# HS

Horizontal split case pump

Installation and operating instructions

**Installation and operating instructions**

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**Original installation and operating instructions**

These installation and operating instructions describe HS.

Sections 1-5 give the information necessary to be able to unpack, install and start up the product in a safe way.

Sections 6-12 give important information about the product, as well as information on service, fault finding and disposal of the product.

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Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

## 1. General information

Grundfos HS horizontal split case pumps are supplied either as complete pump with motor, base frame and approved coupling guard or as a bare shaft pump.

These instructions apply to both types.

The HS pump can be driven by an electric motor or other type of driver. In the following we assume that the pump is driven by an electric motor.

### 1.1 Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury.

Caution

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

Note

Notes or instructions that make the job easier and ensure safe operation.

# 2. Receiving the product

## 2.1 Inspecting the product

The pump is delivered from factory in a crate or wooden box specially designed for transport by forklift truck or a similar vehicle.

Upon receipt, check the pump visually to determine whether any damage has happened during transport or handling.

Check especially for these points:

1. broken or cracked equipment, including base frame, motor or pump feet and flanges
2. broken motor fan cover, bent eyebolts or damaged terminal box
3. missing parts.

Parts or accessories are sometimes wrapped individually or fastened to the equipment.

If any damage or losses have occurred, promptly notify Grundfos' representative and the carrier's agent.

Note

Bolts for HS bare shaft pumps have US threads for which inch tools are required. Bolts for coupling guard and for mounting of pump and motor on the base frame have metric threads.

# 3. Installing the product

## 3.1 Mechanical installation

Warning

All installations must be performed by staff experienced in the placement, alignment and connection of pumping equipment.

### 3.1.1 Location

Install the pump with accessibility for inspection and maintenance. Allow ample space and headroom for the use of an overhead crane or hoist sufficiently strong to lift the unit.

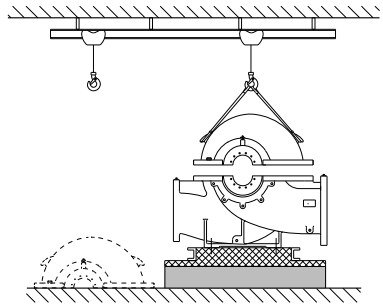


**Fig. 1** HS pump with accessibility for inspection and headroom for the use of an overhead crane

Install the pump as close as possible to the supply of pumped liquid, with the shortest and most direct inlet pipe practical.

### 3.1.2 Foundation

We recommend that you install the pump on a concrete foundation which is heavy enough to provide permanent and rigid support for the entire pump. The foundation must be capable of absorbing any vibration, normal strain or shock. We recommend that the weight of the concrete foundation is 3 times the weight of the complete pump unit. For specific requirements, consult the contractor, engineer, or established industry standards.

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

### 3.1.3 Vibration dampers

Vibration dampers may be required to prevent pump vibrations from being transmitted to the building or the pipework. In order to select the right vibration damper, you need this information:

- Forces transmitted through the damper.
- Motor speed. Take the motor speed into account in the case of speed control.
- Desired dampening in %. The recommended value is 70 %.

The selection of vibration damper differs 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.

### 3.1.4 Expansion joints

Expansion joints provide these advantages:

- Absorption of thermal expansion and contraction of pipework caused by variations in liquid temperature.
- Reduction of mechanical influences in connection with pressure surges in the pipework.
- Isolation of structure-borne noise in the pipework (only rubber bellows expansion joints).

**Caution** Do not fit expansion joints to make up for inaccuracies in the pipework, such as centre displacement or misalignment of flanges.

Fit the expansion joints at a minimum distance of 2 pipe diameters (DN) away from the pump flange on the inlet side. This prevents turbulence in the joints, thus ensuring optimum inlet conditions and minimum pressure drop on the outlet side.

At flow velocities greater than 2.4 m/s, we recommend that you fit larger expansion joints matching the pipework.

### 3.1.5 Foundation and preliminary alignment procedure

The foundation and preliminary alignment procedure has four steps:

1. Pouring of foundation
2. Shimming of base frame
3. Preliminary alignment
4. Grouting.

**Pouring of foundation**

We recommend the following procedure to ensure a good foundation.

1. Pour the foundation without interruptions to within 19-32 mm of the final level. Use vibrators to ensure that the concrete is evenly distributed. The top surface must be well scored and grooved before the concrete sets. This provides a bonding surface for the grout.
2. Embed foundation bolts in the concrete as shown in fig. 2. Allow enough bolt length to reach through grout, shims, lower base frame, nuts and washers.

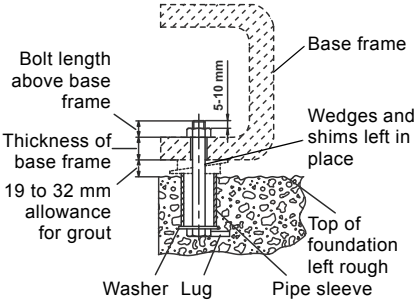


**Fig. 2** Typical foundation bolt design

Let the foundation cure for several days before the base frame is shimmed and grouted.

**Shimming of base frame**

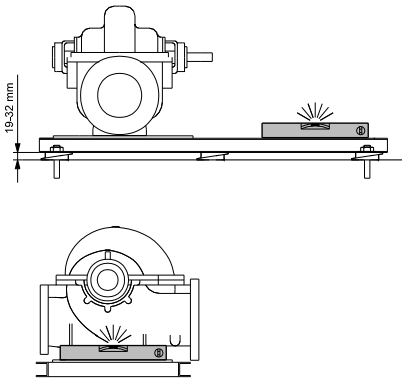


**Fig. 3** Shimming of base frame and levelling of pump

1. Lift/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 foundation bolts and midway between bolts. See fig. 3.
2. Level the base frame by adding or removing shims under the base frame. See fig. 3.
3. Tighten the foundation bolt nuts against the base frame. Make sure the pipes can be aligned to the pump flanges without putting strain on pipes or flanges.

## Preliminary alignment

Warning

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

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

The pumps are equipped with flexible grid couplings as standard. A flexible coupling will only compensate for minor misalignments and you must not use it to compensate for excessive misalignment of the pump and motor shafts. Inaccurate alignment results in vibration and excessive wear on the bearings, shaft and wear rings.

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

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

The preliminary alignment procedure has four steps:

1. Checking coupling clearance

Make sure that the gap between the coupling halves is equal to the values in the table and that the keyways are 180 ° displaced.

| For a coupling with an outside diameter of Ø [mm] | Coupling clearance [mm] | |
|---|---|---|
| | Nominal | Tolerance |
| ∅90-213 | 3.2 | 0/-1 |
| ∅251-270 | 4.8 | 0/-1 |
| ∅306-757 | 6.4 | 0/-1 |

2. Checking soft foot on pump and motor

Soft foot is analogous to sitting down at a table and finding that the table rocks when someone leans on it. Technically, it is a condition where the feet of a motor or a pump are not in the same plane as the base plate.

To check for soft foot, set the pump or motor on its base plate and bolt it down. Set up a dial gauge on one foot, loosen the hold-down bolt, and watch the dial gauge. If the dial gauge indicator moves while loosening the bolt, the pump or motor has soft foot. The movement measured by the dial gauge indicates how many shims you need to level the pump or motor. Repeat this procedure at all four corners.

If the pump has been installed for a long period of time, the stresses induced in the pump casing by soft foot can cause permanent deformation of the casing.

3. 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 ± 0.2 mm of each other.

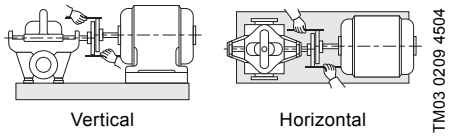


**Fig. 4** Checking parallel alignment

4. 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. The angular alignment is correct when the measurements show that all points of the coupling faces are within ± 0.2 mm of each other.

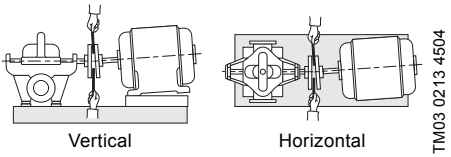


**Fig. 5** Checking angular alignment

Recheck the coupling clearance and tighten the set screws on the couplings.

**Grouting**

Grouting compensates for uneven foundation, distributes weight of unit, dampens vibrations and prevents shifting. Use an approved, non-shrinking grout. If you have questions or doubts about the grouting, consult an expert on grouting.

Proceed as follows:

1. Build a strong formwork around the foundation to contain the grout.
2. Soak top of concrete foundation thoroughly, then remove surface water.
3. Fill the formwork with grout up to the top edge of the base frame. See fig. 6. Allow the grout to dry thoroughly before attaching the pipe to the pump. 24 hours is sufficient time with approved grouting procedure.
4. When the grout has thoroughly hardened, check the foundation bolt nuts and tighten if necessary.
5. Approximately two weeks after the grout has been poured, or when the grout has thoroughly dried, apply an oil-based paint to the exposed edges of the grout to prevent air and moisture from getting in contact with the grout.

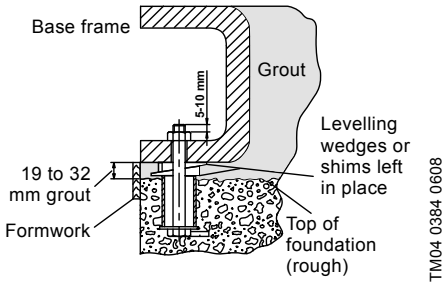


**Fig. 6** Sectional view of foundation with foundation bolt, grouting and base frame

## 3.2 Electrical connection

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

Warning

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.

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

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.

Warning

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.

#### 3.2.1 Frequency converter operation

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.

Note: If in doubt whether the motor supplied 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 of 45 kW and up | Check that one of the motor bearings is electrically isolated. Contact Grundfos. |
| 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.<br>• Or make sure that the motor has reinforced insulation. |
| Supply voltage of 690 V and upwards | • Fit a dU/dt filter.<br>• Make sure that the motor has reinforced insulation. |

### 3.3 Pipes

Caution: Protective covers are fitted to the inlet and outlet ports to prevent foreign bodies from entering the pump during transportation and installation. Remove these covers from the pump before connecting any pipes.

**Inlet and outlet pipe**

In order to minimise friction losses and hydraulic noise in the pipes, choose the pipe that is one or two sizes larger than the pump inlet and outlet ports. Typically, flow velocities must not exceed 2 m/s (6 ft/sec) for the inlet pipe (port) and 3 m/s (9 ft/sec) for the outlet pipe (port).

Make sure that the NPSH available (NPSHA) is higher than the NPSH required (NPSHR). NPSH = Net Positive Suction Head.

#### 3.3.1 General precautions

When installing the pipes, observe these precautions:

1. Always run the pipes direct to the pump.
2. Do not move the pump to the pipes. This could make final alignment impossible and cause stress to the pump flanges and pipes.

Caution: Make sure that both the inlet and outlet pipes are independently supported near the pump so that no strain is transmitted to the pump when you tighten the flange bolts. Use pipe hangers or other supports with necessary spacing to provide support.

3. When you use expansion joints in the pipe system, fit the joints at a minimum distance of 2 pipe diameters away from the pump on the inlet side. This prevents turbulence in the joints, thus ensuring optimum inlet conditions.
4. Install the pipes as straight as possible and avoid unnecessary bends. Where necessary, use 45 ° or long-sweep 90 ° fittings to reduce friction loss.
5. Make sure that all pipe joints are tight.
6. Where you use flanged joints, ensure that the inside diameters match properly.
7. Remove burrs and sharp edges when making up joints.
8. Make sure that the pipes do not cause stress or strain in the pump.
9. Provide for expansion of pipe material by means of expansion joints on both sides of the pump.
10. Always allow sufficient space and accessibility for maintenance and inspection.

### 3.3.2 Inlet pipes

Locate the pump below system level whenever possible. This will facilitate priming, assure a steady liquid flow and provide a positive suction head.

Caution The sizing and installation of the inlet pipe is extremely important.

You can avoid many NPSH problems if you install the inlet pipe properly. See section *3.3.1 General precautions*.

In section *12. Disposing of the product*, common inlet pipe installations are illustrated for two situations:

- flooded systems
  Closed systems and open systems where the liquid level is above the pump inlet.
- suction lift systems
  Closed systems and open systems where the liquid level is below the pump inlet.

### 3.3.3 Valves in the inlet pipe

If the pump is operating under permanent suction lift conditions, install a non-return valve in the inlet pipe to avoid having to prime the pump each time it is started. The non-return valve must be of the flap type or a foot-valve with a minimum of pressure loss.

### 3.3.4 Outlet pipe

The outlet pipe is usually preceded by a non-return valve and an isolating or throttle valve. The non-return valve protects the pump against excessive counterpressure and reverse rotation of the pump and prevents backflow through the pump in case of operational stop or failure of the motor.

In order to minimise friction losses and hydraulic noise in the pipes, flow velocities must not exceed 3 m/s (9 ft/sec) in the outlet pipe (port).

On long horizontal runs, keep the pipe as level as possible.

Avoid high spots, such as loops as they will collect air and throttle the system or lead to uneven pumping.

### 3.3.5 Auxiliary pipes

**Drains**

Install the drain pipes from the pump casing and stuffing boxes to a convenient disposal point.

**Flushing pipes**

- Pumps fitted with stuffing boxes

When the inlet pressure is below the ambient pressure, supply the stuffing boxes with liquid to provide lubrication and prevent the ingress of air. This is normally achieved via a flushing pipe from the outlet side to the stuffing box. You can fit a control valve or orifice plate in the flushing pipe to control the pressure to the stuffing box.

If the pumped liquid is dirty and cannot be used for flushing the packing rings, we recommend a separate clean, compatible liquid supply to the stuffing box at 1 bar (15 psi) above the inlet pressure.

- Pumps fitted with mechanical seals

Seals requiring re-circulation will normally be provided with a flushing pipe from the pump casing.

Caution To avoid seal damage, we recommend that the supply of any external flushing or cooling liquid is continued after the pump is stopped.

### 3.3.6 Measuring instruments

To ensure continuous monitoring of operation, we recommend that you install pressure gauges on the pump inlet and outlet flanges. The pressure gauge on the inlet side must be capable of measuring vacuum. The pressure tappings must only be opened for test purposes. The measuring range of the outlet side pressure gauge must be minimum 20 % above the maximum pump outlet pressure.

When measuring with pressure gauges on the pump flanges, note that a pressure gauge does not register dynamic pressure (velocity pressure). The diameters of the inlet and outlet flanges are different which results in different flow velocities in 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 lower.

## 3.4 Inlet pipe guidelines

### 3.4.1 Common guidelines

**Avoid airlocks or turbulence in the inlet pipe**

Never use reducers in a horizontal inlet pipe as shown in fig. 8. Instead, use an eccentric reducer as illustrated in fig. 7.

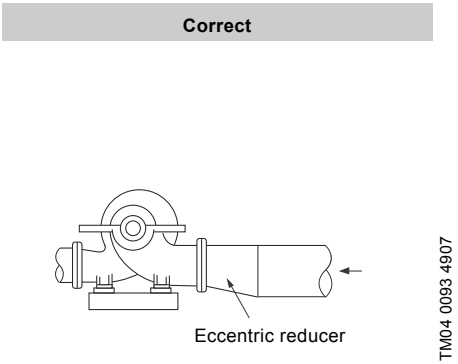


**Fig. 7** Correctly mounted reducer

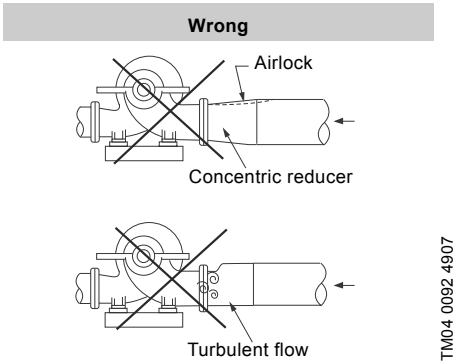


**Fig. 8** Reducers resulting in airlocks and turbulence

### 3.4.2 Flooded systems

Closed systems and open systems where the liquid level is above the pump inlet.

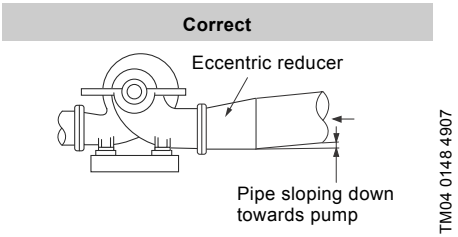


**Fig. 9** Correctly mounted inlet pipe

### 3.4.3 Suction lift systems

Closed systems and open systems where the liquid level is below the pump inlet.

Install the inlet pipe sloping upwards towards the inlet port. Any high point in the pipe will be filled with air and thus prevent proper operation of the pump. When reducing the pipe to the inlet port diameter, use an eccentric reducer with the eccentric side down to avoid airlocks.

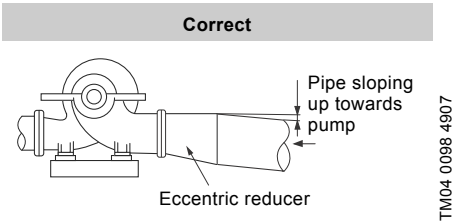


**Fig. 10** Correctly mounted inlet pipe

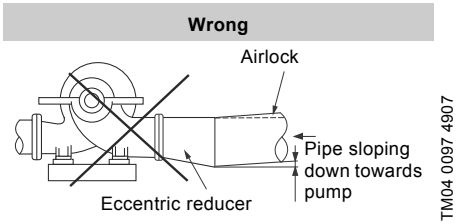


**Fig. 11** Inlet pipe resulting in airlocks

### 3.4.4 Inlet pipe if the feed line comes in different horizontal planes

Avoid high spots, such as loops, as they will collect air and throttle the system or lead to uneven pumping.

**Correct**

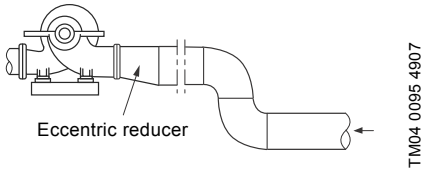


**Fig. 12** Correctly mounted inlet pipe

**Wrong**

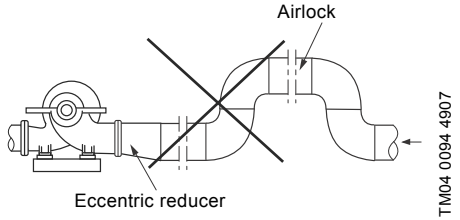


**Fig. 13** Inlet pipe resulting in airlocks

### 3.4.5 Inlet pipe with a horizontal elbow in the feed line

Make sure that the liquid flow is evenly distributed to both sides of the double-suction impeller.

There is always an uneven, turbulent flow through an elbow. See below. If you install an elbow in the inlet pipe near the pump in a position other than vertical, more liquid will enter one side of the impeller than the other. This will result in heavy, unbalanced thrust loads overheating the bearings, causing rapid wear and reducing the hydraulic performance.

**Correct**

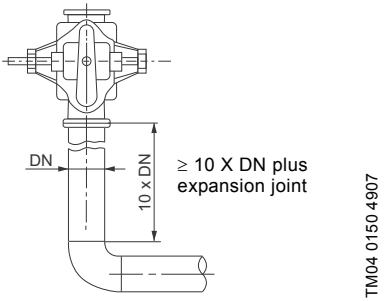


**Fig. 14** Recommended inlet pipe installation with a length of straight pipe between horizontal elbow and pump

**Wrong**

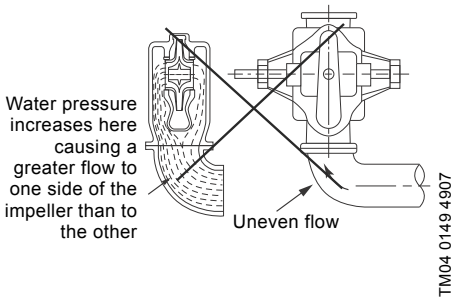


**Fig. 15** Unbalanced loading of a double-suction impeller due to uneven flow through a horizontal elbow close to the pump

### 3.4.6 Installations with vertical inlet pipe in confined space

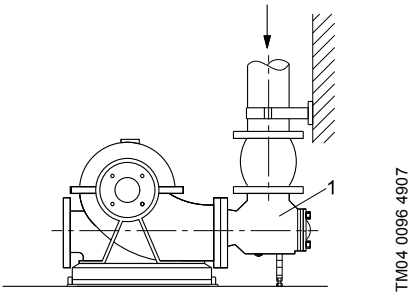


**Fig. 16** Inlet diffuser (1) in the inlet pipe

## 4. Starting up the product

The startup procedure for the pumps has four steps:

1. Prestart checks. See section *4.1 Prestart checks*.
2. Priming. See section *4.2 Priming*.
3. Starting. See section *4.3 Startup*.
4. Final alignment. See section *4.4 Final alignment*.

Warning

Do not start the pump until you have gone through all the prestart checks.

### 4.1 Prestart checks

Prestart checks has four steps:

1. Bearings
2. Stuffing boxes
3. Pressure gauge
4. Direction of rotation.

#### 4.1.1 Bearings

Make sure that all bearings are properly lubricated. See section *8.1.3 Lubrication*.

#### 4.1.2 Stuffing boxes

Make sure that the stuffing box packing rings have been properly tightened.

Note: This does not apply to pumps with mechanical shaft seals.

#### 4.1.3 Pressure gauges

Make sure that the pressure gauge connections are closed.

#### 4.1.4 Direction of rotation

Check the direction of rotation in the following way:

1. Remove coupling grid spring to ensure that there is no connection between pump and motor.
2. Make sure that the motor shaft can turn freely.
3. Start the motor briefly to check the direction of rotation. The correct direction of rotation is indicated by the arrows on the pump casing.

Note: The direction of rotation of the pump is not always the same as the flow direction.

4. If the direction of rotation is wrong, correct it by interchanging two phases on the motor.

Warning

Before interchanging two phases, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

5. Check the direction of rotation again.
6. Reassemble the coupling with the grid spring and guards.

### 4.2 Priming

Note: If not primed properly, the pump will not deliver liquid.

**Closed systems or open systems where the liquid level is above the pump inlet (flooded systems)**

Fill the inlet pipe and pump with liquid and vent them before the pump is started. Proceed as follows:

1. Close the outlet isolating or throttle valve.
2. Loosen the vent screw (17) and the plug for shaft seal flushing (20d).

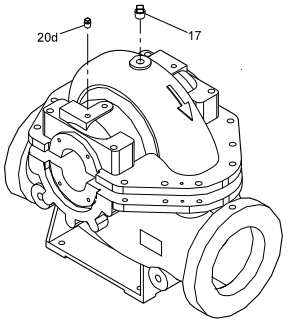


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**Fig. 17** Position of the vent valve and plug for shaft seal flushing

Warning

Pay attention to the direction of the vent hole and ensure that the escaping water does not cause injury to persons or damage to the motor or other components. In hot-water installations, pay special attention to the risk of injury caused by scalding hot water and hot surfaces.

In cold-liquid installations, pay special attention to the risk of injury caused by cold liquids and cold surfaces.

3. Slowly open the isolating valve in the inlet pipe until a steady flow of liquid runs out of the vent hole.
4. Rotate the shaft by hand, if possible, while priming and venting to free entrapped air from the impeller channels.
5. Tighten the vent screw and completely open the isolating or throttle valve(s).

**Open systems where the liquid level is below the pump inlet (suction lift systems)**

Fill the inlet pipe and pump with liquid and vent them before the pump is started. Proceed as follows:

**Suction lift system with foot valve**

1. Close the outlet isolating or throttle valve and open the isolating valve in the inlet pipe.
2. Remove the vent screw and connect a priming device to a drain hole.
3. Fill the inlet pipe and casing with liquid at a pressure of 1 to 2 bar from an external source until the inlet pipe and pump are completely filled with liquid.
4. Rotate the shaft by hand while priming and venting to free entrapped air from the impeller channels.
5. Refit the vent screw and tighten securely.
6. You can fill the inlet pipe with liquid and vent it before you connect the pipe to the pump. You can also install a priming device before the pump.

**Suction lift system without foot valve**

1. Connect an external vacuum pump to the vent hole on the top of the pump casing.
2. Close the outlet isolating or throttle valve and open the isolating valve in the inlet pipe.
3. Open the valves between the pump and vacuum pump.
4. Start the external vacuum pump.
5. Pump until the inlet pipe and the pump are completely filled with liquid.
6. Rotate the shaft by hand while priming and venting to free entrapped air from the impeller channels.
7. When the liquid runs out of the vacuum pump, stop the external vacuum pump and close the valves between the pump and vacuum pump.

Never let the pump run dry. The pump is not self-priming.

Caution Dry running will cause serious damage to the stuffing boxes, shaft seals, wear rings and shaft sleeves.

#### 4.2.1 Opening of valves

1. Open the valves for the flushing liquid to the stuffing boxes.
2. Completely open the isolating valve on the inlet side of the pump and leave the outlet isolating or throttle valve partly open.

### 4.3 Startup

Make sure that the pump is filled with liquid. The pump must not run dry. Dry

Caution running will cause serious damage to the stuffing boxes, shaft seals, wear rings and shaft sleeves.

1. Start the pump.
2. Vent the pump during startup by loosening the vent screw until a steady flow of liquid runs out of the vent hole.

Warning

Pay attention to the direction of the vent hole and ensure that the escaping water does not cause injury to persons or damage to the motor or other components. In hot-water installations, pay special attention to the risk of injury caused by scalding hot water and hot surfaces.

In cold-liquid installations, pay special attention to the risk of injury caused by cold liquids and cold surfaces.

3. When the pipe system has been filled with liquid, slowly open the outlet isolating or throttle valve until it is completely open.
4. Adjust the stuffing box gland (stuffing boxes only). With the pump running, tighten the stuffing box gland to allow a leakage of 40-60 drops per minute. This is required for shaft sleeve lubrication. Tighten the stuffing box gland evenly to provide uniform compression on the packing rings. After initial startup, additional packing rings and adjustment may be required until the packing rings are properly seated.

Do not run a stuffing box dry, and do not

Caution overtighten the stuffing box gland to eliminate leaking as the shaft sleeve will become damaged.

## 4.4 Final alignment

Caution Make final alignment by shimming the motor only.

1. Let the pump run until it has reached its operating temperature under normal operating conditions (approx. 1 hour).
2. Stop the pump.
3. Remove the coupling guard.
4. Check the alignment on the coupling by means of dial gauges. See below.

**Checking coupling alignment by means of dial gauges**

Alternatively, use laser equipment for final alignment.

Start the procedure by removing the coupling grid spring and checking that the motor shaft and pump shaft can turn freely.

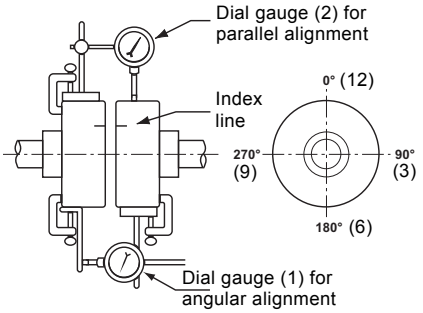
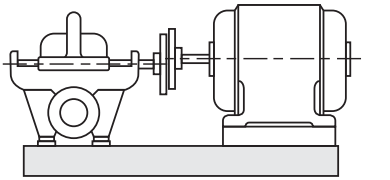



**Fig. 18** The end view of the coupling is seen from the motor

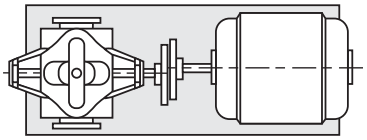
The coupling alignment procedure has four steps:

**Parallel alignment - vertically**



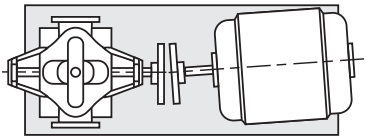

1. Mount the dial gauge (2) in position 0 ° (12 o'clock). See fig. 18.
2. Make the index lines on the two coupling halves. See fig. 18.
3. Set the dial gauge pointer to zero, turn the motor and pump shaft simultaneously until dial gauge is in position 180 ° (6 o'clock) and check that the index lines are still in line.
4. Read the dial gauge (2). If the dial gauge shows a deflection exceeding ± 0.2 mm, add or remove the shims under the motor until the reading of the dial gauge is within the allowable tolerance of ± 0.2 mm.

**Parallel alignment - horizontally**



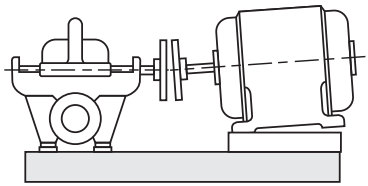

1. Turn the motor and pump shaft to 270 ° (9 o'clock).
2. Set the dial gauge pointer to zero, turn the motor and pump shaft to 90 ° (3 o'clock) and check that the index lines are still in line.
3. Read the dial gauge. If the dial gauge shows a deflection exceeding ± 0.2 mm, move the motor sideways until the reading of the dial gauge is within the allowable tolerance of ± 0.2 mm.
4. Remove the dial gauge (2).

**Angular alignment - horizontally**




1. Mount the dial gauge (1) in position 90 ° (3 o'clock). See fig. 18.
2. Make the index lines on the two coupling halves. See fig. 18.
3. Set the dial gauge pointer to zero, turn the motor and pump shaft simultaneously until the dial gauge is in position 270 ° (9 o'clock) and check that the index lines are still in line.
4. Read the dial gauge (1). If the dial gauge shows a deflection exceeding ± 0.2 mm, move the motor sideways until the deflection is halved.
5. Set the dial gauge pointer to zero, turn the motor and pump shaft simultaneously until the dial gauge is in position 90 ° (3 o'clock) and read the dial gauge (1) again.
6. Now the reading must be within the allowable tolerance of ± 0.2 mm. If not, repeat the procedure.

**Angular alignment - vertically**



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1. Turn the motor and pump shaft until the dial gauge (1) is in position 0 ° (12 o'clock).
2. Set the dial gauge pointer to zero, turn the motor and pump shaft simultaneously until the dial gauge is in position 180 ° (6 o'clock) and check that the index lines are still in line.
3. Read the dial gauge (1). If the dial gauge shows a deflection exceeding ± 0.2 mm, add or remove the shims under the motor until the deflection is halved.
4. Set the dial gauge pointer to zero, turn the motor and pump shaft simultaneously until the dial gauge is in position 0 ° (12 o'clock) and read the dial gauge (1) again.
5. Now the reading must be within the allowable tolerance of ± 0.2 mm. If not, repeat the procedure.
6. Remove the dial gauge (1).

Note

The coupling tolerances may differ from coupling make to coupling make. For the standard coupling, the allowable tolerance is ± 0.2 mm. For other coupling types, see the coupling data supplied with the pump.

Finish the alignment procedure by refitting and tightening the coupling.

## 4.5 Greasing the grid coupling

Pack the spaces between and around the grid with as much lubricant as possible and wipe off the excess lubricant so that it is flush with the top of the grid. See section *8.1.3 Lubrication*.

Position the seals on the hubs so they line up with the grooves in the coupling cover. Position the gaskets on the flanges of the lower coupling cover half and assemble the covers so that the matching marks are on the same side.

Push the gaskets in until they stop against the seals and secure the coupling cover halves with the fasteners provided and tighten them properly. Make sure that the gaskets stay in position during this tightening procedure.

Once the coupling is completely assembled, remove both of the lubricating plugs in the covers and insert a lubricating nipple in one of lubricating holes. Then, pump in lubricant until it is forced out of the opposite lubricating hole. Replace the two lubrication plugs and the installation is complete.

Warning

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

# 5. Storing and handling the product

## 5.1 Handling the product

Warning

Handling must be performed by qualified staff.

When unloading the pump, lift equally at four or more points on the base frame. Do not lift by the motor or pump. Do not lift by the flanges or by the eyebolts on the motor.

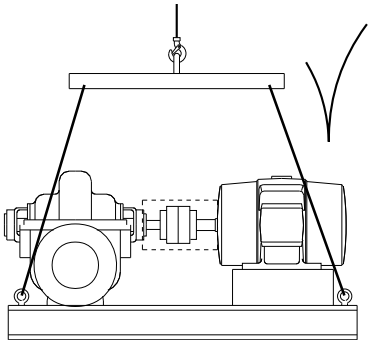

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**Fig. 19** How to lift and handle the HS pumps

**Note** Use shackles at all four corners.

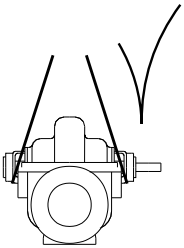

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**Fig. 20** How to lift and handle the HS bare shaft pumps

## 5.2 Temporary storage

If you do not store or operate the pump soon after arrival, store it in a clean, dry place with slow, moderate changes in ambient temperature. Protect the pump from moisture, dust, dirt and foreign bodies. Prior to and during storage we recommend these precautions:

1. Make sure that the bearings are filled with the recommended grease to prevent moisture from entering around the shaft. See section *8.1.3 Lubrication*.
2. 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.
3. Cover the unit with a tarpaulin or other suitable covering if it is to be stored where there is no protective covering.
4. Rotate the shaft two turns every two weeks to prevent corrosion of the bearing surfaces and the stuffing box or shaft seal faces due to moisture.

# 6. Product introduction

## 6.1 Applications

Grundfos HS horizontal split case pumps are typically used in these applications:

- circulation in heating and air conditioning systems, water condensing and boiler feed systems
- liquid transfer and pressure boosting in various industrial systems
- water distribution and water treatment in public water systems.

## 6.2 Pumped liquids

Clean, thin, non-aggressive liquids, not containing solid particles or fibres. Do not pump liquids that will attack the pump materials chemically.

Warning

Do not exceed the maximum operating temperature stated on the nameplate.

When pumping liquids with a density and/or viscosity higher than that of water, the head and flow will be reduced. Alternatively, use motors with correspondingly higher outputs.

The stuffing box packing rings or mechanical shaft seal O-rings chosen must be suitable for the liquid to be pumped.

Special stuffing box packing rings or shaft seal O-rings may be required if you use the pump for pumping treated water:

- at temperatures above 80 °C (176 °F).
- containing additives to prevent system corrosion, calcareous deposits, etc. (this may be the case in heating and ventilating systems).

When pumping liquids other than water, select an appropriate stuffing box or shaft seal. For further information, contact Grundfos.

## 6.3 Identification

The type designation and rating information of Grundfos horizontal split case pumps are stated on the nameplate. See fig. 21. The type designation includes serial number, model number, size and type.

Permanent records for this pump are kept under its year-week code and serial number (5 and 6) and this number must therefore be stated in all correspondence and spare parts orders.

For more information about weight, see the label on the packaging.

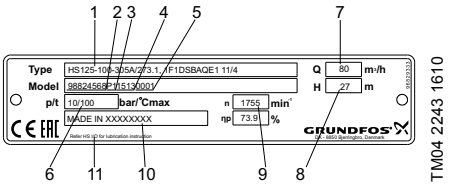


**Fig. 21** Nameplate of CE-marked HS pump

| Pos. | Description |
|---|---|
| 1 | Type designation |
| 2 | Product number |
| 3 | Place of production |
| 4 | Production year and week |
| 5 | Serial number |
| 6 | Maximum pressure and temperature |
| 7 | Rated flow rate (duty-point flow) |
| 8 | Head at rated flow rate (duty-point head) |
| 9 | Speed |
| 10 | Country of production |
| 11 | Reference to lubrication instruction. See section *8.1.3 Lubrication*. |

### 6.3.1 Type key

The type key is an explanation of the product type designation. See fig. 21, pos. 1.

| HS | 125 | -100 | -305x | /273.1 | 5/1 | F | A | BBVP | 1 |
|---|---|---|---|---|---|---|---|---|---|

Type range

Nominal diameter of the inlet port

Nominal diameter of the outlet port

Maximum impeller diameter
If suffix is used, "x" = different impeller design.

Actual impeller diameter

Pump variant:
5/1: Pump with motor and base frame
5/2: Bare shaft pump with base frame
5/3: Bare shaft pump

Code for pipework connection:
F: DIN flange (to EN 1092-2)
G: ANSI flange (to ANSI 250)

Code for materials (pump casing and impeller):
A: Ductile cast-iron pump casing with bronze impeller
B: Cast-iron pump casing with bronze impeller
S: Cast-iron pump casing with stainless-steel impeller
Q: Ductile cast-iron pump casing with stainless-steel impeller

Code for shaft seal or stuffing box:
BBVP: Rubber bellows seal, carbon, aluminium oxide, nitrile rubber
BBQV: Rubber bellows seal, carbon, silicon carbide, FKM
SNEK: Stuffing box with packing rings, uncooled, internal barrier fluid, synthetic polymer packing rings

Direction of rotation:
Pump direction of rotation as seen from motor end
1: Clockwise
2: Counter-clockwise

The example shown is an HS 125-100-305/273.1, standard type with standard coupling, DIN flange, ductile iron pump casing with bronze impeller, BBVP mechanical shaft seal and clockwise direction of rotation.

# 7. Operating the product

## 7.1 Operating checks

1. Check the pump and pipes for leaks.
2. Check and record the pressure gauge readings for future reference.
3. Check the differential pressure. If the differential pressure is lower than anticipated, the motor may be overloaded. See description of measuring instruments in section *3.3.6 Measuring instruments*.
4. Measure the motor current consumption and compare the result with the rated current stated on the motor nameplate. In case of overload, throttle the outlet isolating or throttle valve until the motor is no longer overloaded.
5. Check the bearings for lubrication and temperature. Normal temperature is 70 °C (158 °F). The maximum temperature depends on the type of lubrication. See the lubricating plate on the pump.

Stop the pump immediately if you notice any defects.

Do not start the pump unless the defects have been remedied. See section *10. Fault finding the product*. Report immediately to the supplier that you cannot remedy the defects.

Note

The operating checks apply both during the startup procedure and when checking the pump during normal operation.

## 7.2 Frequency of starts and stops

The recommended maximum number of starts per hour below apply to complete pumps with motor supplied by Grundfos. The values are recommendations only.

**0 to 50 kW**

15 starts per hour. The motor must be stopped for a least 3 minutes before restart.

**51 to 100 kW**

10 starts per hour. The motor must be stopped for a least 5 minutes before restart.

**101 to 315 kW**

5 starts per hour. The motor must be stopped for a least 10 minutes before restart.

**Greater than 315 kW**

2 starts per hour.

## 7.3 Operating at reduced flow and/or head

Do not operate the pump at a flow rate below 10 % of the maximum flow rate stated on the nameplate or with the outlet isolating or throttle valve closed. Operating the pump under such conditions may involve the risk of the pump being overheated. To prevent possible damage, use protective devices such as liquid temperature relay, bearing temperature relay, inlet pressure monitoring, etc.

If a pump is operated at reduced head, the flow will increase and the motor will consume more current than normal. This will result in overheating of the motor. In such situations, throttle the valve on the outlet side, instead. If an automatic throttle valve is installed, this can be done automatically.

# 8. Servicing the product

Warning

If a pump has been used for a liquid injurious to health or toxic, the pump will be classified as contaminated.

If you request Grundfos to service the pump, contact Grundfos with details about the pumped liquid, etc. before you return the pump for service. Otherwise Grundfos can refuse to accept the pump for service.

## 8.1 Maintaining the product

Warning

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

### 8.1.1 General information

Routine maintenance is essential to maintain the pump in a good condition.

A high degree of cleanliness must be maintained during all maintenance procedures.

### 8.1.2 Frequency of inspections

Carry out inspections in accordance with the maintenance table below.

Depending on operating and environmental conditions together with a comparison of previous inspections, the frequency of inspections may be altered to maintain satisfactory operation of the pump.

| | |
|---|---|
| Every week | • Visually check for leaks.<br>• Check for vibrations.<br>• Hand test the bearing housing for any sign of temperature rise.<br>• Check correct leaking from the stuffing boxes (approx. 40-60 drops per minute). |
| Every month | • Check the pump bearing temperature. |
| Every 6 months | • Check the shaft for scores.<br>• Check the alignment of the pump and motor.<br>• Check the fixing bolts and tighten, if necessary.<br>• Check the coupling for wear. |
| Every year | • Check whether the grease in the pump bearings has hardened.<br>• Check the rotating assembly for wear.<br>• Check the wear ring clearances.<br> Warning<br>The impeller and wear rings may have sharp edges due to wear. |

Between the regular maintenance inspections, be aware of signs of motor or pump trouble.

Common symptoms are listed in section *10. Fault finding the product*.

Remedy any fault immediately and avoid costly repairs and shutdowns.

### 8.1.3 Lubrication

**Pump bearings**

Pump bearings are lubricated prior to delivery.

We recommend relubricating intervals of 2000 operating hours. Depending on duty conditions this may vary.

To refill the bearings with fresh grease, follow this procedure:

1. Remove the bearing cap.
2. Add enough grease to fill up 1/3 of the ball bearing.
3. Note the quantity required.
4. Replace the bearing cap.

Repeat this procedure the first three times. Based on the first three relubrications, determine the correct quantity of grease required.

For future relubrications, apply the established quantity of grease through the lubricating nipples. You do not have to remove the bearing caps.

For every 10,000 operating hours or every two years:

1. Remove the bearing caps from pump.
2. Remove old grease.
3. Thoroughly clean the bearing caps.
4. Refill the bearings with fresh grease.
5. Refill the bearing caps completely with fresh grease.
6. Refit the bearing caps in accordance with the assembly instructions.
7. Start the pump briefly several times to distribute the grease in the bearings and to prevent overheating of the grease.

Grease specifications: See *Ball bearing grease* below.

Caution — Do not overgrease!
Too much grease can cause overheating and premature bearing failure.

**Motor bearings**

Lubricate the motor bearings in accordance with the indications on the motor nameplate.

Grease specifications: See *Ball bearing grease* below.

**Ball bearing grease**

| Manufacturer | Lubricant |
|---|---|
| Shell | Dolium R |
| Exxon | Polyrex |
| Chevron | SRI grease NLGI 2 |
| | Black pearl NLGI 2 |
| Philips | Polytac |
| Texaco | Polystar RB |

**Grid coupling**

A grid coupling must be regreased at intervals. Normally, the interval is one year, but it can be shorter if the environment is aggressive or the operating conditions are harsh. Use the same grease for the coupling as for the ball bearings. See *Ball bearing grease*.

Proceed like this:

1. Remove the coupling guards.
2. Remove the two lubricating plugs.
3. Pump grease into one of the lubricating holes to push the old grease out of the opposite hole.
4. Keep pumping until the fresh grease comes out.
5. Refit and fasten the two plugs.
6. Mount the coupling guards again.

## 9. Taking the product out of operation

The following shutdown procedures apply to most normal shutdowns. If the pump is to be inoperative for a long time, follow the storage procedures in section *9.2 Long-term shutdown*.

1. Always close the outlet or throttle valve before stopping the pump. Close the valve slowly to prevent hydraulic shock, but make sure that the pump does not run against closed valve for more than a few seconds.
2. Switch off the power supply to the motor.

### 9.1 Short-time shutdown

1. 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.
2. For short or frequent shutdown periods under freezing conditions, keep the liquid moving within the pump casing and insulate or heat the pump exterior to prevent freezing.

### 9.2 Long-term shutdown

For long shutdown periods or to isolate the pump for maintenance, close the inlet and outlet valves. If no inlet valve is fitted and the pump has positive inlet height, drain all liquid from the inlet pipe to terminate the liquid flow into the pump inlet port. If applicable, turn off any external source of cooling or lubricating liquid to the stuffing boxes or shaft seals. Remove the plugs in the pump drain and vent tappings, as required, and drain all liquid from the pump casing. Remove the stuffing box glands and packing rings, if applicable.

Warning

Make sure that the escaping water does not cause injury to persons or damage to the motor or other components.

In hot-water installations, pay special attention to the risk of injury caused by scalding hot water.

In cold-liquid installations, pay special attention to the risk of injury caused by cold liquid and cold surfaces.

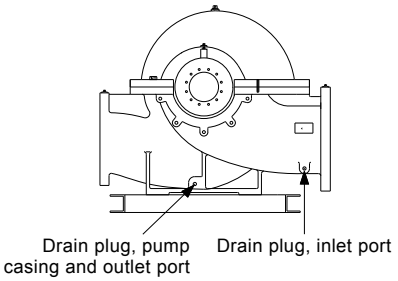


**Fig. 22** Example of drain plugs

1. If freezing conditions will prevail during long shutdown periods after draining the pump, blow out all liquid in passages and locks using compressed air. You can prevent freezing of pumped liquid by filling the pump with antifreeze solution.

Warning

Do not use antifreeze solution if you use the pump for public or potable water supply.

2. Rotate the shaft by hand monthly to coat the bearings with lubricant and delay oxidation and corrosion.
3. Where applicable, follow the motor manufacturer's storage recommendations.

Caution

Do not tighten the vent screw and refit the drain plug until the pump is to be used again.

## 10. Fault finding the product

Warning

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.

| Faults | | | | | | | | | | Causes | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| The pump delivers no liquid. | The pump does not deliver enough liquid | The pump does not create enough pressure. | The pump loses liquid after running for a short time. | The pump consumes too much power. | The motor is overloaded. | Vibrations. | Cavitation noise. | The pump bearings are overheated. | The pump operates for a short time and then stops. | | Reference numbers to remedies. |
| • | | | | | | | | | • | The pump is not primed, lack of priming liquid, incomplete priming. | 1 |
| • | | | | | | | | | | Loss of priming liquid. | 2 |
| • | • | | • | | | | | | • | The suction lift or static lift is too high. | 3 |
| • | • | | | | | | | | | The outlet pressure is too high (measured at the outlet port). | 4 |
| • | • | • | | | | | | | | The speed is too low. | 5 |
| • | • | | | | | | | | | Wrong direction of rotation. | 6 |
| • | • | | | | | | | | | The impeller is completely clogged. | 7 |
| | • | | | | | | | | | The inlet pipe is partially blocked. | 8 |
| | • | • | • | | | | • | | • | Air leak in the inlet pipe or flange. | 9 |
| | • | | • | | | | | | • | Air leak in the stuffing box. The flushing pipe may be blocked. | 10 |
| | • | | • | • | | | • | | | Cavitation; insufficient NPSH (depending on installation). | 11 |
| | • | • | | • | | | | | | The impeller or wear rings are worn. | 12 |
| | • | • | | | | | | | | Defective packing rings. | 13 |
| | • | | | | | | | | | The non-return valve is too small or partially obstructed. The cross section of the non-return valve port must be at least as large as cross section of the inlet pipe. | 14 |
| | • | | • | | | | • | | | The inlet pipe is not immersed deeply enough. | 15 |
| | | • | | | | | | | | The impeller diameter is too small. The probable cause if none of above causes can be established. | 16 |
| | | • | | | | | | | | Obstruction in the casing. | 17 |
| | | • | • | • | | | • | | | Air or gases in the liquid. | 18 |

| Faults | | | | | | | | | | Causes | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| The pump delivers no liquid. | The pump does not deliver. enough liquid | The pump does not create enough pressure. | The pump loses liquid after running for a short time. | The pump consumes too much power. | The motor is overloaded. | Vibrations. | Cavitation noise. | The pump bearings are overheated. | The pump operates for a short time and then stops. | | Reference numbers to remedies. |
| | | ● | | ● | | | | | | The actual duty point of the pump lies to the right of the specified duty point on the pump curve. The result is lower head, higher flow and higher power consumption. | 19 |
| | | | | ● | ● | | | | | The viscosity or specific gravity of the pumped liquid is higher than that of water. | 20 |
| | | | | ● | ● | ● | | ● | | The shaft is bent due to damage. | 21 |
| | | | | ● | ● | ● | | ● | | Mechanical failure of the bearing and/or impeller. | 22 |
| | | | | ● | | ● | | ● | | Misalignment. | 23 |
| | | | | ● | ● | | | | | Electrical defects. | 24 |
| | | | | ● | ● | | ● | | | The speed is too high. | 25 |
| | | | | | | ● | | | | The foundation is not rigid enough. | 26 |
| | | | | | | | | ● | | The lubricating oil or grease is dirty or contaminated. | 27 |

| No. | Cause | Remedy |
|---|---|---|
| 1 | The pump is not primed, lack of priming liquid, incomplete priming. | Fill the pump and inlet pipe completely with pumped liquid. |
| 2 | Loss of priming liquid. | Mend possible leaks in the inlet pipe, joints and fittings. vent the pump casing to remove accumulated air. |
| 3 | The suction lift or static lift is too high. | Reduce the difference in height between the water reservoir or water supply and the pump. |
| 4 | The outlet pressure is too high. | Make sure that valves in the outlet pipe are fully open. |
| 5 | The speed is too low. | 1. Make sure the motor receives full voltage.<br>2. Make sure the frequency is correct.<br>3. Make sure all phases are connected. |
| 6 | Wrong direction of rotation. | Compare the direction of rotation with directional arrow on pump casing. If required, change the direction of rotation by interchanging two phases in the motor. |
| 7 | The impeller is completely clogged. | Dismantle the pump and clean the impeller. |
| 8 | The inlet pipe is partially blocked. | Remove any obstructions in the inlet pipe. |
| 9 | Air leak in the inlet pipe or flange. | Replace or repair the defective pipe section or flange. |
| 10 | Air leak in the stuffing box. | Clean the flushing pipe. Replace the stuffing box packing rings, if necessary. |

| No. | Cause | Remedy |
|---|---|---|
| 11 | Cavitation; insufficient NPSH (depending on installation). | 1. Increase the net positive suction head by placing the pump in a lower position.<br>2. Pressurise the inlet vessel. |
| 12 | The impeller or wear rings are worn. | Replace the impeller and/or wear rings. If necessary, also replace the bearings and shaft. |
| 13 | Defective packing rings. | Replace the packing rings. |
| 14 | The non-return valve is too small or partially obstructed. | Replace or clean the non-return valve. |
| 15 | The inlet pipe is not immersed deeply enough. | Extend the inlet pipe so that the risk of sucking air is eliminated. |
| 16 | The impeller diameter is too small. | Check with Grundfos if you can use a larger impeller. If not, reduce the outlet pipe friction losses. But be careful not to seriously overload motor. |
| 17 | Obstruction in pump casing. | Dismantle the pump and remove the obstruction. |
| 18 | Air or gases in the liquid. | Remove the gas or air from the pumped liquid.<br>See 11) above. |
| 19 | The actual duty point of the pump lies to the right of the specified duty point on the pump curve. The result is lower head, higher flow and higher power consumption. | Install an orifice plate immediately after the outlet flange. The orifice plate will raise the system characteristic or increase the counterpressure thus increasing the head and lowering the flow. The size of the orifice plate must be adapted so that the pressure corresponds to the required duty point. |
| 20 | The viscosity or specific gravity of the pumped liquid is higher than that of water. | Use a larger motor. Consult Grundfos for recommended size.<br>Test the liquid for viscosity and specific gravity. |
| 21 | The shaft is bent due to damage. | Check the deflection of the shaft. The total indicator runout must not exceed 0.05 mm.<br>Possibly replace the shaft. |
| 22 | Mechanical failure of bearing and/or impeller. | Check the bearings and impeller for damage.<br>Possibly replace the bearings or impeller. |
| 23 | Misalignment. | Realign the pump and motor. |
| 24 | Electrical defects. | Check that the voltage and frequency of the power supply are correct.<br>Remedy the possible defects in the motor.<br>Check that the motor is properly cooled. |
| 25 | The speed is too high. | Check that the frequency of the power supply corresponds to the frequency stated on the motor nameplate. |
| 26 | The foundation is not rigid enough. | Retighten the foundation bolt nuts. Check that the foundation was made according to the installation and operating instructions. |
| 27 | The lubricating oil or grease is dirty or contaminated. | Clean the bearings and bearing housings according to the instructions and relubricate the bearings. |

# 11. Technical data

## 11.1 Operating conditions

### 11.1.1 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.

If the ambient temperature or the pump installation altitude exceeds the values below, the motor must not be fully loaded due to the risk of overheating. Overheating may result from excessive ambient temperature or 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.

Caution Bearing service intervals are shorter at temperatures above 40 °C.

**Legend**

| Pos. | Maximum ambient temperature at full load [°C] | Maximum altitude above sea level [m] |
|---|---|---|
| 1 | 40 | 1000 |
| 2 | 60 | 3500 |
| 3 | 55 | 2750 |

| Motor | Number of poles | IE2 and IE3 motors P2 [kW] | Pos. | Other motor sizes P2 [kW] | Pos. |
|---|---|---|---|---|---|
| MG | 2 | 11-22 | 2 | - | - |
| | 4 | 1.5 - 15 | 2 | - | - |
| Siemens | 2 | 30-90[1)] | 3 | - | - |
| | 4 | 18.5 - 200[1)] | 3 | 250-630 | 1 |
| | 6 | 11-160[1)] | 3 | 200-315 | 1 |
| MMG-G | 2 | 11-90 | 1 | - | - |
| | 4 | 1.5 - 630 | 1 | - | - |
| | 6 | 11-132 | 1 | - | - |
| MMG-H | 2 | 11-90 | 2 | - | - |
| | 4 | 1.5 - 315 | 2 | - | - |
| | 6 | 11-132 | 2 | - | - |

1) At ambient temperatures above 40 °C, the motor temperature class is changed from B to F.

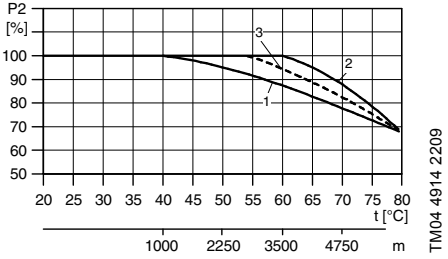


**Fig. 23** Motor output in relation to temperature/altitude

**Example**

Figure 23 shows that you must reduce the load of a MG motor to 88 % when installed 4750 m above sea level.

At an ambient temperature of 75 °C, you must reduce the load of the motor to 78 % of the rated output.

If you install the pump 4750 m above sea level at an ambient temperature of 75 °C, do not load the motor more than 88 % x 78 % = 68.6 % of the rated output.

### 11.1.2 Liquid temperature

The maximum liquid temperature marked on the pump nameplate depends on the mechanical shaft seal used:

Temperature range for NBR: 0 up to 100 °C.

Temperature range for FKM: 15-100 °C.

### 11.1.3 Pressures in the pump

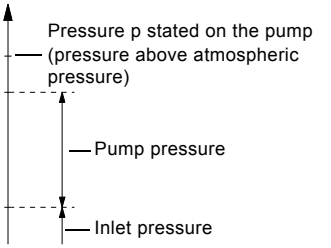


**Fig. 24** Pressures in the HS pump

**Maximum outlet pressure**

Warning

The maximum outlet pressure is the pressure (p) stated on the pump nameplate.

**Minimum inlet pressure**

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

NPSH appears from the data booklet and Grundfos Product Center.

**Maximum inlet pressure**

The inlet pressure + pump pressure must be lower than the maximum pressure (p) of the pump. This is stated on the nameplate. See fig. 21, position 7.

**Minimum flow rate**

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

The continuous flow rate must be at least 25 % of the flow rate in best efficiency point.

**Maximum flow rate**

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

**Sound pressure level**

See page 456 and 457.

### 11.2 Flange forces and torques

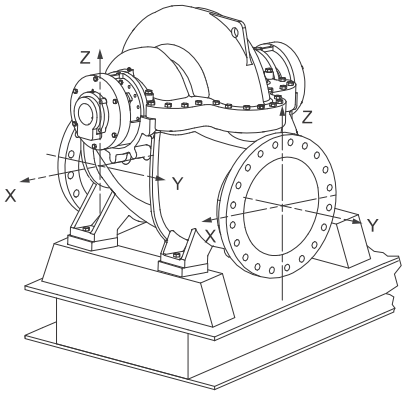


**Fig. 25** Flange forces and torques

**Horizontal pump, side branch, y-axis**

| Diameter DN | Force [N] | | | | Torque [Nm] | | | |
|---|---|---|---|---|---|---|---|---|
| | Fy | Fz | Fx | ΣF* | My | Mz | Mx | ΣM* |
| 25 | 340 | 280 | 300 | 520 | 180 | 210 | 270 | 390 |
| 32 | 420 | 340 | 360 | 660 | 225 | 255 | 330 | 480 |
| 40 | 500 | 400 | 440 | 780 | 270 | 315 | 390 | 570 |
| 50 | 660 | 540 | 600 | 1040 | 300 | 345 | 420 | 615 |
| 65 | 840 | 680 | 740 | 1320 | 330 | 360 | 450 | 660 |
| 80 | 1000 | 820 | 900 | 1580 | 345 | 390 | 480 | 705 |
| 100 | 1340 | 1080 | 1200 | 2100 | 375 | 435 | 525 | 780 |
| 125 | 1580 | 1280 | 1420 | 2480 | 450 | 570 | 630 | 915 |
| 150 | 2000 | 1620 | 1800 | 3140 | 525 | 615 | 750 | 1095 |
| 200 | 2680 | 2160 | 2400 | 4180 | 690 | 795 | 975 | 1440 |
| 250 | 3340 | 2700 | 2980 | 5220 | 945 | 1095 | 1335 | 1965 |
| 300 | 4000 | 3220 | 3580 | 6260 | 1290 | 1485 | 1815 | 2670 |
| 350 | 4660 | 3760 | 4180 | 7300 | 1650 | 1905 | 2325 | 3420 |
| 400 | 5320 | 4300 | 4780 | 8340 | 2070 | 2385 | 2910 | 4290 |
| 450 | 5980 | 4840 | 5380 | 9380 | 2550 | 2940 | 3585 | 5280 |
| 500 | 6640 | 5380 | 5980 | 10420 | 3075 | 3540 | 4335 | 6390 |
| 550 | 7300 | 5920 | 6580 | 11460 | 3660 | 4215 | 5130 | 7590 |
| 600 | 7960 | 6460 | 7180 | 12500 | 4320 | 4980 | 6060 | 8970 |

* ΣF and ΣM are the 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.

## 12. Disposing of the product

Dispose of this product or parts of it 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.

Subject to alterations.

**Airborne noise emitted by HS pumps**

MG motors:

| Motor [kW] | $L_{pA}$ [dB(A)] | |
|---|---|---|
| | 50 Hz | |
| | 2-pole | 4-pole |
| 1.5 | | 47 |
| 2.2 | | 48 |
| 3.0 | | 52 |
| 4.0 | | 48 |
| 5.5 | | 51 |
| 7.5 | | 52 |
| 11 | 60 | 54 |
| 15 | 60 | 54 |
| 18.5 | 60 | |
| 22 | 64 | |

Siemens motors:

| Motor [kW] | $L_{pA}$ [dB(A)] | | |
|---|---|---|---|
| | 50 Hz | | |
| | 2-pole | 4-pole | 6-pole |
| 11 | | | 66 |
| 15 | | | 56 |
| 18.5 | | 60 | 59 |
| 22 | | 60 | 59 |
| 30 | 71 | 62 | 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 | | 70 | 61 |
| 160 | | 70 | 64 |
| 200 | | 70 | 68 |
| 250 | | 73 | 68 |
| 315 | | 73 | 71 |
| 355 | | 75 | |
| 400 | | 75 | |
| 500 | | 75 | |
| 560 | | 78 | |
| 630 | | 78 | |

MMG-G motors:

| Motor [kW] | $L_{pA}$ [dB(A)] | | | | | |
|---|---|---|---|---|---|---|
| | 50 Hz | | | 60 Hz | | |
| | 2-pole | 4-pole | 6-pole | 2-pole | 4-pole | 6-pole |
| 1.5 | | 59 | | | 59 | |
| 2.2 | | 63 | | | 63 | |
| 3.0 | | 63 | | | 63 | |
| 3.7 | | 63 | | | 63 | |
| 4.0 | | 63 | | | 63 | |
| 5.5 | | 64 | | | 65 | |
| 7.5 | | 68 | | | 68 | |
| 11 | 70 | 68 | 62 | 78 | 68 | 59 |
| 15 | 72 | 75 | 65 | 81 | 75 | 62 |
| 18.5 | 72 | 75 | 69 | 81 | 75 | 66 |
| 22 | 72 | 75 | 70 | 81 | 75 | 67 |
| 30 | 73 | 78 | 74 | 86 | 78 | 71 |
| 37 | 73 | 78 | 75 | 86 | 78 | 72 |
| 45 | 73 | 80 | 75 | 87 | 80 | 72 |
| 55 | 78 | 83 | 81 | 88 | 82 | 79 |
| 75 | 80 | 83 | 81 | 90 | 83 | 79 |
| 90 | 80 | 85 | 84 | 91 | 85 | 81 |
| 110 | 84 | 85 | 84 | 91 | 85 | 81 |
| 132 | | 88 | 84 | | 85 | 81 |
| 160 | | 88 | 86 | | 85 | 82 |
| 200 | | 90 | 86 | | 90 | 82 |
| 220 | | | 86 | | | 82 |
| 250 | | 90 | 87 | | 90 | 82 |
| 315 | | 90 | 87 | | 90 | 85 |
| 335 | | 90 | 87 | | 90 | 85 |
| 355 | | 90 | 87 | | 90 | 90 |
| 375 | | 90 | 90 | | 90 | 90 |
| 400 | | 90 | 90 | | 90 | 95 |
| 450 | | 90 | 90 | | 90 | 95 |
| 500 | | 90 | | | 90 | |
| 525 | | 90 | | | 90 | |
| 560 | | 90 | | | 90 | |
| 600 | | 90 | | | 90 | |

MMG-H motors:

| Motor [kW] | $L_{pA}$ [dB(A)] | | |
|---|---|---|---|
| | 50 Hz | | |
| | 2-pole | 4-pole | 6-pole |
| 1.5 | | 58 | |
| 2.2 | | 60 | |
| 3 | | 60 | |
| 4 | | 61 | |
| 5.5 | | 62 | |
| 7.5 | | 62 | |
| 11 | 66 | 60 | 56 |
| 15 | 66 | 60 | 56 |
| 18.5 | 66 | 65 | 59 |
| 22 | 70 | 65 | 59 |
| 30 | 73 | 68 | 59 |
| 37 | 73 | 68 | 59 |
| 45 | 78 | 68 | 60 |
| 55 | 78 | 69 | 60 |
| 75 | 79 | 70 | 68 |
| 90 | 79 | 70 | 69 |
| 110 | | 74 | 70 |
| 132 | | 74 | 70 |
| 160 | | 74 | |
| 200 | | 76 | |
| 250 | | 79 | |
| 315 | | 80 | |

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