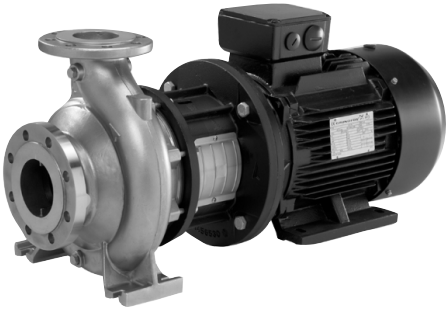
NB, NBG, MTB

Installation and operating instructions



NB NBG MTB
Installation and operating instructions
(all available languages)
http://net.grundfos.com/qr/i/QR96483177

GRUNDFOS

NB, NBG, MTB

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.

2. Product introduction

2.1 Product description

NB, NBG, MTB are non-self-priming, single stage, centrifugal volute pumps with axial inlet port and radial outlet port.

NB pumps comply with EN 733.

NBG pumps comply with ISO 2858.

2.1.1 Pumped liquids of NB, NBG

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

2.1.2 Pumped liquids of MTB

DANGER

Flammable material

Death or serious personal injury

- The pump must not be used for the pumping of inflammable liquids, such as diesel fuel, petrol or similar liquids.

MTB pumps are suitable for industrial machine tool applications, such as:

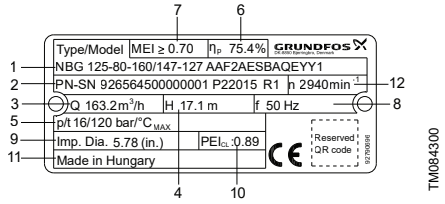
- machining centres
- cooling systems
- grinding machines
- lathes
- parts cleaning systems.

MTB pumps are designed specifically for the transfer of liquids containing solid particles. The pumps are capable of pumping liquids with particles up to 20 mm in size and a weight percentage of up to 1.5 wt%.

When pumping abrasive particles, a reduced life of pump parts can be expected.

2.2 Identification

2.2.1 Nameplate



Example of NB, NBG nameplate

Pos.	Description	
1	Type designation	
2	Identification code	
	92656450	Product number
	00000001	Serial number
	P2	Production site code
	2015	Production year and week (YYWW)
	R1	Range identification (service range code) /
3	Nominal flow rate	
4	Nominal pump head	
5	Pressure rating and maximum temperature	
6	Hydraulic efficiency at best efficiency point	
7	Minimum efficiency index	
8	Frequency	
9	Actual impeller diameter	
10	WRAS approval or Pump Energy Index (PEI) PEI_{CL}: constant load PEI_{VL}: variable load	
11	Country of origin	
12	Rated pump speed	

2.2.2 Type key, NB, NBG

Example 1: NBE 100-160/160-142BSASF1AESBAQERW1
Example 2: NBGE 200-150-315.2/317ACAEF3KFSDAQFYW1
Example 3: NBG 100-65-200/219SAAEF2KESBQQEKX4
Example 4: NB 80-200/222VAXEF1BESBQQEWX2

Pos.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Example 1	NBE		100	-160	/160-142		B	S	AS	F	1	A	E	S	BAQE	R	W	1
Example 2	NBGE	200	-150	-315.2	/317		A	C	AE	F	3	K	F	S	DAQF	Y	W	1
Example 3	NBG	100	-65	-200	/219	S	A		AE	F	2	K	E	S	BQQE	K	X	4
Example 4	NB		80	-200	/222	V	A		XE	F	1	B	E	S	BQQE	W	X	2

Pos.	Explanation
1	Type range
2	Nominal diameter of inlet port (DN)
3	Nominal diameter of outlet port (DN)
4	Nominal impeller diameter [mm]
5	Actual impeller diameter [mm]
6	**Impeller type** 'blank': Closed impeller, cylindrical trim. If one dimension is shown, the impeller has a cylindrical trim, for example 317 'blank': Closed impeller, conical trim. If two dimensions are shown, the impeller has a conical trim, for example 160-142 S: Special open impeller V: Super vortex impeller
7	**Hydraulic version** A: 1st version B: 2nd version C: 3rd version D: 4th version
8	**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
9	**Code for pump version; the codes may be combined** A: Basic version B: Oversize motor C: Without motor D: Pump housing with feet (+E): With ATEX approval, certificate or test report, the second character of the code for pump version is an E F: Design with base frame (+S): With support blocks, the second character of the pump version code is an S X: Special version; used in case of further customisation than already listed
10	**Code for pipe connection** E: Table E flange F: DIN flange G: ANSI flange J: JIS flange
11	**Flange pressure rating (PN - rated pressure)** 1: 10 bar 2: 16 bar 3: 25 bar 4: 40 bar 5: Other pressure rating

Pos.	Explanation				
	Code for materials				
	Code	**Pump housing**	**Impeller**	**Wear ring**	**Shaft**
	A	EN-GJL-250	EN-GJL-200	Bronze/brass	1.4301/1.4308
	A1	EN-GJL-250	EN-GJL-200	Bronze/brass	1.4462
	B	EN-GJL-250	Bronze CuSn10	Bronze/brass	1.4301/1.4308
	B1	EN-GJL-250	Bronze CuSn10	Bronze/brass	1.4462
	C	EN-GJL-250	EN-GJL-200	Bronze/brass	1.4401
	D	EN-GJL-250	Bronze CuSn10	Bronze/brass	1.4401
	E	EN-GJL-250	EN-GJL-200	EN-GJL-250	1.4301/1.4308
	E1	EN-GJL-250	EN-GJL-200	EN-GJL-250	1.4462
	F	EN-GJL-250	Bronze CuSn10	EN-GJL-250	1.4301/1.4308
	F1	EN-GJL-250	Bronze CuSn10	EN-GJL-250	1.4462
	G	EN-GJL-250	EN-GJL-200	EN-GJL-250	1.4401
	H	EN-GJL-250	Bronze CuSn10	EN-GJL-250	1.4401
	I	1.4408	1.4408	1.4517	1.4462
12	J	1.4408	1.4408	Carbon-graphite-filled PTFE (Graflon®)	1.4462
	K	1.4408	1.4408	1.4517	1.4401
	L	1.4517	1.4517	1.4517	1.4462
	M	1.4408	1.4517	1.4517	1.4401
	N	1.4408	1.4408	Carbon-graphite-filled PTFE (Graflon®)	1.4401
	P	1.4408	1.4517	Carbon-graphite-filled PTFE (Graflon®)	1.4401
	R	1.4517	1.4517	Carbon-graphite-filled PTFE (Graflon®)	1.4462
	S	EN-GJL-250	1.4408	Bronze/brass	1.4401
	S1	EN-GJL-250	1.4408	Bronze/brass	1.4462
	T	EN-GJL-250	1.4517	Bronze/brass	1.4462
	U	1.4408	1.4517	1.4517	1.4462
	W	1.4408	1.4517	Carbon-graphite-filled PTFE (Graflon®)	1.4462
	Z	1.4469	1.4469	1.4410	1.4410
	X	Special version			

Pos.	Explanation
13	**Rubber parts in pump** E: EPDM F: FXM (Fluoraz®) K: FFKM (Kalrez®) M: FEPS (PTFE-sheathed silicone O-ring) O: HNBR V: FKM (Viton®)
14	**Shaft seal arrangement** S: Single seal
15	**Shaft seal in pump** Letter code for mechanical shaft seal and shaft seal rubber parts. See Letter codes for shaft seals.
16	Code for rated motor power [kW]. See Codes for rated motor power.
17	Code for phase and voltage [V] or other information. See Codes for phase and voltage or other information.
18	Code for speed variant [rpm]. See Codes for speed variant.

Example 1: NBE
100-160/160-142BSASF1AESBAQERW1 shows an NBE 100-160 pump with these characteristics:

- 160-142 mm closed impeller, conical trim
- hydraulic version B
- with built-in differential-pressure sensor
- pump with support blocks
- DIN flange to EN 1092-2 pipe connection
- 10 bar flange pressure rating
- cast iron pump housing, EN-GJL-250
- cast iron impeller, EN-GJL-200
- bronze/brass wear ring
- stainless steel shaft, EN 1.4301/1.4308
- EPDM O-rings for pump cover
- single shaft seal arrangement
- BAQE shaft seal
- 30 kW motor, not for sale in North America, 2-pole, 50 Hz.

Example 2: NBGE
200-150-315.2/317ACAEF3KFSDAQFYW1 shows an NBGE 200-150-315.2 pump with these characteristics:

- 317 mm closed impeller, cylindrical trim
- hydraulic version A
- without built-in sensor, one cable and one pressure sensor are supplied with the pump.
- pump with ATEX approval
- DIN flange to EN 1092-2 pipe connection
- 25 bar flange pressure rating
- stainless steel pump housing, EN 1.4408
- stainless steel impeller, EN 1.4408
- stainless steel wear ring, EN 1.4517
- stainless steel shaft, EN 1.4401
- FXM O-rings for pump cover
- single shaft seal arrangement
- DAQF shaft seal
- motor size outside DOE scope, not for sale in North America, 2-pole, 50 Hz.

Example 3: NBG
100-65-200/219SAAEF2KESBQQEKX4 shows an NBG 100-65-200 pump with these characteristics:

- 219 mm semi-open impeller
- hydraulic version A
- basic version
- with ATEX approval, certificate or report
- DIN flange to EN 1092-2 pipe connection
- 16 bar flange pressure rating
- stainless steel pump housing, EN 1.4408
- stainless steel impeller, EN 1.4408
- stainless steel wear ring, EN 1.4517
- stainless steel shaft, EN 1.4401
- EPDM O-rings for pump cover
- single shaft seal arrangement
- BQQE shaft seal
- 4 kW (3.7 hp) motor, US DOE regulated motor, 4-pole, 60 Hz.

Example 4: NB
80-200/222VAXEF1BESBQQEWX2 shows an NB 80-200 pump with these characteristics:

- 222 mm super vortex impeller
- hydraulic version A
- PWIS-free certificate included
- DIN flange to EN 1092-2 pipe connection
- 10 bar flange pressure rating
- cast iron pump housing, EN-GJL-250
- bronze CuSn10 impeller
- bronze/brass wear ring
- stainless steel shaft, EN 1.4301/1.4308
- EPDM O-rings for pump cover
- single shaft seal arrangement
- BQQE shaft seal
- 90 kW motor, US DOE regulated motor, 2-pole, 60 Hz..

2.2.2.1 Letter codes for shaft seals

Pos. 15 in NB, NBG 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".

2.2.2.2 Codes for rated motor power

Pos. 16 in NB, NBG type key example.

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

2.2.2.3 Codes for phase and voltage or other information

Pos. 17 in NB, NBG type key example.

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.

2.2.2.4 Codes for speed variant

Pos. 18 in NB, NBG type key example.

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.

2.2.3 Type key, MTB

Example of type key: MTB 65-200/199A-F-ABQQE								
Pos.	1	2	3	4	5	6	7	8
Code	MTB	65	-200	/199	A	F	A	BQQV

Pos.	Description
1	Pump type
2	Nominal diameter of outlet port (DN)
3	Pump housing size [mm]
4	Actual impeller diameter [mm]
5	Code for pump version A: Basic version
6	Code pipe connection F: DIN flange
7	Code for materials A: Cast iron
8	Code for shaft seal and rubber pump parts B: Rubber bellows seal Q: Silicon carbide (SiC) E: EPDM V: FKM

The example describes an MTB 65-200 pump with an actual impeller diameter of 199 mm, of the basic version, with DIN flanges, made of cast iron and with a BQQV shaft seal.

The pump is fitted with FKM O-rings as standard.

3. Receiving the product

3.1 Performance test

The pumps are tested 100 % before leaving the factory. The test includes a function test where the pump performance is measured to ensure that the pump meets the requirements of relevant standards. Test certificates are available from Grundfos.

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.

Related information

8. Storing the product

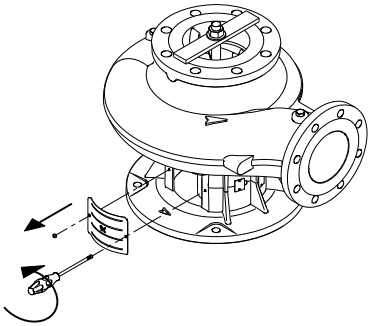
4. Installing the product

4.1 Mounting of motor on bare shaft pumps

4.1.1 Mounting of motor on pump housing without feet

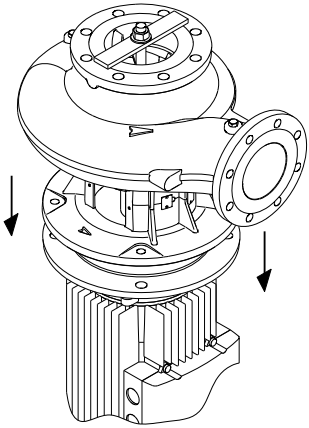
The pumps are supplied with a transport bracket protecting the shaft seal during transport. When you mount the motor, follow the instructions and drawings as below.

1. Remove the coupling guard and loosen the set screws in the shaft.



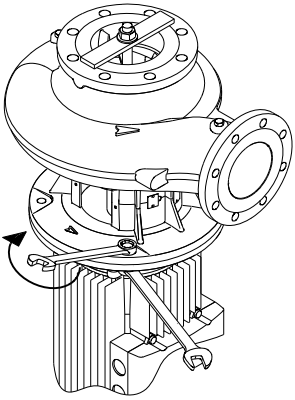
TM053327

2. Place the pump on the motor.



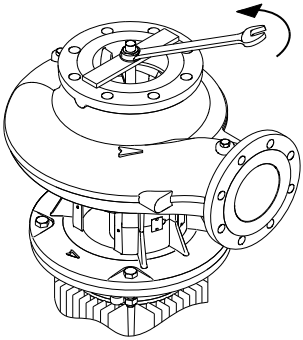
TM033906

3. Fit and tighten the motor screws to the correct torque. See below.
   - M8: 20 ± 4 Nm
   - M10: 40 ± 8 Nm
   - M12: 70 ± 15 Nm
   - M16: 145 ± 30 Nm
   - M20: 150 ± 30 Nm
   - M24: 200 ± 40 Nm



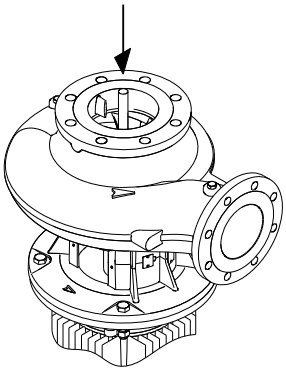
TM033907

4. Remove the nut, washer and transport bracket.



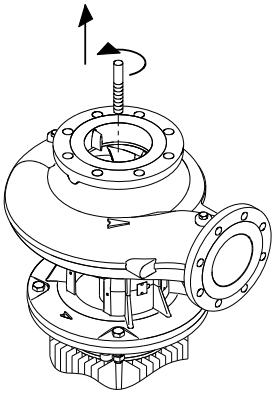
TM033908

5. Press down the threaded pipe to ensure that the shaft is in bottom position.



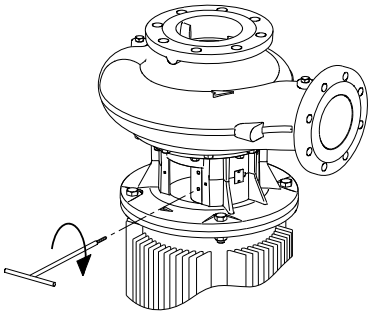
TM033909

6. Remove the threaded pipe.



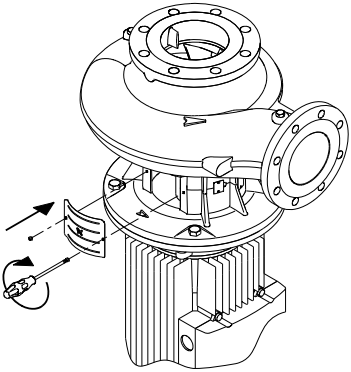
TM033910

7. Apply Loctite 243 to the threads of the set screws. Tighten the set screws to the correct torque.
   - M5: 6 ± 2 Nm
   - M6: 8 ± 2 Nm
   - M8: 15 ± 3 Nm



TM033911

8. Fit the coupling guard. Tighten the screws to the correct torque.
   - M5 x 10 mm: 6 ± 2 Nm

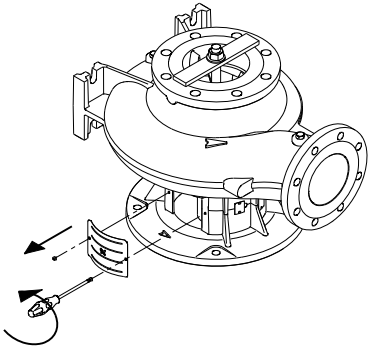


TM033912

4.1.2 Mounting of motor on pump housing with feet

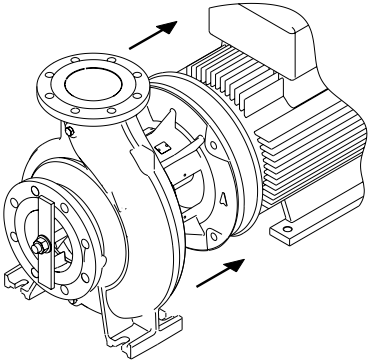
The pumps are supplied with a transport bracket protecting the shaft seal during transport. When you mount the motor, follow the instructions and drawings as below.

1. Remove the coupling guard and loosen the set screws in the shaft.



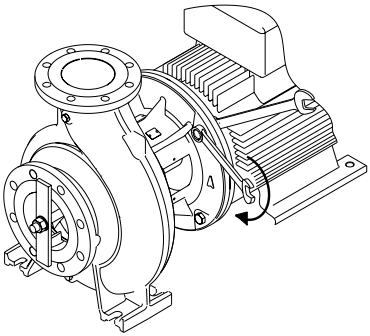
TM033913

2. Place the pump at the end of the motor and push the parts together.



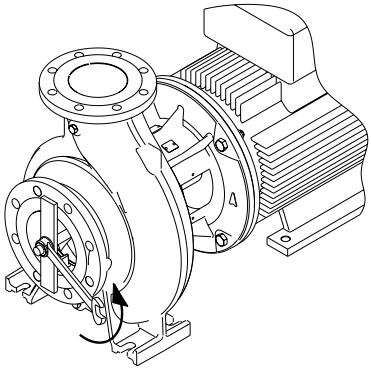
TM033905

3. Fit and tighten the motor screws to the correct torque. See below.
   - M8: 20 ± 4 Nm
   - M10: 40 ± 8 Nm
   - M12: 70 ± 15 Nm
   - M16: 145 ± 30 Nm
   - M20: 150 ± 30 Nm
   - M24: 200 ± 40 Nm



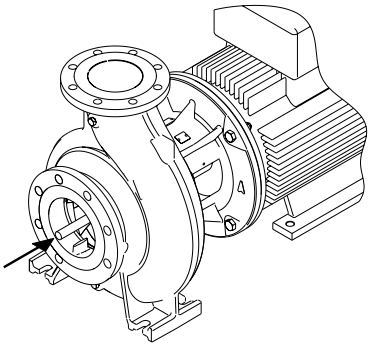
TM033914

4. Remove the nut, washer and transport bracket.



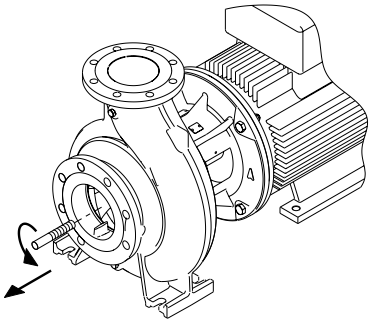
TM033915

5. Press down the threaded pipe to ensure that the shaft is in bottom position.



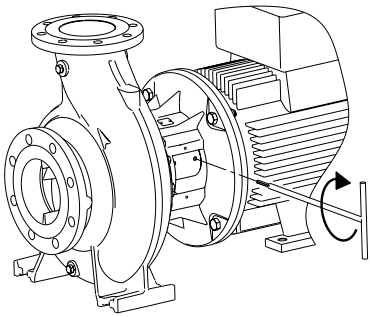
TM033916

6. Remove the threaded pipe.



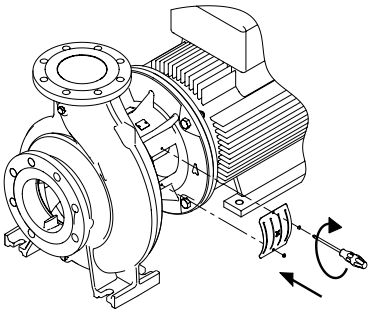
TM033917

7. Apply Loctite 243 to the threads of the set screws. Tighten the set screws to the correct torque. See below.
   - M5: 6 ± 2 Nm
   - M6: 8 ± 2 Nm
   - M8: 15 ± 3 Nm



TM033918

8. Fit the coupling guard. Tighten the screws to the correct torque. See below.
   - M5 x 10 mm: 6 ± 2 Nm



TM033919

4.2 Location

CAUTION
Hot or cold surface
Minor or moderate personal injury

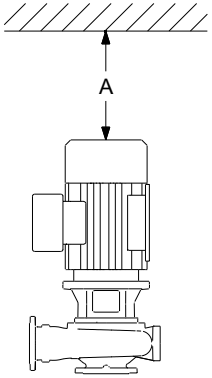
- When pumping hot or cold liquids, make sure that no one can accidentally come into contact with hot or cold surfaces.

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

4.2.1 Vertical installation, NB, NBG

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

- Pumps fitted with motors up to and including 4 kW require a 0.3 m clearance above the motor.
- Pumps fitted with motors of 5.5 kW and up require at least a 1 m clearance above the motor to allow the use of lifting equipment.



TM034128

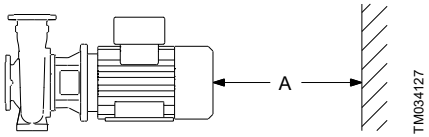
Clearance above the motor

Motor	Minimum clearance, A
0.25 - 4 kW	0.3 m
5.5 - 37 kW	1 m

4.2.2 Horizontal installation, NB, NBG

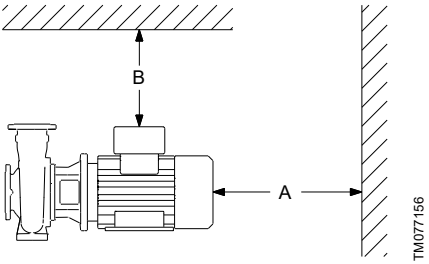
For inspection and repair, allow suitable clearances for pump or motor removal.

- Pumps fitted with motors up to and including 4 kW require a 0.3 m clearance behind the motor.
- Pumps fitted with motors of 5.5 kW and up require a 0.3 m clearance behind the motor and at least a 1 m clearance above the motor to allow the use of lifting equipment.
- NB pumps with base frame must have the same clearance as pumps with motors from 5.5 to 200 kW.



Clearance behind the motor

Motor	Minimum clearance, A
0.25 - 4 kW	0.3 m

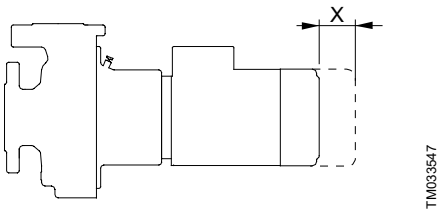


Clearance behind and above the motor

Motor	Minimum clearance	
	A	B
5.5 - 200 kW	0.3 m	1 m

4.2.3 Minimum clearance of MTB

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



Motor and pump head removal

Pump	P2 [kW]	Minimum clearance, X [mm]	
		Motor only	Motor and pump head
50 Hz			
MTB 50-200	3.0	60	140
MTB 65-160	5.5	80	100
	7.5		
MTB 65-200	11	100	100
	15		
60 Hz			
MTB 50-200	3.0	60	140
	4.0		
	5.5	80	
MTB 65-125	7.5	80	100
MTB 65-160	11	110	100
	15		

5. Mechanical installation

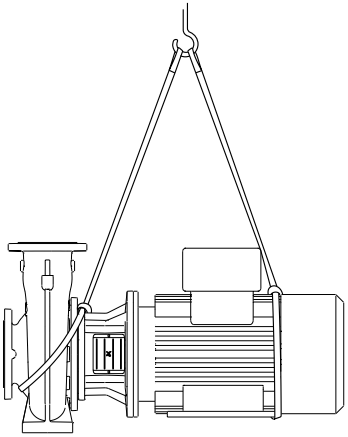
The pump must be installed according to national water regulations and standards.

5.1 Lifting the product

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

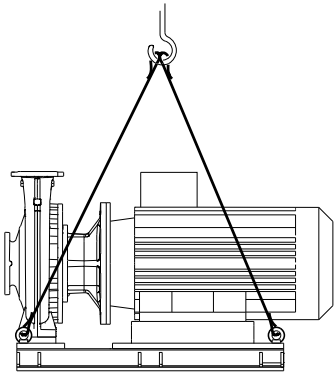
Weight: See label on the packing.

Lift the pumps by means of nylon straps and shackles or a hook as shown on figures below.



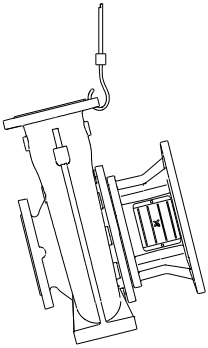
TM033973

Correct lifting of pump without base frame



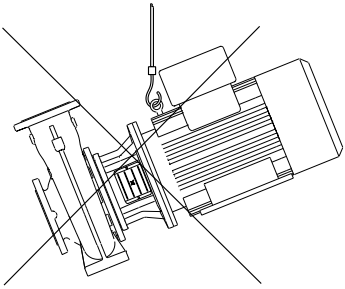
TM045179

Correct lifting of pump with base frame



TM053309

Correct lifting of pump without motor



TM033972

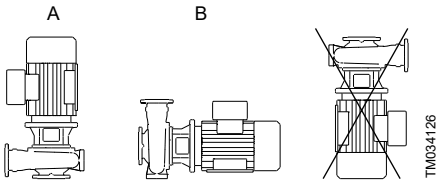
Incorrect lifting of pump

5.2 Installation positions

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

The pumps can be installed with the motor and pump shaft in all positions between vertical and horizontal, but the motor must never fall below the horizontal plane.

Horizontal motors with feet must always be supported.



Installation positions

A:	0.25 - 37 kW
B:	0.25 - 200 kW

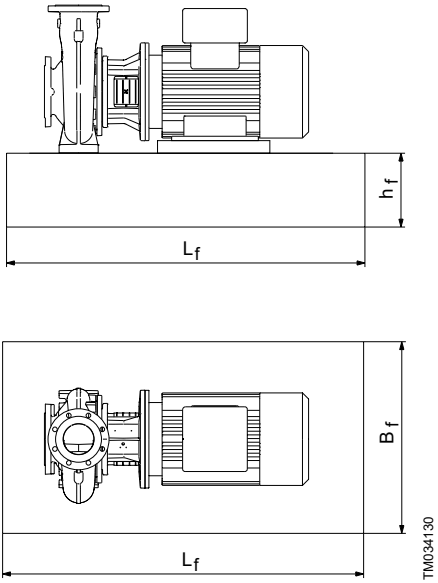
Fit isolating valves on either side of the pump as this makes it unnecessary to drain the system if the pump needs to be cleaned or repaired.

5.3 Foundation of NB, NBG, MTB pump without base frame

Non-compliance may result in functional faults which will damage the pump components.

Observe the following requirements when preparing the 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.
- Optimally, the weight of the concrete foundation should be at least 1.5 times the weight of the pump.
- The concrete foundation must have an absolutely level and even surface.
- The foundation length and width must always be 200 mm larger than the length and width of the pump. See the figure below.



Foundation

- The minimum height of the foundation, indicated by h_f, can then be calculated by the following formula:

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

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

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

- In installations where noise-less operation is particularly important, we recommend a foundation with a mass up to 5 times that of the pump. See also Vibration damping.

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.

Related information

5.6.1 Elimination of noise and vibrations

5.6.2 Vibration dampers

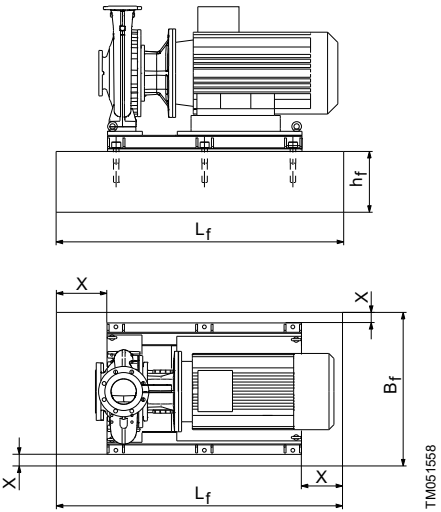
5.4 Foundation of NB, NBG pump with base frame

This section applies only to 50 Hz pumps as base frames are not supplied for 60 Hz pumps.

Non-compliance may result in functional faults which will damage the pump components.

Observe the following requirements when preparing the 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.
- Optimally, the weight of the concrete foundation should at least be 1.5 times the weight of the pump.
- The foundation must be 100 mm larger than the base frame on all four sides. See the figure below.



Foundation, X equal to minimum 100 mm

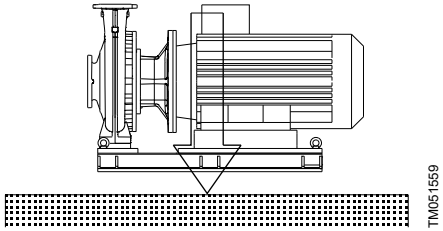
- The minimum height of the foundation, h_f, can then be calculated with the following formula:

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

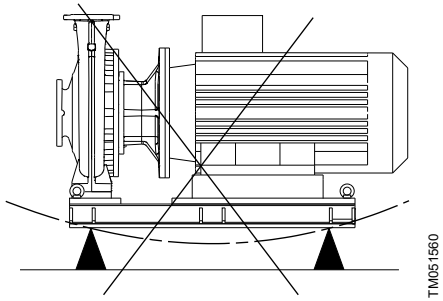
h_f	Height of the foundation [m]
L_f	Length of the foundation [m]
B_f	Width of the foundation [m]
m_{pump}	Mass of the pump [kg]
$\delta_{concrete}$	Density of the concrete [kg/m^3]

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

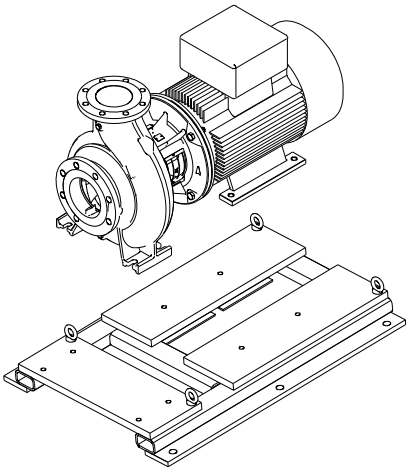
- Place the pump on the foundation, and fasten it. The base frame must be supported under its entire area. See the figures below.



Correct foundation



Incorrect foundation



Base frame with pouring holes

- It is important to prepare a good foundation before installing the pump.
- NB, NBG pumps with base frame are always prepared for grouting.
- Grouting anchors are welded to the base frame.
- For NB, NBG 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.

Poles	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	

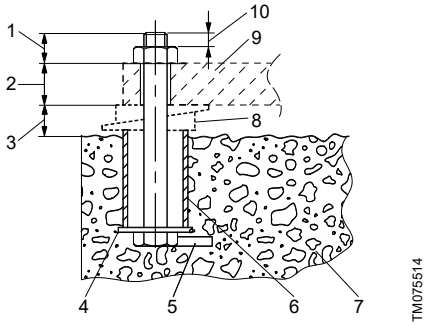
5.4.1 Procedure of installing the product on the foundation

5.4.1.1 Preparing the foundation

Contact your concrete supplier for advice if any doubts.

Follow the steps below to ensure a good foundation:

1. Use an approved, non-shrinking concrete.
2. Pour the foundation without interruptions to within 0.75 - 1.25 inches (19-32 mm) of the final level.
3. Use vibrators to ensure that the concrete is evenly distributed.
4. Embed anchor bolts in the concrete.
5. Allow enough bolt length to reach through grout, shims, lower part of base frame, nuts and washers. See the figure below.



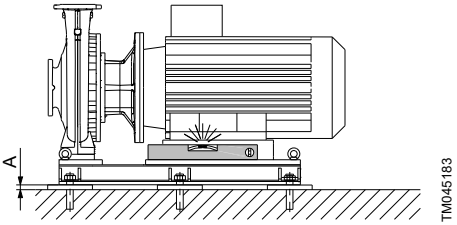
Pos.	Description
1	Bolt length above the support rail
2	Thickness of the support rail
3	19-32 mm (0.75 - 1.25 in) allowance for grout
4	Washer
5	Lug
6	Pipe sleeve
7	Foundation with rough top
8	Wedges and shims left in place
9	Support rail
10	5-10 mm (0.2 - 0.4 in.)

6. Let the foundation cure for several days before levelling and grouting the base frame.

5.4.1.2 Levelling the base frame

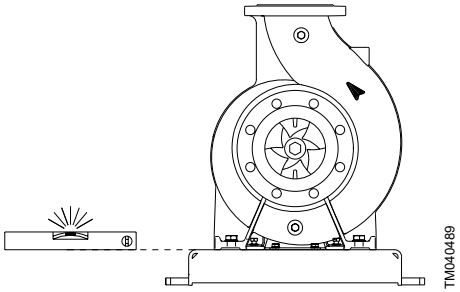
Follow the steps below to level the base frame:

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



A: 19-32 mm

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



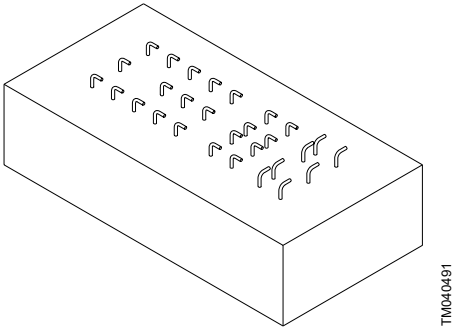
3. Tighten the anchor bolt nuts against the base frame.
4. Make sure the piping can be aligned to the pump flanges without putting strain on pipes or flanges.

5.4.1.3 Grouting

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

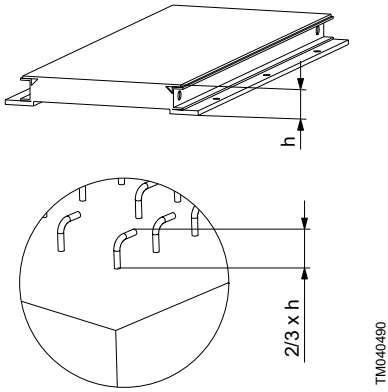
Grouting compensates for an uneven foundation, distributes the weight of the unit, dampens vibrations and prevents shifting. Follow the steps below to do the grouting:

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.



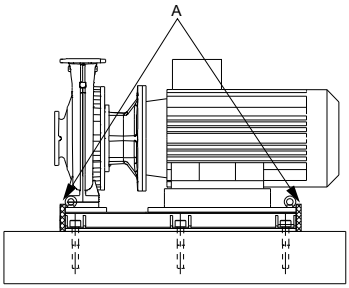
Example of foundation with minimum 20 bars

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



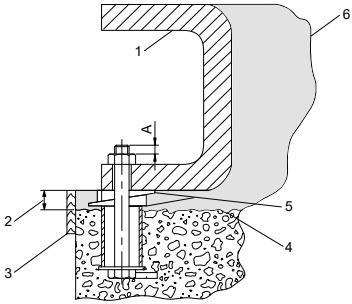
5. Soak top of concrete foundation thoroughly, then remove surface water.

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



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.



Pos.	Description
1	Base frame
2	19-32 mm (0.75 - 1.25 in) grout
3	Formwork

Pos.	Description
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.

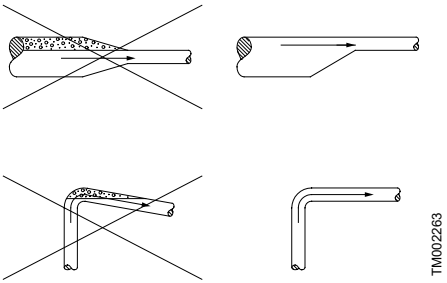
5.5 Pipes

5.5.1 Pipe installation

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

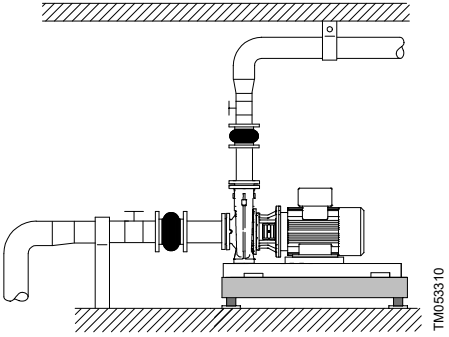
The inlet and outlet pipes must be of an adequate size, taking the pump inlet pressure into account.

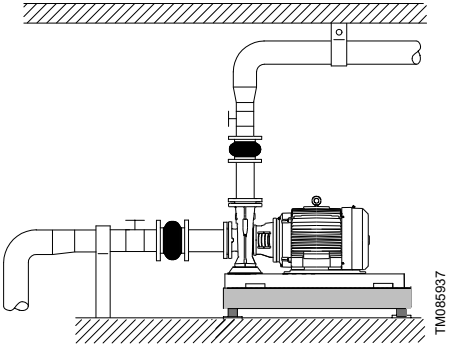
The pipes must be installed in a way that air pockets are avoided, especially on the inlet side of the pump.



Pipelines

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



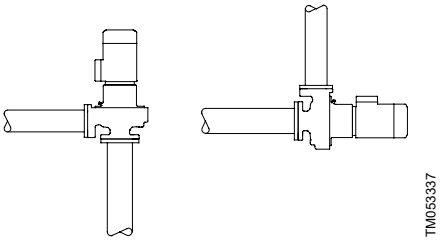


Pump installation

5.5.2 Direct mounting in pipes

To ensure quiet operation, suspend the pipes from suitable pipe hangers.

Pumps fitted with motors up to and including frame size 132 are suitable for direct mounting in supported pipes.



Direct mounting in pipes

This type of installation does not allow the use of expansion joints.

5.5.3 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.

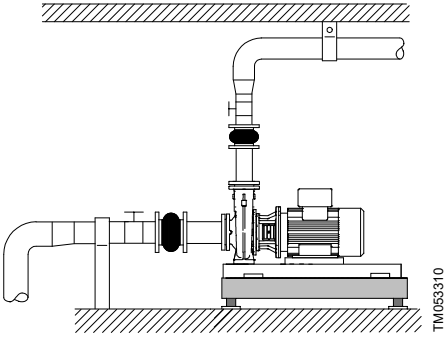
5.6 Vibration damping

5.6.1 Elimination of noise and vibrations

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

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

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



5.6.2 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.

5.7 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

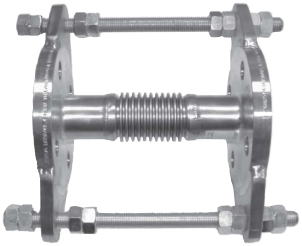
TM024981

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.

5.8 Measuring instruments

5.8.1 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.

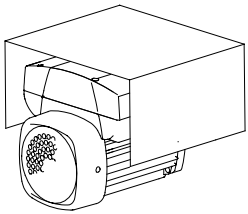
5.8.2 Ammeter

We recommend connecting an ammeter to check the motor load.

5.9 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.
- The pump must be connected to an external main switch close to the pump and to a motor-protective circuit breaker. Make sure that you can lock the main switch in OFF position (isolated). Type and requirements as specified in EN 60204-1, 5.3.2.

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.

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 responsible authorities or trade organisations must be observed.

6.1 Motor protection

DANGER
Electric shock
Death or serious personal injury

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

DANGER
Automatic startup
Death or serious personal injury

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

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

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

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

6.2 Cable entry and screwed connection, MG motor

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

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

6.3 Torque for terminal cover of MG motors

For pumps with below MG motors, torque specification should be followed to avoid breaking the terminal cover.

Type	Thread size (mm)	Tightening torque (Nm)
MG 71/80	d 5.0	1.8 - 2.2
MG 90/100	d 5.0	3-4
MG 112/132	d 5.0	3-4
MG 160/180	d 6.0	4-6

6.4 Synchronous motors

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

TM044289

Example of installation without filter

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

Synchronous motors must not be connected directly to mains supply.

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

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

TM077181

Example of CUE nameplate

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

6.5 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. Startup

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

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 the product

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.

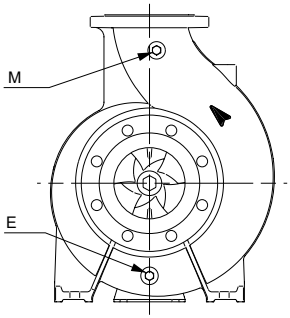
WARNING
Escaping liquid
Death or serious personal injury
- Pay attention to the orientation of the priming hole to ensure that the escaping liquid does not cause personal injury or damage to the motor or other components.
- In hot-liquid installations, pay special attention to the risk of personal injury 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.

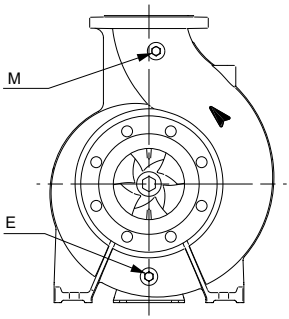
1. Close the isolating valve in the outlet pipe and slowly open the isolating valve in the inlet pipe.
2. Remove the priming plug indicated by M.
3. Pour liquid through the hole until the inlet pipe and the pump are completely filled with liquid.
4. Fit the priming plug indicated by M.
5. The inlet pipe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



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.



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.

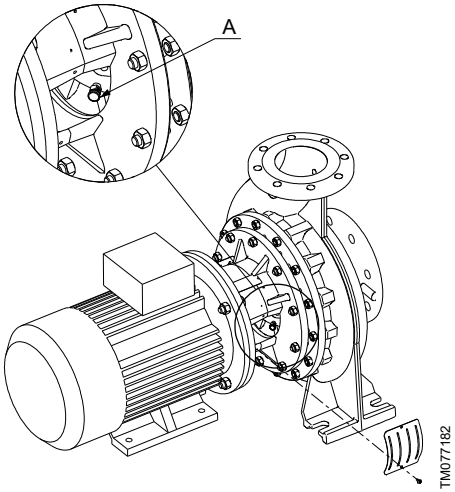
7.3 Checking the direction of rotation

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

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

7.4 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 in the pump head or pump head cover until a steady stream of liquid runs out of the vent hole.



Position of vent screw (A)

WARNING
Escaping liquid
Death or serious personal injury

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

4. When the pipes have been filled with liquid, slowly open the isolating valve on the outlet side until it is fully open.

5. Check the overload by measuring the motor current consumption and comparing the value to the rated current stated on the motor nameplate. In case of overload, throttle the valve on the outlet side until the motor is no longer overloaded.

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

6. Always measure the motor current consumption during startup.

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

7.5 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
56-71	100	250	350
80-100	60	140	160
112-132	30	60	80
160-180	15	30	50
200-225	8	15	30
250-315	4	8	12

7.7 Reference readings of monitoring equipment

We recommend that you take initial readings of these parameters:

- vibration level - use SPM (shock pulse method) measuring points (only for NK and NKG)
- inlet and outlet pressure - use pressure gauges.

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

8. Storing the product

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

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

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

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

9. Servicing the product

9.1 Contaminated products

CAUTION
Biological hazard
Minor or moderate personal injury
- Flush the pump thoroughly with clean water and rinse the pump parts in water after dismantling.

The product will be classified as contaminated if it has been used for a liquid which is 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.

9.2 Service kits

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

Related information

- *www.grundfos.com*
- *NB Service Kit Catalogue*
- *NBG Service Kit Catalogue*
- *MTB Service Kit Catalogue*

10. Maintaining the product

DANGER
Electric shock and unintended pump start
Death or serious personal injury
- Before starting work on the product, switch off the power supply. Make sure that the power supply cannot be accidentally switched on.

10.1 Maintenance of the pump

The pump is maintenance-free.

10.2 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.

10.3 Maintaining the motor

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

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

10.4 Lubrication of motor bearings

10.4.1 MG motors

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

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

10.4.2 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.

Related information

10.4.3 Bearing grease

10.4.3 Bearing grease

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

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

10.5 Applying sealant to plugs

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

11. Taking the product out of operation

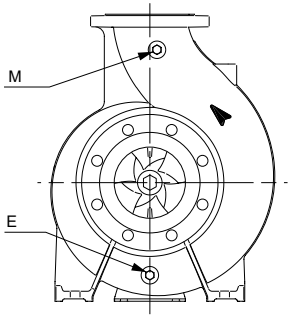
11.1 Protecting the pump during periods of inactivity and frost

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

WARNING
Escaping liquid
Death or serious personal injury

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

1. Drain the pump by removing the drain plug.



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

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

12. Fault finding the product

DANGER
Electric shock
Death or serious personal injury

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

WARNING
Escaping liquid
Death or serious personal injury

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

CAUTION
Hot or cold surface
Minor or moderate personal injury

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

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

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

Fault	Cause	Remedy
5. The temperature in the pump or motor is too high.	a) There is air in the inlet pipe or pump.	Vent the inlet pipe or the pump and replenish.
	b) The inlet pressure is too low.	Increase the liquid level on the inlet side. Open the isolating valve in the inlet pipe. Make sure that all the conditions in 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.	Check the relief holes of the impeller and the lock rings on the inlet side.
	e) The motor-protective circuit breaker is defective or the setting is incorrect.	Check the setting of the motor-protective circuit breaker and replace, if necessary.
	f) The motor is overloaded.	Reduce the flow rate.

Related information

5.5.1 Pipe installation

6.5 Frequency converter operation

13. Technical data

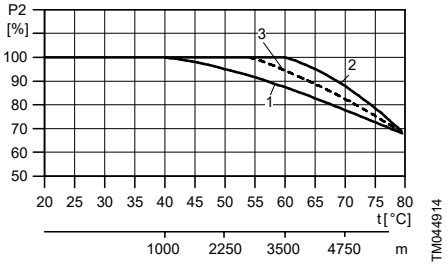
13.1 Operating conditions

13.1.1 Ambient temperature and altitude

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

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

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



The maximum motor output depends on the ambient temperature and altitude

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

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

13.1.2 Liquid temperature

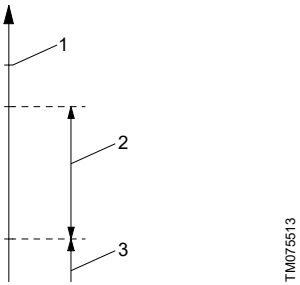
Liquid temperature: -40 to +140 °C

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

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

13.1.3 Maximum operating pressure

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



Pressures in the pump

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

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

13.1.4 Minimum inlet pressure

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

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

- The inlet conditions are poor.
- The operating pressure is low.

13.1.5 Maximum inlet pressure

The inlet pressure + 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.

The NB pumps comply with IEC 60335-2-51 if the maximum inlet pressure is equal to or less than 1.2 MPa (12 bar).

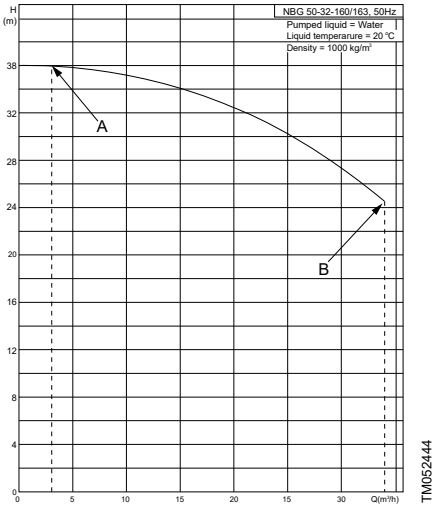
13.1.6 Minimum flow rate

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

13.1.7 Maximum flow rate

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

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



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

Pos.	Description
A	Minimum flow rate
B	Maximum flow rate

Related information

- *www.grundfos.com*

13.1.8 Shaft seals

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

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

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

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

13.2 Electrical data

See the motor nameplate.

13.3 Sound pressure level

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

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

50 Hz motor

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

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

60 Hz motor

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

Motor [kW]	Maximum sound pressure level [dB(A)] - ISO 3743		
	Three-phase motors		
	2-pole	4-pole	6-pole
0.25	-	-	-
0.37	-	-	-
0.55	-	-	-
0.75	-	-	-
1.1	64	51	-
1.5	64	52	62
2.2	65	55	60
3	54	57	67
4	68	56	67
5.5	68	62	67
7.5	73	62	70
11	70	66	70
15	70	66	57
18.5	70	63	57
22	70	63	59
30	71	65	59
37	71	65	61
45	75	65	64
55	75	68	64
75	77	71	63
90	77	71	63
110	81	75	62
132	81	75	62

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

14. Disposing of the product

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

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

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

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

Appendix A

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
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

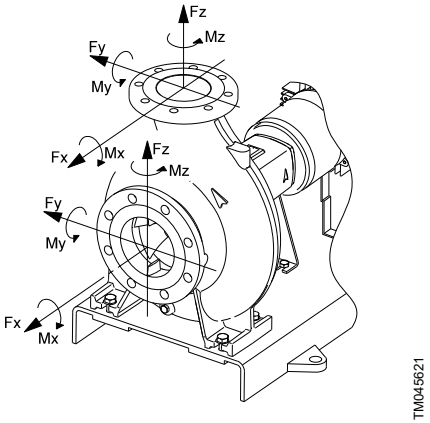
本表格依据 SJ/T 11364 的规定编制

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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