GJL-250	Bronze CuSn10	EN-GJL-250	1.4021/1.4034
	G	EN-GJL-250	EN-GJL-200	EN-GJL-250	1.4401
	H	EN-GJL-250	Bronze CuSn10	EN-GJL-250	1.4401
	I	1.4408	1.4408	1.4517	1.4462
	J	1.4408	1.4408	Carbon-graphite-filled PTFE (Graflon®)	1.4462
12	K	1.4408	1.4408	1.4517	1.4401
	L	1.4517	1.4517	1.4517	1.4462
	M	1.4408	1.4517	1.4517	1.4401
	N	1.4408	1.4408	Carbon-graphite-filled PTFE (Graflon®)	1.4401
	P	1.4408	1.4517	Carbon-graphite-filled PTFE (Graflon®)	1.4401
	R	1.4517	1.4517	Carbon-graphite-filled PTFE (Graflon®)	1.4462
	S	EN-GJL-250	1.4408	Bronze/brass	1.4401
	T	EN-GJL-250	1.4517	Bronze/brass	1.4462
	U	1.4408	1.4517	1.4517	1.4462
	W	1.4408	1.4517	Carbon-graphite-filled PTFE (Graflon®)	1.4462
	Z	1.4469	1.4469	1.4410	1.4410
	X	Special version			

Pos.	Explanation
13	**Rubber parts in pump** E: EE F: FF G: FE H: KE I: KM J: KV K: KK M: MN N: ME O: OO V: VV • The first letter indicates material of elastomer between pump housing and cover, and elastomer between cover and split cover. • The second letter indicates material of elastomer between split cover and seal housing. See the material description in the table below.

Code	Material description
E	EPDM
F	FXM (Fluoraz®)
K	FFKM (Kalrez®)
M	FEPS (PTFE-sheathed silicone O-ring)
O	HNBR
V	FKM (Viton®)

14	**Shaft seal arrangement** B: Stuffing box C: Cartridge seal, single D: Cartridge seal, double O: Back-to-back, double seal P: Tandem, double seal S: Single seal
15	**Shaft seal(s) in pump** Letter or digit code for mechanical shaft seal and shaft seal rubber parts • 4 letters: Single mechanical shaft seal, such as BQQE, or single cartridge seal, such as HBQV • 4 digits: - double seal solution; example 2716, where 27 is DQQV, primary seal, and 16 is BQQV, secondary seal; - double cartridge seal; example 5150, where 51 is HQQU, primary seal, and 50 is HBQV, secondary seal The relation between letters and digits of the shaft seals is described in Codes for shaft seals.
16	Code for rated motor power [kW]. See Codes for rated motor power.
17	Code for phase and voltage [V] or other information. See Codes for phase and voltage or other information.
18	Code for speed variant [rpm]. See Codes for speed variant.

Example 1: NKGE 125-100-160/160-140BSA1F2AESBAQERW1 shows an NKGE 125-100-160 pump with these characteristics:

- 160-140 mm closed impeller, conical trim
- hydraulic version B
- with built-in differential-pressure sensor
- grease-lubricated standard bearing design
- standard coupling
- DIN flange to EN 1092-2 pipe connection
- 16 bar flange pressure rating
- cast iron pump housing, EN-GJL-250
- cast iron impeller, EN-GJL-200
- bronze/brass wear ring
- stainless steel shaft, EN 1.4021/1.4034
- EPDM O-rings for pump cover and seal cover
- EPDM O-ring for pump cover
- single shaft seal arrangement
- BAQE shaft seal
- 30 kW motor, not for sale in North America, 2-pole, 50 Hz.

Example 2: NKGE 200-150-315.2/317ACA1F3AESDAQFYW4 shows an NKG 200-150-315.2 pump with these characteristics:

- 317 mm closed impeller, cylindrical trim
- hydraulic version A
- without built-in sensor, one cable and one pressure sensor are supplied with the pump.
- grease-lubricated standard bearing design
- standard coupling
- DIN flange to EN 1092-2 pipe connection
- 25 bar flange pressure rating
- cast iron pump housing, EN-GJL-250
- cast iron impeller, EN-GJL-200
- bronze/brass wear ring
- stainless steel shaft, EN 1.4021/1.4034
- EPDM O-rings for pump cover and seal cover
- EPDM O-ring for seal housing
- single shaft seal arrangement
- DAQF shaft seal
- motor size outside DOE scope, not for sale in North America, 4-pole, 60 Hz..

Example 3: NKG 100-65-200/219SAZ1F2KESBQQEXX4 shows an NKG 100-65-200 pump with these characteristics:

- 219 mm semi-open impeller
- hydraulic version A
- bare shaft pump, oil-lubricated heavy-duty bearing design
- DIN flange to EN 1092-2 pipe connection
- 16 bar flange pressure rating
- stainless steel pump housing, EN 1.4408
- stainless steel impeller, EN 1.4408
- stainless steel wear ring, EN 1.4517
- stainless steel shaft, EN 1.4401
- EPDM O-rings for pump cover and seal cover
- EPDM O-ring for seal housing
- single shaft seal arrangement
- BQQE shaft seal
- bare shaft pump without motor, for 4-pole operation, 60 Hz,.

Example 4: NK 32-125/97AA1F1AESBQQEHX2 shows an NK 32-125 pump with these characteristics:

- 97 mm closed impeller, cylindrical trim
- hydraulic version A
- grease-lubricated standard bearing design
- standard coupling
- DIN flange to EN 1092-2 pipe connection
- 10 bar flange pressure rating
- cast iron pump housing, EN-GJL-250
- cast iron impeller, EN-GJL-200
- bronze/brass wear ring
- stainless steel shaft, EN 1.4021/1.4034
- EPDM O-rings for pump cover and seal cover
- EPDM O-ring for seal housing
- single shaft seal arrangement
- BQQE shaft seal
- 1.5 kW motor, US DOE regulated motor, 2-pole, 60 Hz.

Example 5: NK 80-200/222VAXEF1BESBQQEWX2 shows an NK 80-200 pump with these characteristics:

- 222 mm super vortex impeller
- hydraulic version A
- PWIS-free certificate included
- DIN flange to EN 1092-2 pipe connection
- 10 bar flange pressure rating
- cast iron pump housing, EN-GJL-250
- bronze CuSn10 impeller
- bronze/brass wear ring
- stainless steel shaft, EN 1.4021/1.4034
- EPDM O-rings for pump cover and seal cover
- EPDM O-ring for seal housing
- single shaft seal arrangement
- BQQE shaft seal
- 90 kW motor, US DOE regulated motor, 2-pole, 60 Hz..

Codes for shaft seals

The digits are only used for double shaft seal solutions.

Digits	Letters	Description
10	BAQE	Single mechanical shaft seal
11	BAQV	Single mechanical shaft seal
12	BBQE	Single mechanical shaft seal
13	BBQV	Single mechanical shaft seal
15	BQQE	Single mechanical shaft seal
16	BQQV	Single mechanical shaft seal
19	AQAE	Single mechanical shaft seal
20	AQAV	Single mechanical shaft seal
21	AQQE	Single mechanical shaft seal
22	AQQV	Single mechanical shaft seal
23	AQQX	Single mechanical shaft seal
24	AQQK	Single mechanical shaft seal
25	DAQF	Single mechanical shaft seal
26	DQQE	Single mechanical shaft seal
27	DQQV	Single mechanical shaft seal
28	DQQX	Single mechanical shaft seal
29	DQQK	Single mechanical shaft seal
50	HBQV	Cartridge seal
51	HQQU	Cartridge seal
52	HAQK	Cartridge seal
	SNEA	Stuffing box
	SNEB	Stuffing box
	SNEC	Stuffing box
	SNED	Stuffing box
	SNOA	Stuffing box
	SNOB	Stuffing box
	SNOC	Stuffing box
	SNOD	Stuffing box
	SNFA	Stuffing box
	SNFB	Stuffing box
	SNFC	Stuffing box
	SNFD	Stuffing box

Letter codes for shaft seals

Code example	Description	Code explanation
B	Shaft seal type	A: O-ring seal with fixed driver B: Rubber bellows seal D: O-ring seal, balanced H: Cartridge seal, balanced
Q	Material of rotating seal face	A: Carbon, metal-impregnated with antimony which is not approved for potable water B: Carbon, resin-impregnated Q: Silicon carbide
Q	Material of stationary seal	A: Carbon, metal-impregnated with antimony which is not approved for potable water Q: Silicon carbide
E	Material of secondary seal and other rubber and composite parts, except the wear ring	E: EPDM V: FKM (Viton®) F: FXM (Fluoraz®) K: FFKM (Kalrez®) X: HNBR U: Dynamic O-rings in FFKM and static O-rings in PTFE

For a thorough description of shaft seal types and materials, see the data booklet "NB, NBG, NK, NKG, NBE, NBGE, NKE, NKGE - Custom-built pumps according to EN 733 and ISO 2858".

Letter codes for stuffing boxes

Example: SNEA

Code	Description	Explanation
S	Stuffing box type	S: Packing type stuffing box
N	Cooling method	N: Uncooled stuffing box
E	Barrier liquid	E: With internal barrier liquid F: With external barrier liquid O: Without barrier liquid
A	Material	A: PTFE-impregnated fibre packing rings (Buraflon®) and EPDM O-rings in the pump housing B: Graphite-PTFE compound packing rings (Thermoflon®) and EPDM O-ring in the pump housing C: PTFE-impregnated fibre packing rings (Buraflon®) and FKM O-ring in the pump housing D: Graphite-PTFE compound packing rings (Thermoflon®) and FKM O-ring in the pump housing

For a thorough description of stuffing boxes and materials, see the data booklet "NB, NBG, NK, NKG, NBE, NBGE, NKE, NKGE - Custom-built pumps according to EN 733 and ISO 2858".

Codes for rated motor power

Pos. 16 in NK, NKG type key example.

Code	Description	
	[hp]	[kW]
A	0.16	0.12
B	0.25	0.18
C	0.33	0.25
D	0.5	0.37
E	0.75	0.55
F	1	0.75
G	1.5	1.1
H	2	1.5
I	3	2.2
J	4	3
K	5 (5.5[1])	3.7 (4[1])
L	7.5	5.5
M	10	7.5
N	15	11
O	20	15
P	25	18.5
Q	30	22
R	40	30
S	50	37
T	60	45
U	75	55
V	100	75
W	125	90
X	Bare shaft pump	
Y	> 200[2]	> 150[2]
1	150	110
2	175	132
3	200	150
4	215[3]	160[3]
5	250[3]	185[3]

[1] Value in bracket is for the standard IEC motor size. Value outside bracket is for the motor size according to NEMA standards.

[2] Used for pumps where the pump shaft input power exceeds 200 hp (150 kW) and is not regulated under the DOE pump rule.

[3] Special cases with power sizes above 200 hp (150 kW) which are still regulated under the DOE pump rule. For example: Pump has a P2 value of 198 hp (147.6 kW) in its duty point (in DOE scope) but customer wants the 215 hp (160 kW) motor instead of the 200 hp (150 kW). The pump is in scope of the DOE regulation and requires a PEI value and a motor code.

Codes for phase and voltage or other information

Pos. 17 in NK, NKG type key example.

Code	Description
A	E-motor (ECM[1]), 1 x 200-240 V
B	E-motor (ECM[1]), 3 x 200-240 V
C	E-motor (ECM[1]), 3 x 440-480 V
D	E-motor (ECM[1]), 3 x 380-500 V
V	Intended for use with external VFD only, asynchronous motor
W	Not for sale in North America
X	No motor or US DOE regulated motor (CC marked motor)
Y	Out of DOE scope
Z	E-motor, asynchronous motor

[1]ECM: Electronically Commutated Motor.

Codes for speed variant

Pos. 18 in NK, NKG type key example.

Code	Description
A	1450-2200 RPM, E-motor (ECM[1])
B	2900-4000 RPM, E-motor (ECM[1])
C	4000-5900 RPM, E-motor (ECM[1])
1	2-pole, 50 Hz (Asynchronous motor)
2	2-pole, 60 Hz (Asynchronous motor)
3	4-pole, 50 Hz (Asynchronous motor)
4	4-pole, 60 Hz (Asynchronous motor)
5	6-pole, 50 Hz (Asynchronous motor)
6	6-pole, 60 Hz (Asynchronous motor)
7	8-pole, 50 Hz (Asynchronous motor)
8	8-pole, 60 Hz (Asynchronous motor)

[1]ECM: Electronically Commutated Motor.

3. Receiving the product

3.1 Delivery

The pumps are tested 100 % before leaving the factory. The test includes a function test where the pump performance is measured to ensure that the pump meets the requirements of relevant standards. Test certificates are available from Grundfos. After the installation, the alignment of pump and motor must be checked again. See section Alignment of pump and motor.

3.2 Transporting the product

WARNING
Overhead load
Death or serious personal injury

- Pay attention to the pump weight, and take precautions to prevent personal injury if the pump topples or falls by accident.

- Always transport the pump in the specified position.
- Securely fasten the pump to prevent damage to the shaft and shaft seal caused by excessive vibrations and knocks.
- Do not lift the pump by the shaft.

3.3 Inspecting the product

- Confirm that the product received is in accordance with the order.
- Confirm that the voltage, phase and frequency of the product match the voltage, phase and frequency of the installation site. See Identification.
- Check the product for defects or damages immediately upon receipt. Any accessory ordered will be packed in a separate container and shipped with the product.
- If any equipment is damaged in transit, report it immediately to the carrier's agent. Make complete notations on the freight bill.

3.4 Storage after delivery

The contractor must inspect the equipment on delivery and make sure it is stored so as to avoid corrosion or damage. See Storing the product.

4. Installing the product

4.1 Location

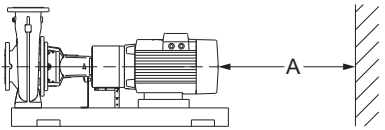
CAUTION
Hot or cold surface
Minor or moderate personal injury

- When pumping hot or cold liquids, make sure that persons cannot accidentally come into contact with hot or cold surfaces.

The pump must be sited in a well-ventilated, but frost-free location.

For inspection and repair, allow suitable clearances for pump or motor removal.

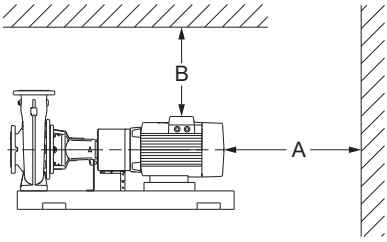
- Pumps fitted with motors up to and including 4 kW require a 0.3 m clearance behind the motor.



Clearance behind the motor

Motor	Minimum clearance, A
0.25 - 4 kW	0.3 m

- Pumps fitted with motors of 5.5 kW and up require a 0.3 m clearance behind the motor and at least a 1 m clearance above the motor to allow the use of lifting equipment.



Clearance behind and above the motor

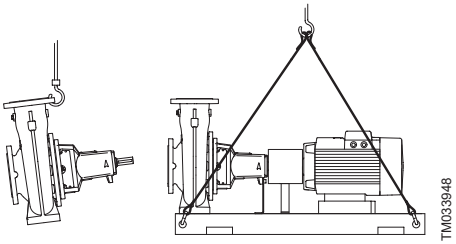
Motor	Minimum clearance	
	A	B
5.5 kW and up	0.3 m	1 m

5. Mechanical installation

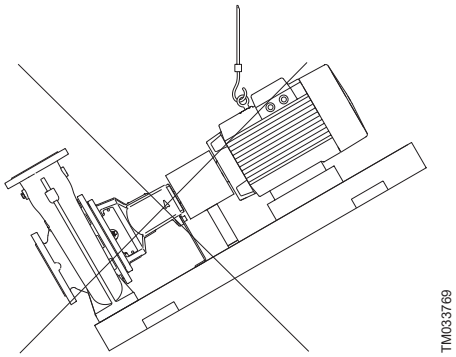
5.1 Lifting the product

Motors from 4 kW and up are supplied with lifting eyes which must not be used for lifting the entire pump unit.

- Lift the pumps by means of nylon straps and shackles.



Correct lifting of pump

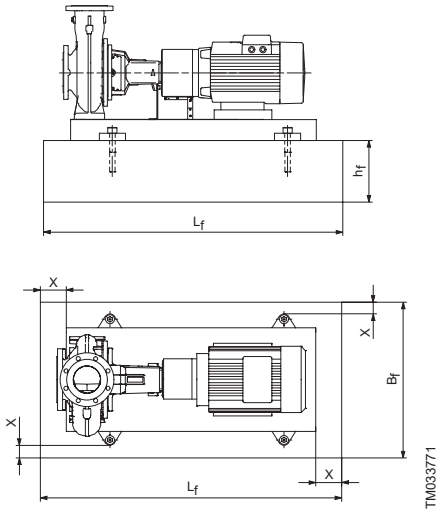


Incorrect lifting of pump

5.2 Foundation of horizontally mounted NK, NKG pumps

We recommend that you install the pump on a plane and rigid concrete foundation which is heavy enough to provide permanent support for the entire pump. The foundation must be capable of absorbing any vibration, normal strain or shock. As a rule of thumb, the weight of the concrete foundation should at least be 1.5 times the weight of the pump.

The foundation must be 100 mm larger than the base frame on all four sides.



Foundation, X equal to minimum 100 mm

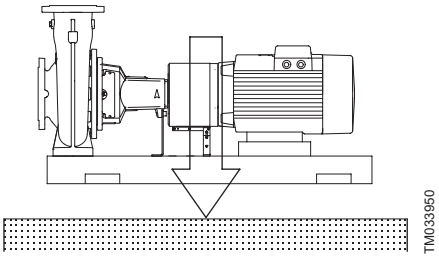
The minimum height of the foundation, h_f, can then be calculated:

$$h_f = \frac{m_{pump} \times 1.5}{L_f \times B_f \times \delta_{concrete}}$$

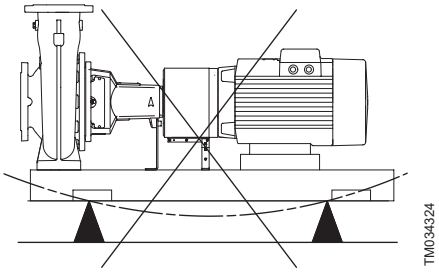
h_f	Height of the foundation [m]
L_f	Length of the foundation [m]
B_f	Width of the foundation [m]
m_{pump}	Mass of the pump [kg]
$\delta_{concrete}$	Density of the concrete [kg/m^3]

The density, δ, of concrete is usually taken as 2,200 kg/m^3.

Place the pump on the foundation, and fasten it. The base frame must be supported under its entire area.



Correct foundation



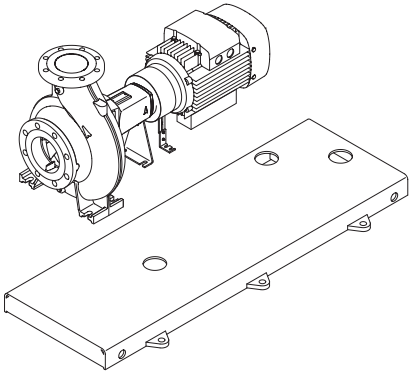
Incorrect foundation

5.2.1 Grouting of horizontally mounted NK, NKG pumps

For NK, NKG pumps with 2-pole motors equal to or bigger than 55 kW, grouting of the base frame is mandatory in order to prevent vibration energy from the rotating motor and liquid flow to evolve.

Grouting requirements apply to both EN/ISO and C-channel base frames.

	P2 lower than or equal to 45 kW	P2 equal to or higher than 55 kW
2-pole	Grouting optional	Grouting mandatory
4-pole	Grouting optional	
6-pole	Grouting optional	



TM034587

EN/ISO base frame with pouring holes

5.2.2 Preparing the foundation

We recommend the following procedures to ensure a good foundation:

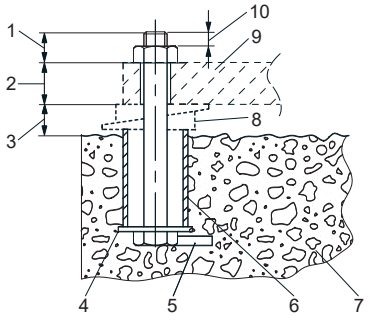
1. Pour the foundation without interruption to 19 to 32 mm of the final level.

   Use an approved, non-shrinking concrete. Contact your concrete supplier for advice if any doubts.

2. Use vibrators to ensure that the concrete is evenly distributed. The top surface must be well scored and grooved before the concrete sets. This provides a bonding surface for the grout.

3. Embed anchor bolts in the concrete.

   Allow enough bolt length to reach through grout, shims, the lower part of the support rail, nuts and washers.



TM075514

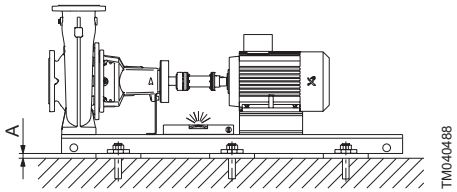
Pos.	Description
1	Bolt length above the support rail
2	Thickness of the support rail
3	19-32 mm allowance for grout
4	Washer
5	Lug
6	Pipe sleeve
7	Foundation with rough top
8	Wedges and shims left in place
9	Support rail
10	5-10 mm

4. Let the foundation cure for several days before levelling and grouting the support rail.

5.2.3 Levelling the base frame

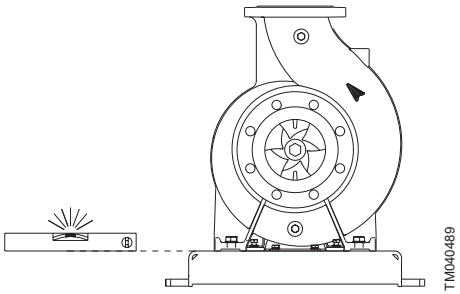
Follow the steps below to level the base frame:

1. Lift or jack up the base frame to the final level 19-32 mm above the concrete foundation, and support the base frame by means of blocks and shims both at the anchor bolts and midway between bolts.



A: 19-32 mm

2. Level the base frame by adding or removing shims under the base frame.



3. Tighten the anchor bolt nuts against the base frame.
4. Make sure the piping can be aligned to the pump flanges without putting strain on pipes or flanges.

5.2.4 Preliminary alignment

DANGER
Electric shock
Death or serious personal injury

- Before starting work on the pump, make sure that the power supply has been switched off and cannot be accidentally switched on again.

The pump and motor are pre-aligned on the base frame from the factory. Some deformation of the base frame may occur during transport and it is therefore essential to check the alignment at the installation site before the final grouting.

A flexible coupling will only compensate for minor misalignments and must not be used to compensate for excessive misalignment of the pump and motor shafts. Inaccurate alignment results in vibration and excessive wear on the bearings, shaft or wear rings.

Carry out alignment of the motor by placing shims of different thickness under the motor. If possible, replace several thin shims with one thick shim.

Carry out alignment of the motor only, as pipe strain will occur if the pump is shifted.

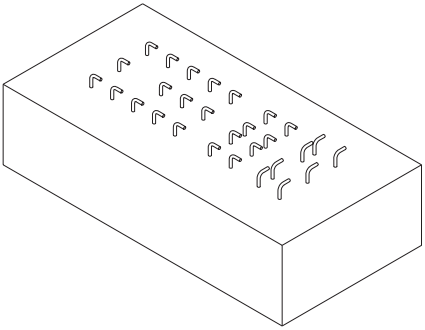
5.2.5 Grouting

If you have questions or doubts about the grouting, please contact an expert on grouting.

Grouting compensates for an uneven foundation, distributes the weight of the unit, dampens vibrations and prevents shifting. Follow the steps below to do the grouting:

1. Use an approved, non-shrinking grout.
2. Embed reinforcing steel bars into the foundation by means of 2K anchor adhesive glue.

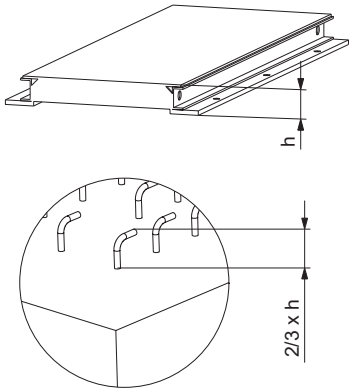
3. The number of steel bars depends on the size of the base frame, but we recommend that you distribute a minimum of 20 bars evenly over the whole area of the base frame.



TM040491

Example of foundation with minimum 20 bars

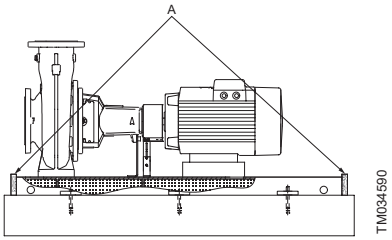
4. The free end of the steel bar must be 2/3 the height of the base frame to ensure a proper grouting.



TM040490

5. Soak top of concrete foundation thoroughly, then remove surface water.

6. Ensure proper shuttering at both ends of the base frame.



TM034590

A: shuttering

7. If necessary, check the levelling of the base frame again before grouting.

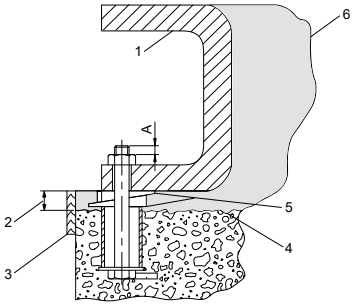
8. Pour non-shrinking grout through the openings of the base frame until the space underneath the base frame has been filled completely.

9. Fill the formwork with grout up to the base frame top level.

10. Allow the grout to dry thoroughly before attaching piping to the pump. 24 hours is sufficient time with approved grouting procedure.

11. When the grout has thoroughly hardened, check the anchor bolt nuts, and tighten, if necessary.

12. Approximately two weeks after pouring the grout, or when the grout has thoroughly dried, apply an oil-based paint to the exposed edges of the grout to prevent the grout from getting into contact with air and moisture.



TM032946

Pos.	Description
1	Base frame
2	19-32 mm (0.75 - 1.25 in) grout
3	Formwork
4	Foundation with rough top
5	Levelling wedges and shims left in place
6	Grout
A	5-10 mm (0.2 - 0.4 in.)

After installation is finished, tighten the screws connecting the flange, feet and the anchor bolts according to the tightening torques. You must apply an anti-loose method, such as mounting lock washers.

5.3 Alignment of pump and motor

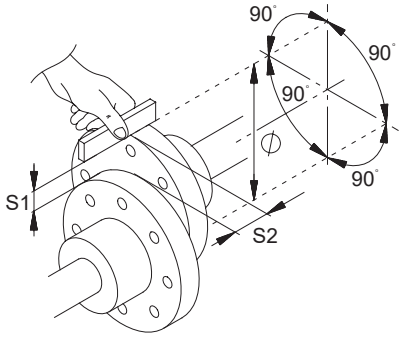
When a complete unit is supplied assembled from the factory, the coupling halves have been accurately aligned by means of foil inserted under the pump and motor mounting surfaces as required.

As the pump/motor alignment may be affected during transport and installation, it must always be checked again before starting the pump.

It is important to check the final alignment when the pump has obtained its operating temperature under normal operating conditions.

It is very important that the pump/motor alignment is carried out correctly. Follow the procedure below.

The values for ∅ and S2 can be found in the following table. The value for S1 is 0.2 mm.



TM018753

Alignment

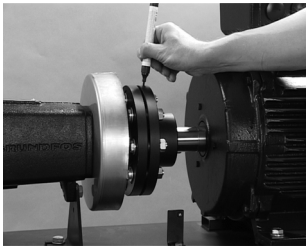
5.3.1 Aligning the pump and motor with a straightedge ruler

1. Make a rough alignment of pump and motor, and tighten the screws in the base frame to the correct torque.

TM038340

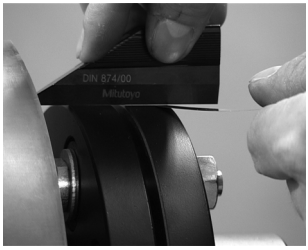
See the table Tightening torquesTightening torques for hexagon head screws..

2. Make a mark on the coupling, for instance with a marker pen.



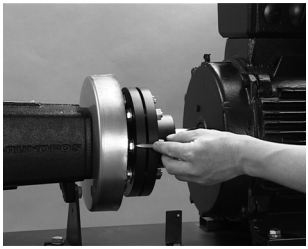
TM038301

3. Hold a straightedge ruler against the coupling, and determine the inaccuracy, if any, with a feeler gauge.



TM038300

4. Turn the coupling 90 °, and repeat the measurement with straightedge and feeler gauge.



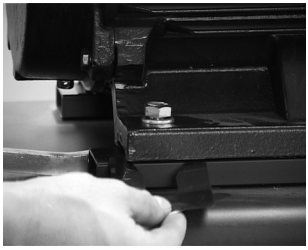
TM038302

   - If the measured values are less than 0.2 mm, the alignment is complete. Go to step 8.

5. Adjust the position of the motor. Loosen the screws that hold the motor in place.

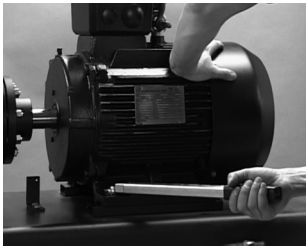
TM038321

6. Insert shims with the required thickness.



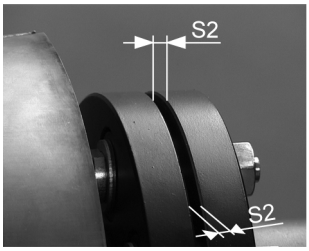
TM038322

7. Tighten the screws to the correct torque. Go to step 3, and check the alignment once more.



TM038324

8. Check the gap S2 both vertically and horizontally.



TM038325

- If the air-gap width is within the tolerances, the alignment is complete.
- If not, go to step 6.

See the table Air-gap width S2Air-gap width for couplings..

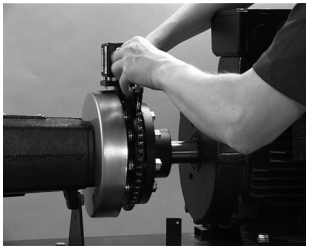
5.3.2 Aligning the pump and motor with laser equipment

1. Make a rough alignment of pump and motor, and tighten the screws in the base frame to the correct torque.

TM038340

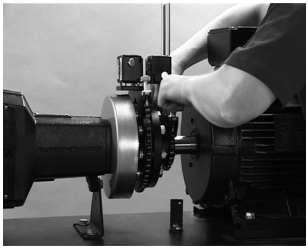
See the table Tightening torquesTightening torques for hexagon head screws..

2. Fasten one laser bracket to the pump coupling.



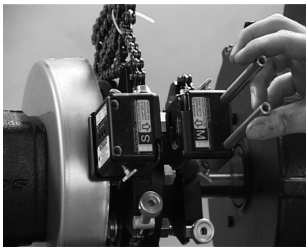
TM038303

3. Fasten the other laser bracket to the motor coupling.



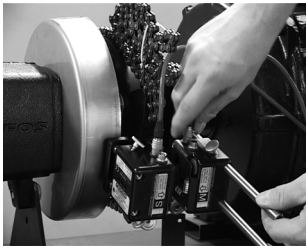
TM038304

4. Place laser unit S, stationary, on the stationary part and laser unit M, movable, on the movable part.



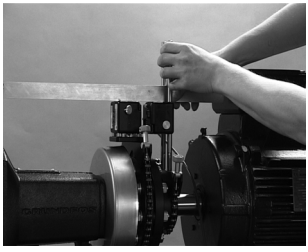
TM038305

5. Interconnect the laser units, and connect one laser unit to the control box.



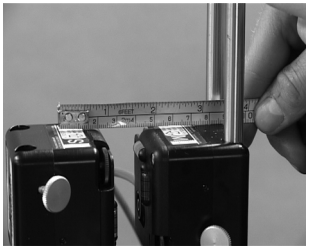
TM038306

6. Make sure that the laser units are at the same height.



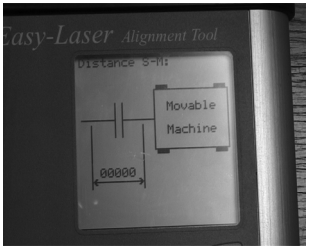
TM038307

7. Measure the distance between the white lines on the laser units.



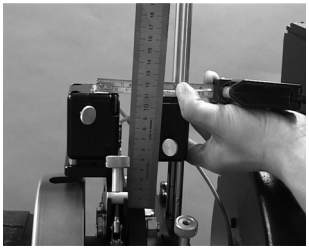
TM038309

8. Enter the distance.



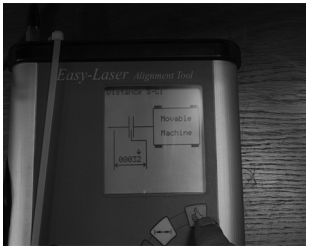
TM038308

9. Measure the distance between the S unit and the centre of the gap between the couplings.



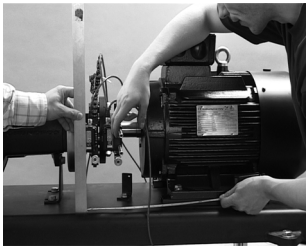
TM038310

10. Enter the distance.



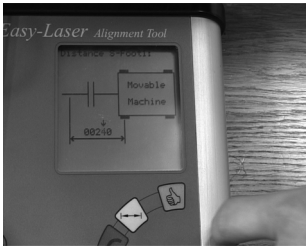
TM038311

11. Measure the distance from the S unit to the first screw on the motor.



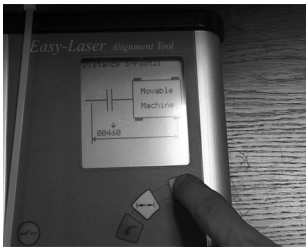
TM038312

12. Enter the distance.



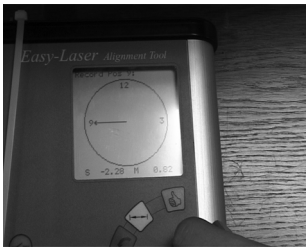
TM038313

13. Measure the distance from the S unit to the rear screw on the motor.



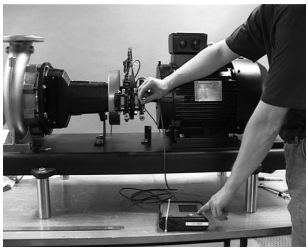
TM038314

14. The control box shows that the laser units must be turned to position 9 o'clock.



TM038315

15. Turn the laser units to position 9 o'clock.

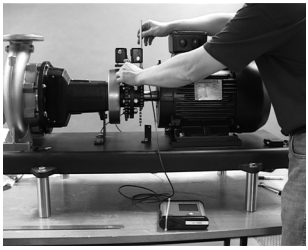


TM038316

16. Confirm on the control box.

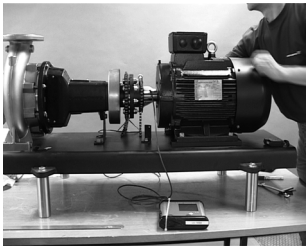
TM038319

17. Turn the laser units to position 12 o'clock. Confirm on the control box.



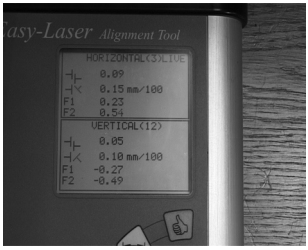
TM038317

18. Turn the laser units to position 3 o'clock. Confirm on the control box.



TM038318

19. If the measured values are less than 0.1 mm, the alignment is complete. Go to step 24.

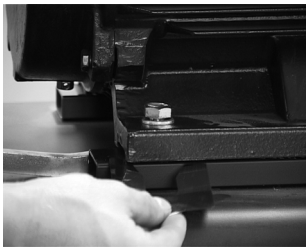


TM038320

20. Adjust the position of the motor. Loosen the screws that hold the motor in place.

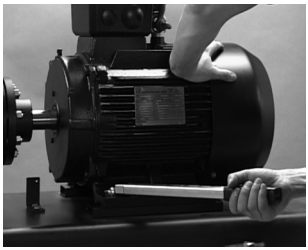
TM038321

21. Insert shims with the required thickness.



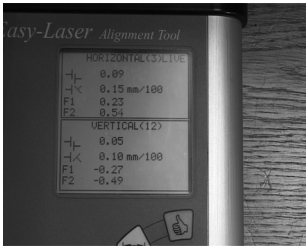
TM038322

22. Tighten the screws to the correct torque again.



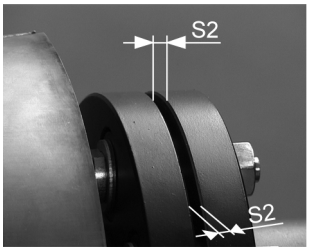
TM038324

23. Repeat the alignment until the values are within the tolerances. Go to step 14.



TM038320

24. Check the gap S2.



TM038325

See the table Air-gap width S2Air-gap width for couplings..

5.3.3 Tightening torques

Description	Dimensions	Tightening torque [Nm]
Hexagon head screw	M6	10 ± 2
	M8	12 ± 2.4
	M10	23 ± 4.6
	M12	40 ± 8
	M16	80 ± 16
	M20	120 ± 24
	M24	120 ± 24

5.3.4 Air-gap width S2

Measure S2 all the way around the coupling. The maximum permissible deviation between the largest and the smallest measurement is 0.2 mm.

After the installation is finished, tighten the screws connecting the flange, feet and the anchor bolts according to the tightening torques. Anti-loose method should be applied.

Outside coupling diameter [mm]	Air-gap width S2 [mm]			
	Standard coupling		Spacer coupling	
	Nominal	Tolerance	Nominal	Tolerance
80	-	-	4	0/-1
95			4	
110			4	
125	4	0/-1	4	
140			4	
160			4	
200			6	
225			6	
250			8	

If the coupling and motor are not supplied by Grundfos, make sure to follow the coupling manufacturer's instructions.

WARNING
Crushing hazard
Death or serious personal injury

- To protect persons from rotating machine parts, always install all guards after the installation is complete and before starting the pump.

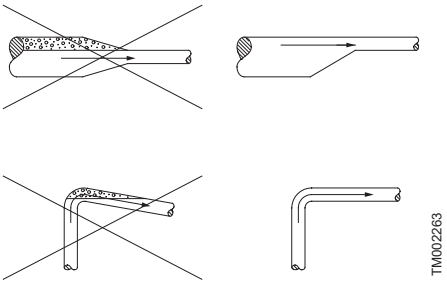
5.4 Pipes

5.4.1 Pipe installaiton

When installing the pipes, the pump housing must not be stressed by the pipes.

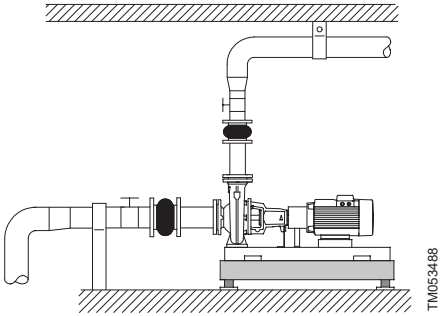
The inlet and outlet pipes must be of an adequate size, taking the pump inlet pressure into account.

The pipes must be installed in a way that air pockets are avoided, especially on the inlet side of the pump.



Pipelines

The isolating valves must be fitted on either side of the pump to avoid having to drain the system if the pump needs to be cleaned or repaired. The pipes must be adequately supported as close to the pump as possible, both on the inlet and the outlet side. The counterflanges must lie true against the pump flanges without being stressed as stress would cause damage to the pump.



Pump installation

5.4.2 Bypass

DANGER
Explosion hazard
Death or serious personal injury

- The pump is not allowed to run against a closed valve except during startup. Operating against a closed valve at an extended period of time will cause an increase in temperature and the formation of steam and may result in damages to or explosion of the pump housing. The valve must be kept open during operation.

If there is any danger of the pump running against a closed valve, ensure a minimum liquid flow through the pump by connecting a bypass or drain to the outlet pipe. The minimum flow rate must be at least 10 % of the maximum flow rate. The flow rate and head are stated on the pump nameplate.

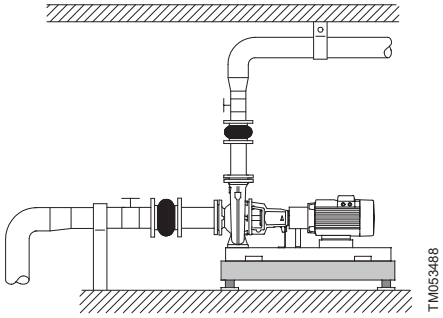
5.5 Vibration damping

5.5.1 Elimination of noise and vibrations

In order to achieve optimum operation and minimum noise and vibration, consider vibration damping of the pump. Generally, always consider this for pumps with motors of 11 kW and up. Vibration damping is mandatory for motors of 90 kW and up. Smaller motor sizes, however, may also cause undesirable noise and vibration.

Noise and vibration are generated by the revolutions of the motor and pump and by the flow in pipes and fittings. The effect on the environment is subjective and depends on correct installation and the state of the rest of the system.

Elimination of noise and vibrations is best achieved by means of a concrete foundation, vibration dampers and expansion joints. See the figure below.



5.5.2 Vibration dampers

To prevent the transmission of vibrations to buildings, we recommend that you isolate the pump foundation from building parts by means of vibration dampers. This decision must be made by the customer or designer or consultant of the installation.

The selection of the right vibration damper requires the following data:

- forces transmitted through the damper
- motor speed, taking speed control, if any, into consideration
- required damping in % - suggested value is 70 %.

The selection of vibration damper will differ from installation to installation. In certain cases, a wrong damper may increase the vibration level. Vibration dampers must therefore be sized by the supplier of the vibration dampers.

If you install the pump on a foundation with vibration dampers, always fit expansion joints on the pump flanges. This is important to prevent the pump from "hanging" in the flanges.

5.6 Expansion joints

Expansion joints provide these advantages:

- absorption of thermal expansion and contraction of pipes caused by variations in liquid temperature
- reduction of mechanical influences in connection with pressure surges in the pipes
- isolation of structure-borne noise in the pipes, applying only to rubber bellows expansion joints.

! Do not install expansion joints to make up for inaccuracies in the pipes, such as centre displacement or misalignment of flanges.

The expansion joints must be fitted at a minimum distance of 1 to 1.5 times of the pipe diameters away from the pump on the inlet and the outlet side. This will prevent turbulence in the expansion joints, thus ensuring optimum inlet conditions and minimum pressure loss on the outlet side. At flow velocities greater than 5 m/s, we recommend that you fit larger expansion joints matching the pipes.

The figures below show examples of rubber bellows expansion joints with or without limiting rods.

TM024979

Rubber bellows expansion joint with limiting rods

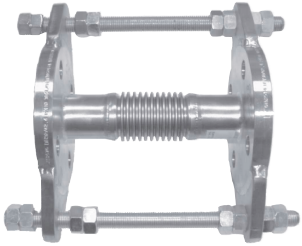
TM024981

Rubber bellows expansion joint without limiting rods

We always recommend that you use expansion joints with limiting rods for flanges larger than DN 100 in order to reduce the effects of the expansion or contraction forces on the pipes.
Follow the supplier's instructions and pass them on to advisers or pipe installers.

You must anchor the pipes in such a way that they do not stress the expansion joints and the pump.

The figure below shows an example of a metal bellows expansion joint with limiting rods.



TM024980

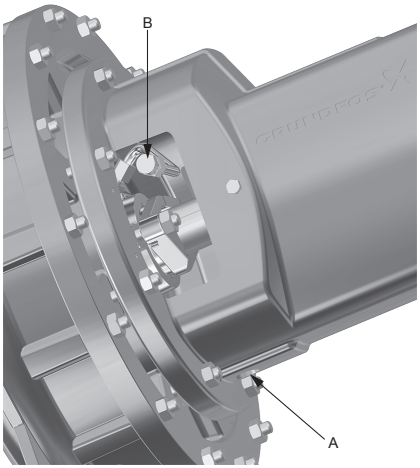
Metal bellows expansion joint with limiting rods

Due to the risk of rupture of the rubber bellows, we recommend that you use metal bellows expansion joints at temperatures above 100 °C combined with high pressure.

5.7 Stuffing box piping

Pumps with stuffing box will always have a continuous leakage during normal operation. We recommend to connect a drainage pipe to the drain hole (A) of the bearing bracket, G1/2, to collect the leaking liquid.

For pumps with stuffing box, type SNF, and external barrier liquid, connect the external flush pipe to the pipe (B) with an outer diameter of 8 mm before starting the pump.



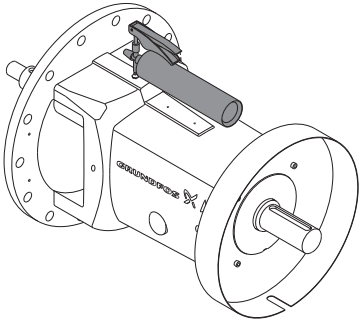
TM063413

Pipe connections for stuffing box operation

5.8 Bearing bracket

5.8.1 Lubricating bearing bracket with grease

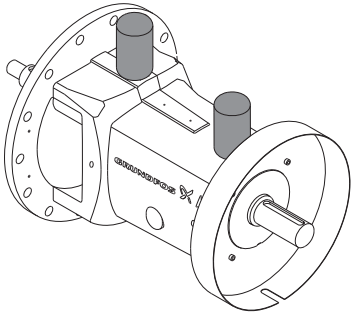
- For bearing bracket with grease nipples, relubricate the bearings using a grease gun.



TM061826

For recommended re-lubricating intervals, see section Grease-lubricated bearings.

- For bearing bracket with automatic grease lubricators, the lubricators are supplied separately.
  1. Remove the grease nipples.
  2. Fit the grease lubricators on top of the bearing bracket.
  3. Set the grease lubricators to empty within 12 months according to the instructions supplied with the lubricators.

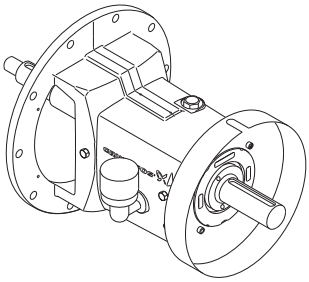


TM045173

5.8.2 Bearing bracket with constant-level oiler

There is no oil in bearing bracket when it is delivered.

Fit the constant-level oiler on the bearing bracket before filling oil into the bearing bracket. See instructions on the label on the reservoir.

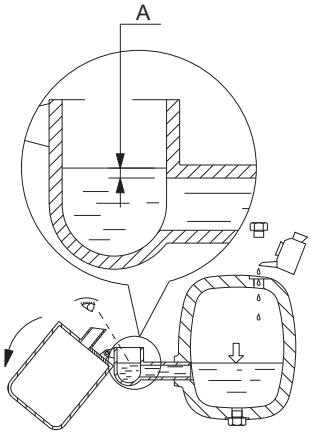


TM045174

Bearing bracket with constant-level oiler

Filling the oil

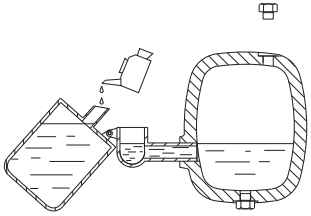
1. Remove the filling plug.
2. Hinge down the constant-level oiler, and pour the oil through the filling hole until the oil reaches level in the connection elbow.



TM053612

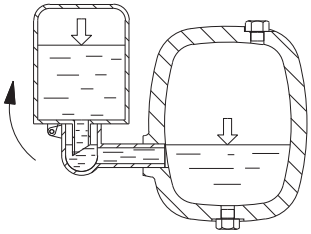
- A: 1-3 mm

3. Fill the reservoir of the constant-level oiler with oil, and snap it back into operating position. Now oil will be filled into the bearing bracket. Air bubbles can be seen in the reservoir during this process. Continue until the correct oil level is reached.



TM077127

4. When no bubbles appear in the reservoir, refill the reservoir, and snap it back into operating position.

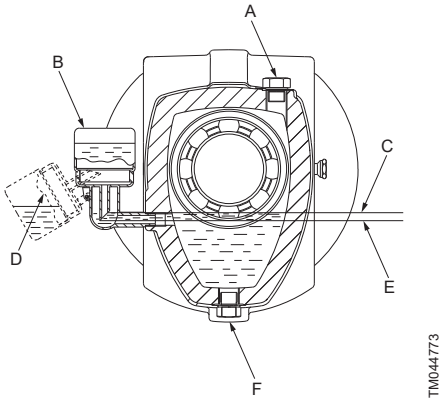


TM077128

5. Fit the filling plug.

The oil level in the bearing bracket must always be as shown in the figure below.

Check the oil level regularly during operation, and add oil, if necessary. The oil level must always be visible in the sight glass.



TM044773

Code	Description
A	Filling plug
B	Full constant-level oiler
C	Correct oil level in bearing bracket with constant-level oiler during operation
D	Oil level in constant-level oiler when being filled with oil
E	Oil level when filling
F	Drain plug

Checking the oil level

The oil level in the bearing bracket will be correct as long as the function of the constant-level oiler is correct.

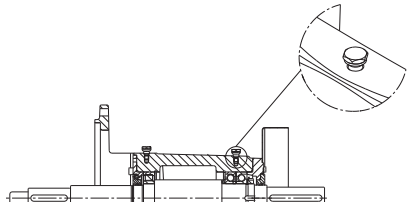
- To check the function of the constant-level oiler, slowly drain oil through the drain plug until the constant-level oiler starts to operate, that is until air bubbles can be seen in the reservoir.

5.9 Bearing monitoring

5.9.1 Vibration level

The vibration level gives an indication of the condition of the bearings.

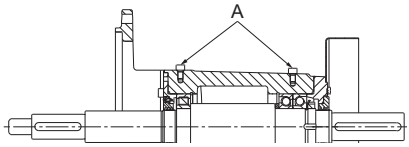
Bearing brackets with constant-level oiler are prepared for vibration measurement by means of the shock pulse method (SPM).



TM044925

Bearing bracket with SPM measuring points

Bearing brackets with automatic grease lubricators or grease nipples are prepared for retrofitting of SPM fittings. Holes are plugged from factory.



TM063500

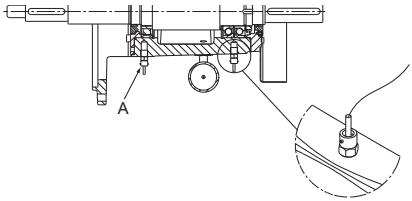
- A: plugged holes for SPM fitting

Bearing bracket for retrofitting of SPM measuring equipment

5.9.2 Temperature

Bearing brackets with automatic grease lubricators, grease nipples or constant-level oiler have tappings for Pt100 sensors for monitoring the temperature of the bearings.

These sensors can be factory-fitted, but can also be retrofitted. A Grundfos sensor is available.



TM077129

- A: 1/4" tapping for Pt100 sensor

Pt100 sensors fitted in bearing bracket

5.10 Pressure gauge and mano-vacuum gauge

To ensure continuous monitoring of the operation, we recommend that you install a pressure gauge on the outlet side and a mano-vacuum gauge on the inlet side. The pressure gauge tappings must only be opened for test purposes. The measuring range of the gauges must be 20 % above the maximum pump pressure.
When measuring with pressure gauge on the pump flanges, note that a pressure gauge does not register dynamic pressure.

On all pumps, the diameters of the inlet and outlet flanges are different which results in different flow velocities at the two flanges. Consequently, the pressure gauge on the outlet flange will not show the pressure stated in the technical documentation, but a value which may be up to 1.5 bar or approximately 15 m of head lower.

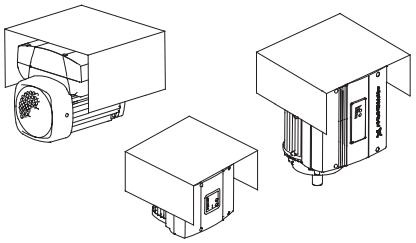
5.11 Ammeter

We recommend connecting an ammeter to check the motor load.

5.12 Condensation cover

When installing the pumps outdoors, provide the motor with a suitable cover to avoid condensation.

When mounting the condensation cover on top of the motor, make sure to leave enough space for the air to cool the motor.



Motors with condensation cover

6. Electrical connection

The electrical connection must be carried out by a qualified electrician in accordance with local regulations.

DANGER
Electric shock
Death or serious personal injury

- Before removing the terminal box cover, and before removing or dismantling the pump, make sure that the power supply has been switched off and that it cannot be accidentally switched on again. Use lockout-tagout if available. The pump must be connected to an external main switch.

DANGER
Explosive environment
Death or serious personal injury

- Whenever powered equipment is used in explosive surroundings, the rules and regulations generally or specifically imposed by the relevant authorities or trade organisations must be observed.

The operating voltage and frequency are stated on the nameplate. Make sure that the motor is suitable for the power supply of the installation site.

The electrical connection must be carried out as shown in the wiring diagram inside the terminal box cover.

6.1 Motor protection

DANGER
Electric shock
Death or serious personal injury

- The motor must be protected against overload by an external motor-protective circuit breaker with IEC trip class 10 or 20.
- Grundfos recommends using trip class 20.
- The current setting of the motor-protective circuit breaker must be adjusted to the nominal current stated on the motor nameplate.

DANGER
Automatic startup
Death or serious personal injury

- Before starting any repair work on motors incorporating a thermal switch or thermistors, make sure that the motor cannot restart automatically after cooling.

Three-phase motors must be connected to a motor-protective circuit breaker.

All three-phase Grundfos MG and MMG motors of 3 kW and up incorporate a thermistor. See the instructions in the motor terminal box.

The electrical connection must be carried out as shown in the wiring diagram on the back side of the terminal box cover.

6.2 Cable entry and screwed connection, MG motor

All motors are supplied without screwed cable entries. The table below shows the numbers and sizes of cable entry holes of the terminal box of Grundfos MG motors according to the standard EN 50262.

Frame size	Model	Number x dimensions	Description
MG 71 and 80	B, C	2 x M20 x 1.5	The holes have precast threads and are closed with knock-out cable entries.
MG 90 and 100	B, C, D	4 x M20	The holes are closed with knock-out cable entries.
MG 112 and 132	C, D, F, H	4 x M25	
MG 160 and 180	F, H	4 x M40 2 x M20	

6.3 Synchronous motors

Pumps fitted with synchronous motors must be connected to a Grundfos CUE frequency converter.

Example of installation without filter

Symbol	Designation
1	CUE
4	Standard motor
One line	Unscreened cable
Double line	Screened cable

Synchronous motors must not be connected directly to mains supply.

The CUE must be of T/C CUE203 followed by additional numbers and characters. See the CUE Installation and operating instruction to setup frequency driver together with synchronous motor.

If another frequency driver brand other than CUE is required or specified, contact Grundfos.

Example of CUE nameplate

Text description	
T/C	CUE (product name) 203... (internal code)

6.4 Frequency converter operation

All three-phase motors can be connected to a frequency converter.

Frequency converter operation will often expose the motor insulation system to a heavier load and cause the motor to be more noisy than usual due to eddy currents caused by voltage peaks.

A large motor driven via a frequency converter will be loaded by bearing currents.

Check these operating conditions if the pump is driven via a frequency converter:

Operating conditions	Action
2-pole motors from 45 kW, 4-pole motors from 37 kW and 6-pole motors from 30 kW	Check that one of the motor bearings is electrically isolated. Contact Grundfos.
Noise critical applications	Fit an output filter between the motor and the frequency converter. This reduces the voltage peaks and thus the noise.
Particularly noise critical applications	Fit a sinusoidal filter.
Cable length	Fit a cable that meets the specifications laid down by the frequency converter supplier. The length of the cable between motor and frequency converter affects the motor load.
Supply voltage up to 500 V	Check that the motor is suitable for frequency converter operation.
Supply voltage between 500 V and 690 V	Fit a sinusoidal filter between the motor and the frequency converter which reduces the voltage peaks and thus the noise, or check that the motor has reinforced insulation.
Supply voltage of 690 V and higher	Fit a sinusoidal filter and check that the motor has reinforced insulation.

7. Starting up the product

7.1 Checking pumps with stuffing box

Do not start the pump until it has been filled with liquid and vented.

CAUTION
Biological hazard
Minor or moderate personal injury

- When pumping drinking water, the pump must be flushed thoroughly with clean water before startup in order to remove any foreign matters, such as preservatives, test liquid or grease.

1. In the case of pumps with stuffing box, check that the stuffing box gland is correctly fitted. It must be possible to turn the pump shaft manually.
2. If the pump has been inactive for a long period, turn it manually to make sure it has not got stuck.
3. Loosen the stuffing box or remove the packing.

7.2 Flushing the pipe system

CAUTION
Biological hazard
Minor or moderate personal injury

- When pumping drinking water, the pump must be flushed thoroughly with clean water before startup in order to remove any foreign matters, such as preservatives, test liquid, or grease.

- Before starting up the pump, thoroughly clean, flush and fill the pipe system with clean water.

The warranty does not cover any damage caused by flushing the pipe system by means of the pump.

The pump is not designed to pump liquids containing solid particles such as pipe debris and welding slag.

7.3 Priming

7.3.1 Priming the product in closed systems or open systems where the liquid level is above the pump inlet

1. Close the isolating valve in the outlet pipe and slowly open the isolating valve in the inlet pipe. Both the pump and the inlet pipe must be completely filled with liquid.

WARNING
Escaping liquid
Death or serious personal injury

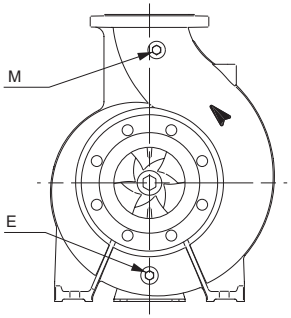
- Pay attention to the orientation of the priming hole to ensure that the escaping liquid does not cause personal injury or damage to the motor or other components.
- In hot-liquid installations, pay special attention to the risk of personal injury caused by scalding hot liquid.
- In cold-liquid installations, pay special attention to the risk of personal injury caused by cold liquid.

2. Loosen the priming plug in order to vent the pump. Once liquid runs out, tighten the priming plug.

7.3.2 Priming the product in inlet operation with non-return valve

The inlet pipe and the pump must be filled with liquid and vented before the pump is started.

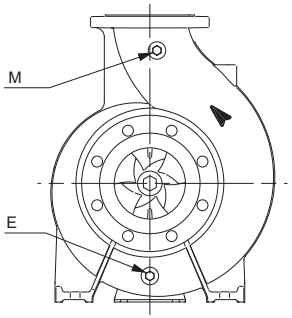
1. Close the isolating valve in the outlet pipe and slowly open the isolating valve in the inlet pipe.
2. Remove the priming plug indicated by M.
3. Pour liquid through the hole until the inlet pipe and the pump are completely filled with liquid.
4. Fit the priming plug indicated by M.
5. The inlet pipe may be filled and vented via the priming plug. Alternatively, a priming device with funnel can be installed before the pump.



Drain plug (E), priming and venting plug (M)

7.3.3 Priming the product in open systems where the liquid level is below the pump inlet

1. If an isolating valve is fitted on the inlet side of the pump, the valve must be fully open.
2. Close the isolating valve in the outlet pipe, and tighten the priming and drain plugs.



Drain plug (E), priming and venting plug (M)

3. Connect a manual venting pump with the funnel instead of a priming device.
4. Install a slide valve between the venting pump and the centrifugal pump in order to protect the venting pump against excessive pressure.
5. Once the slide valve at the manual venting pump has been opened, vent the inlet pipe using short, rapid pump strokes until the liquid runs out on the outlet side.
6. Close the valve at the venting pump.

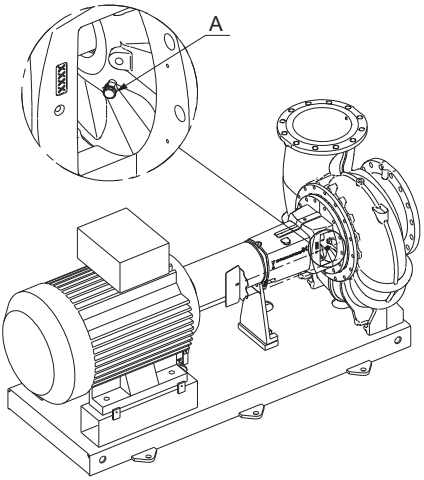
7.4 Checking the direction of rotation

Do not start the pump to check the direction of rotation until it has been filled with liquid.

The correct direction of rotation is shown by arrows on the pump housing, and can visibly be checked by means of the motor fan. Looking at the motor fan, the direction of rotation must be clockwise.

7.5 Starting up the pump

1. Fully open the isolating valve on the inlet side of the pump and leave the isolating valve on the outlet side almost closed.
2. Start the pump.
3. Vent the pump during startup by loosening the air vent screw in the pump head or pump head cover until a steady stream of liquid runs out of the vent hole.



Position of vent screw (A)

WARNING
Escaping liquid
Death or serious personal injury

- Pay attention to the orientation of the vent hole to ensure that the escaping liquid does not cause personal injury or damage to the motor or other components.
- In hot-liquid installations, pay special attention to the risk of personal injury caused by scalding hot liquid.
- In cold-liquid installations, pay special attention to the risk of personal injury caused by cold liquid.

4. When the pipes have been filled with liquid, slowly open the isolating valve on the outlet side until it is fully open.
5. Check the overload by measuring the motor current consumption and comparing the value to the rated current stated on the motor nameplate. In case of overload, throttle the valve on the outlet side until the motor is no longer overloaded.

If the pump is fitted with a motor with an output selected on the basis of a specific maximum flow rate, the motor may be overloaded if the differential pressure is lower than anticipated.

6. Always measure the motor current consumption during startup.

At the moment of startup, the input current of the pump motor is up to six times higher than the full-load current stated on the motor nameplate.

7.6 Shaft seal run-in period

The seal faces are lubricated by the pumped liquid, meaning that there may be a certain amount of leakage from the shaft seal. When the pump is started for the first time, or when a new shaft seal is installed, a certain run-in period is required before the leakage is reduced to an acceptable level. The time required depends on the operating conditions, that is, every time the operating conditions change, a new run-in period is started.

Under normal conditions, the leaking liquid evaporates, and as a result, no leakage will be detected.

Liquids such as kerosene do not evaporate, and drops are visible, but it is not a shaft seal failure.

7.6.1 Mechanical shaft seals

Mechanical shaft seals are precision components. If the mechanical shaft seal of a recently installed pump fails, it normally happens within the first few hours of operation. The main cause of such failures is improper installation of the shaft seals and/or mishandling of the pump during installation.

7.6.2 Stuffing box

The stuffing box gland must not be too tight during startup in order to let sufficient liquid lubricate the shaft and the packing rings. Once the stuffing box housing and the stuffing box gland have reached approximately the same temperature as the pump parts, the running-in of the stuffing box gland is complete. If the stuffing box leaks too much, retighten the gland slightly and evenly while the pump is running. To ensure continuous lubrication, a few drops should always drop from the stuffing box to protect the packing rings or shaft sleeve. We recommend 40 to 60 drops/minute.

7.7 Number of motors starting or stopping

Frame size	Maximum number of motor starts per hour		
	Number of poles		
	2	4	6
56-71	100	250	350
80-100	60	140	160
112-132	30	60	80
160-180	15	30	50
200-225	8	15	30
250-315	4	8	12

7.8 Reference readings of monitoring equipment

We recommend taking initial readings of these parameters:

- vibration level - use SPM measuring points
- bearing temperature - if sensors have been fitted
- inlet and outlet pressure - use pressure gauges.

The readings can be used as reference in case of abnormal operation.

8. Storing the product

1. The contractor must inspect the equipment on delivery and make sure that it is stored in such a way that corrosion and damage are avoided.
2. If you do not operate the pump soon after arrival, store it in a clean, dry place under slow, moderate changes in ambient temperature.
3. Protect the pump from moisture, dust, dirt and foreign bodies. Before and during storage we recommend the following precautions:
   a. Make sure that the bearings are filled with the recommended grease to prevent moisture from entering around the shaft.
   b. Make sure that the inlet and outlet ports and all other openings are covered with cardboard, wood or masking tape to prevent foreign objects from entering the pump.
   c. If the unit is to be stored where there is no protective covering, cover it with a tarpaulin or waterproof material, or other suitable covering.
   d. Rotate the shaft two turns every two weeks to prevent corrosion of the bearing surfaces and the stuffing box or shaft seal faces caused by moisture.
4. If the pump is to be stored for more than six months before being put into operation, apply a suitable corrosion inhibitor to the internal pump parts.

   Make sure that the corrosion inhibitor used does not affect the rubber parts with which it comes into contact.

   Commercially available preservatives can be used for this purpose. Please observe the manufacturer's instructions for application or removal.
5. Keep all openings covered until the pipes are ready to be fitted to prevent water and dust from entering the pump.

   The cost of having to dismantle the pump during startup to remove foreign objects can be very high.

9. Servicing the product

9.1 Contaminated products

CAUTION
Biological hazard
Minor or moderate personal injury

- Flush the pump thoroughly with clean water and rinse the pump parts in water after dismantling.

The product will be classified as contaminated if it has been used for a liquid which is toxic or injurious to health.

If you request Grundfos to service the product, contact Grundfos with details about the liquid before returning the product for service. Otherwise, Grundfos can refuse to accept the product for service.

The product must be cleaned thoroughly before you return it.

Costs of returning the product are to be paid by the customer.

9.2 Service kits

Service kits for the products, see Grundfos Product Center in *www.grundfos.com* or Service Kit Catalogue.

10. Maintaining the product

DANGER
Electric shock and unintended pump start
Death or serious personal injury

- Before starting work on the product, switch off the power supply. Make sure that the power supply cannot be accidentally switched on.

10.1 Maintenance of the pump

The pump is maintenance-free.

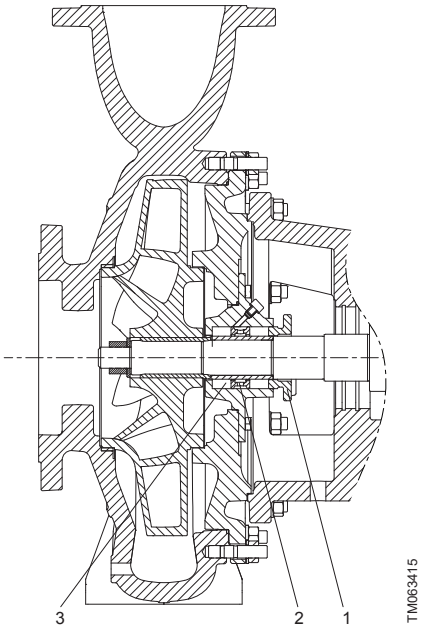
10.1.1 Maintenance of the mechanical shaft seals

Mechanical shaft seals are maintenance-free, working almost without any leakages. If any considerable and increasing seepage occurs, check the mechanical shaft seal immediately. If the sliding surfaces are damaged, replace the entire shaft seal. Treat mechanical shaft seals with the greatest care.

10.1.2 Stuffing box

If the stuffing box leaks too much and cannot be further tightened, the stuffing box must be repacked. After removal, clean and check the shaft sleeve, chamber and stuffing box gland. For further information, see the service instructions for NK.

10.1.3 Replacing the packing rings



Sectional view of a stuffing box

Pos.	Description
1	Stuffing box gland
2	Packing ring
3	Distribution ring

Follow these steps when replacing the packing rings:

1. Loosen stuffing box gland and remove it.
2. Remove old packing ring, distribution ring, if any, and packing rings behind the distribution ring, using a packing ring hook.
3. Insert two new packing rings one at a time. Push them firmly into position, staggering the joints 120 degrees.
4. Insert distribution ring, if any.
5. For D24/D32, insert one, and for D42/D48/D60, insert two more packing rings, staggering the joints 120 degrees. If no distribution ring is used, two extra packing rings will be required.
6. Reinstall stuffing box gland.

Starting pumps with new packing rings

Packing rings require lubrication. Therefore, the stuffing box must always be allowed to leak 40 to 60 drops per minute. Never overtighten the stuffing box gland.

For suction lift applications, it can be necessary to slightly overtighten the gland while starting the pump to avoid air from entering the pump. Air in the pump in this situation will result in the pump being unable to draw the liquid to the pump.

1. Loosen the gland immediately when the pump delivers liquid allowing a leakage of 40 to 60 drops per minute.
2. Readjust after a few hours of operation if leakage increases.

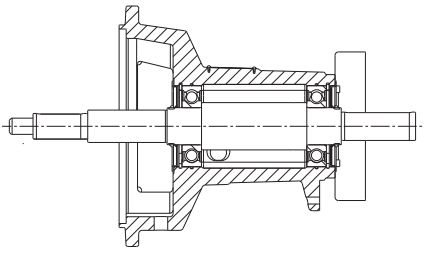
10.1.4 Shaft sleeve replacement

The shaft sleeve can be worn out as the sleeve life depends on the application. When the leakage is too high even with new packing rings in combination with a slight overtightening, the shaft sleeve needs to be replaced.

10.2 Lubrication of bearings in bearing bracket

10.2.1 Grease-lubricated bearings

Pump with greased-for-life bearings

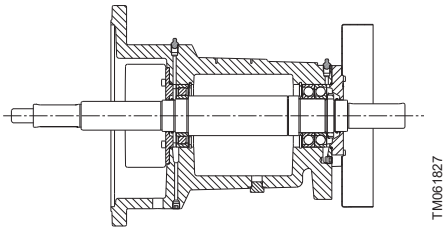


Bearing bracket with closed, greased-for-life bearings

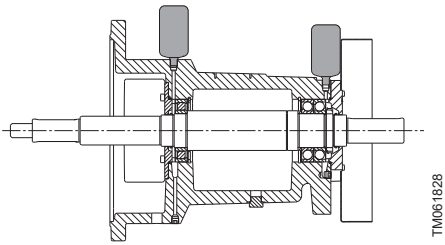
The bearing bracket with closed, greased-for-life bearings is maintenance-free. Under optimum operating conditions, the bearing life will be approximately 17,500 operating hours. After that period, we recommend that you replace the bearings. See section Taking the product out of operation.

To check the bearings, regularly listen to them by means of a solid rod. There are no SPM measuring points for this type of bearing bracket.

Pump with lubrication nipples or automatic grease lubricators



Bearing bracket with open roller bearing and double angular contact bearing lubricated via grease nipples



Bearing bracket with open roller bearing and double angular contact bearing lubricated via automatic grease lubricators

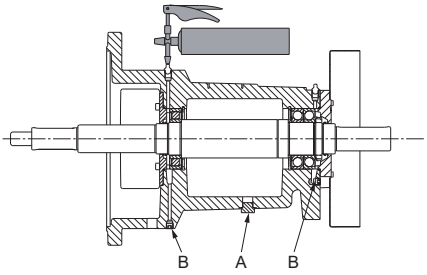
If the pump has grease nipples or automatic grease lubricators, the grease in the bearings must be renewed during the whole life time.

Under optimum operating conditions, the bearing life will be approximately 100,000 operating hours. After that period, we recommend that you replace the bearings. See section Taking the product out of operation. New bearings must be filled with grease according to Grundfos specifications. Clean up all the used grease in the bearing bracket before replacing the new bearing.

Installing automatic grease lubricators

Replace lubricators every 12 months. When replacing the lubricators, follow this procedure:

1. Remove the main drain plug in the bottom of the bearing bracket for one hour during operation to remove old and excess grease.
2. Fit the new lubricators on top of the bearing bracket and set them to empty within 12 months according to the instruction supplied with the lubricators.



- A: Main drain plug
- B: Grease drain plugs

3. Refit the main drain plug in the bottom of the bearing bracket.

   Grundfos recommends SKF SYSTEM 24 lubricators, type LAGD 125/HP2 or LAGD 60/HP2.

Quantity	Product number
2 x LAGD 125/HP2	96887371
2 x LAGD 60/HP2	97776374

Relubrication via grease nipples

Grundfos recommends the following relubricating intervals and grease quantities:

Diameter of shaft [mm]	Relubricating interval [operating hours]	Grease quantity [g]	
		Roller bearing	Angular contact bearing
24	7500	11	15
32	4500	13	20
42	4500	22	30
48	3500	27	38
60	3500	30	41

The relubricating interval is an estimated value, valid for an operating temperature up to 70 °C. We recommend to halve the intervals for every 15 °C increase in operating temperature above 70 °C.

Renewing the grease

If there is visible grease leakage, we recommend that you open the bearing bracket cover and replace the V ring. See section Taking the product out of operation.

If the pump has been stored or is out of operation for more than six months, we recommend you to replace the grease before the pump is put into operation.

In case of ingress of contamination, more frequent relubrication than indicated by the relubricating interval will reduce the negative effects of foreign particles. This will reduce the damaging effects caused by overrolling the particles. Liquid contaminants, such as water or process liquids, also call for shorter relubricating intervals. In case of severe contamination, consider continuous relubrication.

Never mix greases with different thickeners, such as a lithium-based grease with a sodium-based grease, before checking with the suppliers.

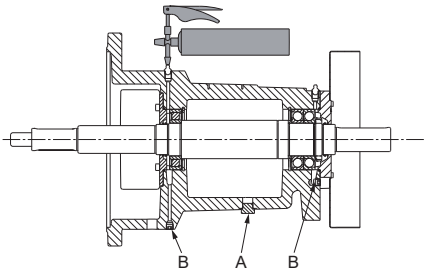
Never mix a mineral oil with a synthetic oil.

Some lubricants are compatible, but assessing the compatibility of two lubricants can be difficult. As a general rule, always relubricate a bearing with the same lubricant as was used originally.

Follow this procedure to renew grease:

1. Place a suitable container under the bearing bracket to collect used grease.
2. Remove the grease drain plugs.

3. Fill the bearing bracket with the recommended quantity of grease by means of a grease gun.



- A: Main drain plug
- B: Grease drain plugs

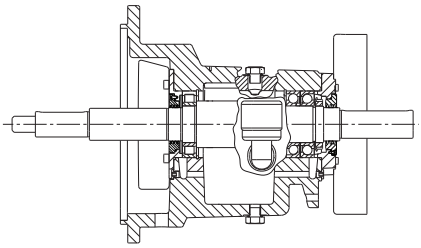
Renewing the grease

Grundfos recommends SKF LGHP2 grease for relubrication. See the table below.

Basic characteristics	
Code, DIN 51825	K2N-40
Consistency class, NLGI	2-3
Thickener	Polyurea (di-urea)
Base oil	Mineral
Operating temperature	-40 to +150 °C, -40 to +302 °F
Dropping point, ISO 2176	240 °C, 464 °F
Density, DIN 5175	At 20 °C, 68 °F: 0.85 - 0.95 g/cm^3
Base oil viscosity	
40 °C, 104 °F	96 mm^2/s
100 °C, 212 °F	10.5 mm^2/s

4. Refit the drain plugs.

10.2.2 Lubricating the bearings with oil



Bearing bracket with oil-lubricated roller and double angular contact bearings

Under optimum operating conditions, the life of the roller and double angular contact bearings will be approximately 100,000 operating hours. After that period, we recommend that you replace the bearings. See section Taking the product out of operation.

To monitor the bearing condition, regularly measure vibration levels using the SPM measuring points on the bearing bracket.

See section Vibration level.

- Lubricate the bearings with mineral oil.

  Intervals for oil change as well as the required quantities are specified below.

Bearing temperature	Initial oil change	Subsequent oil changes
Up to 70 °C	After 400 hours	Every 4400 hours
70-90 °C		Every 2200 hours

Bearing type	Diameter of coupling shaft [mm]	Approximate oil quantity [ml]
Roller and angular contact bearings	42	850
	48	1700
	60	1350

10.2.3 Changing the oil

1. Place a suitable container under the bearing bracket to collect used oil.
2. Remove the filling plug and the drain plug.
3. After drainage of the bearing bracket, fit the drain plug, and fill the bearing bracket with new oil. See section Bearing bracket with constant-level oiler.

Check the oil level regularly during operation, and add oil, if necessary. The level must always be visible in the sight glass.

Basic characteristics Shell Omala 68	Test method	
Viscosity grade	ISO	68
AGMA EP Gear Oil Grade		68
Old AGMA Grade		2 EP
Viscosity		
At 40 °C, 104 °F	D 445	68 mm^2/s
At 100 °C, 212 °F	D 445	8.8 mm^2/s
Flash point, COC, °F	D 92	405
Pour point, °F	D 97	-15

10.3 Monitoring equipment

We recommend that you take weekly readings of these parameters:

- vibration level - use SPM measuring points
- bearing temperature - if sensors have been fitted
- inlet and outlet pressure - use pressure gauges.

Alternatively, follow the maintenance plan laid out for your application.

10.4 Maintaining the motor

It is important to keep the motor clean in order to ensure adequate ventilation.

- Check the motor at regular intervals.
- If the pump is installed in a dusty environment, check and clean it regularly.

10.5 Lubrication of motor bearings

10.5.1 MG motors

The bearings of motors up to 11 kW are greased for life and require no lubrication.

The bearings of motors of 11 kW and up must be greased in accordance with the indications on the motor nameplate.

10.5.2 Siemens motors

Motors up to and including frame size 250 have maintenance-free, greased-for-life bearings.

Motors of frame sizes larger than 250 must be greased according to the indications on the motor nameplate. Grease spills from the motor may occur.

10.5.3 Other motors

For other motor makes with grease nipples, lubricate the motor according to the indications on the motor nameplate. Grease specifications: See section Bearing grease.

10.5.4 Bearing grease

The lithium-based grease used should meets the following specifications:

- NLGI class 2 or 3
- viscosity of basic oil: 70 to 150 cSt at +40 °C
- temperature range: -30 °C to +140 °C during continuous operation.

10.6 Applying sealant to plugs

Remember to clean the threads and apply sealant to the plug when assembling it.

11. Taking the product out of operation

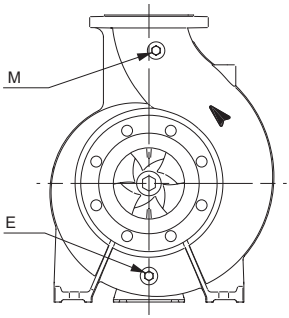
11.1 Protecting the pump during periods of inactivity and frost

Pumps that are not being used during periods of frost must be drained to avoid damage.

WARNING
Escaping liquid
Death or serious personal injury

- Ensure that the escaping liquid does not cause personal injury or damage to the motor or other components.
- In hot-liquid installations, pay special attention to the risk of personal injury caused by scalding hot liquid.
- In cold-liquid installations, pay special attention to the risk of personal injury caused by cold liquid.

1. Drain the pump by removing the drain plug.



Drain plug (E), priming and venting plug (M)

2. Do not tighten the priming plug or replace the drain plug until the pump is to be used again.
3. If the pump is to be drained before a long period of inactivity, inject a few drops of silicone oil on the shaft at the bearing bracket. This will prevent the shaft seal faces from seizing up.

12. Fault finding the product

DANGER
Electric shock
Death or serious personal injury

- Before removing the terminal box cover and before removing or dismantling the pump, make sure that the power supply has been switched off and that it cannot be accidentally switched on again.

WARNING
Escaping liquid
Death or serious personal injury

- Pay attention to the orientation of the vent hole to ensure that the escaping liquid does not cause personal injury or damage to the motor or other components. In hot-liquid installations, pay special attention to the risk of personal injury caused by scalding hot liquid. In cold-liquid installations, pay special attention to the risk of personal injury caused by cold liquid.

CAUTION
Hot or cold surface
Minor or moderate personal injury

- When pumping hot or cold liquids, make sure that persons cannot accidentally come into contact with hot or cold surfaces.

Fault	Cause	Remedy
1. The pump delivers no or too little liquid.	a) The electrical connection is wrong, for instance two phases.	Check the electrical connection and remedy, if necessary.
	b) The direction of rotation is wrong.	Interchange two phases of the power supply.
	c) There is air in the inlet pipe.	Vent and fill the inlet pipe and pump.
	d) The counterpressure is too high.	Set the duty point in accordance with the data sheet. Check the system for impurities.
	e) The inlet pressure is too low.	Increase the liquid level on the inlet side. Open the isolating valve in the inlet pipe. Make sure that all the conditions in *Stuffing box piping* are complied with.
	f) The inlet pipe or impeller is blocked by impurities.	Clean the inlet pipe or pump.
	g) The pump draws in air due to a defective seal.	Check the pipeline seals, pump housing gaskets and shaft seals. Replace gaskets and seals, if necessary.
	h) The pump draws in air due to low liquid level.	Increase the liquid level on the inlet side and keep it as constant as possible.

Fault	Cause	Remedy
2. The motor-protective circuit breaker has tripped because the motor is overloaded.	a) The pump is blocked by impurities.	Clean the pump.
	b) The pump is running above rated duty point.	Set the duty point in accordance with the data sheet.
	c) The density or viscosity of the liquid is higher than specified when ordering.	If less flow is sufficient, reduce the flow on the outlet side. Otherwise, fit a more powerful motor.
	d) The motor-protective circuit breaker overload setting is incorrect.	Check the setting of the motor-protective circuit breaker and replace, if necessary.
	e) The motor runs on two phases.	Check the electrical connection. Replace the fuse, if defective.
3. The pump makes too much noise. The pump runs unevenly and vibrates.	a) The inlet pressure is too low, that is the pump cavitates.	Increase the liquid level on the inlet side. Open the isolating valve in the inlet pipe. Make sure that all the conditions in *Stuffing box piping* are complied with.
	b) There is air in the inlet pipe or pump.	Vent and fill the inlet pipe or pump.
	c) The counterpressure is lower than specified.	Set the duty point in accordance with the data sheet.
	d) The pump draws in air due to low liquid level.	Increase the liquid level on the inlet side and keep it as constant as possible.
	e) The impeller is out of balance or the impeller blades are clogged.	Clean and check the impeller.
	f) The inner parts are worn.	Replace the defective parts.
	g) The pump is stressed by the pipes thus causing starting noise.	Mount the pump so that it is not stressed. Support the pipes.
	h) The bearings are defective.	Replace the bearings.
	i) The motor fan is defective.	Replace the fan.
	j) The coupling is defective.	Replace the coupling. Align the coupling. See related information for *Alignment of pump and motor*.
	k) There are foreign bodies in the pump.	Clean the pump.
	l) Frequency converter operation.	See related information for *Frequency converter operation*.
4) The pump, connections, shaft seal or stuffing box are leaking.	a) The pump is stressed by the pipes thus causing leaks in the pump housing or connections.	Mount the pump so that it is not stressed. Support the pipes.
	b) Pump housing gaskets and gaskets at connections are defective.	Replace the pump housing gaskets or gaskets at connections.
	c) The mechanical shaft seal is dirty or stuck together.	Check and clean the mechanical shaft seal.
	d) The mechanical shaft seal is defective.	Replace the mechanical shaft seal.
	e) The stuffing box is defective.	Retighten the stuffing box. Repair or replace the stuffing box.
	f) The shaft surface or shaft sleeve is defective.	Replace the shaft or the shaft sleeve. Replace the packing rings in the stuffing box.

Fault	Cause	Remedy
5) The temperature in the pump or motor is too high.	a) There is air in the inlet pipe or pump.	Vent the inlet pipe or the pump and replenish.
	b) The inlet pressure is too low.	Increase the liquid level on the inlet side. Open the isolating valve in the inlet pipe. Make sure that all the conditions in *Stuffing box piping* are complied with.
	c) The bearings are lubricated with too little, too much or unsuitable lubricant.	Replenish, reduce or replace the lubricant.
	d) The pump with bearing seatis stressed by the pipes.	Mount the pump so that it is not stressed. Support the pipes. Check the alignment of the coupling. See related information for *Alignment of pump and motor*.
	e) The axial pressure is too high.	Check the relief holes of the impeller and the lock rings on the inlet side.
	f) The motor-protective circuit breaker is defective or the setting is incorrect.	Check the setting of the motor-protective circuit breaker and replace, if necessary.
	g) The motor is overloaded.	Reduce the flow rate.
6) Oil is leaking from the bearing bracket.	a) The bearing bracket has been filled with too much oil through the filling hole, resulting in an oil level above the bottom of the shaft.	Drain off oil until the constant-level oiler starts to operate, that is when air bubbles can be seen in the reservoir.
	b) The oil seals are defective.	Replace the oil seals.
7) Oil is leaking from the reservoir.	The threads on the reservoir are damaged.	Replace the reservoir.

13. Technical data

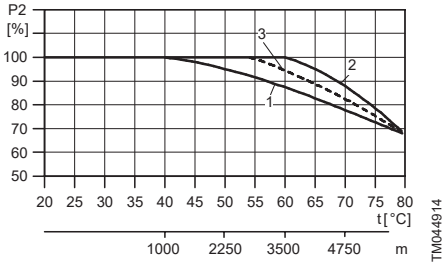
13.1 Operating conditions

13.1.1 Ambient temperature and altitude

Do not exceed the allowable maximum ambient temperature stated on the motor nameplate. If nothing is stated, then the maximum allowed ambient temperature is 40 °C.

The ambient temperature and the installation altitude are important factors for the motor life as they affect the life of the bearings and the insulation system.

If the ambient temperature exceeds the recommended maximum ambient temperature or the installation altitude exceeds the recommended maximum altitude above sea level, seeing the figure below, the motor must not be fully loaded due to the low density and consequently low cooling effect of the air. In such cases, it may be necessary to use a motor with a higher output.



The maximum motor output depends on the ambient temperature and altitude

Pos.	Description
1	0.25 - 0.55 kW MG motors
2	0.75 - 22 kW MG motors, IE2/IE3
	0.75 - 450 kW MMG-H motors, IE2
	0.25 - 200 kW MMG-H motors, IE3
3	0.75 - 462 kW Siemens motors, IE2
	0.25 - 462 kW Siemens motors, IE3
	0.75 - 462 kW Siemens motors, IE4

Example: A pump with a 1.1 kW IE2 MG motor: If this pump is installed 4750 m above sea level, the motor must not be loaded more than 88 % of the rated output. At an ambient temperature of 75 °C, the motor must not be loaded more than 78 % of the rated output. If the pump is installed 4750 m above sea level at an ambient temperature of 75 °C, the motor must not be loaded more than 88 % x 78 % = 68.6 % of the rated output.

13.1.2 Liquid temperature

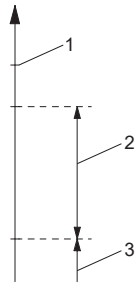
Liquid temperature: -40 to +140 °C

The maximum liquid temperature is stated on the pump nameplate. It depends on the shaft seal chosen.

For EN-GJL-250 cast-iron pump housings, local regulations may not allow liquid temperatures above 120 °C.

13.1.3 Maximum operating pressure

Do not exceed the maximum operating pressure stated on the pump nameplate.



Pressures in the pump

Pos.	Description
1	Maximum operating pressure, that is pressure above atmospheric pressure
2	Pump pressure
3	Inlet pressure

The total value of the inlet pressure and the pump pressure must be lower than the maximum operating pressure stated on the pump nameplate. Operation against a closed valve gives the highest operating pressure.

13.1.4 Minimum inlet pressure

Pay attention to the minimum inlet pressure to avoid cavitation. The risk of cavitation is higher in the following situations:

- The liquid temperature is high.
- The flow rate is considerably higher than the pump's nominal flow rate.
- The pump is operating in an open system with suction lift.
- The liquid is sucked through long pipes.
- The inlet conditions are poor.
- The operating pressure is low.

13.1.5 Maximum inlet pressure

The total value of the inlet pressure and the pump pressure must be lower than the maximum operating pressure stated on the pump nameplate. Operation against a closed valve yields the highest operating pressure.

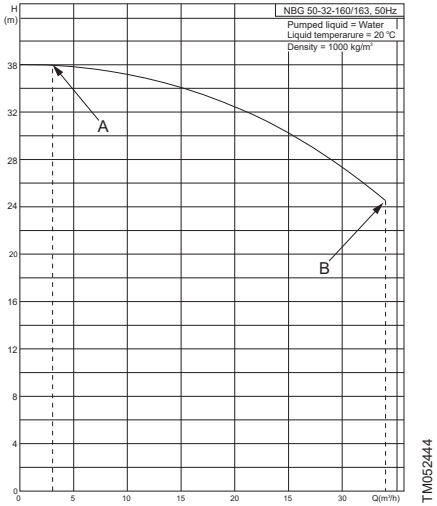
13.1.6 Minimum flow rate

The pump must not run against a closed valve as it causes an increase in temperature and a formation of steam in the pump. That may result in shaft damage, impeller erosion, short life of bearings and damage to the stuffing boxes or mechanical shaft seals due to stress or vibration. The continuous stable flow rate must be at least 10 % of the rated flow rate. The rated flow rate is stated on the pump nameplate.

13.1.7 Maximum flow rate

Do not exceed the maximum flow rate, otherwise there is a risk of cavitation or overload, for instance.

The minimum and maximum flow rates are indicated either on the performance curve pages in the relevant data booklets, or on a curve for a specific pump when selecting it in the Grundfos Product Center. See www.grundfos.com.



Example from Grundfos Product Center in www.grundfos.com showing minimum and maximum flow rate

Pos.	Description
A	Minimum flow rate
B	Maximum flow rate

13.1.8 Shaft seals

The operating range of the seals is described for two main applications: Pumping of water or pumping of coolants.

Seals with a temperature range of 0 °C and up are mainly used for pumping water, while seals for temperatures below 0 °C are mainly intended for coolants.

We do not recommend that you operate the pump at maximum temperature and maximum pressure at the same time as the seal life will be reduced and periodic noise will occur.

Shaft seal diameter [mm]						28, 38	48	55	60
Shaft seal type		**Seal faces**	**Rubber**	**Code**	**Temperature range**	**Max. pressure [bar]**			
	Bellows seal, type B, unbalanced	AQ_1	EPDM	BAQE	0-120 °C	16	16	16	16
		AQ_1	FKM	BAQV	0-90 °C	16	16	16	16
		BQ_1	EPDM	BBQE	0-120 °C	16	16	16	16
		BQ_1	FKM	BBQV	0-90 °C	16	16	16	16
		Q_7Q_7	EPDM	BQQE	-25 to +120 °C	16	16	16	16
		Q_7Q_7	FKM	BQQV	-10 to +90 °C	16	16	16	16
	O-ring seal, type A, unbalanced	Q_1A	EPDM	AQAE	0-120 °C	16	16	16	16
		Q_1A	FKM	AQAV	0-90 °C	16	16	16	16
		Q_1Q_1	EPDM	AQQE	-25 to +90 °C	16	16	16	16
		Q_1Q_1	FKM	AQQV	-10 to +90 °C	16	16	16	16
		Q_1Q_1	HNBR	AQQX	-15 to +90 °C	16	16	16	16
		Q_1Q_1	FFKM	AQQK	0-90 °C	16	16	16	16
	O-ring seal, type D, balanced	AQ_1	FXM	DAQF	0-140 °C	25	25	25	25
		Q_6Q_6	EPDM	DQQE	-20 to +120 °C	25	25	25	25
		Q_6Q_6	FKM	DQQV	-10 to +90 °C	25	25	25	25
		Q_6Q_6	HNBR	DQQX	-15 to +120 °C	25	25	25	25
		Q_6Q_6	FFKM	DQQK	0-120 °C	25	25	25	25

13.1.9 Stuffing box

Stuffing box type	Code	Temperature range	Max. pressure [bar]
Stuffing box without cooling, with internal barrier liquid	SNE	-30 - +120 °C	16
Stuffing box without cooling, without barrier liquid	SNO	-30 - +120 °C	16
Stuffing box without cooling, with external barrier liquid	SNF	-30 - +120 °C	16

13.2 Electrical data

See the motor nameplate.

13.3 Sound pressure level

The data in this table applies for pumps including motor, such as MG, MMG and Siemens motors.

The values stated are maximum sound pressure levels. Tolerances are according to ISO 4871.

50 Hz motor

2-pole:	n = 2900 min^{-1}
4-pole:	n = 1450 min^{-1}
6-pole:	n = 970 min^{-1}

Motor [kW]	Maximum sound pressure level [dB(A)] - ISO 3743		
	Three-phase motors		
	2-pole	4-pole	6-pole
0.25	56	41	-
0.37	56	45	-
0.55	57	42	40
0.75	56	42	43
1.1	59	50	43
1.5	58	50	47
2.2	60	52	52
3	59	52	63
4	63	54	63
5.5	63	57	63
7.5	60	58	66
11	60	60	66
15	60	60	66
18.5	60	63	66
22	66	63	66
30	71	65	59
37	71	66	60
45	71	66	58
55	71	67	58
75	73	70	61
90	73	70	61
110	76	70	61
132	76	70	61
160	76	70	65
200	76	70	-
250	82	73	-
315	82	73	-
355	77	75	-
400	-	75	-

60 Hz motor

2-pole:	n = 3500 min^{-1}
4-pole:	n = 1750 min^{-1}
6-pole:	n = 1170 min^{-1}

Motor [kW]	Maximum sound pressure level [dB(A)] - ISO 3743		
	Three-phase motors		
	2-pole	4-pole	6-pole
0.25	-	-	-
0.37	-	-	-
0.55	-	-	-
0.75	-	-	-
1.1	64	51	-
1.5	64	52	62
2.2	65	55	60
3	54	57	67
4	68	56	67
5.5	68	62	67
7.5	73	62	70
11	70	66	70
15	70	66	57
18.5	70	63	57
22	70	63	59
30	71	65	59
37	71	65	61
45	75	65	64
55	75	68	64
75	77	71	63
90	77	71	63
110	81	75	62

Motor [kW]	Maximum sound pressure level [dB(A)] - ISO 3743		
	Three-phase motors		
	2-pole	4-pole	6-pole
132	81	75	62
160	81	75	66
200	81	75	70
280	86	-	72
288	-	77	75
353	86	-	-
362	-	77	-
398	81	-	-
408	-	79	-
460	-	79	-

13.4 Belt drive

If the unit is belt-driven, the following data must not be exceeded:

Speed n [min^{-1}]	Max. motor power [kW] for shaft end				
	Ø24	Ø32	Ø42	Ø48	Ø60
1000	4	7	11	18	22
1500	5	10	25	32	38
2000	6	14	25	-	-
2500	7	17.5	-	-	-
3000	10	20	-	-	-

For higher power outputs, mount an intermediate shaft with pedestal bearings.

13.5 Operation with combustion engine

When operating with petrol or diesel engines, the engine manufacturer's installation and operating instructions must be strictly observed. Particularly the direction of rotation is very important.

- Viewed from the drive shaft end, the pump rotates to the right, clockwise.
- Viewed from the drive shaft end, the motor must therefore rotate to the left, counterclockwise.
- The correct direction of rotation is indicated by the arrow on the pump housing.
- If the engine is installed in a closed area, the combustion air data as well as data for exhaust gases must be particularly noted.
- When draining the tank, make sure to have containers of adequate size ready for this purpose.

14. Disposing of the product

This product or parts of it must be disposed of in an environmentally sound way.

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

The crossed-out wheelie bin symbol on a product means that it must be disposed of separately from household waste. When a product marked with this symbol reaches its end of life, take it to a collection point designated by the local waste disposal authorities. The separate collection and recycling of such products will help protect the environment and human health.

See also end-of-life information at *www.grundfos.com/product-recycling*.

A.1. China RoHS, table A

产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr6+)	多溴联苯 (PBB)	多溴联苯醚 (PBDE)
泵壳	X	O	O	O	O	O
紧固件	X	O	O	O	O	O
管件	X	O	O	O	O	O
定子	X	O	O	O	O	O
转子	X	O	O	O	O	O

本表格依据 SJ/T 11364 的规定编制

O：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 该规定的限量要求。

该产品环保使用期限为 10 年，标识如左图所示。
此环保期限只适用于产品在安装与使用说明书中所规定的条件下工作

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Revision Info
Last revised on 09-09-2020

96658410 **04.2021**

ECM: 1310104

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