NK - IEC, Range 2

Installation and operating instructions

NK
Installation and operating instructions
(all available languages)
http://net.grundfos.com/qr/i/92699989

GRUNDFOS

NK - IEC, Range 2

Original installation and operating instructions

Table of contents

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.

1.3 Target group

These installation and operating instructions are intended for professional installers and for the operators of the product.

We recommend that installation is carried out by skilled persons with technical qualifications required by the specific legislation in force.

2. Product introduction

2.1 Product description

The product is a non-self-priming, single stage, centrifugal volute pump with axial inlet port and radial outlet port.

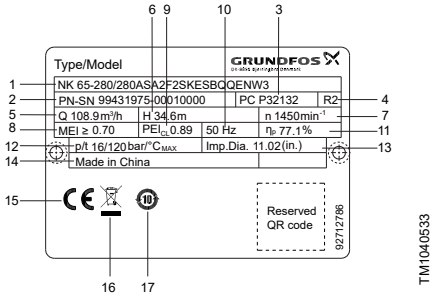
NK pumps comply with EN 733.

2.1.1 Pumped liquids

Pumped liquids must be clean, thin, non-explosive and without particles or fibers. The pumped liquid must not attack the pump materials chemically.

2.2 Identification

2.2.1 Nameplate



Example of NK nameplate

Pos.	Description	
1	Type designation	
2	Identification code	
	99431975	Product number
	00010000	Serial number
3	Production code - production site, year and week	
4	Range identification (service range code)	
5	Nominal flow rate	
6	Nominal pump head	
7	Rated pump speed	
8	Minimum efficiency index (MEI)	
9	Pump Energy Index (PEI), constant load	
10	Frequency	
11	Hydraulic pump efficiency	
12	Pressure rating and maximum temperature	
13	Actual impeller diameter	
14	Country of origin	
15	CE mark	
16	EU/WEEE mark	
17	China RoHS mark	

2.2.2 Type key

Example 1: NK 32-180/166AAEF2S3ESBQQEGX4
Example 2: NK 150-350/328-324AAEF2TBESBQQEWX4
Example 3: NKE 65-225/242ASA2F2SKESBQQENWA

Pos.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Example 1	NK	32	-180	/166		A		AE	F	2	S3	E	S	BQQE	G	X	4
Example 2	NK	150	-350	/328-324		A		AE	F	2	TB	E	S	BQQE	W	X	4
Example 3	NKE	65	-225	/242		A	S	A2	F	2	SK	E	S	BQQE	N	W	A

Pos.	Explanation
1	Type range
2	Nominal diameter of outlet port (DN)
3	Nominal impeller diameter [mm]
4	Actual impeller diameter [mm]
5	**Impeller type** 'blank': Closed impeller, cylindrical trim. If one dimension is shown, the impeller has a cylindrical trim, for example 166. 'blank': Closed impeller, conical trim. If two dimensions are shown, the impeller has a conical trim, for example 328-324. S: Special open impeller V: Super vortex impeller
6	**Hydraulic version** A: 1st version B: 2nd version C: 3rd version D: 4th version
7	**Sensor/motor 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 G: Non -E pump/ -E pump with semi-integrated VFD/CUE: Motor with Grounding ring: Non drive-end H: Non -E pump/ -E pump with semi-integrated VFD/CUE: Motor with hybrid bearing (HYB): Non drive-end I: Non -E pump/ -E pump with semi-integrated VFD/CUE: Motor with insulated bearing: Non drive-end

Pos.	Explanation
8	**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 + grease lub. std. bearing design W1: Bare shaft + grease lubricated H.D. bearing design X: Special version; used in case of further customisation than already listed
9	**Pipe connection** E: Table E flange F: DIN flange G: ANSI flange J: JIS flange
10	**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**
	S3	EN-GJL-250	1.4308	No wear ring	1.4301 + 1.0503
	S4	EN-GJL-250	1.4308	No wear ring	1.4401
	S5	EN-GJL-250	1.4308	No wear ring	1.4462
	S8	EN-GJL-250	1.4408	No wear ring	1.4401
	S9	EN-GJL-250	1.4408	No wear ring	1.4462
	SB	EN-GJS-500-7 ductile	1.4308	No wear ring	1.4301 + 1.0503
	SC	EN-GJS-500-7 ductile	1.4308	No wear ring	1.4401
	SD	EN-GJS-500-7 ductile	1.4308	No wear ring	1.4462
11	SG	EN-GJS-500-7 ductile	1.4408	No wear ring	1.4401
	SH	EN-GJS-500-7 ductile	1.4408	No wear ring	1.4462
	SI	EN-GJS-500-7 ductile	1.4308	No wear ring	1.4410
	SJ	EN-GJS-500-7 ductile	1.4408	No wear ring	1.4410
	SK	EN-GJL-250	1.4308	No wear ring	1.4410
	SL	EN-GJL-250	1.4408	No wear ring	1.4410
	T2	EN-GJL-250	1.4517	No wear ring	1.4462
	T3	EN-GJL-250	1.4517	No wear ring	1.4410
	TA	EN-GJS-500-7 ductile	1.4517	No wear ring	1.4462
	TB	EN-GJS-500-7 ductile	1.4517	No wear ring	1.4410
	X	Special version			
	Rubber parts in pump				
	E: EPDM				
	F: FXM (Fluoraz®)				
12	K: FFKM (Kalrez®)				
	M: FEPS (PTFE-sheathed silicone O-ring)				
	O: HNBR				
	V: FKM (Viton®)				
	Shaft seal arrangement				
	B: Stuffing box				
	C: Cartridge seal, single				
13	D: Cartridge seal, double				
	O: Back-to-back, double seal				
	P: Tandem, double seal				
	S: Single seal				

Pos.	Explanation
14	**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.
15	Code for rated motor power [kW]. See Codes for rated motor power.
16	Code for phase and voltage [V] or other information. See Codes for phase and voltage or other information.
17	Code for speed variant [rpm]. See Codes for speed variant.

Example 1: NK 32-180/166AAEF2S3ESBQQEGX4 shows an NK 32-180 pump with these characteristics:

- 166 mm closed impeller, cylindrical trim
- hydraulic version A
- pump without sensor
- grease-lubricated standard bearing design
- with certificate/report (with standard coupling)
- DIN flange to EN1092-2
- 16 bar flange pressure rating
- cast iron pump housing, EN-GJL-250
- stainless steel impeller, 1.4308
- no wear ring
- stainless steel shaft, 1.4301
- EPDM O-rings for pump cover and seal cover
- single shaft seal arrangement
- BQQE shaft seal
- 1.1 kW motor, no motor or US DOE Regulated Motor (CC marked motor), 4-pole, 60 Hz.

Example 2: NK 150-350/328-324AAEF2TBESBQQEWX2 shows an NK 150-350 pump with these characteristics:

- 328-324 mm closed impeller, conical trim
- hydraulic version A
- pump without sensor
- grease-lubricated standard bearing design
- with certificate/report (with standard coupling)
- DIN flange to EN1092-2
- 16 bar flange pressure rating
- ductile iron pump housing, EN-GJS-500-7
- duplex stainless steel impeller, 1.4517
- no wear ring
- super duplex stainless steel shaft, 1.4410
- EPDM O-rings for pump cover and seal cover
- single shaft seal arrangement
- BQQE shaft seal
- 90 kW motor, no motor or US DOE Regulated Motor (CC marked motor), 2-pole, 60 Hz.

Example 3: NKE 65-225/242ASA2F2SKESBQQENWA shows an NKE 65-225 pump with these characteristics:

- 242 mm closed impeller, cylindrical trim
- hydraulic version A
- Built-in differential-pressure sensor, Series 2000
- grease-lubricated standard bearing design
- spacer coupling
- DIN flange to EN1092-2
- 16 bar flange pressure rating
- cast iron pump housing, EN-GJL-250
- stainless steel impeller, 1.4308
- no wear ring
- super duplex stainless steel shaft, 1.4410
- EPDM O-rings for pump cover and seal cover
- single shaft seal arrangement
- BQQE shaft seal
- 11 kW motor, not for sale in North American, 1450-2200 rpm.

Related information

2.2.2.1 Codes for shaft seals

2.2.2.3 Codes for rated motor power

2.2.2.4 Codes for phase and voltage or other information

2.2.2.5 Codes for speed variant

2.2.2.1 Codes for shaft seals

Digits	Letters	Description
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

2.2.2.2 Letter codes for shaft seals

Pos. 14 in NK type key example.

Code	Description	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".

2.2.2.3 Codes for rated motor power

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]
6		26

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.

2.2.2.4 Codes for phase and voltage or other information

Code	Description
A	E-motor (ECM [4]), 1 x 200-240 V
B	E-motor (ECM[4]), 3 x 200-240 V
C	E-motor (ECM[4]), 3 x 440-480 V
D	E-motor (ECM[4]), 3 x 380-500 V
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

[4] ECM: Electronically Commutated Motor.

2.2.2.5 Codes for speed variant

Code	Description
A	1450-2200 RPM, E-motor (ECM [5])
B	2900-4000 RPM, E-motor (ECM[5])
C	4000-5900 RPM, E-motor (ECM[5])
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)

[5] ECM: Electronically Commutated Motor.

3. Receiving the product

3.1 Delivery

The pumps are not tested for performance before leaving the factory unless it was specifically ordered. 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.

Related information

5.2 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

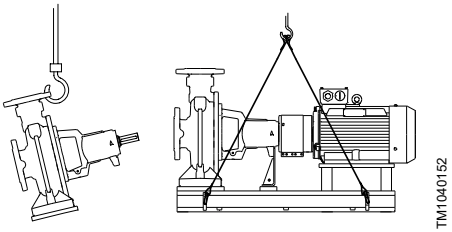
The contractor must inspect the equipment on delivery and make sure it is stored so as to avoid corrosion or damage. See Storing the product.

3.5 Lifting the product

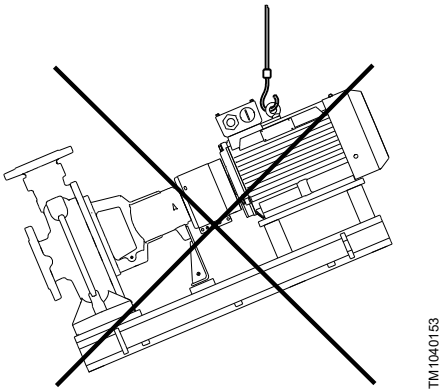
Weight: See the label on the packing.

For motors which come with lifting eyes, the lifting eyes 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

4. Installation requirements

4.1 Location

CAUTION
Hot or cold surface
Minor or moderate personal injury

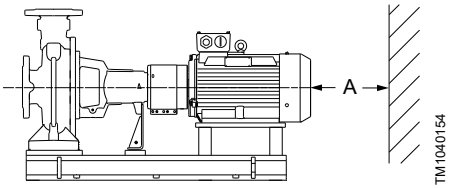
- When pumping hot or cold liquids, make sure that no one can accidentally come into contact with hot or cold surfaces.

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

4.1.1 Minimum clearance

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

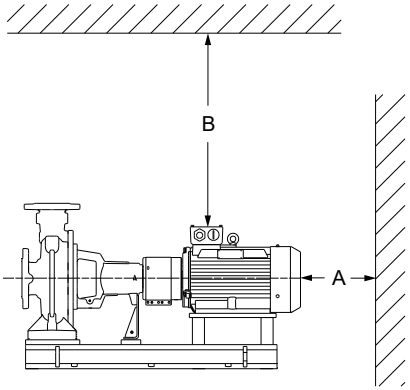
- Pumps fitted with motors up to and including 5 hp (4 kW) require a 12 inches (0.3 m) clearance behind the motor.



Clearance behind the motor

Motor	Minimum clearance, A
0.25 - 4 kW	0.3 m

- Pumps fitted with motors of 7.5 hp (5.5 kW) and up require a 12 inches (0.3 m) clearance behind the motor and at least a clearance of 40 inches (1 m) above the motor to allow for the use of lifting equipment.



Clearance behind and above the motor

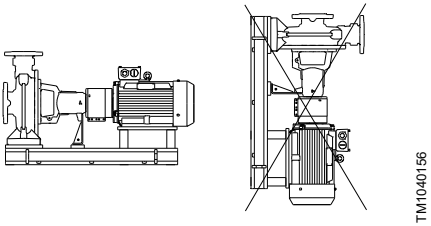
Motor	Minimum clearance	
	A	B
5.5 kW and up	0.3 m	1 m

4.2 Installation position

Arrows on the pump housing show the direction of the flow of liquid through the pump.

Only horizontal installation is allowed for NK-Conexus pumps. Contact Grundfos for information on extra installation requirements if special installation positions are needed.

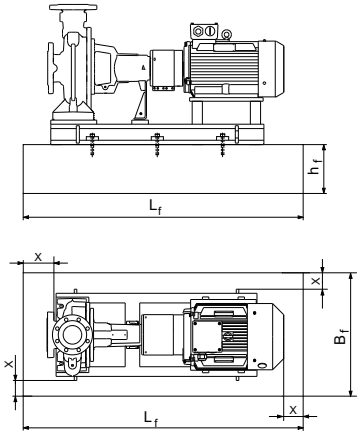
The motor must never be positioned below the horizontal plane. Horizontal motors with feet must always be supported.



5. Mechanical installation

5.1 Foundation

- 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 be at least 1.5 times the weight of the pump.
- The foundation must be at least 4 inches (100 mm) larger than the base frame on all four sides.



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Foundation, X equal to minimum 100 mm

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

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

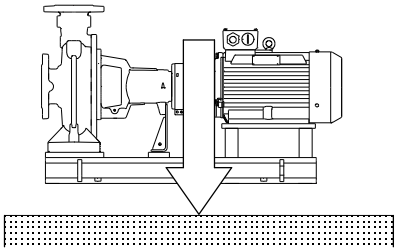
h_f	Height of the foundation [in] [m]
L_f	Length of the foundation [in] [m]
B_f	Width of the foundation[in] [m]
m_{pump}	Mass of the pump [lbs] [kg]
$\delta_{concrete}$	Density of the concrete [lb/in^3] [kg/m^3]

The density of concrete, indicated by δ, is usually taken as 0.08 lb/in^3 (2,200 kg/m^3)

- In installations where noiseless operation is particularly important, we recommend a foundation with a mass up to 5 times that of the pump.

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.

The base frame must be supported under its entire area.



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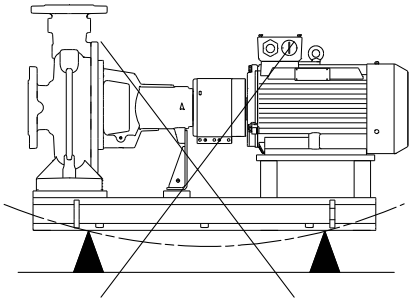
Correct foundation



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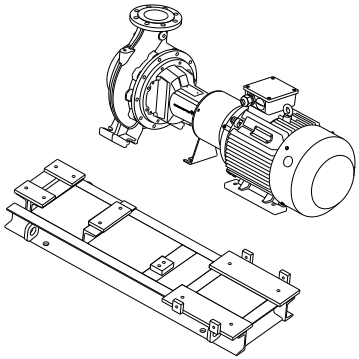
Incorrect foundation

5.1.1 Grouting of horizontally mounted NK pumps

For NK 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.

	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	



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Base frame cavities to be filled with grout

5.1.2 Preparing the foundation

We recommend the following procedures to ensure a good foundation:

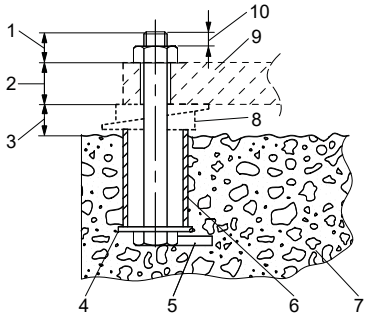
1. Pour the foundation without interruption to 19 to 32 mm of the final level.

   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.



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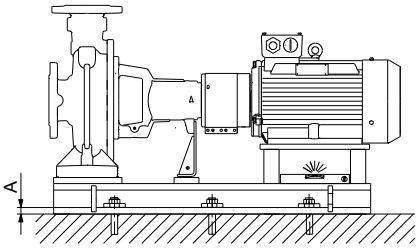
Pos.	Description
1	Bolt length above the support rail
2	Thickness of the support rail
3	19-32 mm allowance for grout
4	Washer
5	Lug
6	Pipe sleeve
7	Foundation with rough top
8	Wedges and shims left in place
9	Support rail
10	5-10 mm

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

5.1.3 Levelling the base frame

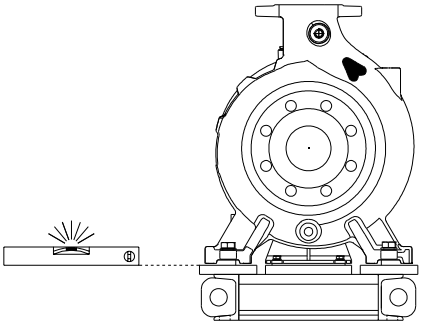
Follow the steps below to level the base frame:

1. Lift or jack up the base frame to the final level 0.75 - 1.25 inches (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: 0.75 - 1.25 inches (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.

5.1.4 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.

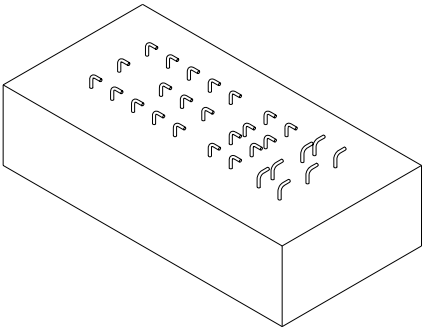
Carry out alignment of the motor only, as pipe strain will occur if the pump is shifted.

5.1.5 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:

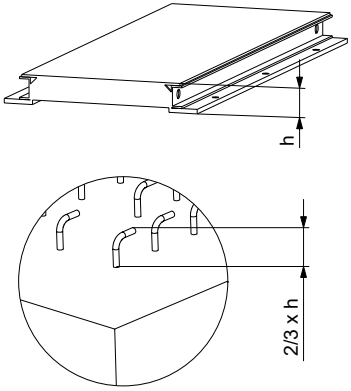
1. Use an approved, non-shrinking grout.
2. Embed reinforcing steel bars into the foundation by means of 2K anchor adhesive glue.
3. The number of steel bars depends on the size of the base frame, but we recommend that you distribute a minimum of 20 bars evenly over the whole area of the base frame.



TM040491

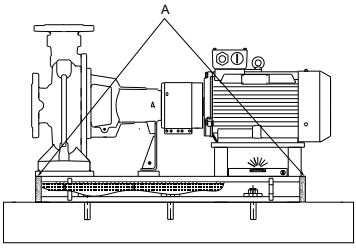
Example of foundation with minimum 20 bars

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.

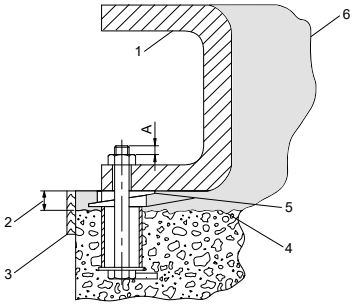


TM1040357

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.

5.2 Alignment of pump and motor

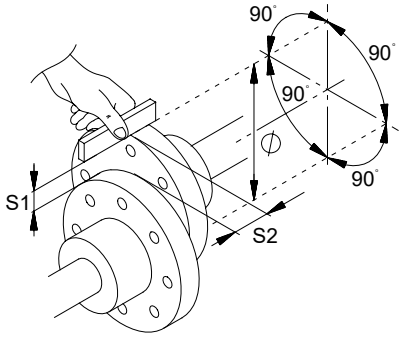
When a complete unit is supplied assembled from the factory, the coupling halves have been accurately aligned by means of foil inserted under the pump and motor mounting surfaces as required.

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

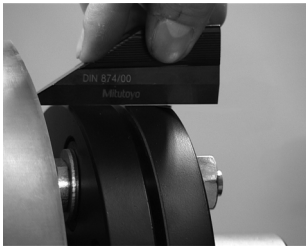


TM018753

Alignment

5.2.1 Aligning the pump and motor with a straightedge ruler

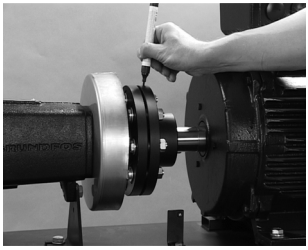
1. Make a rough alignment of pump and motor, and tighten the screws in the base frame to the correct torque.



TM038340

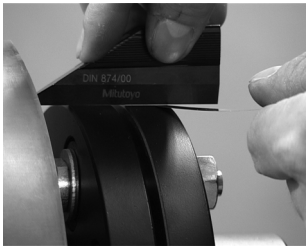
See the table Tightening torques.

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



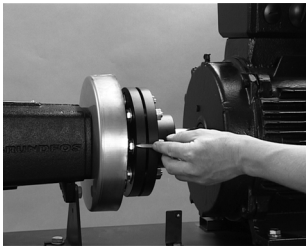
TM038301

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.



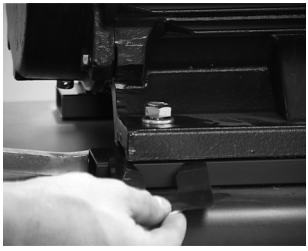
TM038302

- 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.

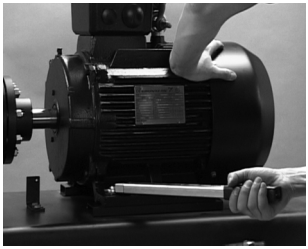
TM038321

6. Insert shims with the required thickness.



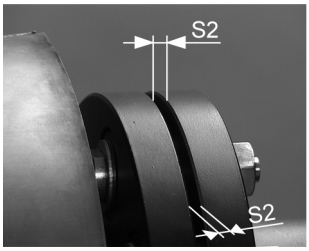
TM038322

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.



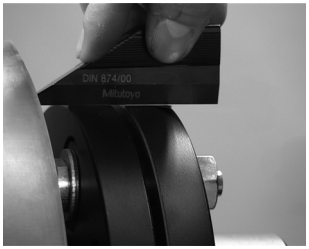
TM038325

- 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 S2.

5.2.2 Aligning the pump and motor with laser equipment

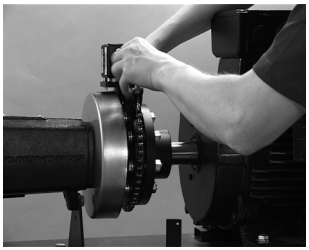
1. Make a rough alignment of pump and motor, and tighten the screws in the base frame to the correct torque.



TM038340

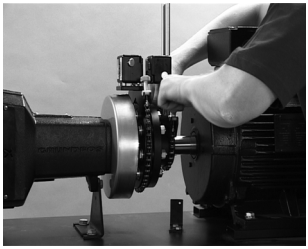
See the table Tightening torques.

2. Fasten one laser bracket to the pump coupling.



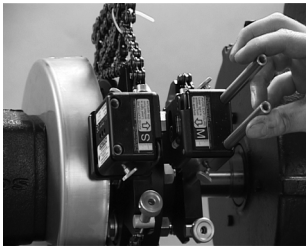
TM038303

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



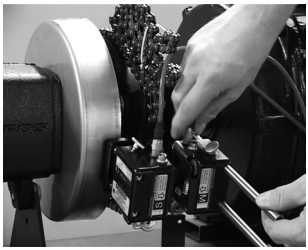
TM038304

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



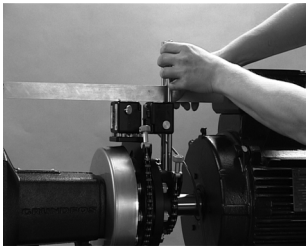
TM038305

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



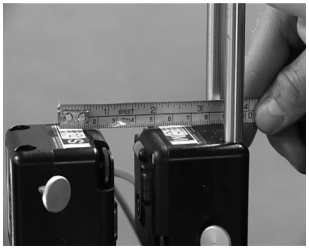
TM038306

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



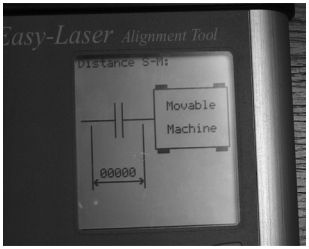
TM038307

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



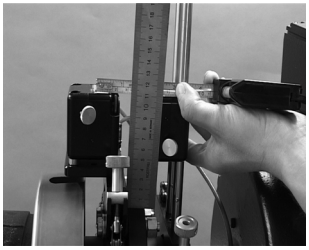
TM038309

8. Enter the distance.



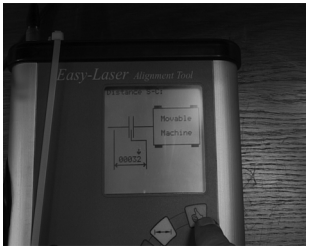
TM038308

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



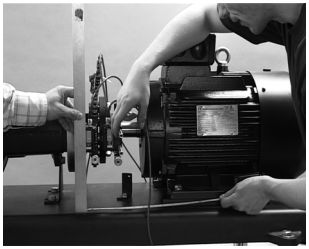
TM038310

10. Enter the distance.



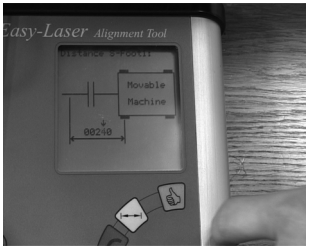
TM038311

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



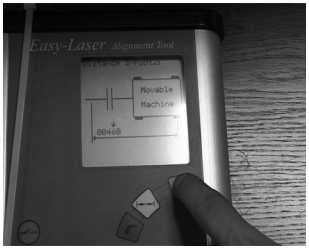
TM038312

12. Enter the distance.



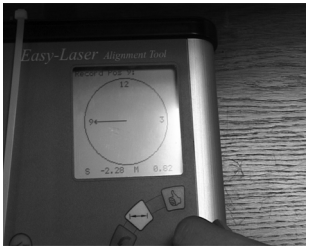
TM038313

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



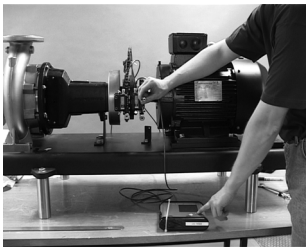
TM038314

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.

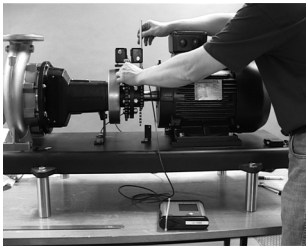


TM038316

16. Confirm on the control box.

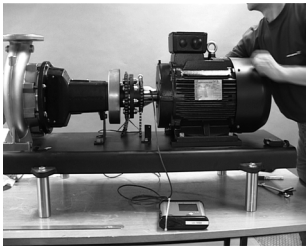
TM038319

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



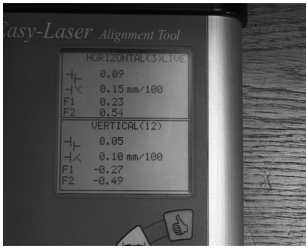
TM038317

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.

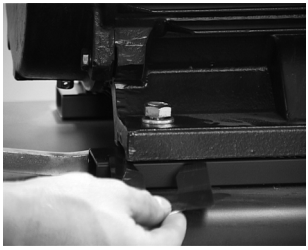


TM038320

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

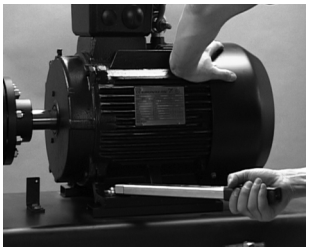
TM038321

21. Insert shims with the required thickness.

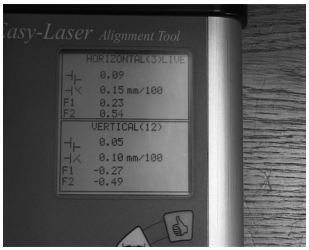


TM038322

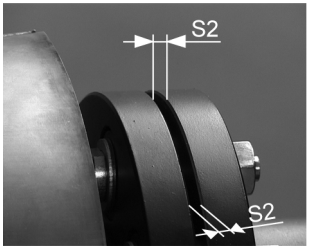
22. Tighten the screws to the correct torque again.



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



24. Check the gap S2.



See the table Air-gap width S2.

TM038324

TM038320

TM038325

5.2.3 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	
	Nominal	Tolerance
80	-	-
95		
110		
125	4	0/-1
140		
160		
200		
225		
250		

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

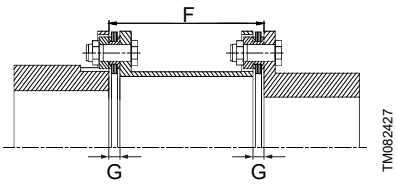
WARNING
Crushing of hands
Death or serious personal injury

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

5.2.4 Alignment of pump and motor with spacer coupling

5.2.4.1 Checking the axial distance between flange ends

1. Put the motor and the pump in the working position.
2. Take four readings along circumference with 90 ° interval and calculate the average value to measure the axial distance F between the two flange ends.
3. Adjust the position of the motor and pump until the value of F meets the standard on the assembly drawing.
   - The deviation must be within 0 to 0.4 mm.



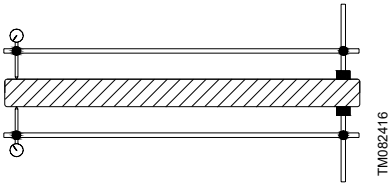
Type	Outside coupling diameter [mm]	Disc thickness [mm], G	Distance between flange ends [mm], F
TDE4-6	90	7.2	100,140, 180
TDE4-14	100	8.4	100,140, 180
TDE4-22	120	9.5	140, 180, 200, 250
TDE4-44	130	10.7	140, 180, 200, 250, 300
TDE4-112	146	11.1	140, 180, 200, 250, 300
TDE4-142	176	13.6	180, 200, 250, 300
TDE4-220	196	15.2	180, 200, 250, 300
TD6-470	196	13.3	180, 200, 250, 300
TDE4-220	226	13	180, 200, 250, 300

5.2.4.2 Measuring the dial indicator sag

When you use the dial indicator to measure the deviation, you must consider the misalignment caused by the dial indicator sag. This is particularly important if distances between shafts are long or the alignment accuracy requirement is high.

Obey the instructions below to measure the dial indicator sag before you use the dial indicator.

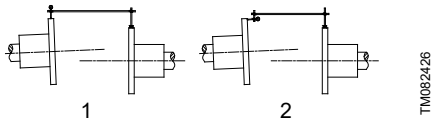
1. Install the magnetic base on a shaft which is able to rotate.
2. Fix the dial indicator support according to the actual length of the dial indicator rod.
3. Read the dial indicator in position 12 o'clock and position 6 o'clock.



4. Record the difference as the dial indicator sag.

5.2.4.3 Angular and parallel aligning of the pump and the motor with dial indicators

1. Use the dial indicator to measure the deviation of the circumference for parallel alignment and the end faces for angular alignment.
2. Determine the location of shafts by analyzing the measurements
3. Adjust the shafts based on the results. See the section Accepted misalignment.



1	Parallel alignment
2	Angular alignment

Related information

5.2.4.4 Accepted misalignment

5.2.4.4 Accepted misalignment

Type	Outside coupling diameter [mm]	Accepted misalignment	
		Angular [mm]	Parallel [mm]
TDE4-6	90	0.10	0.10
TDE4-14	100	0.15	0.15
TDE4-22	120	0.20	0.20
TDE4-44	130	0.25	0.25
TDE4-112	146	0.25	0.25
TDE4-142	176	0.30	0.30
TDE4-220	196	0.35	0.35
TD6-470	196	0.20	0.20
TD6-523	226	0.25	0.25

If the coupling type is not a Trumy spacer coupling, consult the device manufacturer for accepted misalignment.

5.2.5 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

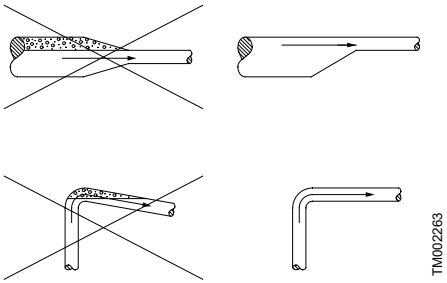
5.3 Pipes and connections

5.3.1 Pipe system

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.



Recommended pipe installation to avoid friction and air pockets

The pipes must be as straight as possible, so as to avoid unnecessary bends and fittings. Where necessary, use 45 ° or long-sweep 90 ° pipe bends to decrease friction loss.

Where flanged joints are used, internal diameters must match properly and mounting holes must be aligned.

Do not apply force to pipes when making any connections.

5.3.2 Connecting the inlet pipes

- Run the inlet pipe as direct as possible, and optimally, make sure the length is at least ten times the pipe diameter. A short inlet pipe can be the same diameter as the inlet port. A long inlet pipe must be one or two sizes larger than the inlet port, depending on the length, and with a reducer between the pipe and the inlet port.
- If possible, run a horizontal inlet line along an even gradient. We recommend a gradual upward slope to the pump under suction lift conditions, and a gradual downward slope under positive inlet pressure conditions.
- Avoid any high points, such as pipe loops, as this may create air pockets and throttle the system, or cause erratic pumping.
- Install a valve on the inlet line to allow for isolation of the pump during shutdown and maintenance, and to facilitate pump removal.

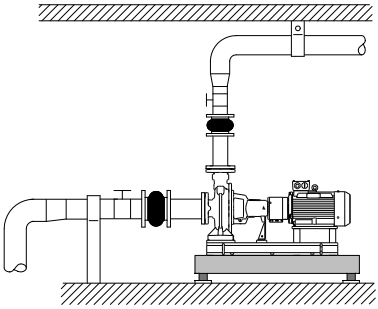
Where two or more pumps are connected to the same inlet line, install valves to isolate each pump from the line.

- Always install valves in positions that do not yield air pockets.
- During pumping operation, the valves on the inlet line must always be fully open.

5.3.3 Connecting the outlet pipes

We recommend that you use long horizontal outlet pipes.

- Install a valve near the outlet port to allow for isolation of the pump during shutdown and maintenance, and to facilitate pump removal.
- Avoid high points in the outlet pipe because it might entrap air or gas, and thus retard pump operation.
- If water hammer occurs, for example when check valves are used, close the outlet valve before pump shutdown.
- Make sure the pipes are adequately supported as close to the pump as possible, both on the inlet and the outlet side.



Pump installation

The counterflanges must be properly aligned so that the pump is not strained while the flange bolts are tightened.

5.3.4 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.

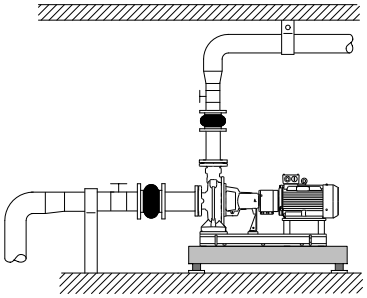
5.4 Vibration damping

5.4.1 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 15 hp (11 kW) and up. Vibration damping is mandatory for motors of 125 hp (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.



5.4.2 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.

5.5 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

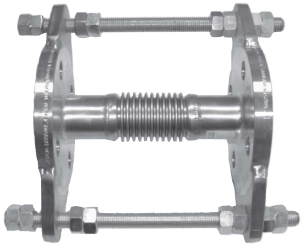
TM024981

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

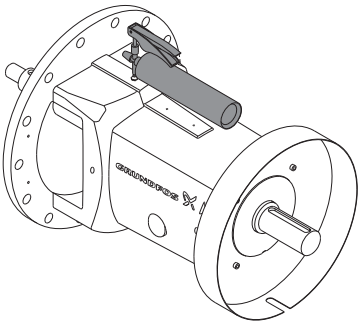
Metal bellows expansion joint with limiting rods

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.

5.6 Bearing bracket

5.6.1 Lubricating bearing bracket with grease

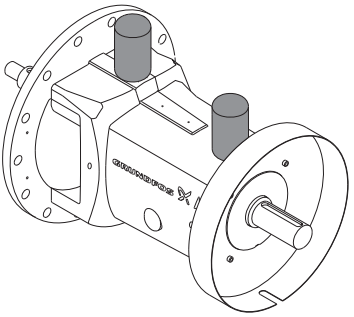
- For bearing bracket with grease nipples, relubricate the bearings using a grease gun.



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

Related information

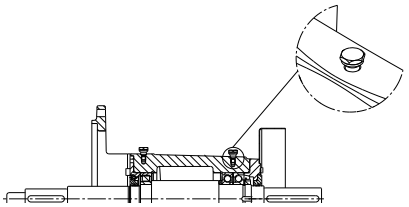
Pump with greased-for-life bearings

5.7 Bearing monitoring

5.7.1 Vibration level

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

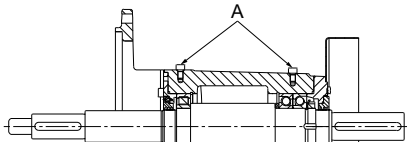
Bearing brackets with constant-level oiler are prepared for vibration measurement by means of the shock pulse method (SPM).



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

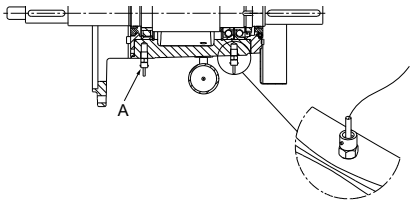
- A: plugged holes for SPM fitting

Bearing bracket for retrofitting of SPM measuring equipment

5.7.2 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

5.8 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.

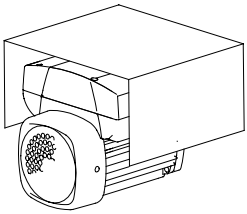
5.9 Ammeter

We recommend connecting an ammeter to check the motor load.

5.10 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.



TM1040101

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 organisationsorganizations 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 Voltage and frequency variation

The motor will operate satisfactorily under the following voltage and frequency variations, but not necessarily in accordance with the standards established for operation under rated conditions:

- The voltage variation must not exceed 10 % above or below the rating specified on the motor nameplate.
- The frequency variation must not exceed 5 % above or below the motor rating.

6.2 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.

6.3 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 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.

7.2 Priming

7.2.1 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

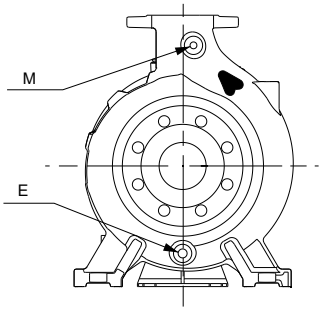
- Pay attention to the orientation of the priming hole to ensure that the escaping liquid does not cause personal injury or damage to the motor or other components.
- In hot-liquid installations, pay special attention to the risk of personal injury caused by scalding hot liquid.
- In cold-liquid installations,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

7.2.2 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.

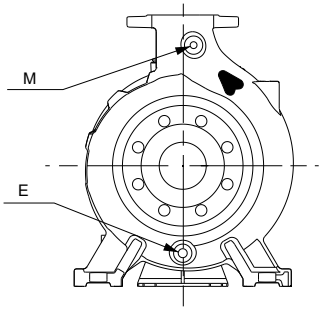


TM1040359

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

7.2.3 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.



TM1040359

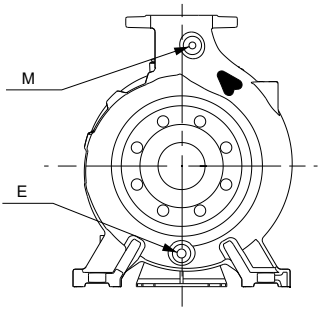
Drain plug (E), priming and venting plug (M)

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.

7.3 Checking the direction of rotation

The pump must be filled with liquid when checking the direction of rotation.

The correct direction of rotation is shown by arrows on the pump housing. See the figure below.



TM1040359

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

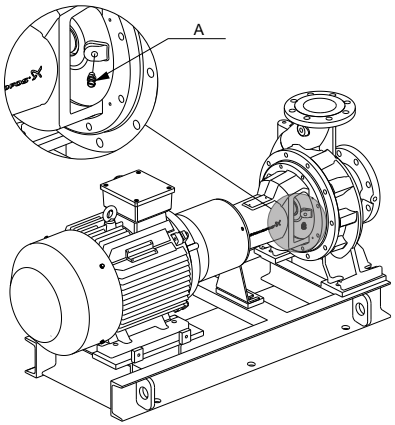
1. Check the direction of rotation by watching the motor fan rotation.
2. Turn the motor on for a brief while to ensure that the direction of rotation is correct as indicated by the arrow cast into the pump housing.

   This should only be done for three-phase motors.
3. If the direction of rotation is incorrect, interchange two wires at the motor starter terminals T1 and T2.

Use extreme caution to ensure that motors are turned on only briefly when determining proper direction of rotation.

7.4 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/plug 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)/plug

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.

7.5 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.

7.5.1 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 Number of motors starting or stopping

Frame size	Maximum number of motor starts per hour		
	Number of poles		
	2	4	6
71M	100	250	350
80M	60	140	160
90S	60	140	160
90L	60	140	160
100L	60	140	160
112M	30	60	80
132S	30	60	80
132M	-	60	80
160M	15	30	50
160L	15	30	50
180M	15	30	-
180L	-	30	50
200L	8	15	30
225S	-	15	-
225M	8	15	30
250M	4	8	12
280S	4	8	12
280M	4	8	12
315S	4	8	12
315M	4	8	12
315L	4	8	12
355M	3	6	8
355L	3	6	8
355X	3	6	8

7.7 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. Service

DANGER
Moving machine parts
Death or serious personal injury

- Before any inspection, maintenance, service or repair of the product, make sure the motor controls are in the "OFF" position, locked and tagged.

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 the power supply cannot be accidentally switched on. Use logout-tagout if available.

8.1 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 injurious to health or toxic. If you request Grundfos to service the product, contact Grundfos with details about the pumped 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.

8.2 Maintenance

DANGER
Moving machine parts
Death or serious personal injury

- Before any inspection, maintenance, service or repair of the product, make sure the motor controls are in the "OFF" position, locked and tagged.

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 the power supply cannot be accidentally switched on. Use logout-tagout if available.

8.2.1 Maintenance of the pump

The pump is maintenance-free.

8.2.1.1 Maintaining the mechanical shaft seals

Mechanical shaft seals are maintenance-free, working almost without any leakages.

- If any considerable or 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 utmost care.

End suction pumps equipped with mechanical shaft seals are matched to the operating conditions for which the pump was sold. Observe the following precautions to avoid shaft seal damage and achieve maximum shaft seal life.

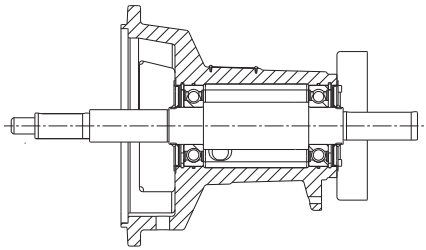
Do not run the pump dry or against a closed valve. Dry running will cause shaft seal failure.

Do not exceed the temperature or pressure limitations for the mechanical shaft seal in use.

8.2.2 Lubrication of bearings in bearing bracket

8.2.2.1 Grease-lubricated bearings

Pump with greased-for-life bearings



Bearing bracket with closed, greased-for-life bearings

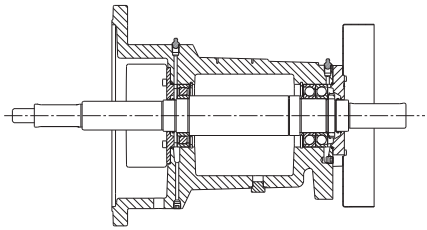
The bearing bracket with closed, greased-for-life bearings is maintenance-free. Under optimum operating conditions, the bearing life will be approximately 17,500 operating hours. After that period, we recommend that you replace the bearings. See section Taking the product out of operation.

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.

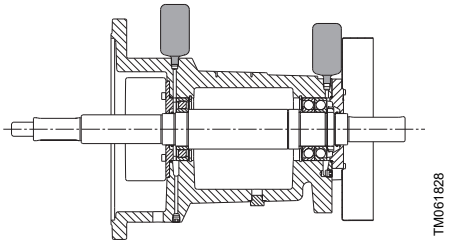
Related information

9.1 Protecting the pump during periods of inactivity and frost

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.

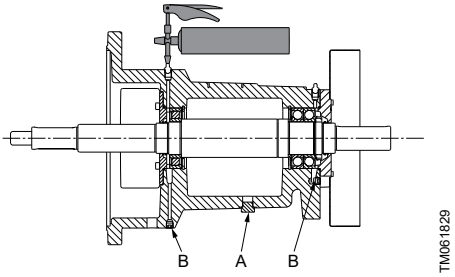
Related information

9.1 Protecting the pump during periods of inactivity and frost

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.

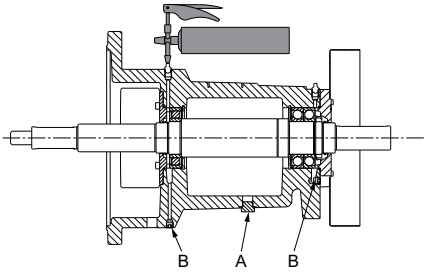
Never mix greases with different thickeners, such as a lithium-based grease with a sodium-based grease, before checking with the suppliers.

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.

Related information

9.1 Protecting the pump during periods of inactivity and frost

8.2.3 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.

8.2.4 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.

8.2.4.1 Lubrication of motor

Always follow the motor manufacturer's lubricating instructions.

Some information is stated on the motor nameplate, and additional information can be found in the installation and operating manual from the motor manufacturer.

8.2.5 Lubrication of motor bearings

8.2.5.1 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.

8.2.5.2 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.

8.3 Applying sealant to plugs

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

8.4 Service kits

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

9. Taking the product out of operation

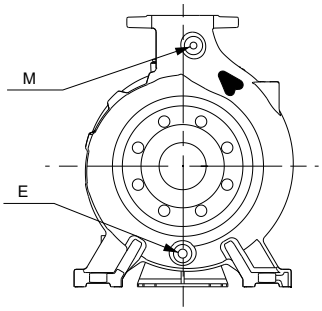
9.1 Protecting the pump during periods of inactivity and frost

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.



TM1040359

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.

9.2 Short-term shutdown

For overnight or temporary shutdown periods under nonfreezing conditions, the pump may remain filled with liquid. The pump must be fully primed before restarting.

For short or frequent shutdown periods under freezing conditions, the liquid must be kept moving within the pump housing and the pump exterior must be insulated or heated to prevent freezing.

9.3 Long-term shutdown

For long shutdown periods, or to isolate the pump for maintenance, the inlet gate valve must be closed. If no inlet valve is used and the pump has positive inlet pressure, all liquid must be drained from the inlet line to stop the liquid flow from entering the pump inlet. The plug in the pump drain and vent holes must be removed, as required, and all liquid must be drained from the pump housing.

If there are freezing conditions during long shutdown periods, the pump must be drained completely, and all liquid passages and pockets must be blown out with compressed air. Freezing of the pumped liquid can also be prevented by filling the pump with antifreeze solution.

9.4 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.

10. 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.	1. Check the electrical connection. 2. Remedy, if necessary.
	b) The direction of rotation is wrong.	• Interchange two phases of the power supply.
	c) There is air in inlet pipe.	• Vent the inlet pipe or the pump.
	d) The counterpressure is too high.	1. Set the duty point according to the flow and head that the pump is selected for. 2. Check the system for debris. 3. Clean the system, if necessary.
	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 section Pipes and connections are complied with.
	f) The inlet pipe or impeller is blocked by debris.	• Clean the inlet pipe or pump.
	g) The pump draws in air due to a defective seal.	1. Check the pipeline seals, pump housing gaskets and shaft seals. 2. Replace gaskets and seals, if necessary.
	h) The pump draws in air due to low liquid level.	1. Increase the liquid level on the inlet side. 2. Keep the liquid level 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 debris.	• Clean the pump.
	b) The pump is running above rated duty point.	• Set the duty point according to the flow and head that the pump is selected for.
	c) The density or viscosity of the liquid is higher than specified upon order.	• If less flow is sufficient, reduce the flow on the outlet side. • If less flow is insufficient, fit a more powerful motor.
	d) The motor-protective circuit breaker overload setting is incorrect.	1. Check the setting of the motor-protective circuit breaker. 2. Adjust the setting if necessary.
	e) The motor runs on two phases.	1. Check the electrical connection. 2. Replace the fuse, if defective.
	f) The motor may be faulty	1. Check the motor. 2. Replace the motor if necessary.
3. The pump makes too much noise. The pump runs unevenly and vibrates.	a) The inlet pressure is too low, resulting in cavitation in the pump.	• Increase the liquid level on the inlet side. • Open the isolating valve in the inlet pipe. • Make sure that all the conditions in section Pipes are complied with.
	b) There is air in the inlet pipe or pump.	• Vent the inlet pipe or the pump.
	c) The counterpressure is lower than specified.	• Set the duty point according to the flow and head that the pump is selected for.
	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.	1. Clean the impeller. 2. Check the impeller blades, clean them if necessary.
	f) The split coupling is out of balance.	1. Check coupling gap and that set screws in split coupling are tightened. 2. Disassemble split coupling to inspect keys and keyways and their alignment with coupling pieces.
	g) The inner parts are worn.	• Replace the defective parts.
	h) The pump is stressed by the pipes thus causing starting noise.	• Mount the pump so that it is not stressed. • Support the pipes.
	i) The bearings are defective.	• Replace the bearings.
	j) The motor fan is defective.	• Replace the fan.
	k) There are foreign bodies in the pump.	• Clean the pump.
	l) Frequency converter operation causes noise.	• Find the different remedies in Frequency converter operation section. See section Frequency converter operation.

Fault	Cause	Remedy
4. The pump, connections or mechanical shaft seal is leaking.	a) The pump is stressed by the pipes which causes leaks in the pump housing or at 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 shaft surface is defective.	• Replace the shaft.
5. The temperature in the pump or motor is too high.	a) There is air in the inlet pipe or pump.	1. Vent the inlet pipe or the pump. 2. Fill up the inlet pope and the pump again.
	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 section Pipes are complied with.
	c) The bearings are lubricated with too little, too much or unsuitable lubricant.	• Replenish, reduce or replace the lubricant.
	d) The axial pressure is too high.	1. Check the relief holes of the impeller on the inlet side. 2. Clean the holes, if necessary
	e) The motor-protective circuit breaker is defective or the setting is incorrect.	1. Check the setting of the motor-protective circuit breaker. 2. Replace the circuit breaker if necessary.
	f) 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.

Related information

5.3.1 Pipe system

6.3 Frequency converter operation

11. Technical data

11.1 Operating conditions

11.1.1 Ambient temperature and altitude

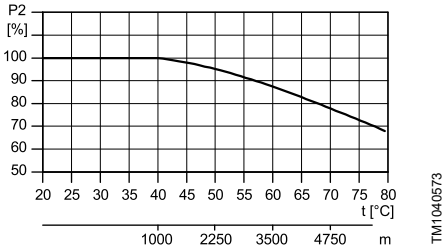
Do not exceed the allowable maximum ambient temperature stated on the motor nameplate. If nothing is stated, then the maximum allowed ambient temperature is 40 °C.

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

The installation altitude is the height of the installation site above sea level.

See the figure below if the ambient temperature or the installation altitude exceeds the recommended maximum ambient temperature or the maximum altitude. 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.

Motor make	Motor P2	Derating curve
MMG-W	0.25 - 375 kW	As below
MMG-H	0.25 - 375 kW	As below
MMG-G	0.25 - 375 kW	As below



The maximum motor output depending on the ambient temperature and altitude

For example, for a pump with a 1.1 kW IE3 MMG-W motor, if it is installed 4750 m above the see level, the load of the motor must not exceed 77 % of the rated power. If it is installed at an ambient temperature of 75 °C, the load of the motor must not exceed 72 % of the rated power. If the pump is installed 4750 m above the see level at an ambient temperature of 75 °C, the load of the motor must not exceed 55.4 %, that is 77 % x 72 %, of the rated power.

11.1.2 Liquid temperature

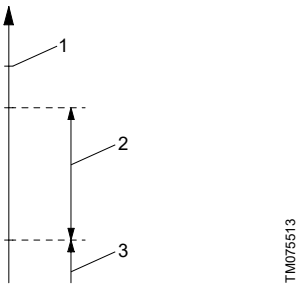
Liquid temperature: -40 to +140 °C

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.

11.1.3 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.

11.1.4 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.

11.1.5 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.

11.1.6 Flow rates

Minimum flow rate

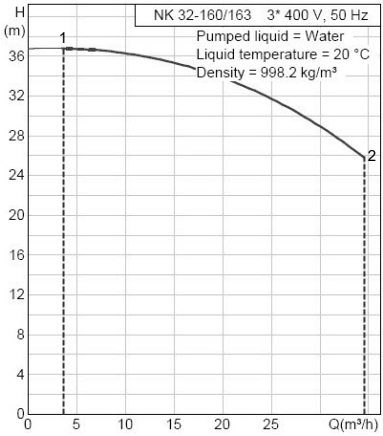
The pump must not run against a closed outlet valve as this causes an increase in temperature or formation of steam in the pump. This may cause shaft damage, impeller erosion, short life of bearings, damage to stuffing boxes or mechanical shaft seals due to stress or vibration.

The continuous flow rate must be at least 10 % of the maximum flow rate.

Maximum flow rate

The maximum flow rate must not be exceeded as otherwise there is a risk of for instance cavitation and overload.

The maximum flow rate can be read either from the performance curve pages or from a curve on a specific pump when selecting it in Grundfos Product Center.



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Example from Grundfos Product Center showing minimum and maximum flow rate

Pos.	Description
1	Minimum flow rate
2	Maximum flow rate

11.1.7 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	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 D, balanced	AQ_1	FXM	DAQF	0-140 °C	25	25	25	25
	Q_6Q_6	EPDM	DQQE	-25 to +120 °C	25	25	25	25

11.2 Electrical data

See the motor nameplate.

11.3 Sound pressure level

Data in this table apply to pump including motor.

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

50Hz 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	-	55	-
0.37	-	55	57
0.55	-	55	57
0.75	66	55	58
1.1	67	55	58
1.5	69	55	58
2.2	69	55	59
3	69	55	60
4	69	56	60
5.5	70	62	60
7.5	70	64	67
11	77	66	67
15	77	66	67
18.5	79	67	68
22	80	67	68
30	85	70	69
37	85	72	70
45	85	72	72
55	88	74	72
75	88	77	75
90	-	77	75
110	-	78	-
132	-	87	-
160	-	87	-
185	-	87	-
200	-	88	-
220	-	90	-
250	-	90	-
280	-	90	-
315	-	90	-

60Hz 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	-	58	-
0.37	-	58	-
0.55	-	58	60
0.75	-	58	61
1.1	70	58	61
1.5	72	58	61
2.2	72	58	62
3	72	58	63
4	72	59	63
5.5	73	65	63
7.5	73	67	70
11	80	69	70
15	80	69	70
18.5	82	70	71
22	83	70	71
30	88	73	72
37	88	75	73
45	88	75	75
55	91	77	75
75	91	80	78
90	91	80	78
110	-	81	78
132	-	90	78
160	-	90	85
185	-	90	-
200	-	91	-
220	-	93	-
250	-	93	-
280	-	93	-

Motor [kW]	Maximum sound pressure level [dB(A)] - ISO 3743		
	Three-phase motors		
	2-pole	4-pole	6-pole
315	-	93	-
355	-	96	-
375	-	96	-

11.4 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.

12. 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*.

13. Document quality feedback

To provide feedback about this document, scan the QR code using your phone's camera or a QR code app.

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A.1. 中国 RoHS

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
印刷电路板	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

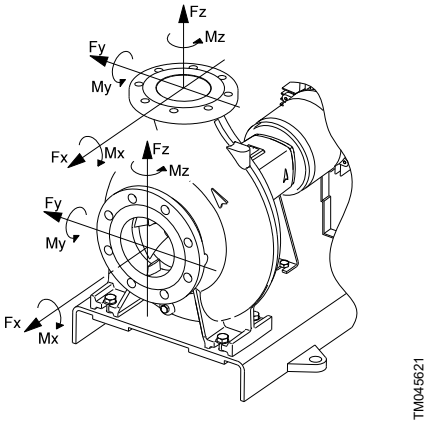
本表格依据 SJ/T 11364 的规定编制

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

Appendix B

B.1. Flange forces and torques



Flange forces and torques

Cast iron flanges	Diameter DN	Force [N]				Torque [N-m]			
		Fy	Fz	Fx	ΣF 1)	My	Mz	Mx	ΣM 1)
Horizontal pump, x-axis, inlet port	25	245	298	263	455	210	245	315	455
	32	298	368	315	578	263	298	385	560
	40	350	438	385	683	315	368	455	665
	50	473	578	525	910	350	403	490	718
	65	595	735	648	1155	385	420	525	770
	80	718	875	788	1383	403	455	560	823
	100	945	1173	1050	1838	438	508	613	910
	125	1120	1383	1243	2170	525	665	735	1068
	150	1418	1750	1575	2643	613	718	875	1278
	200	1890	2345	2100	3658	805	928	1138	1680
	250	2700	3460	2980	5220	1260	1460	1780	2620
	300	3220	4000	3580	6260	1720	1980	2420	3560
	350	3760	4660	4180	7300	2200	2540	3100	4560
	400	4300	5320	4780	8340	2760	3180	3880	5720
	450	4840	5980	5380	9380	3400	3920	4780	7040
	500	5380	6640	5980	10420	4100	4720	5780	8520

Cast iron flanges	Diameter DN	Force [N]				Torque [N-m]			
		Fy	Fz	Fx	ΣF [1]	My	Mz	Mx	ΣM [1]
Horizontal pump, x-axis, outlet port	32	315	298	368	578	263	298	385	560
	40	385	350	438	683	315	368	455	665
	50	525	473	578	910	350	403	490	718
	65	648	595	735	1155	385	420	525	770
	80	788	718	875	1383	403	455	560	823
	100	1050	945	1173	1838	438	508	613	910
	125	1243	1120	1383	2170	525	665	735	1068
	150	1575	1418	1750	2748	613	718	875	1278
	200	2100	1890	2345	3658	805	928	1138	1680
	250	2980	2700	3340	5220	1260	1460	1780	2620
	300	3580	3220	4000	6260	1720	1980	2420	3920
	350	4180	3760	4660	7300	2200	2540	3100	4560
	400	4780	4300	5320	8340	2760	3180	3880	5720
	450	5380	5080	5980	9380	3400	3920	4780	7040
	500	5980	5380	6640	10420	4100	4720	5780	8520

[1] ΣF and ΣM are vector sums of the forces and torques

Stainless steel flanges	Diameter DN	Force [N]				Torque [N-m]			
		Fy	Fz	Fx	ΣF [2]	My	Mz	Mx	ΣM [2]
Horizontal pump, x-axis, inlet port	25	490	595	525	910	420	490	630	910
	32	595	735	630	1155	525	595	770	1120
	40	700	875	770	1365	630	735	910	1330
	50	945	1155	1050	1820	700	805	980	1435
	65	1190	1470	1295	2310	770	840	1050	1540
	80	1435	1750	1575	2765	805	910	1120	1645
	100	1890	2345	2100	3675	875	1015	1225	1820
	125	2240	2765	2485	4340	1050	1330	1470	2135
	150	2835	3500	3150	5285	1225	1435	1750	2555
	200	3780	4690	4200	7315	1610	1855	2275	3360
	250	4725	6055	5215	9135	2205	2555	3115	4585
	300	5635	7000	6265	10955	3010	3465	4235	6230
	350	6580	8155	7315	12775	3850	4445	5425	7980
	400	7525	9310	8365	14595	4830	5565	6790	10010
	450	8470	10465	9415	16415	5950	6860	8365	12320
	500	9415	11620	10465	18235	7175	8260	10115	14910

Stainless steel flanges	Diameter DN	Force [N]				Torque [N-m]			
		Fy	Fz	Fx	ΣF [2]	My	Mz	Mx	ΣM [2]
Horizontal pump, x-axis, outlet port	32	630	595	735	1155	525	595	770	1120
	40	770	700	875	1365	630	735	910	1330
	50	1050	945	1155	1820	700	805	980	1435
	65	1295	1190	1470	2310	770	840	1050	1540
	80	1575	1435	1750	2765	805	910	1120	1645
	100	2100	1890	2345	3675	875	1015	1225	1820
	125	2485	2240	2765	4340	1050	1330	1470	2135
	150	3150	2835	3500	5495	1225	1435	1750	2555
	200	4200	3780	4690	7315	1610	1855	2275	3360
	250	5215	4725	5845	9135	2205	2555	3115	4585
	300	6265	5635	7000	10955	3010	3465	4235	6860
	350	7315	6580	8155	12775	3850	4445	5425	7980
	400	8365	7525	9310	14595	4830	5565	6790	10010
	450	9415	8890	10465	16415	5950	6860	8365	12320
	500	10465	9415	11620	18235	7175	8260	10115	14910

[2] ΣF and ΣM are vector sums of the forces and torques

If not all loads reach the maximum permissible value, one of the values is allowed to exceed the normal limit. Contact Grundfos for further information.

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