CVM, CHM

Installation and operating instructions

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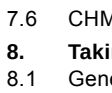
Original installation and operating instructions

These installation and operating instructions describe CVM and CHM pumps.

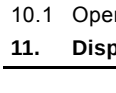
Sections 1-4 give the information necessary to be able to unpack, install and start up the product in a safe way.

Sections 5-11 give important information about the product, as well as information on service, fault finding and disposal of the product.

CONTENTS



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



Read this document before starting service work on the product. Installation and service work must comply with local regulations and accepted codes of good practice.

Observe the safety instructions in the installation and operating instructions for the product.

The use of this product requires experience with and knowledge of the product. Persons with reduced physical, sensory or mental capabilities must not use this product, unless they are under supervision or have been instructed in the use of the product by a person responsible for their safety. Children must not use or play with this product.

1. General Information

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 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. Receiving the product

2.1 Unpacking the product

WARNING

Overhead load

Death or serious personal injury

- Do not lift the product by the eyebolts on the motor. Unload and handle the product with a sling.

2.2 Inspecting the product

- Check that the product received is in accordance with the order.
- Check that the voltage, phase and frequency of the product match the voltage, phase and frequency of the installation site. See section *6.3 Pump identification*.
- Check the product for defects and damage immediately after receiving it. Any accessories ordered will be packed in a separate container and shipped with the product.
- If any equipment is damaged in transit, promptly report this to the carrier's agent. Make complete notations on the freight bill.

2.3 Temporary storage after delivery

- If the product is not to be installed and operated immediately after receiving it, store it in a clean, dry area at a moderate ambient temperature.
- Rotate the shaft by hand periodically, at least weekly, to coat the bearing with lubricant to delay oxidation and corrosion.
- Follow the motor manufacturer's storage recommendations where applicable.

3. Installing the product

3.1 Location

- Locate the pump as close as possible to the liquid supply. Use the shortest and most direct inlet pipe practical. Refer to *3.4.2 Inlet pipe*.
- Locate the pump below system level wherever possible. This will facilitate priming, assure a steady liquid flow and provide a positive inlet pressure.
- The Net Positive Suction Head (NPSH) available must always be equal to or exceed the required NPSH specified on the pump performance curve. Make sure the required NPSH is provided at the inlet.
- Always allow sufficient accessibility space for maintenance and inspection. Provide a clearance of 610 mm with ample head room for use of a hoist strong enough to lift the product.
- Electrical characteristics must match those specified on the motor nameplate, within the limits covered in section *4. Starting up the product*.
- Do not expose the product to sub-zero temperatures to prevent the pumped liquid from freezing. If there is frost during shutdown periods, see sections *4. Starting up the product* and *8.2 Short-time shutdown*.

3.2 Pump foundation

Install the pump permanently on a firm, raised concrete foundation of sufficient size to dampen any vibration and prevent any deflection or shaft misalignment. The foundation may float on springs or be a raised part of the floor.

Proceed as follows:

1. Pour the foundation without interruption to 20-40 mm below the final pump level. Leave the top of the foundation rough. Then clean and wet it down.
2. Scour and groove the top surface of the foundation before the concrete sets to provide a suitable bonding surface for the grout.
3. Place anchor bolts in pipe sleeves for positioning allowance. See fig. 1.
4. Allow enough bolt length for grout, base flange, nuts, and washers.
5. Allow the foundation to cure several days before proceeding to install the pump.

3.3 Securing the base plate

When the raised concrete foundation has been poured and allowed to set, proceed as follows:

1. Lower the base plate over the anchor bolts and rest it on loose adjustment wedges or shims placed near each anchor bolt and at intervals not exceeding 610 mm (24 inch) along each side.
2. Place the shims or wedges so that they raise the bottom of the base plate 20-32 mm (0.75 - 1.25 inch) above the foundation, allowing clearance for grout.
3. Level the pump shaft, flanges, and base plate using a spirit level, adjusting the wedges or shims, as required. Note that CVM pumps do not require alignment.
4. Make sure that the pipes can be aligned to the pump flanges without placing any strain on either flange.
5. After pump alignment has been established, put nuts on the anchor bolts and tighten them just enough to keep the base plate from moving.
6. Construct a formwork around the concrete foundation and pour grout inside the base plate, as shown in fig. 1. The grout will compensate for uneven foundation, distribute the weight of the pump, and prevent shifting.

Use an approved, non-shrinking grout.

7. Allow at least 24 hours for the grout to set before proceeding with the pipe connections.

- After the grout has thoroughly hardened, check the anchor bolts and tighten them if necessary. Recheck the pump alignment after tightening the anchor bolts.

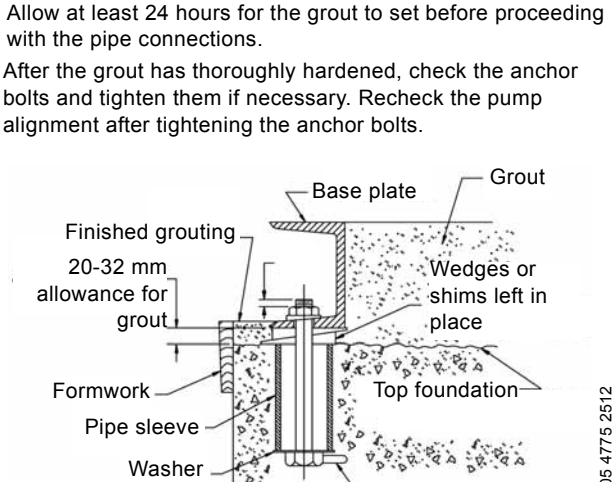


Fig. 1 Anchor bolt installation

3.4 Mechanical installation

3.4.1 Pipes

Do not let the pump support the pipes. Use pipe hangers or other supports at proper intervals to provide pipe support near the pump.

- Make sure that both the inlet and outlet pipes are independently supported and properly aligned so that no strain is transmitted to the pump when flange bolts are tightened.
- Make sure the pipes are as straight as possible, so as to avoid unnecessary bends and fittings. Where necessary, use 135 ° or long-sweep 90 ° pipe bends to decrease friction loss.
- Where flanged joints are used, make sure that the inside diameters match properly and that mounting holes are aligned.
- Do not apply force to pipes when making any connections.

3.4.2 Inlet pipe

The inlet pipe must be installed in a manner that minimises pressure loss and permits sufficient liquid flow into the pump during starting and operation.

Observe the following precautions when installing the inlet pipe:

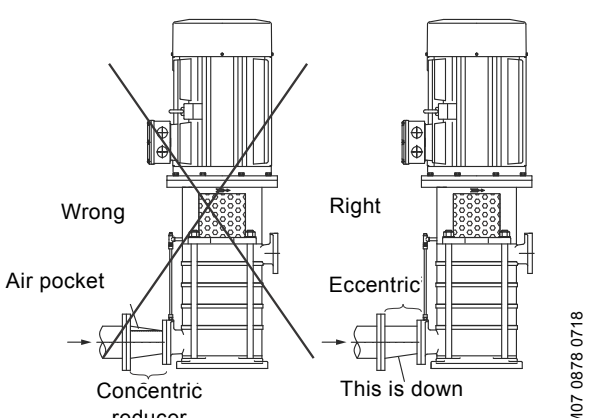


Fig. 2 Inlet pipe

- Run the inlet pipe as direct as possible, and ideally, 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.
- Use an eccentric reducer, with the tapered side down. See fig. 2.

At no point must the diameter of the inlet pipe be smaller than that of the pump 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 (see fig. 3), as this may create air pockets and throttle the system or cause erratic pumping.
- Install a gate valve in the inlet line to be able to isolate the pump during shutdown and maintenance, and to facilitate pump removal. Where two or more pumps are connected to the same inlet line, install two gate valves to be able to isolate each pump from the line.
- Always install gate or butterfly valves in positions that prevent air pockets.

Do not use globe valves, particularly when NPSH is critical.

- During pumping operation, the valves on the inlet line must always be fully open.
- Install properly sized pressure gauges in the tapped holes on the pump inlet and outlet flanges.
  Pressure gauges will enable the operator to monitor the pump performance and determine whether the pump conforms to the parameters of the performance curve. If cavitation, vapor binding, or other unstable operating situations occur, the pressure gauges will indicate wide fluctuation in the inlet and outlet pressures.

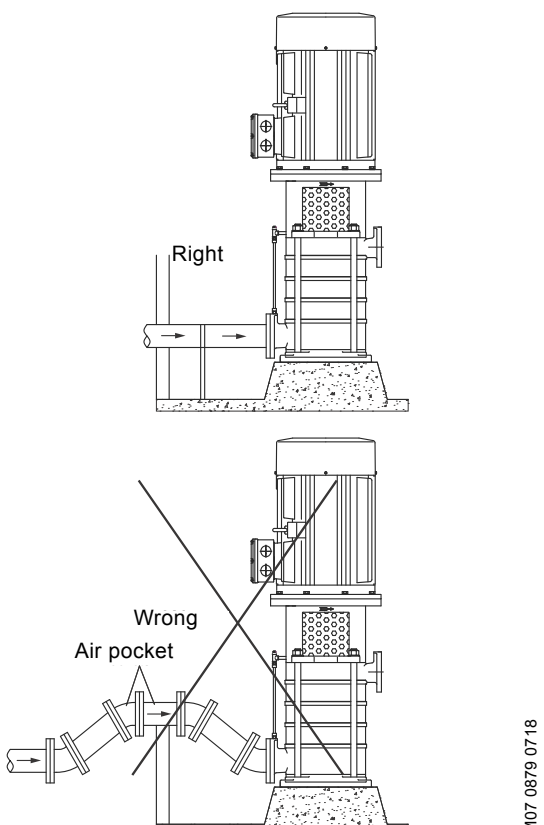


Fig. 3 Air pocket prevention

3.4.3 Outlet pipe

- A short outlet pipe can be the same diameter as the pump outlet port. A long outlet pipe must be one or two sizes larger than the outlet port, depending on the length.
- It is best to use long horizontal outlet pipes.
- Install a gate valve near the outlet port to be able to isolate the pump during shutdown and maintenance and to facilitate pump removal.
- Any high points in the outlet pipe may entrap air or gas and thus delay pump operation.

If non-return valves are used, close the outlet gate valve before pump shutdown to prevent water hammer from occurring.

3.4.4 Mechanical shaft seals

Mechanical shaft seals require no maintenance or adjustment.

CVM and CHM 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 to obtain maximum shaft seal life:

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

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

Clean and purge the inlet pipe in new installations before installing and operating the pump. Pipe scale, welding slag and other abrasives can cause rapid shaft seal failure.

3.4.5 Coupling alignment of CHM pumps

The pump and motor were accurately aligned from factory, but handling during shipment usually alters this pre-alignment.

1. If the pump and motor were shipped mounted on a common base frame as an assembly, remove the coupling guard.
2. **Checking parallel alignment**
   Place a straight edge across both coupling rims at the top, the bottom and both sides. See fig. 4. After each adjustment, recheck all features of alignment. Parallel alignment is correct when the measurements show that all points of the coupling faces are within ± 0.127 mm of each other.
   If misalignment is detected, loosen the motor and shift or shim as necessary to realign. Then retighten the anchor bolts. Always align the motor to the pump as pipe strain will occur if the pump is shifted. Never reposition the pump on the base frame.

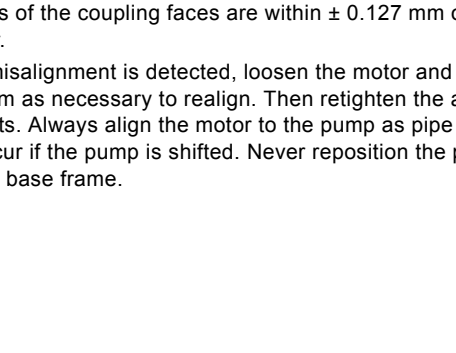


Fig. 4 Checking parallel alignment

3. **Checking angular alignment**
   Insert a pair of inside callipers or a taper gauge at four points at 90 ° intervals around the coupling. See fig. 5. Angular alignment is correct when the measurements show that all points of the coupling faces are within ± 0.127 mm of each other.
   – If misalignment is detected, loosen the motor and shift or shim as necessary to realign. Then retighten the anchor bolts. Always align the motor to the pump as pipe strain will occur if the pump is shifted. Never reposition the pump on the base frame.

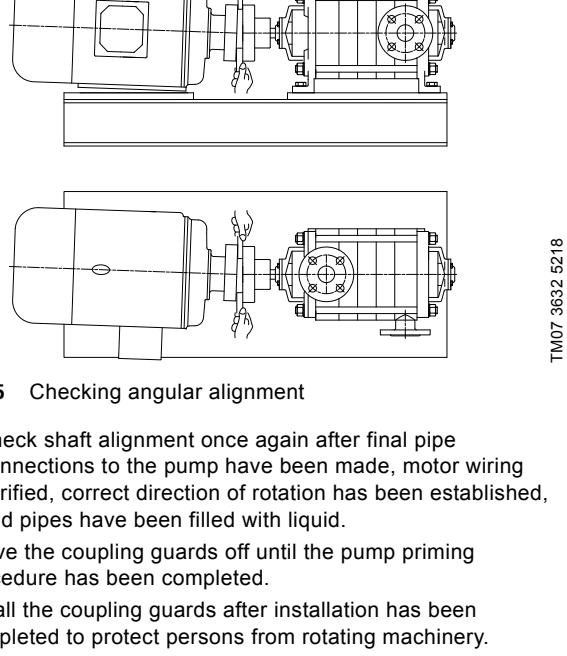


Fig. 5 Checking angular alignment

   – Check shaft alignment once again after final pipe connections to the pump have been made, motor wiring verified, correct direction of rotation has been established, and pipes have been filled with liquid.
4. Leave the coupling guards off until the pump priming procedure has been completed.
5. Install the coupling guards after installation has been completed to protect persons from rotating machinery.

3.5 Electrical connection

The electrical connections must be carried out by an authorised electrician in accordance with local regulations.

The operating voltage and frequency are marked on the motor nameplate.

DANGER

Electric shock

Death or serious personal injury

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

Make sure that the motor is suitable for the power supply of the installation site.

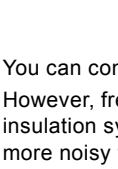
Carry out the electrical connections as shown on the motor nameplate or in the wiring diagram on the back of the terminal box cover.

For further information, contact the motor supplier.

3.5.1 Frequency converter operation

DANGER

Explosive environment



Death or serious personal injury

- Whenever you use powered equipment in explosive surroundings, observe the rules and regulations generally or specifically imposed by the relevant responsible authorities or trade organisations.

You can connect all three-phase motors to a frequency converter.

However, frequency converter operation often exposes the motor insulation system to a heavier load and causes the motor to be more noisy than usual due to eddy currents caused by voltage peaks.

If in doubt whether the supplied motor can handle frequency converter operation contact the motor supplier,

In addition, large motors driven via a frequency converter will be loaded by bearing currents.

When the pump is operated via a frequency converter, check the following operating conditions:

Operating conditions	Action
2-, 4- and 6-pole motors, frame size 225 and larger	Ensure that the non-drive-end motor bearing is electrically isolated.
Noise-critical applications	Fit a dU/dt filter between the motor and the frequency converter. It 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 the motor and frequency converter affects the motor load.
Supply voltage up to 500 V	Make sure that the motor is suitable for frequency converter operation.
Supply voltage between 500 V and 690 V	• Fit a dU/dt filter. It reduces the voltage peaks and thus the noise. • Or make sure that the motor has reinforced insulation.
Supply voltage of 690 V and upwards	• Fit a dU/dt filter. • Make sure that the motor has reinforced insulation.

4. Starting up the product

4.1 Priming

CVM and CHM pumps are non-self-priming and must be completely primed, that is filled with liquid, before starting.

- If the pump will be operating with a positive inlet pressure, prime it by opening the inlet valve and allowing liquid to enter the pump housing. Open the vents and make sure all air is forced out of the pump by the liquid before closing the vents.
- Rotate the shaft by hand to free entrapped air from the impeller passageways.
- If the pump will be operating with a suction lift, priming must be accomplished by other methods. Use foot valves or ejectors, or fill the pump housing and the inlet line manually with liquid.

Never run the pump dry in the hope that it will prime itself. The result will be serious damage to the shaft seals, pump wear rings and shaft sleeves.

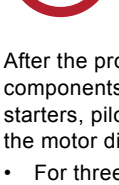
4.2 Pre-start checklist

Do not operate the product above the nameplate conditions. This may damage the product.

Make the following inspections before starting your CVM or CHM pump:

1. Make sure the inlet and outlet pipes have been cleaned and flushed to remove dirt and debris.
2. Check the direction of rotation which must be clockwise. Operating in reverse will destroy the impeller and shaft.
3. Make sure all wiring connections to the motor and starting device are in accordance with the wiring diagram.
4. If the motor has been in storage for a long time, either before or after installation, refer to the motor instructions before starting.
5. Check the voltage, phase and frequency with the motor nameplate. Turn the impeller by hand to make sure it rotates freely.
6. Tighten the plugs in the gauge and drain holes. If the pump is fitted with pressure gauges, keep the gauge cocks closed when they are not in use.
7. Check the inlet and outlet pipes for leaks, and make sure all flange bolts are tightened securely.

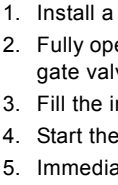
4.3 Motor direction of rotation



Never check the motor direction of rotation unless the pump and motor couplings have been disconnected and physically separated. Failure to follow this instruction can result in serious damage to the pump and the motor if the direction of rotation is wrong.

After the product has been wired and checked to ensure that all components in the system, such as disconnect devices, magnetic starters, pilot devices and motors, are properly connected, check the motor direction of rotation as follows:

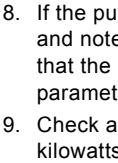
- For three-phase products only, momentarily start the motor to ensure that the direction of rotation is correct as indicated by the arrow cast into the pump housing.
  If the direction of rotation is incorrect, interchange two wires at the motor starters terminals T1 and T2.
- For Wye-Delta motors rotation must be verified for both wye and delta connections.



The pumps must not be operated while dry.

Use extreme caution that motors are started only momentarily to determine proper direction of rotation.

4.4 Starting the pump



DANGER

Moving machine parts

Death or serious personal injury

- Mount an approved coupling guard before operating the product.

1. Install a coupling guard on coupled products.
2. Fully open the gate valve, if any, in the inlet line, and close the gate valve in the outlet line.
3. Fill the inlet line with liquid and completely prime the pump.
4. Start the pump.
5. Immediately make a visual check of the pump and inlet pipe for pressure leaks.
6. Immediately after the pump has reached full operating speed, slowly open the outlet gate valve until complete system flow is achieved.
7. Check the outlet pipe for pressure leaks.
8. If the pump is fitted with pressure gauges, open gauge cocks and note down pressure readings for future reference. Verify that the pump is performing in accordance with the parameters specified in the performance curves.
9. Check and note down voltage, amperage per phase and kilowatts, if a wattmeter is available.

4.5 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.
- The sum of the voltage and frequency variations must not exceed 10 % above or below the motor rating, provided the frequency variation does not exceed 5 %.

5. Handing and storing the product

See sections *2.3 Temporary storage after delivery*, *8.2 Short-time shutdown* and *8.3 Long-term shutdown*.

6. Product introduction

6.1 Applications

Grundfos CVM and CHM pumps are intended for use in the following applications:

- building services
- water supply.

Building services

Liquid transfer and pressure boosting in the following:

- Circulation of liquids
- heating and cooling water in central heating, district heating, ventilation and air-conditioning systems
- water supply
- boosting systems
- water circulation for swimming pools.

Water supply

Liquid transfer and pressure boosting in the following:

- Filtration and transfer at waterworks
- waterworks and substations
- water-treatment plants
- dedusting plants
- recooling systems
- installations for soil sanitation.

6.2 Pumped liquids

CVM and CHM pumps are suitable for pumping clean, thin, non-aggressive liquids, not containing solid particles or fibres. Do not pump liquids that will attack the pump materials chemically.

6.3 Pump identification

6.3.1 Nameplate

All pumps are identified by catalogue and serial numbers. These numbers are stamped on the pump nameplate, as shown in fig. 6, affixed to the pump housing. Refer to these numbers in all correspondence with Grundfos.

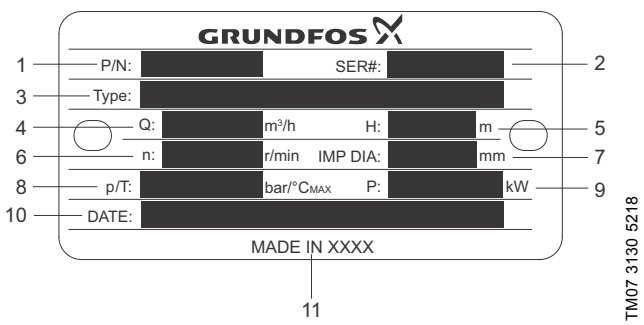


Fig. 6 Nameplate of CVM, CHM pumps

Pos.	Description
1	Product number
2	Serial number
3	Type designation (see *Type key* on page 8)
4	Rated flow rate [m^3/h]
5	Pump head at rated flow rate [m]
6	Speed of rotation [rpm]
7	Impeller diameter [mm]
8	Pressure rating and maximum temperature
9	Rated motor power [kW]
10	Production date, year-month-date
11	Country of production

6.3.2 Type key

Example	CVM	5/	4-	B10	(R)	H	55	4
Type								
CVM: vertical multi-stage pump								
CHM: horizontal multi-stage pump								
Pump inlet nominal diameter								
Number of stages								
Material code (B-10/20., I, N or X*)								
Option: with wear ring								
Motor power unit (optional)								
H: NEMA motor [HP]								
None: IEC motor [kW]								
Motor power rated x 10								
Motor poles								

* X material code is made according to customer requirement or with special construction for different application.

7. Servicing the product

7.1 Maintaining the product

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.

7.2 Lubricating the product

7.2.1 Lubricating the motor

Always follow the motor manufacturer's lubricating instructions, if they are available, and periodically check grease fittings and drain plugs for leaks. If the lubricating instructions are not available, refer to the table below for recommended lubricating intervals.

- The motor can be lubricated both when it is running or when it is stopped.
  Remove the grease drain plug, if any, and filler plug on the grease fitting. Grease with clean lubricant until grease appears at the drain hole or along the motor shaft.

Recommended lubricating intervals

Motor speed [rpm]	Motor power [kW]	Operating conditions		
		Standard	Severe	Extreme
1450 and below	0.25 - 5.5	3 years	1 year	6 months
	7.5 - 30	1-3 years	6 months - 1 year	3 months
	37-110	1 year	6 months	3 months
	132 and up	1 year	6 months	3 months
above 1450	all kW	6 months	3 months	3 months

Standard conditions:

Operating 8 hours per day, normal or light load, clean air, 37 °C maximum ambient temperature.

Severe conditions:

Operating continuously 24-hours, shock loads or vibrations, poor ventilation, 37-65 °C ambient temperature.

Extreme conditions:

Operating continuously, heavy shocks or vibrations, dirt or dust in the air, extremely high ambient temperature.

One-half to one cubic inch (0.5^3 - 1^3 inch) of grease is sufficient for motors of 4 kW and lower, with proportionately more grease for bigger kW motors.

Most fractional and some integral frame motors have "sealed-for-life" bearings, and do not require further lubrication throughout motor life.

The table *Approved grease lubricants* in section *7.2.2 Lubricating the pump* lists the recommended types of grease for both pump and motor lubrication. These grease types have all been thoroughly tested and must be used whenever possible.

7.2.2 Lubricating the pump

CVM pump bearings are water lubricated and do not require grease.

Grease lubrication

In the standard configuration, CHM pumps on horizontal base frames contain regreasable bearings and are packed with grease at the factory before shipping. The bearing grease is good for one year or 2000 hours of normal operation, whichever occurs first. After this time, a regular grease schedule use an approved grease and proceed as described below.

Approved grease lubricants

Manufacturer	Lubricant
Kyodo Yushi*	Multemp SRL*
Shell	Dolium® R
Exxon	Polyrex®
Chevron	SRI Grease NLGI 2
	Black Pearl - NLGI 2
Philips	Polytac™
Texaco	Polystar RB

* Brand of grease used in factory

- Remove the drain plug, if any, and the filler plug. Add clean lubricant until grease appears at the drain hole or along the pump shaft. On pumps with drain hole, all old grease can be purged. In such cases, the drain hole must be left unplugged for several minutes during pump operation to allow excess grease to be forced out.
- Lubricate the pump bearings at 1-3 month intervals, depending on the severity of the environment.

Do not over-grease! Too much grease can cause overheating and premature bearing failure.

7.3 Disassembling the pump

7.3.1 Preparations before disassembling the pump

DANGER

Electric shock

Death or serious personal injury

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

CAUTION

Toxic material

Minor or moderate personal injury

- Wash down the pump before doing any work on it.

DANGER

Hot, caustic, flammable or toxic materials, including vapors

Death or serious personal injury

- Be extremely cautious when venting or draining hazardous liquids.
  Wear protective clothing when there are caustic, corrosive, volatile, flammable, or hot liquids.
  Do not breathe toxic vapors.
  Do not allow sparks, open fire or hot surfaces near the equipment.

To avoid leakage, make sure not to damage the seal seat, mechanical seal head and O-ring during disassembling the pump.

Complete disassembly instructions are outlined below. Proceed only as far as required to perform the maintenance work needed.

1. Switch off the power supply.
2. Drain the system.
3. Flush the system, if necessary.
4. For close-coupled pumps: Remove the motor fixation bolts.

7.3.2 Disassembling CVM pump

1. Disassemble the coupling guard (14).
2. Remove the coupling (13): Disassemble connected screws, remove one half of the coupling, loosen the screw that secures the washer (17), and then remove the other coupling half.
3. Remove the annular key (18) and key (16B).
4. Disassemble the motor (15).
5. Disassemble balance-pipe units (8).
6. Disassemble the studs (22).
7. Remove the connection seat (19).
8. Remove the seal cap (12).
9. Remove the mechanical seal (11).
10. Remove the outlet stage (21).
11. Remove the balancing drum (9).
12. Remove the key and middle sleeve (2B).
13. Remove the impeller (5).
14. Remove the impeller key (16C).
15. Disassemble the middle stage (6), middle sleeve (2B) and impeller (5).
16. Repeat steps 12-15 to disassemble the middle stage (6), guide vane (7A), middle sleeve (2B), impeller (5) and impeller key (16C) until all impellers are disassembled.
17. Pull out the shaft (1), and disassemble the bottom sleeve (2A).

7.3.3 Disassembling CHM pump

1. Disassemble the balance-pipe units (8).
2. Remove the coupling (5).
3. Remove the key (f2).
4. Remove the bearing cover (a4).
5. Remove the round nut (a3).
6. Remove the bearing frame (a7), bearing (a8) and bearing sleeve (a5) together.
7. Remove the slinger (a10).
8. Remove the seal cap (c2) and seal assembly (c1).
9. Remove the bearing cover (a17).
10. Remove the bearing frame (a21) and bearing (a19).
11. Remove the slinger (a20).
12. Remove the seal cap (c9) and seal assembly (c7).
13. Disassemble the studs (f5).
14. Remove the connection seat (a23).
15. Remove the inlet casing (b7).
16. Remove the middle sleeve (c4).
17. Remove the impeller (f7).
18. Disassemble the middle casing (d2).
19. Remove the guide vane (d1).
20. Repeat steps 16-19 to disassemble the middle casing (d2), guide vane (d1), middle sleeve (c4), impeller (f7) and impeller key (d3) until all impellers are disassembled.
21. Remove the shaft (f1).
22. Disassemble the balance hub (b4).

7.3.4 CVM component inspection

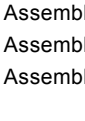
While the pump is disassembled, all components must be inspected for wear, damage, deterioration or erosion.

- Check the wear of the bottom sleeve (2A) and sleeve bearing (3). Replace them if they are loose, rough or noisy when rotated.
- Check the balancing drum (9) and balance sleeve (10). Replace them if they are seriously worn.
- If the sleeve bearing (3) and balance sleeve (10) need to be replaced, remove them and tap new bearing and balance sleeve into the right position with a plastic rod. Once in place secure them with the locating screw.
- Check the radial runout of the shaft (1) at seal position. The maximum allowed radial runout is 0.05 mm.

Order a replacement part with the name and position used in the drawing on page 11.

7.3.5 Reassemble CVM pump

1. All parts must be clean before reassembly.
2. Place the key (16C) and balancing drum (9) on the pump shaft (1).
3. Place the outlet case (21) and connection seat (19) on a flat surface with the outlet stage (21) upwards.
4. Assemble the end-stage guide-vane (7B).
5. Push the shaft (1) with balance drum (9) into the outlet stage (21) and support the pump shaft (1) with a support block to ensure that the balancing drum (9) and balance sleeve (10) are at the same horizontal level.
6. Assemble the key (16C), impeller (5) and middle sleeve (2B).
7. Assemble the middle stage (6).
8. Assemble the guide vane (7A).
9. Repeat assembling the key (16C), impeller (5), middle sleeve (2B), middle stage (6), guide vane (7A), bottom sleeve (2A), and then lock.
10. Insert the studs (22).
11. Assemble the inlet stage (23).



Pay attention to the direction of the inlet and outlet flange. They must be fit for the installation requirement.

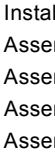
12. Preliminarily screw nuts (20) onto studs (22).
13. Reverse the hydraulic component and place the connection seat (19) upwards.
14. Tighten the locating nut (20) in cross direction gradually.
15. Assemble the mechanical seal (11) and seal cap (12).

The mechanical seal face must be clean.

16. Assemble the motor (15).
17. Ensure that the pump shaft key (16B) and motor shaft key (16A) are in the same direction.
18. Assemble a half coupling (13) with the keyway on the shaft.
19. Secure the washer (17) on the motor shaft end.
20. Turn the shaft coupling by hand and ensure it can rotate freely.
21. Assemble the other coupling half.
22. Assemble the balance-pipe unit (8).
23. Assemble the coupling guard (14).

7.3.6 Reassemble CHM pump

1. All parts must be clean before reassembly.
2. Connect the balance hub (b4) on the pump shaft (f1).
3. Place the outlet casing (b2) and connection seat (a16) on a flat surface with the outlet casing (b2) upwards.
4. Assemble the end-stage guide-vane (b3).
5. Push the shaft (f1) with balance hub (b4) into the outlet casing (12) and support the pump shaft (f1) with a support block to ensure that the balance hub (b4) and balance sleeve (b2) are in the same horizontal level.
6. Assemble the impeller (f7), middle sleeve (c4) and key (d3).
7. Assemble the guide vane (d1).
8. Repeat steps 6 and 7 until all of the middle sleeve (c4) is built.
9. Assemble the inlet casing (b7) and connection seat (a23).



Pay attention to the direction of the inlet and outlet flange. They must be fit for the installation requirement.

10. Assemble the studs (f5) and preliminarily screw nuts (f3) onto the studs (f5).
11. Reverse the hydraulic component and make it level.
12. Tighten the nut (f3) in cross direction gradually.
13. Assemble the seal assembly (c1) and seal cap (c2).
14. Assemble the slinger (a10).
15. Install lip seal (a9) to the bearing frame (a7).
16. Assemble the bearing (a8) and round nut (a3), and then lock.
17. Assemble the seal assembly (c7) and seal cap (c9).
18. Assemble the slinger (a20).
19. Assemble the bearing (a19).
20. Assemble the bearing covers (a4) and (a17).
21. Assemble the balance-pipe unit (f8) and the coupling (5).

The mechanical seal face must be clean in both drive end and non-drive end.

7.4 CVM, sectional drawing and parts list

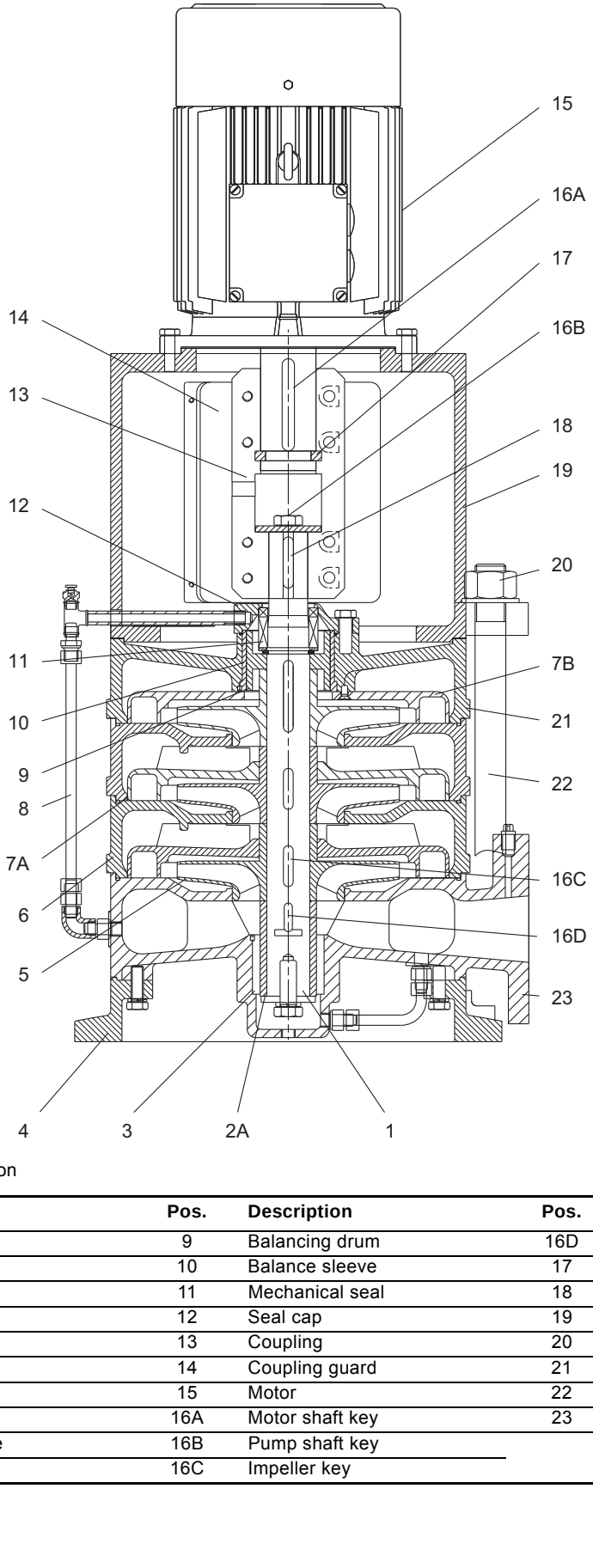


Fig. 7 CVM pump construction

Pos.	Description	Pos.	Description	Pos.	Description
1	Shaft	9	Balancing drum	16D	Sleeve key
2A	Bottom sleeve	10	Balance sleeve	17	Washer
2B	Middle sleeve	11	Mechanical seal	18	Key
3	Sleeve bearing	12	Seal cap	19	Connection seat
4	Base	13	Coupling	20	Locknut
5	Impeller	14	Coupling guard	21	Outlet casing
6	Middle casing	15	Motor	22	Stud
7A	Guide vane	16A	Motor shaft key	23	Inlet casing
7B	End-stage guide-vane	16B	Pump shaft key		
8	Balance-pipe unit	16C	Impeller key		

7.5 CHM, sectional drawing and parts list

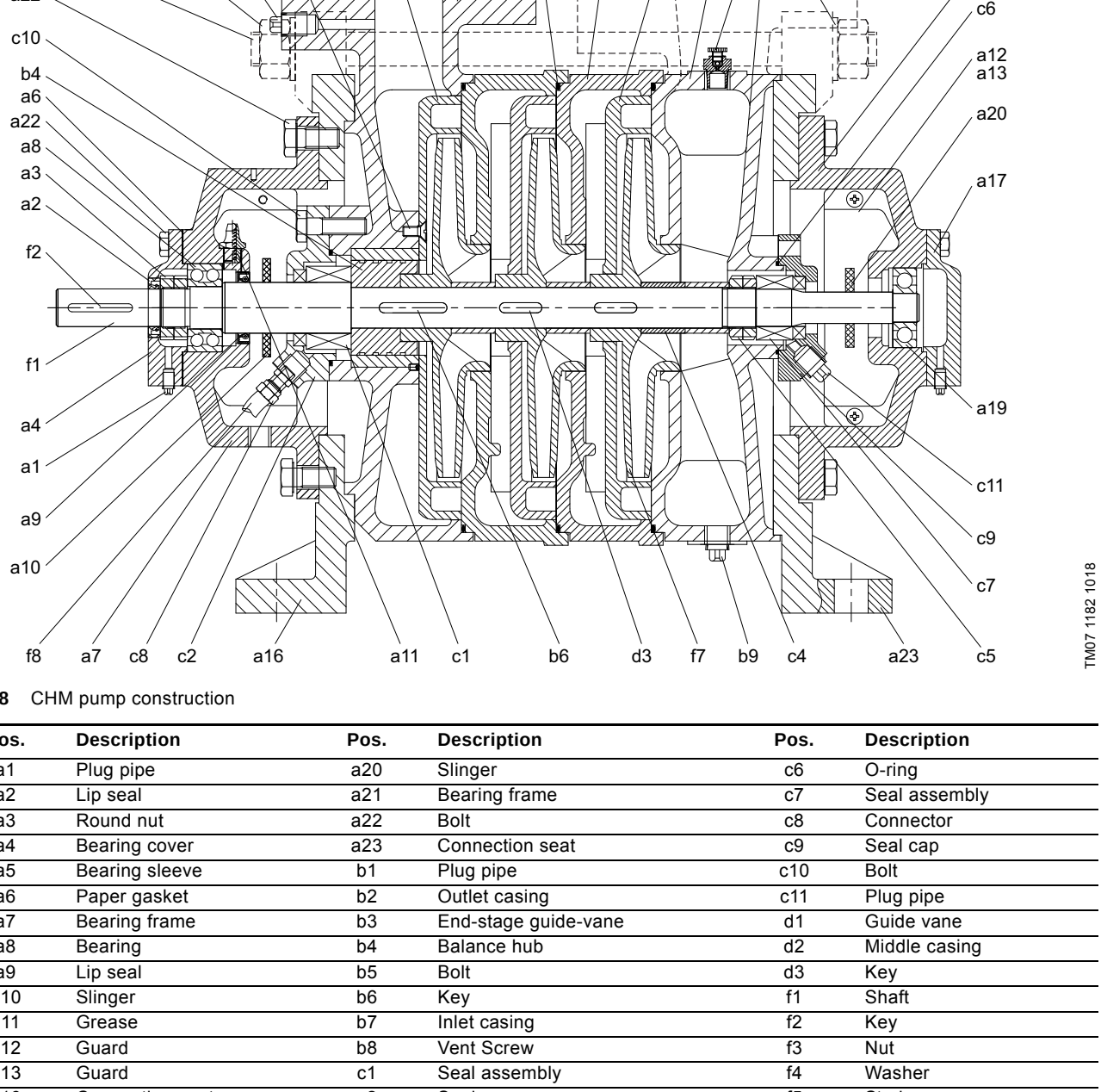


Fig. 8 CHM pump construction

Pos.	Description	Pos.	Description	Pos.	Description
a1	Plug pipe	a20	Slinger	c6	O-ring
a2	Lip seal	a21	Bearing frame	c7	Seal assembly
a3	Round nut	a22	Bolt	c8	Connector
a4	Bearing cover	a23	Connection seat	c9	Seal cap
a5	Bearing sleeve	b1	Plug pipe	c10	Bolt
a6	Paper gasket	b2	Outlet casing	c11	Plug pipe
a7	Bearing frame	b3	End-stage guide-vane	d1	Guide vane
a8	Bearing	b4	Balance hub	d2	Middle casing
a9	Lip seal	b5	Bolt	d3	Key
a10	Slinger	b6	Key	f1	Shaft
a11	Grease	b7	Inlet casing	f2	Key
a12	Guard	b8	Vent Screw	f3	Nut
a13	Guard	c1	Seal assembly	f4	Washer
a16	Connection seat	c2	Seal cap	f5	Stud
a17	Bearing cover	c3	Washer	f6	O-ring
a18	Bolt	c4	Middle sleeve	f7	Impeller
a19	Bearing	c5	Round nut	f8	Tubing

7.6 CHM pump with sleeve bearings

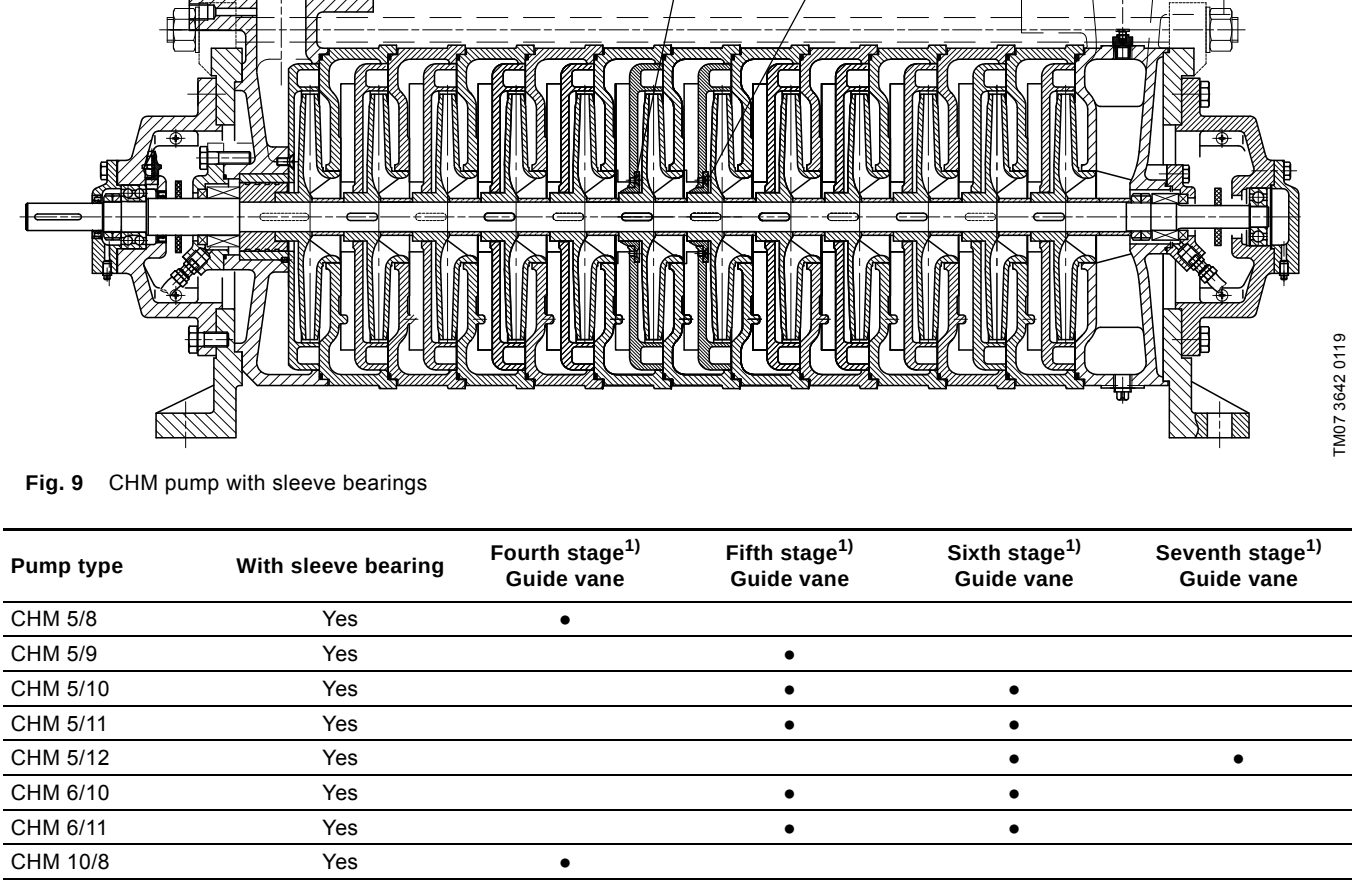


Fig. 9 CHM pump with sleeve bearings

Pump type	With sleeve bearing	Fourth stage[1)] Guide vane	Fifth stage[1)] Guide vane	Sixth stage[1)] Guide vane	Seventh stage[1)] Guide vane
CHM 5/8	Yes	•			
CHM 5/9	Yes		•		
CHM 5/10	Yes		•	•	
CHM 5/11	Yes		•	•	
CHM 5/12	Yes			•	•
CHM 6/10	Yes		•	•	
CHM 6/11	Yes		•	•	
CHM 10/8	Yes	•			
CHM 10/9	Yes		•		
CHM 10/10	Yes		•	•	

[1)] The stage is counted from the drive end.

Bolt torque standard in inch

Specification (Grade 8)	Recommended torque [Nm]	Tolerance
5/16"	18	± 10 %
3/8"	33	± 10 %
1/2"	81	± 10 %
5/8"	153	± 10 %
3/4"	285	± 10 %
7/8"	461	± 10 %
1"	685	± 10 %
1.25"	1300	± 10 %

Bolt torque standard in metric

Specification (Grade 8.8)	Recommended torque [Nm]	Tolerance
M8	20	± 10 %
M10	38	± 10 %
M12	85	± 10 %
M16	170	± 10 %
M20	330	± 10 %
M24	548	± 10 %
M27	810	± 10 %
M30	1215	± 10 %

8. Taking the product out of operation

The following shutdown procedures will apply for the CVM pumps in most normal shutdown situations. If the pump will be out of operation for a long time, follow the storage procedures in section *8.3 Long-term shutdown*.

8.1 General procedure

- Always close the outlet gate valve before stopping the pump. Close the valve slowly to prevent hydraulic shock.
- Switch off and lock off the power supply to the motor.

8.2 Short-time shutdown

- For overnight or temporary shutdown periods under non-freezing conditions, the pump may remain filled with liquid. Make sure the pump is fully primed before restarting.
- For short or frequent shutdown periods under freezing conditions, keep the liquid moving within the pump housing and insulate or heat the pump exterior to prevent freezing.

8.3 Long-term shutdown

- For long shutdown periods, or to isolate the pump for maintenance, close the inlet gate valve. If no inlet valve is used and the pump has positive inlet pressure, drain all liquid from the inlet line to stop the liquid flow into the pump inlet. Remove the plugs in the pump drain and vent holes, as required, and drain all liquid from the pump housing.
- If there will be freezing conditions during long shutdown periods, completely drain the pump and blow out all liquid passages and pockets with compressed air. Freezing of the pumped liquid can also be prevented by filling the pump with antifreeze solution.

9. Fault finding the product

DANGER

Electric shock

Death or serious personal injury

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

CAUTION

Toxic material

Minor or moderate personal injury

- Wash down the pump before doing any work on it.

DANGER

Hot, caustic, flammable or toxic materials, including vapors

Death or serious personal injury

- Be extremely cautious when venting or draining hazardous liquids.
  Wear protective clothing when there are caustic, corrosive, volatile, flammable, or hot liquids.
  Do not breathe toxic vapors.
  Do not allow sparks, open fire or hot surfaces near the equipment.

Fault	Cause	Remedy
1. The outlet pressure is too low.	a) The speed of rotation is too low.	Reestablish correct speed and direction of rotation.
	b) The system pressure is lower than anticipated.	Decrease the system flow.
	c) There is air or gas in the pumped liquid.	Remove the air from the pumped liquid.
	d) The wear rings are worn.	Replace the wear rings.
	e) The impeller is damaged.	Repair or replace the impeller.
	f) The impeller diameter is too small.	Replace the impeller with one of the correct diameter.
	g) The direction of rotation is wrong.	Interchange two wires in the power supply.
	h) The pump has lost its prime.	Re-prime the pump.
	i) There is insufficient NPSH.	Restore the required NPSH.
	j) Passages are restricted.	Clean the impeller and pump housing passages.
	k) Joints or the stuffing box are leaking.	• Tighten the joints or the stuffing box gland. • Replace the shaft sleeve. • Replace the gaskets.
2. The inlet pressure is insufficient.	a) The inlet line is drawing air.	Tighten the connections.
	b) The suction lift is too high or there is insufficient NPSH.	Reduce the suction lift or restore the required NPSH.
	c) Air or gas is trapped in the pumped liquid.	Remove the trapped air or gas from the liquid.
	d) The strainer is clogged.	Clean the strainer.
3. The noise level has increased.	a) Poor alignment of the pump. The inlet and outlet pipe clamps are loose.	• Reestablish proper alignment of the pump and the motor. • Support the inlet and outlet pipes. • Make sure the vibration dampers, flexible pipes and conduit connectors are installed correctly.
	b) The foundation is cracked.	Repair the foundation.
	c) The ball bearings are worn.	• Replace the worn bearings. • Renew the lubrication.
	d) The motor is unbalanced.	• Disconnect the motor and operate it alone. • Remove large pieces of debris, such as wood or rags from the pump. • Clean out the pump, if necessary.
	e) Hydraulic resonance.	• Alter the resonant pipes. • Change the pump speed. • Insert a pulsation damper on the pump or the pipes. • Insert a flow straightener.

Fault	Cause	Remedy
4. The flow is insufficient.	a) The pump is not primed.	Prime the pump.
	b) The system pressure exceeds the shut off pressure.	• Increase the liquid level on the inlet side. • Open the gate valve in the inlet pipe.
	c) The speed of rotation is too low.	Reestablish the correct speed of rotation.
	d) The suction lift is too high or there is insufficient NPSH.	Reduce the suction lift or restore the required NPSH.
	e) The strainer or the impeller is clogged.	Clean the strainer and the impeller passages.
	f) The direction of rotation is wrong.	Reestablish the correct direction of rotation.
	g) The joints are leaking.	Tighten the joints.
	h) The shaft or coupling is broken.	Repair or replace damaged parts.
	i) The inlet valve is closed.	If the inlet valve is closed, open it slowly.
	j) There is not enough inlet pressure for hot or volatile liquids.	Reestablish required inlet pressure.
	k) The foot valve is too small.	Replace the foot valve.
	l) The hydraulic parts are worn or damaged.	Repair or replace the worn parts.
	m) There is excessive clearance between the wear surfaces.	See section *7.3.4 CVM component inspection*.
5. The pump loses its prime after starting.	a) Joints or the stuffing box are leaking.	• Tighten the joints or the stuffing box gland. • Replace the shaft sleeve. • Replace the gaskets.
	b) The suction lift is too high or there is insufficient NPSH.	Reduce the suction lift or restore the required NPSH.
6. Excessive power is required.	a) The speed of rotation is too high.	Reduce the speed of rotation.
	b) The pump is operating beyond its recommended performance range.	Set the duty point in accordance with the recommended performance range.
	c) The specific gravity or viscosity of the pumped liquid is too high.	If less flow is sufficient, reduce the flow on the outlet side, or fit the pump with a more powerful motor.
	d) The shaft is bent.	Replace the shaft.
	e) The stuffing box is too tight.	Retighten the stuffing box if possible. Alternatively, repair or replace the stuffing box.
	f) The impeller clearance is too small causing rubbing or worn wear surfaces.	Adjust the impeller clearance, if possible, or replace the wear ring.
	g) There is an electrical or mechanical defect in the motor.	Contact your local service centre for diagnostics.
	h) The pump is restricted in its rotation.	Remove any obstacles or replace any worn parts.
	i) The lubrication of the motor is incorrect.	Reestablish correct lubrication of the motor.

10. Technical data

10.1 Operating conditions

10.1.1 Flow rate

Minimum flow rate

The pump must not run against a closed outlet valve as this will cause 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 vibrations.

The minimum continuous flow rate is shown when selecting the pump in Grundfos Selector online selection tool.

Maximum flow rate

The maximum flow rate must not exceed the value stated on the performance curves. If the maximum flow rate is exceeded, cavitation and overload may occur.

10.1.2 Ambient temperature and altitude

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.

Too high ambient temperature or low density and consequently low cooling effect of the air may result in overheating.

In such cases, it may be necessary to use a motor with a higher output.

10.1.3 Liquid temperature

The maximum liquid temperature depends on the material of the mechanical shaft seal, O-rings and gaskets used:

- Temperature range for BUNA:
  0-100 °C.
- Temperature range for FKM:
  15-135 °C.
- Temperature range for EPDM:
  15-135 °C.

10.1.4 Outlet pressure

Maximum outlet pressure

The maximum outlet pressure is the pressure (total dynamic head) stated on the pump nameplate.

10.1.5 Inlet pressure

Minimum inlet pressure

The minimum inlet pressure must correspond to the NPSH curve for the pump + a safety margin of minimum 0.5 m head.

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 rated flow rate.
- The pump is operating in an open system with suction lift.
- The inlet conditions are poor.
- The operating pressure is low.

Maximum inlet pressure

Inlet pressure + pump pressure must be lower than the maximum pressure (total dynamic head) of the pump.

11. Disposal

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.

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