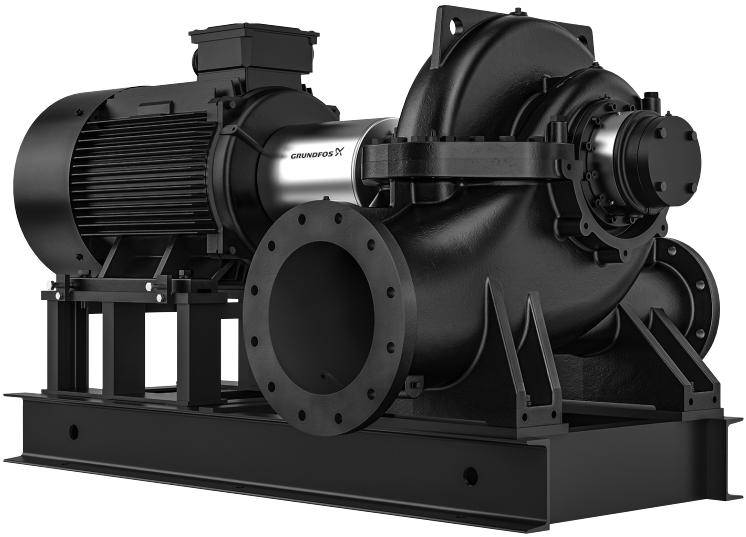
LS

Large LS models, flow range is greater than 3000 m^3/h

Installation and operating instructions



GRUNDFOS

LS

English (GB)
Installation and operating instructions 4

Original installation and operating instructions

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1. General information

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

1.1 Hazard statements

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

DANGER

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

WARNING

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

CAUTION

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

The hazard statements are structured in the following way:

SIGNAL WORD

Description of the hazard

Consequence of ignoring the warning

- Action to avoid the hazard.

1.2 Notes

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

Observe these instructions for explosion-proof products.

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

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

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

Tips and advice that make the work easier.

2. Delivery and handling

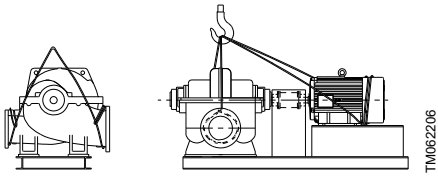
2.1 Receiving

- Check pumping unit for shortage and damage immediately upon arrival. Pump accessories when required are packaged in a separate container and shipped with the unit.
- If equipment is damaged in transit, promptly report this to the carrier's agent. Make complete notations on the freight bill to speed satisfactory adjustment by the carrier.
- Unload and handle the unit with a sling.

2.2 Handling

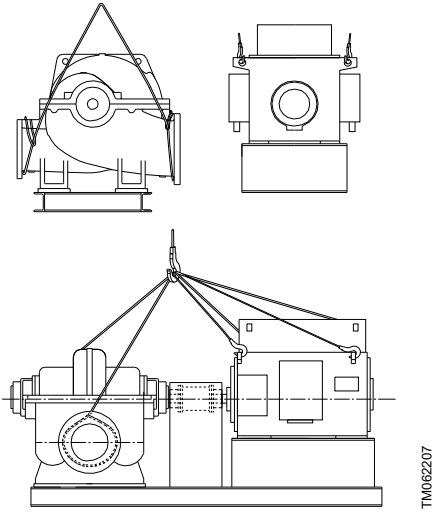
2.2.1 Pump and motor using common baseplate

DANGER
Overhead load
Death or serious personal injury
- Do not lift unit by eye bolts on the motor.



TM062206

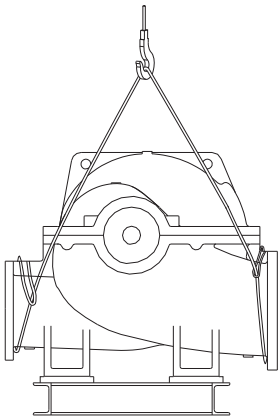
Lifting pump with low-voltage motor



TM062207

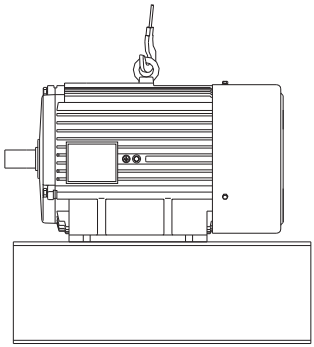
Lifting pump with high-voltage motor

2.2.2 Separate baseplate for pump and motor



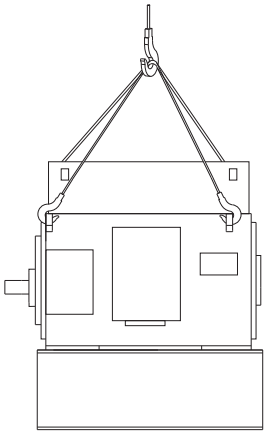
TM062208

Lifting separate pump with baseplate



TM062209

Lifting low-voltage motor with baseplate



TM062210

Lifting high-voltage motor with baseplate

2.3 Temporary storage

- If the pump is not to be installed and operated soon after arrival, store it in a clean, dry area of moderate ambient temperature.
- Rotate the shaft by hand periodically to coat bearing with lubricant to prevent oxidation and corrosion.
- If the pump is stored more than six months, it must be checked and cleaned before it is put into operation.
- Follow motor manufacturer's storage recommendations where applicable.

3. Mechanical installation

All installations should be performed by personnel experienced with the placement, connection, and alignment of pump equipment. The following instructions are general in nature, and may not deal with the specifics of your installation. Read these instructions thoroughly before installing and operating your LS pump. Successful operation depends on careful attention to the procedures described in this manual. Keep this instruction manual handy for future use.

3.1 Location

- Locate the LS pump as close to the suction supply as possible. Use the shortest and most direct suction piping practical. Refer to section suction piping.
- Locate the pump below system level wherever possible. This will facilitate priming, assure a steady liquid flow, and provide a positive suction head.
- Make sure sufficient NPSH (Net Positive Suction Head) is provided at the suction end by considering the pump's location in relation to the entire system.

The correct pump location can provide a safety pump operation. Available NPSH must always. 0.5 - 1.0 m higher than the required NPSH specified on the pump performance curve.

- Always allow sufficient accessibility for maintenance and inspection. Provide a clear space with ample head room for use of a hoist strong enough to lift the unit.
- Make sure a suitable power source is available for the pump motor. Electrical characteristics should match those specified on the motor data plate.
- Avoid pump exposure to sub-zero temperatures to prevent pump liquid form freezing. If freezing conditions exist during shutdown periods, see sections short duration shutdown and extended period shutdown for specific recommendations.

Related information

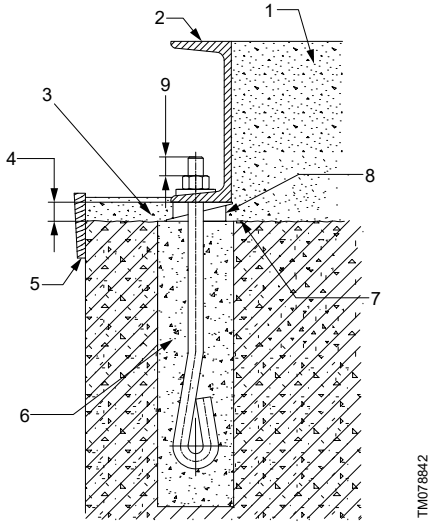
5.2 Suction piping
6.6 Short duration shutdown
6.7 Extended period shutdown

3.2 Foundation

LS pumps should be permanently installed on a firm and concrete foundation mounting pad of sufficient size (over 200 mm) to dampen any vibration and prevent any deflection or misalignment. The pad may float on springs or be a raised part of the equipment room floor. The foundation should be poured without interruption to 18-35 mm below the final pump elevation. The top surface should be well scored or

grooved before the concrete sets to provide a suitable bonding surface for the grout. Anchor bolts should be set in pipe sleeves for positioning allowance, as shown in figure below. Allow enough bolt length for grout, lower base plate flange, nuts and washers. Allow the foundation to cure several days before proceeding with pump installation.

For pump and motor directly connected, the foundation weight is 3-5 times of pump unit; for pump and diesel engine directly connected, the foundation weight is 5-8 times of pump unit.



Anchor bolt installation

Pos.	Description
1	Grout
2	Base plate
3	Finished grouting
4	Allowance for grout: 18-35 mm
5	Dam
6	Grout
7	Top of foundation leave rough clean & wet down
8	Wedges or shims left in place
9	10 mm

3.2.1 Securing the baseplate

- After the concrete pad has been poured and set, lower the pump base plate over the anchor bolts and rest it on loose adjustment wedges or shims placed near each anchor bolt and at intervals not to exceed 610 mm along each side.
- Shims or wedges must be placed to raise the bottom of the base 20-30 mm above the pad, allowing clearance for grout. Level the pump shaft, flanges, and base plate using a spirit level, adjusting the wedges or shims, as required.
- Check to make sure that the piping can be aligned to the pump flanges without placing any strain on either flange.
- After pump alignment has been established, attach nuts on foundation bolts and tighten them just enough to keep the unit base plate from moving. Construct a form or dam around the concrete pad and pour grout in and around the pump base, as shown in section foundation. Grout compensates for uneven foundation, distributes the weight of the unit, and prevents shifting. Use an approved, non-shrinking grout. Allow at least 24 hours for this grout to set before proceeding with piping connections.
- After the grout has thoroughly hardened, check the foundation bolts and tighten if necessary. Recheck the pump alignment after the foundation bolts are secured.

Related information

3.2 Foundation

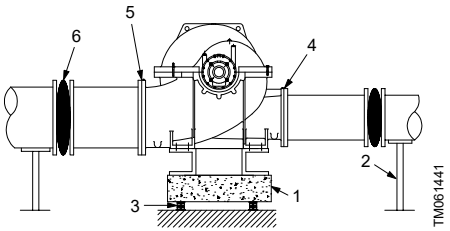
3.3 Pump flexible installation and connection

There are two methods for pump flexible installation:

- Using damper and soft connector.
- Using anti-vibration pad and soft connector.

3.3.1 Using damper and soft connector

In order to prevent the vibration transfer to the nearby buildings, we suggest to use the damper to segregate the pump base from nearby buildings. If the pump installed on the damper base, soft connectors must be installed to the inlet and outlet pipe, it is propitious to the pump's operation.



Base with damper and soft connector

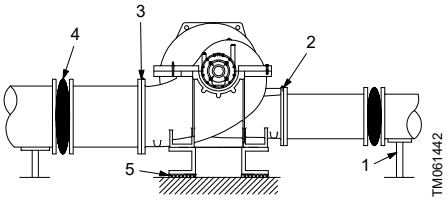
Pos.	Description
1	Damper base
2	Pipe support
3	Damper
4	Outlet
5	Inlet
6	Soft connector

Do not install the pump base plate on the damper directly.

The selection and installation of damper and damper base should follow the supplier.

3.3.2 Using anti-vibration pad and soft connector

Another way is to use the anti-vibration pad to segregate the pump base from nearby buildings and soft connectors must be also installed to the inlet and outlet pipe. It is easy to connect, but the effect is not as good as using damper.



Pump with anti-vibration pad

Pos.	Description
1	Pipe support
2	Outlet
3	Inlet
4	Soft connector
5	Anti-vibration pad

4. Electrical installation

4.1 Motors, general

- All electrical installations should be accomplished by qualified electrician. Disconnect and lock out the electrical power source, before starting any installation or service work.
- Read and match the starting and overload control devices with motor nameplate information. Always follow control manufacturer's instructions for proper installation and connection.
- Grease lubricated motors are fully lubricated at the time of manufacture and do not require further lubrication if prompt installation follows. If the motor has been in storage for six months or longer, refer to section motor lubrication and lubricate the motor before starting.

Related information

8.1 Motor lubrication

5. Piping

5.1 General precaution

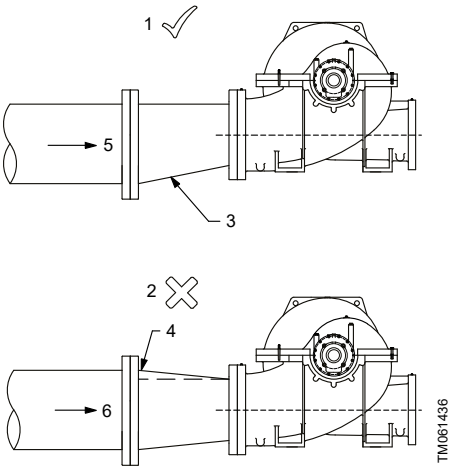
Do not use pump as a support for piping.

- Use pipe hangers or other supports at proper intervals to provide complete piping support near the pump.
- Both suction and discharge piping should be independently supported and properly aligned so that no strain is transmitted to the pump when flange bolts are tightened.
- Do not spring or force piping when making any connections.
- Make sure piping is as straight as possible, avoiding unnecessary bends and fittings.

5.2 Suction piping

The sizing and installation of suction piping is particularly important. It must be selected and installed in a manner that minimizes pressure loss and permits sufficient liquid flow into the pump during starting and operation. Many NPSH problems can be traced directly to improper design of suction piping systems. Observe the following precautions when installing suction piping:

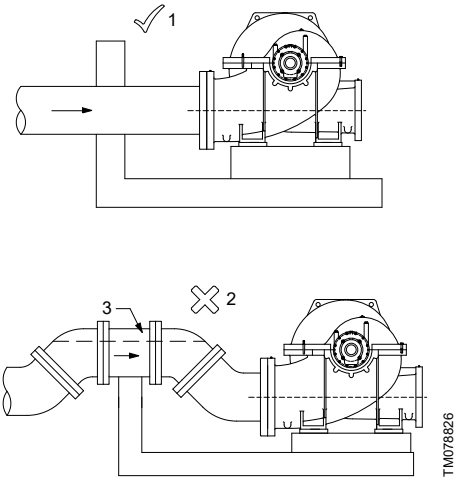
- Suction piping should be as straight as possible, and ideally the pipe length should be at least seven times the pipe diameter. Short suction piping can be the same diameter as the suction opening. Longer piping should be one or two sizes larger (depending on length), reducing to the diameter of the pump suction opening.
- Use an eccentric reducer, with the eccentric side down, when reducing the pipe diameter to the diameter of suction opening.



Suction piping eccentric vs. concentric

Pos.	Description
1	Right
2	Wrong
3	Taper is down
4	Air pocket
5	Eccentric reducer
6	Concentric reducer

- At no point should suction piping be smaller in diameter than the pump suction opening.
- Horizontal suction lines should follow an even gradient, if possible. A gradual upward slope to the pump is recommended for suction lift conditions.
- Avoid any high points, such as pipe loops, that may create air pockets and throttle the system or produce erratic pumping.



Suction piping (Avoid high points)

Pos.	Description
1	Right
2	Wrong
3	Air pocket

- Install a valve in the suction line to isolate the pump during shutdown and maintenance, and facilitate pump removal.
- Gate valve should be installed in place where is not easy to create air pocket.
- During pumping operation, valves on suction line must always be at full open.

5.3 Discharge piping

- Short discharge piping can be the same diameter as the pump discharge opening. Longer piping should be one or two sizes larger depending on length.
- Any high points in discharge piping may entrap air or gas and thus retard pump operation. So an air vents should be installed to exhaust air in the pump.
- An even gradient is best for long horizontal runs of discharge piping.
- Install a valve near the discharge opening to prime and start the pump. The discharge gate valve is also used to isolate the pump during shutdown, maintenance, and facilitate pump removal.
- If the possibility of liquid hammer exists, (i.e. check valves are used) close the discharge gate valve before pump shut down.

The selection and installation for reducer should base on the national standard.

5.4 Pressure gauges installation

Pressure gauges properly sized for the range of operation, should be installed in gauge taps on the pump suction and discharge nozzles.

5.5 General information of shaft sealing

- Grundfos offers both mechanical shaft seals and stuffing boxes as a means to seal the shaft.
- Pumps with stuffing boxes are normally packed before shipment. If the pump is installed within 60 days after shipment, the packing material will be in good condition for operation with a sufficient supply of lubrication. If the pump is stored for a longer period, it may be necessary to repack the stuffing boxes. Refer to section replacing the stuffing. The stuffing box must be supplied at all times with a source of clean, clear liquid to flush and lubricate the packing.
- When pumps are equipped with mechanical shaft seals, no maintenance or adjustment is required.

Related information

10.3 Replacing the stuffing

5.6 Packing gland adjustment

- Make sure the flushing fluid lines are connected and their valves are open. After pump start-up, with the pump running, the leakage of the packing gland should be adjusted to meet the following standards in table below, this is required for shaft sleeve lubrication.

The leakage of stuffing box

Rated flow rate (m^3/h)	**≤50**	**>50–100**	**>100–300**	**>300–1000**	**>1000**
Leakage (ml/min)	15	20	30	40	60

- The packing gland should be tightened evenly to provide uniform compression on the packing material. Do not operate packing dry, and do not over tighten packing gland to eliminate leaking as the shaft sleeve will become damaged. After initial start-up, additional packing and adjustment may be required until the packing is properly seated.

5.7 Mechanical shaft seals

All LS pumps that are equipped with mechanical shaft seals are matched to conditions for which the pump was sold. Observe the following precautions to avoid seal damage and obtain maximum seal life:

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

Do not run the pump dry or against a closed valve. Dry operation will cause seal failure within seconds.

- Exhaust air in the seal cavity and pipes before pump starting.
- Clean and purge suction piping in new installations before installing and operating pump. Pipe scale, welding slag and other abrasives can cause rapid seal failure.
- The mechanical shaft seal does not leak at all during normal operation, therefore if any appreciable leakage occurs; the seal should be removed, inspected and if necessary replaced.
- Mechanical shaft seals should be stocked as spare parts to reduce equipment down time.

5.8 Coupling alignment

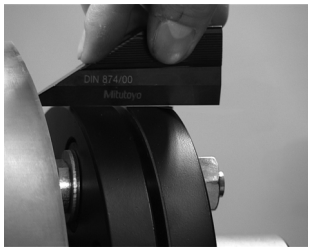
Check shaft alignment once again after pump installation is completed. The following anchoring and alignment procedures are typical and, if performed with care, should result in a smooth running, trouble-free installation.

- If the pump and motor were shipped mounted on the pump base as an assembly, remove the coupling guard.
- The pump and motor were accurately aligned at the factory, but handling during shipment usually alters this pre-alignment. Use a small straight edge and feeler gauges or a dial indicator or a laser. To choose one of the following three methods to perform alignment.

WARNING
Crushing of hands
Death or serious personal injury
- To protect personnel from rotation machinery, always install coupling guards after installation is complete before starting the pump.

5.8.1 Aligning the pump and motor with a straightedge ruler

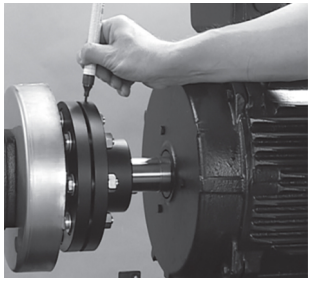
1. Make a rough alignment of pump and motor, and tighten the screws in the base frame to the correct torque.



TM038340

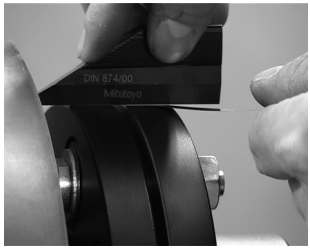
See the table tightening torques.

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



TM082476

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



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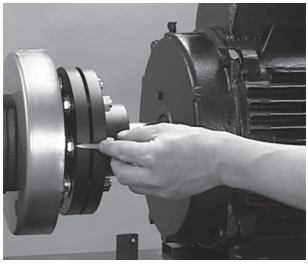
4. Turn the coupling 90°, and repeat the measurement with straightedge and feeler gauge.



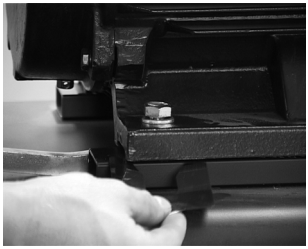
TM082477

- If the measured values are less than 0.13 mm, the alignment is complete. Go to step 8.

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

TM038321

6. Insert shims with the required thickness.



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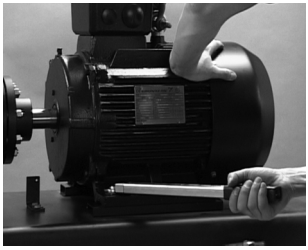
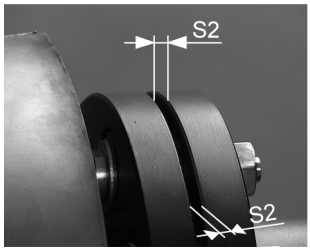
7. Tighten the screws to the correct torque. Go to step 3, and check the alignment once more.



TM038324

8. Check the gap S2 both vertically and horizontally.



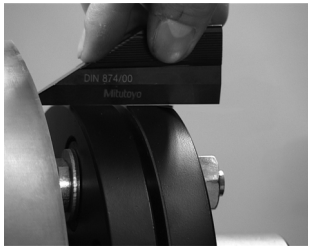
TM038325

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

See the table Air-gap width S2.

5.8.2 Aligning the pump and motor with a dial indicator

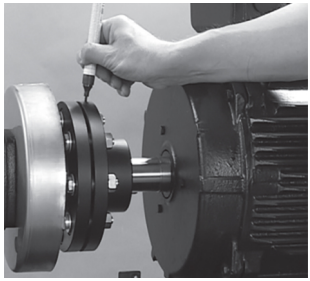
1. Make a rough alignment of pump and motor, and tighten the screws in the base frame to the correct torque.



TM038340

See the table tightening torques.

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



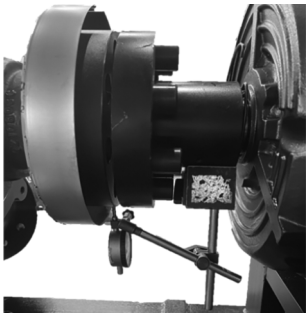
TM082476

3. Fasten a dial indicator to the hub of coupling guard, make sure the dial indicator is on the outer circumference of coupling guard.

TM082486

4. Turn the motor coupling and measure the deviation along circumference on 0°, 90°, 180° and 270°.

TM082487



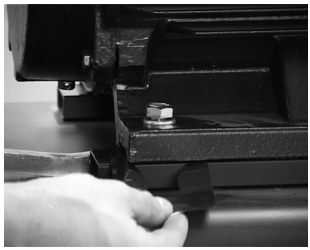
TM082488

TM082489

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

TM038321

6. Insert shims with the required thickness.



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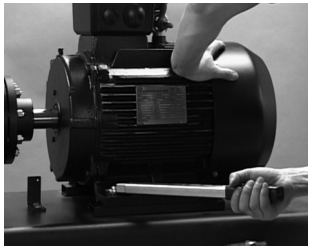
7. Tighten the screws to the correct torque. Go to step 3, and check the alignment once more.



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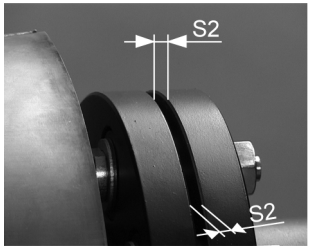
8. Check the gap S2 both vertically and horizontally.



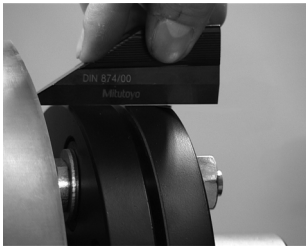
TM038325

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

See the table Air-gap width S2.

5.8.3 Aligning the pump and motor with a laser equipment

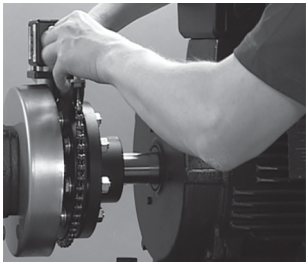
1. Make a rough alignment of pump and motor, and tighten the screws in the base frame to the correct torque.



TM038340

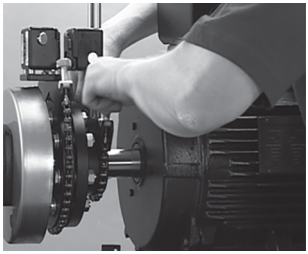
See the table Tightening torques.

2. Fasten one laser bracket to the pump coupling.



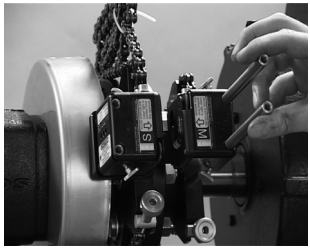
TM082478

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



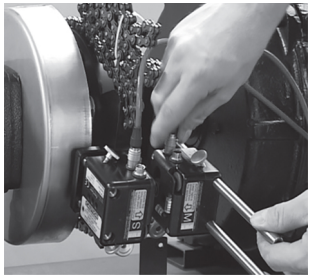
TM082479

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



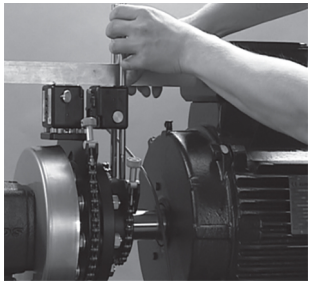
TM038305

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



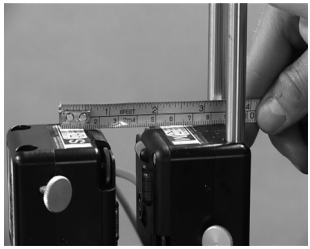
TM082480

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



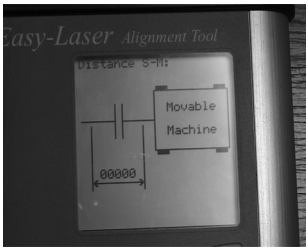
TM082481

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



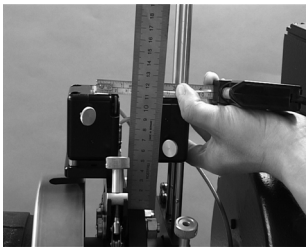
TM038309

8. Enter the distance.



TM038308

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

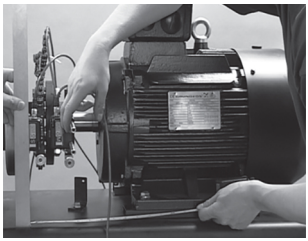


TM038310

10. Enter the distance.

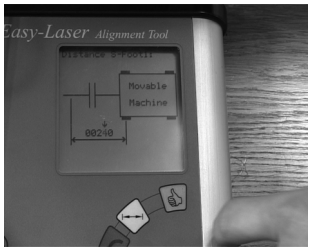
TM038311

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



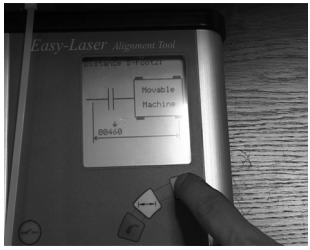
TM082482

12. Enter the distance.



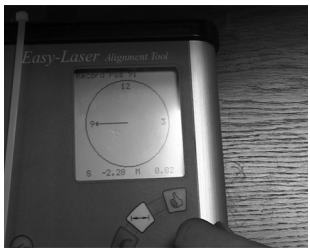
TM038313

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



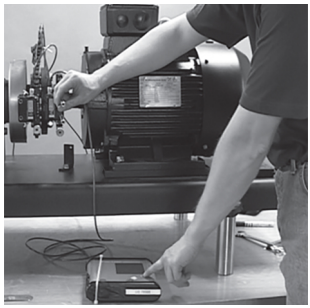
TM038314

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



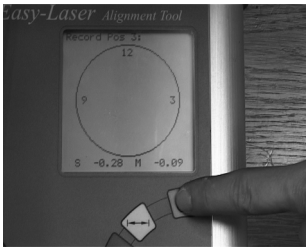
TM038315

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



TM082483

16. Confirm on the control box.

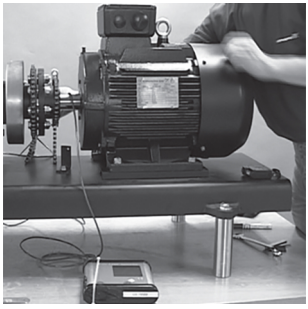


TM038319

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

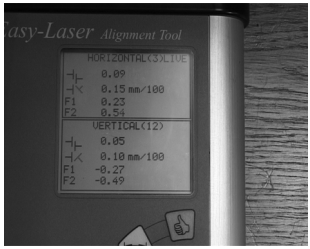
TM082484

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



TM082485

19. If the measured values are less than 0.13 mm, the alignment is complete. Go to step 24.

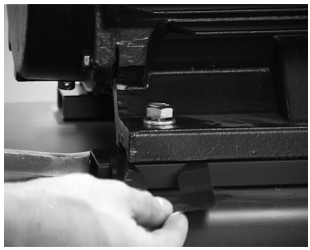


TM038320

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

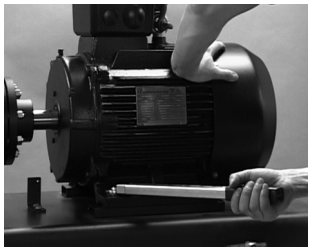
TM038321

21. Insert shims with the required thickness.



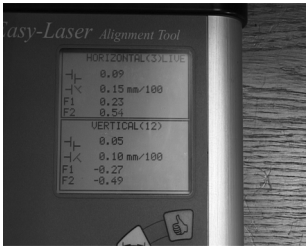
TM038322

22. Tighten the screws to the correct torque again.



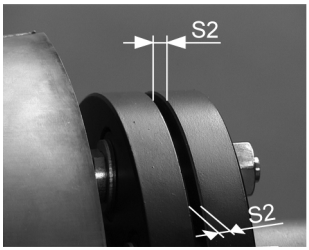
TM038324

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



TM038320

24. Check the gap S2.



TM038325

See the table Air-gap width S2.

5.8.4 Tightening torques

Refer to this tightening torques table when align the motor and pump.

Description	Dimensions	Tightening torque [Nm]
Hexagon head screw	M4	3 ± 10 %
	M6	9 ± 10 %
	M8	21 ± 10 %
	M10	41 ± 10 %
	M12	72 ± 10 %
	M14	114 ± 10 %
	M16	177 ± 10 %
	M18	244 ± 10 %
	M20	345 ± 10 %
	M22	470 ± 10 %
	M24	597 ± 10 %

5.8.5 Pin coupling air-gap width S2

Measure S2 all the way around the coupling. The maximum permissible deviation between the largest and the smallest measurement is 0.13 mm.

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

Outside coupling diameter [mm]	Air-gap width S2 [mm]	
	Standard coupling	
	Nominal	Tolerance
90	3 mm	± 0.5
150	3 mm	± 0.5
220	4 mm	± 0.5
260	5 mm	± 0.5
320	5 mm	± 0.5

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

WARNING
Crushing of hands
Death or serious personal injury
- To protect persons from rotating machine parts, always install all guards after the installation is complete and before starting the pump.

5.9 Spacer coupling installation

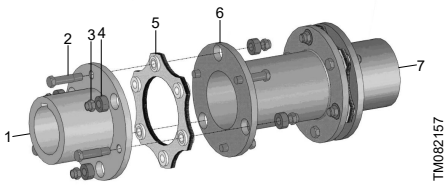
5.9.1 Preparation

- Check the spacer coupling for possible transport damage and missing parts. Clean the spacer coupling components.
- Proper lifting and assembling devices should be on hand.

5.9.2 Installing the spacer coupling

Make sure the spacer coupling is clean.

Make sure the keys fit in key slots between shafts and hubs properly with a small clearance over the top to keep dynamic balance.



Spacer coupling

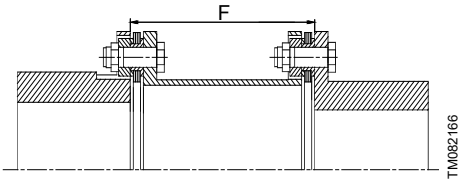
Pos.	Description
1	Hub
2	Bolt
3	Lock nut
4	Sleeve
5	Disc pack
6	Spacer
7	Hub

1. Install the hub on the shaft. Make sure the shaft end align with the hub end. If necessary, place limit blocks to limit the gap between coupling and shaft shoulder. Use shaft lock nut or end plate to secure the hub axially. To achieve clearance fit, install the hub on the shaft directly and use soft hammer to hit the hub gently.

After the installation of hubs, apply rust prevention to the hubs immediately.

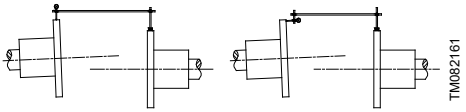
2. Use dial indicator to check hub circumference and end face. Adjust the hub alignment according to the measurements. The deviation of hub circumference and end face mustn't exceed 0.05 mm. For hub flange diameter bigger than 250 mm, the maximum deviation is 0.08 mm. Re-install the hub if the deviation exceeds the limit. Refer to section tightening torques for spacer coupling.

3. Place the motor and the pump in working position and measure the distance F between the two hub surfaces of the motor and pump. Take four readings along circumference with 90° interval and calculate the average value. Adjust the position of the motor and pump until the value of F meets the dimension Ls in the assembly drawing, Ls is the distance between pump shaft end and motor shaft end. The deviation should be from 0 mm to 0.4 mm.

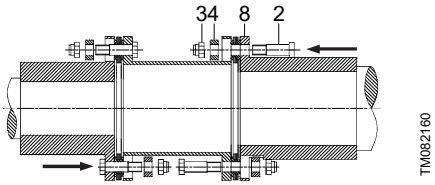


4. Choose one of the following methods that suits best for the installation:
   a. Use professional aligning apparatus.
   b. Use the dial indicator to measure the deviation of the circumference and the end face. Determine the location of shafts by analyzing the measurements, and then adjust the shafts based on the results. See section on accepted misalignment.

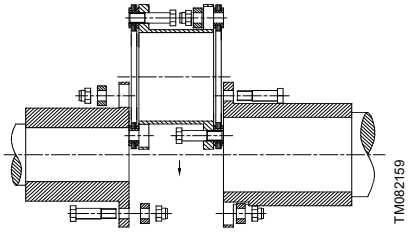
      In order to improve the precision, use two dial indicators that locate equidistant to axis to measure the deviation of the end face.



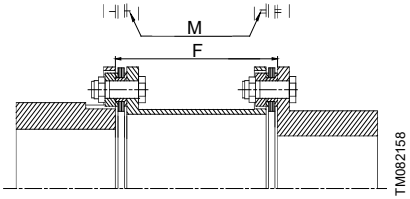
5. Place the disc packs and the spacer between the hubs, tighten with bolts, sleeves and self-locking nuts or slotted nuts. The hexagon bolts (2) must be installed next to flanges (8). The sleeves (4) and the nuts (3) must be installed next to each other. Reversion is prohibited. Refer to the figure below.



- With short shafts distance, pre-install the bolts into spacer and then perform the step above.



- The dynamically balanced coupling parts must be installed according to the position mark (M) on the coupling. Fasteners with the same specification in the same set of coupling can be replaced with each other.



6. Tighten the nuts diagonally and evenly and make sure the bolts won't rotate when tightening. Use the torque wrench to achieve the required tightening torque at least in two rounds. See section on torque.

Apply a little grease to the nut thread before the installation.

Self-locking nuts can be used repeatedly. But if the nuts can be freely tightened to bolts manually or the nuts have defects, the users mustn't use them.

For slotted nuts, insert a cotter pin to secure and make sure it won't loosen when operating.

7. Turn the motor for two or three rounds slowly. Make sure it can rotate freely.

Related information

5.9.4 Tightening torques for spacer coupling

5.9.3 Accepted misalignment

Accepted misalignment is usually provided by device manufacturer. Refer to table below for the deviations of hubs and radial direction if you don't have the data.

The deviation of hub's end face and radial direction

Type	Dial indication	
	End face (mm)	Radial (mm)
TDE4-4	0.10	0.16
TDE4-6	0.10	0.10
TDE4-14	0.15	0.15
TDE4-22	0.20	0.20
TDE4-44	0.25	0.25
TDE4-112	0.25	0.25
TDE4-142	0.30	0.30
TDE4-220	0.35	0.35
TD6-4	0.08	0.08
TD6-11	0.10	0.10
TD6-21	0.10	0.10
TD6-42	0.15	0.15
TD (P) 6-66	0.10	0.10
TD (P) 6-150	0.15	0.15
TD (P) 6-210	0.15	0.15
TD (P) 6-370	0.20	0.20
TD (P) 6-470	0.20	0.20
TD (P) 6-523	0.25	0.25
TD (P) 6-840	0.25	0.25
TD (P) 6-1300	0.25	0.25
TD (P) 6-2100	0.30	0.30
TD (P) 6-2700	0.30	0.30
TD (P) 6-3300	0.35	0.35
TD (P) 6-4200	0.40	0.40
TD (P) 8-840	0.15	0.15
TD (P) 8-1700	0.20	0.20
TD (P) 8-2700	0.20	0.20
TD (P) 8-3300	0.25	0.25
TD (P) 8-4200	0.30	0.30
TD (P) 8-6600	0.30	0.30
TD (P) 8-8400	0.35	0.35
TD (P) 8-9011	0.35	0.35
TD (P) 8-9015	0.40	0.40
TD (P) 8-9021	0.45	0.45
TD (P) 8-9026	0.45	0.45
TD (P) 10-5300	0.15	0.15
TD (P) 10-8400	0.20	0.20
TD (P) 10-9011	0.20	0.20
TD (P) 10-9013	0.20	0.20
TD (P) 10-9019	0.20	0.20
TD (P) 10-9023	0.25	0.25
TD (P) 10-9033	0.25	0.25

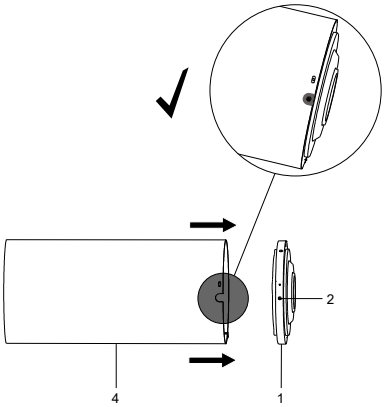
5.9.4 Tightening torques for spacer coupling

Refer to this tightening torques table when install the spacer coupling.

Type	Tightening torque (Nm)
M4	3
M5	8
M6	8
M8	15
M10	25
M12	45
M16	100
M18	150
M20	180
M24	350
M27	500
M30	700
M36	1200
M42	1900

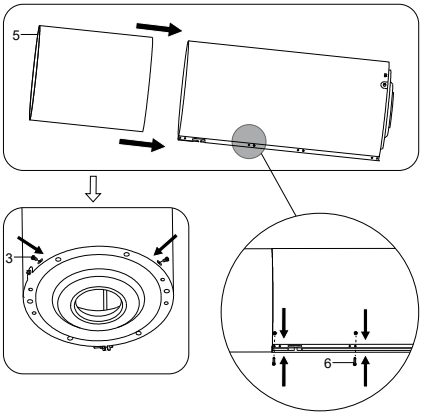
5.10 Installing coupling guard

1. Align the notch of coupling guard and the lubricating nipple (2). Then install the coupling guard (4) to the outer ring of the bearing housing (1) (or [1] the fixing ring for pre-installation).



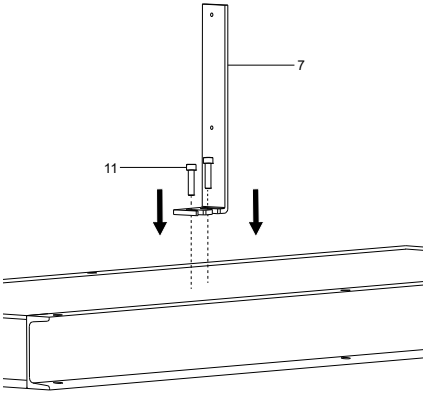
Installing the coupling guard to bearing housing

2. Install the coupling guard spacer (5) to the other side of coupling guard, and then fasten bolts (6) (3).



Install the coupling guard spacer

3. Pre-install the supporting foot (7) on the base frame via bolts (11).

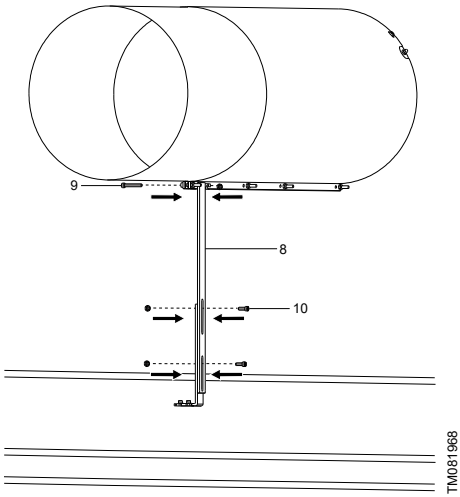


Pre-installing the supporting foot

The purpose of pre-installation is to provide space for adjustment in the following steps.

Normally, the base frame is a common base frame for motor and pump. For separated base frame, install the supporting foot directly to the concrete foundation.

4. Pre-install supporting bracket (8) to coupling guard (4) and supporting foot (7) via bolts (9) (10).



Pre-installing supporting bracket

The purpose of pre-installation is to provide space for adjustment in the following steps.

5. Adjust the axial position of coupling guard and the height of supporting bracket. Then fasten the bolts (9) (10) (11).
6. Adjust the location of coupling guard spacer. Make sure it can match properly with coupling guard and motor cover.

1) The fixing ring of pre-installation is only used in LS 1000-700-X. Align the the notch of fixing ring with lubricating nipple and install the coupling guard to fixing ring, then tighten the fasteners.

6. Operation

6.1 Priming

Tighten the bolts which attached lower and upper case before pump priming, especially for high pressure pumps (working pressure is more than 1.6 MPa).

- LS pump is no self-priming, and must be completely primed (filled with liquid) before starting.
- If the pump will operate with a positive suction head, prime by opening the suction valve and allowing liquid to enter pump casing. Open air vents at this time, and make sure all air is forced from pump by liquid before closing.
- If pump has a suction lift, priming must be accomplished by other methods. The use of foot valves or ejectors, or manual filling of the pump casing and suction line with liquid are possible methods suggested for this purpose.

Never run the pump dry in the hope that it will prime itself! Serious damage to the mechanical shaft seal will result.

6.2 Pre-start checklist

WARNING
Mechanical injury
Death or serious personal injury

- Don't operate the product above the nameplate conditions. Consult instruction book for proper operation and maintenance of the pump and its supporting components.

Never use LS pump to flush the pipe system.

Make the following inspections before starting a LS pump:

- Make sure the suction and discharge piping has been cleaned and flushed to remove dirt and debris before operating pump.
- Make sure all wiring connections to the motor (and starting device) match the wiring diagram and produce clockwise rotation as viewed from the back of the motor.
- If the motor has been in storage for an extended length of time, either before or after installation, refer to motor instructions before starting.
- Check voltage, phase, and line circuit frequency with the motor nameplate.
- Turn rotating element by hands or tools to make sure it rotates freely.
- Tighten plugs in gauge and drain taps. If pump is fitted with pressure gauges, keep gauge cocks closed when not in use.
- Recheck the motor to pump alignment, refer to section coupling alignment.
- Check suction and discharge piping for leaks, and make sure all flange bolts are securely tightened.
- Check all pressure gauges and valves at suction and discharge piping.

Related information

5.8 Coupling alignment

6.3 Motor rotation

Never check drive rotation unless pump and drive couplings are disconnected and physically separated. Failure to follow this instruction can result in serious damage to pump and driver if rotation is wrong.

After the unit has been wired and checked to insure that all components in the system (disconnect device, magnetic starters, pilot devices and motors) are properly connected, check motor rotation as follows:

- Make sure coupling is disconnected, and then momentarily energize the motors to ensure that rotation is correct as indicated by the arrow cast into the pump casing. If rotation is incorrect, interchange two wires at the motor starter terminals T1 and T2.
- For Wye-delta starting, motors rotation has to be verified for both star and delta connections.

6.4 Starting the pump

WARNING
Crushing of hands
Death or serious personal injury

- Do not operate the pump without an approved coupling guard in place.
-

1. Install coupling guard on flexible coupled units.
2. Make sure pump is filled with liquid.
3. Fully open valve (if any) in suction line, and close valve in discharge line.
4. If applicable, turn on any external source of cooling or lubricating fluid to the shaft seals.
5. Start the motor (pump).
6. Immediately after the pump reaches full operating speed, slowly crack open the discharge valve, and open bleed valves at system high points. Do not open discharge valve completely until system is full of liquid, purged of air and checked for leaks.

7. After entirely filling the system, fully open discharge valve and close system bleed valves.
8. If the pump is fitted with pressure gauges, open gauge cocks and record pressure reading for future reference. Verify that the pump is performing in accordance with the parameters specified on the performance curve.
9. Check and record voltage, amperage per phase, and kilowatts, if a watt meter is available.

6.5 Pump shutdown

- Always close the discharge gate valve before stopping pump. Close valve slowly to prevent hydraulic shock.
- Cut off power to the motor.

6.6 Short duration 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 fluid moving within pump casing and insulate or heat pump exterior to prevent freezing.

6.7 Extended period shutdown

- For long shutdown periods, or to isolate the pump for maintenance, close suction gate valve. Remove plugs in pump drain and vent taps, as required, and drain all liquid form the pump volute casing.
- If freezing conditions will exist during long shutdown periods, completely drain the pump and blow out all liquid in passages and pockets with compressed air. Freezing of pump liquid can also be prevented by filling the pump with an antifreeze solution.
- Rotate the shaft by hand (or other auxiliary means) monthly to coat bearings with lubricant and retard oxidation and corrosion.
- Where applicable follow motor manufacturer's storage recommendations. Refer to section Temporary storage.

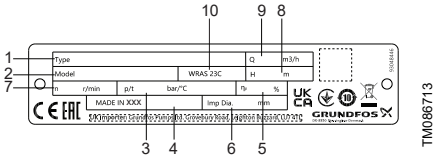
Related information

2.3 Temporary storage

7. Pump identification

All LS pumps are identified by Pump Type and Serial Numbers. These numbers are stamped on the pump nameplate affixed to each pump volute, and should be referred to in all correspondence with LS pumps.

7.1 Nameplate



Nameplate of LS pump

Pos.	Description
1	Type
2	Model
3	Pressure rating and maximum temperature
4	Country of production
5	Hydraulic pump efficiency at optimum efficiency point
6	Impeller diameter
7	Speed of rotation [r/min]
8	Pump head at rated flow rate [m]
9	Rated flow rate [m^3/h]
10	Drinking water approval

8. Lubrication and maintenance

8.1 Motor lubrication

WARNING
Mechanical injury
Death or serious personal injury

- Do not attempt any maintenance (except for adding motor lubricant), inspection, repairing or cleaning in the vicinity of rotating equipment.
- Before attempting any inspection or repair on the pump, the drive controls must be in the "OFF" position, locked and tagged to prevent injury to personnel performing service on the pump.

Always follow the motor manufacture's lubrication instructions, and periodically check grease fittings and drain plugs for leaks.

If lubrication instructions do not accompany the motor, refer to the table below for recommended lubrication periods.

Motor speed [rpm]	Motor power [kW]	Operation conditions		
		Standard	Severe	Extreme
≤ 1750	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	1 year	6 months	3 months
> 1750	All power	6 months	3 months	3 months

Recommended lubrication periods

Standard conditions:

8 hours per day operation, normal or light loading, clean air, maximum ambient temperature is less than 38 °C.

Severe conditions:

Continuous 24-hour operation, shock loading or vibration, poor ventilation, 38-66 °C, ambient temperature.

Extreme conditions:

Continuous operation, heavy shock or vibration, dirt or dust in the air, extreme ambient temperature.

- To lubricate the motor while running or at rest, remove grease drain plug (if any) and filler plug on grease fitting. Grease with clean lubricant until grease appears at drain hole or along motor shaft.
- Most low power motors using "sealed-for-life" bearings require no lubrication.
- Table Recommended bearing grease for motors and pumps in section grease lubrication lists the recommended types of grease for motor and pump lubrication. These types have all been thoroughly tested and should be used whenever possible.

Related information

8.2.1 Grease lubrication

8.2 Pump lubrication

WARNING
Mechanical injury hazard
Death or serious personal injury

- Operation of the unit with proper lubrication.

LS pumps have bearings that may be grease-lubricated or oil-lubricated.

8.2.1 Grease lubrication

Grease lubricated bearings are packed with grease at our factory prior to shipping. This initial filling of grease is good for one year or 2000 hours of normal operation, whichever occurs first. After this time, a regular grease maintenance schedule must be implemented.

Recommended bearing grease for motors and pumps	
Manufacturer	**Lubricant**
KYODO YUSHI 2)	MULTEMP SRL 2)
SHELL	Dolium R
EXXON	Polyrex
CHEVRON	SRI grease NLGI 2
	Black pearl NLGI 2
PHILIPS	Polytac
TEXACO	Polystar RB

2) Brand is used in factory

Recommend to use the same grease lubrication. If need to replace with a new grease lubrication, please clean up and fill in with a new grease lubrication.

Grease specification

Be sure to use the grease according to the following criterion:

- NLGI: Level 2 or Level 3
- Viscosity: Below 40 °C, 26-150 cSt

- Temperature range: Continuous operating -40 ~ +150 °C .

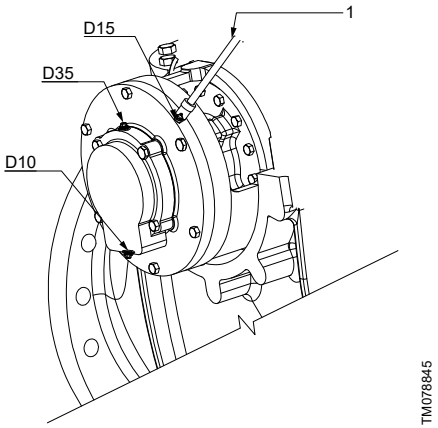
Maintenance schedule

Pump type	Bearing location	Lubrication maintenance		
		Grease quantity [g]		Period [hour]
		First add	Reload	
LS 500-300-490E	Drive end	150	60	3000
	Non-drive end	150	60	3000
LS 500-300-508F	Drive end	150	60	3000
	Non-drive end	150	60	3000
LS 500-300-710B	Drive end	150	60	3000
	Non-drive end	150	70	3000
LS 500-300-680C	Drive end	150	60	3000
	Non-drive end	150	70	3000
LS 450-350-397B	Drive end	60	40	3000
	Non-drive end	60	40	3000
LS 500-350-608A	Drive end	115	60	3000
	Non-drive end	115	60	3000
LS 500-350-702A	Drive end	115	60	3000
	Non-drive end	115	60	3000
LS 500-400-423A	Drive end	100	60	3000
	Non-drive end	100	60	3000
LS 500-400-458C	Drive end	100	60	3000
	Non-drive end	100	60	3000
LS 500-400-530B	Drive end	100	60	3000
	Non-drive end	100	60	3000
LS 500-400-498C	Drive end	100	60	3000
	Non-drive end	100	60	3000
LS 600-400-722A	Drive end	200	90	3000
	Non-drive end	200	70	3000
LS 600-450-625A	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 600-500-498A	Drive end	100	60	3000
	Non-drive end	100	60	3000
LS 600-500-610B	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 600-500-610D	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 700-450-1010A	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 700-450-950B	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 700-500-667D	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 700-500-670A	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 700-500-725E	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 700-500-730A	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 700-500-585F	Drive end	200	70	3000
	Non-drive end	200	90	3000
LS 800-600-683B	Drive end	240	60	3000
	Non-drive end	240	90	3000
LS 800-600-667C	Drive end	220	70	3000
	Non-drive end	220	90	3000

Pump type	Bearing location	Lubrication maintenance		
		Grease quantity [g]		Period [hour]
		First add	Reload	
LS 1000-700-815C	Drive end	300	100	3000
	Non-drive end	300	130	3000
LS 1000-700-770E	Drive end	300	100	3000
	Non-drive end	300	130	3000
LS 1000-700-800G	Drive end	300	100	3000
	Non-drive end	300	130	3000

Grease maintenance operation

1. Remove plug D10 from bearing cap to drain off the waste grease, and remove plug D35 to release air in.
2. Use grease gun to add grease from grease fitting D15, see the above maintenance table for the suitable added quantity.
3. Assemble the plugs (D10, D35) back after the grease maintenance.



Grease lubricated bearing construction

Pos.	Description
1	Grease gun

Grease replacement

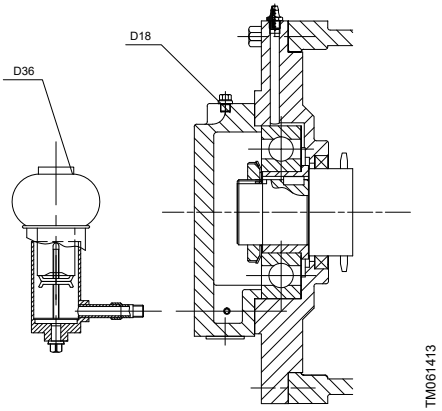
Replace the grease every 10,000 operating hours or every two years.

1. Remove the bearing caps from the pump.
2. Remove old grease.
3. Clean the bearing caps thoroughly.
4. Refill the bearing with new grease.
5. Refit the bearing caps according to the installation instructions
6. Refill grease from lubricating nipples D15 (grease amount see in Maintenance schedule).
7. Start the pump briefly a few times to distribute the grease in the bearings and to avoid overheating the grease.

Do not over grease. Too much grease can cause over-heating and premature bearing failure. The bearing manufacturers recommend that the bottom 1/3 of the bearing be filled with grease.

8.2.2 Oil lubrication

On those LS pumps ordered with oil lubricated bearings, a regular oil maintenance program must be enforced. Pumps with oil lubricated bearings, as shown in figure below, are fitted with a transparent reservoir (D36) (constant level oiler) on the bearing cover (D18) that maintains the oil level about the centre line of the lower bearing. If necessary, the oil supply in the reservoir of the constant level oiler must be renewed. To refill, remove the reservoir (D36) and fill with oil. After filling with oil replace into operating position.



Oil lubricated bearing construction

After the first 100 hours of operation, the oil should be changed. To change the oil, remove the drain plug at the bottom of the bearing cover (D18). After draining oil, replace the fittings and refill with an acceptable oil selected from the table below. After the first oil change, the oil should be changed again at 2000 hours and then at intervals of 8000 hours or once yearly thereafter.

List of recommended lube oils

Manufacturer	Oil brand
Standard Oil Company	Mobil DTE Oil Medium
Shell Oil Company	Shell Morlina Oil S46

Lubricant should be according with ISO VG46 under normal temperature condition (0-60 °C), please contact Grundfos in case of special conditions.

8.3 Stuffing box packing shaft seal-water lubrication

The stuffing box must be supplied at all times with a source of clean, clear liquid to flush and lubricate the packing. Only a sufficient volume of sealing liquid to create a definite direction of flow from the stuffing box inward to the pump casing is required. Piping from the pump discharge dome to the packing box is supplied on LS pumps when requested.

8.4 Packing maintenance

The stuffing box should be packed with fresh packing before initial start-up, after repairs to the pump, and in case of excessive leakage. Any time the packing is replaced, the shaft sleeves should be inspected for wear, roughness or scouring and replaced with new ones, if necessary. For instructions on filling the stuffing box, see section replacing the stuffing.

Related information

10.3 Replacing the stuffing

9. Disassembly for maintenance

Depending on the liquid being pumped, the pump should be washed down before any work is done on it.

- LS pumps are designed for ease of maintenance and, as such, the seals, sleeves, wear rings, clearances and bearings can be inspected without having to remove the complete rotating element or having to disconnect the suction or discharge piping, or disturbing the alignment of the pump set.
- Work on this equipment is to be performed only by qualified personnel. Before performing any maintenance on the pump, read the instructions in this document.
- Before beginning disassembly of the pump, close the suction and discharge isolation valves, turn off any external source of cooling or lubricating fluid to the shaft seals, drain the pump case by opening the drain and vent plugs, and disconnect and lock off the motor power source.

10. Bearing, seal and packing replacement

10.1 Bearing replacement

(Refer to sectional drawings in section Construction.)

1. Remove coupling half (G1) from pump shaft (F1) using a wheel puller and remove coupling key (F2).
2. Remove cap screws on bearing caps, then remove bearing caps (D18) and (D5). For oil lubrication, remove plugs at the bottom of the bearing housings and drain off the oil before removing bearing caps.

10.1.1 Removing the bearing

Non-driven end deep groove ball bearing (D6) removal

- **For structure type 1, 2 and 3 (see section sectional drawing, structure type 1, structure type 2, structure type 3)**

1. Loosen the round nut (D14), then remove round nut (D14), lock washer (54c) and tab washer (54d).
2. Remove cap screws on bearing housing (D4), and slide bearing housing with bearing sleeve (C2) and deep groove ball bearing (D6) off its end of shaft (F1).
3. Slide deep groove ball bearing (D6) and bearing sleeve (C2) from bearing housing (D4).
4. Slide deep groove ball bearing (D6) from bearing sleeve (C2).

- **For structure type 4 (see section sectional drawing, structure type 4)**

1. Remove snap ring (D27) using clasp forceps.
2. Remove bearing housing (D4) with deep groove ball bearing (D6), off its end of shaft (F1).
3. Slide deep groove ball bearing (D6) from bearing housing (D4).

Driven-end deep groove ball bearing removal

- **For structure type 1, 2 and 4 (see section sectional drawing, structure type 1, structure type 2 and structure type 4)**

1. Remove cap screws from bearing housing (D4).
2. Remove bearing housing (D4) with deep groove ball bearing (D19) off the shaft using resistance tubing.

- **For structure type 3 (see section sectional drawing, structure type 3)**

1. Remove cap screws on bearing housing (D4) and set screws on bearing sleeve (C8), then remove bearing sleeve (C8), bearing housing (D4) and deep groove ball bearing (D19) using clasp forceps.
2. Remove deep groove ball bearing (D19) and bearing sleeve (C8) from bearing housing (D4).
3. Remove deep groove ball bearing (D19) from bearing sleeve (C8).

Related information

14.1 Structure type 1
14.2 Structure type 2
14.3 Structure type 3
14.4 Structure type 4

10.1.2 New bearing installation

Install a new bearing according to the reverse process of removing the bearing.

Loosen the screws on seal cover (D1) to separate the friction pair surfaces of machine sealing ring from machine static sealing ring to avoid damaging the sealing surface before install or remove bearing.

Don't knock the coupling. Inappropriate force may damage bearing and sealing surface.

Make sure all parts in bearing are clean. Any impurity or particle can lead to bearing failure quickly.

Don't add grease too much. Too much grease causes bearing heating then failure. Generally, the filling content of grease is 25 % - 50 % of bearing inner space.

10.2 Mechanical shaft seal replacement

10.2.1 Removing mechanical shaft seal

1. Follow the steps in section bearing removal to remove bearing housings (D4).

Only recommend to remove bearing from bearing assembly when replace the shaft.

2. Remove slinger (D9) from the shaft.
3. Loosen the screws on seal cover (D1), and then remove the seal cover (D1) from seal housing (D2).
4. Remove stationary ring of mechanical shaft seal (D3) from seal cover.

- **For structure type 1, 2 and 3 (see section sectional drawing, structure type 1, structure type 2 and structure type 3)**
  - Remove rotating ring of mechanical shaft seal (D3) from shaft (F1).

- **For structure type 4 (see section sectional drawing, structure type 4)**
  - Remove rotating ring of mechanical shaft seal (D3) off sleeve (C6).

Related information

10.1.1 Removing the bearing
14.1 Structure type 1
14.2 Structure type 2
14.3 Structure type 3
14.4 Structure type 4

10.2.2 New mechanical shaft seal installation

When installation, don't press sealing element directly. If necessary, press in seal seat with proper tools. When assemble, lubricate new seat's rubber cap with liquid soap.

1. Clean seal cover (D1).
2. Lightly lubricate new seat's rubber cap with liquid soap.
3. Press in seal seat with proper tool or fingers, making sure seat is seated squarely and all the way into seal cap or bearing housing. Do not touch seal seat or head faces.
4. Clean and lightly lubricate shaft sleeves (C6) or shaft (F1). Make sure there are no sharp edges or corners to cut the seal's rubber parts.
5. Reinstall machine sealing ring of seal (D3) to shaft (F1) or sleeve (C6).
6. Reinstall seal cover (D1) with machine static sealing ring into seal housing (D2), fixed screw.
7. Follow Bearing Replacement steps F.1.b to complete assembly.

10.3 Replacing the stuffing

1. Loosen stuffing box gland (D33) and put it to the place near the slinger (D9).
2. Remove packing (D31) and distribution ring (D30) with a packing hook. Then remove the packing (D31) behind distribution ring (D30).
3. If retainer for packing (D32) comes out, put it back to the original position.
4. Fill two or three circles of packing (D31) to replace the old one in front of distribution ring (D30) . Stagger the joints 120° on each packing circle and push them firmly back against the retainer of packing.
5. Insert distribution ring (D30) to the original position.
6. Fill three or four circles of packing (31) to replace the old one behind distribution ring (D30) and stagger the joints 120° on each packing circle.
7. Install stuffing box gland (D33).
8. Lubricate the packing ring, ensure it's leakage meets the standard, see on section packing gland adjustment. Never over tighten packing gland.
9. In suction lift systems, tighten the packing before the pump starts. Loosen the packing immediately after the pump starts and ensure it's leakage meets the standard, see on section packing gland adjustment. After a few hours of operation, adjust the tightness based on the leakage of packing.

Related information

5.6 Packing gland adjustment

11. Disassembly and assembly of LS pumps

11.1 Dismantling the pump

1. Follow the steps in section bearing, seal & packing replacement to remove coupling (G1), bearing cap (D18&D5), bearing housing (D4), slinger (D9), seal cover (D1) (or packing gland (D33)), seal housing (D2), mechanical shaft seal (D3) (or packing ring (D31) and distribution ring (D30).
2. Remove all the bolts and nuts that holding casing halves (A2 & A1) together.
3. Remove case roll pin, and then lift up upper case (A2).
4. Place casing gasket and all the other gaskets in water to keep them from drying out and shrinking.
5. Take out shaft assembly.
6. Slide wear ring (B3) off impeller (B1).

For the structure type 1 (see section sectional drawing, structure type 1):

- Remove lock nut (B5) with hook wrench.
- Mark on the impeller (B1) before removing it from shaft (F1), make sure it can be installed identically afterwards.
- Remove impeller (B1) from shaft (F1), and then remove key (B2).

For the structure type 2 and 3 (see section sectional drawing, structure type 2 and structure type 3):

- Loosen the set screws of shaft sleeves (B5), and then remove sleeve nut (C1). Recommend to use hook wrench during the procedure.
- Mark on the impeller (B1) before removing it from shaft (F1), make sure it can be installed identically afterwards.
- Remove impeller (B1) from shaft (F1), and then remove key (B2).

For the structure type 4 (see section sectional drawing, structure type 4):

- Remove sleeve nut with hook wrench, and remove seal sleeve (C6) and inner sleeve (B5).
- Mark on the impeller (B1) before removing it from shaft (F1), make sure it can be installed identically afterwards.
- Remove impeller (B1) from shaft (F1), and then remove key (B2).

Related information

14.1 Structure type 1
14.2 Structure type 2
14.3 Structure type 3
14.4 Structure type 4

11.2 Assembly of LS pumps

Assembly of LS pumps is the opposite steps of disassembly.

12. Component inspection

- While the pump is disassembled, all components should be inspected for wear, damage, deterioration or erosion.
- Shaft sleeves should be inspected and if worn or deeply scored should be replaced.
- Wear ring (B3) should be checked for erosion or wear and if badly deteriorated, replaced to renew original pump performance. If clearance between wear ring and impeller is greater than 0.06", it will affect pump performance and new rings should be installed.
- Examine the lapped faces of the mechanical shaft seals (D3) for scoring, heat checking or cracking. Examine mechanical shaft seal elastomers (rubber components) for deterioration or hardening. Replace mechanical shaft seals if any damage exists.
- Check any external source of cooling or lubricating fluid lines, and/or recirculation lines and ports for clogs, kinks or other restrictions.
- Clean machined mating surfaces of all components to remove grit, grime and/or old sealing material before reassembling pump.

13. Ordering parts

Groundfos has over 100 years of experience in the design, manufacture, and application of centrifugal pumps and pumping systems. Grundfos' commitment to state-of-the-art pump design and quality manufacturing assures maximum user benefits with optimum equipment life at lower cost.

Grundfos' commitment to their customers continues through an extensive service organization. Highly trained technicians can assist customers with initial startup, troubleshooting, repair, and system analysis.

Grundfos maintains an extensive stock of replacement parts and parts kits for our pumps. In order to reduce pump repair time and shorten inconvenient pump service interruptions, it is suggested that the pump user stock spare parts. For suggested spare parts see replacement Parts Guide B1b.2, attached, and contact your local Grundfos Sales Representative (see back cover for the number of your nearest Grundfos sales office). Since spare parts requirements and quantities vary for specific pump constructions, allow your Grundfos Representative to help in defining your spare part requirements. To ensure that the proper replacement parts are ordered for your particular pump model, when you call:

- Identify all pertinent data from the pump nameplate, see section Nameplate. This should always include the pump product number or type designation, and the pump serial number.
- For replacement of impellers, include the nameplate, operating conditions (Flow rate and Head) and the impeller diameter.
- Identify all parts by item number and description as indicated by the appropriate assembly drawing in this manual, for your particular pump model.

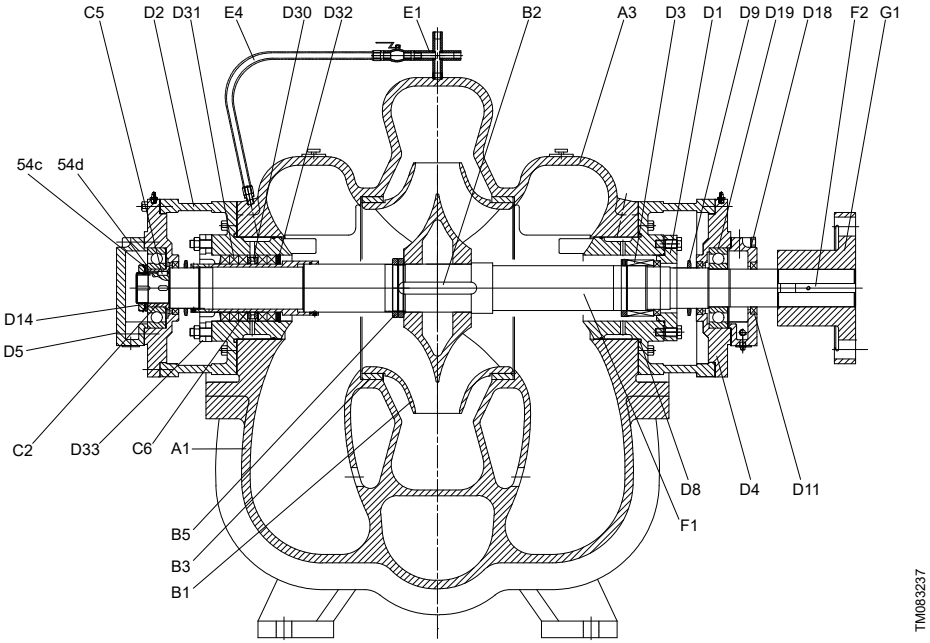
Related information

7.1 Nameplate

14. Construction

14.1 Structure type 1

Non-balanced mechanical shaft seal (or stuffing box with shaft sleeve), bearing with bearing sleeve in the non-drive end, deep groove ball bearing in the drive end.



Sectional drawing, structure type 1

Pos.	Description	Pos.	Description	Pos.	Description
A1	Lower pump case	D2	Seal housing	D30	Distribution ring
A2	Upper pump case	D3	Mechanical shaft seal	D31	Packing
B1	Impeller	D4	Bearing housing	D32	Retainer for packing
B2	Key	D5	Bearing cap, non-drive end	D33	Stuffing box gland
B3	Wear ring	D6	Deep groove ball bearing, non-drive end	E1	Cross connection
B5	Lock nut	D8	O-ring	E4	Flushing pipe
C1	Sleeve nut	D9	Slinger	F1	Shaft
C2	Bearing sleeve	D11	Oil seal	F2	Key

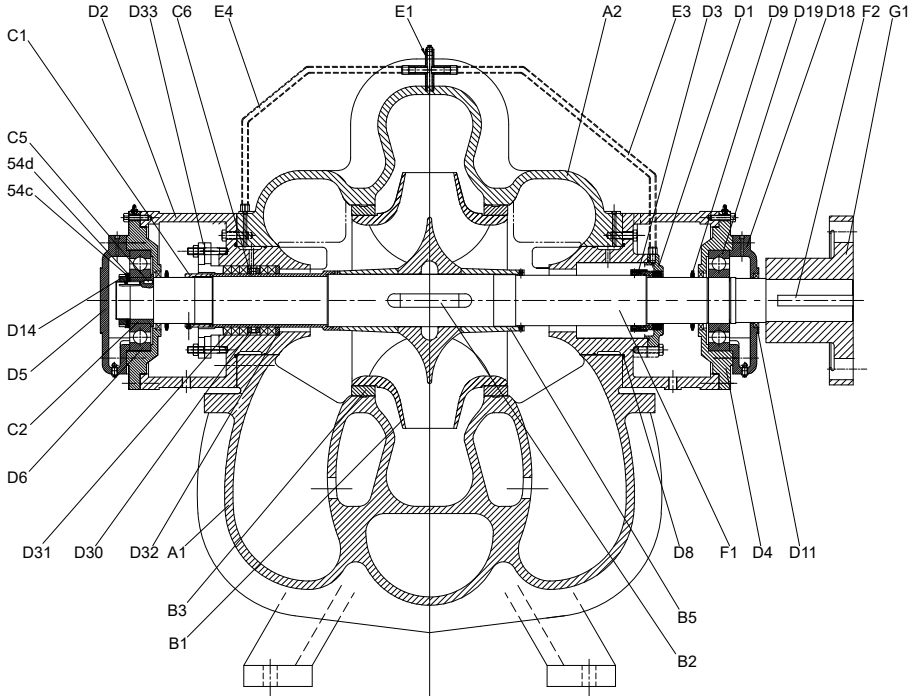
Pos.	Description	Pos.	Description	Pos.	Description
C5	Key	D14	Lock nut	G1	Coupling half
C6	Sleeve	D18	Bearing cap, drive end	54c	Lock washer
D1	Seal cover	D19	Deep groove ball bearing, drive end	54d	Tab washer

Applicable types:

LS 500-350-608A, LS 500-350-702A, LS 500-300-710B, LS 500-300-680C, LS 600-400-722A, LS 600-500-610B, LS 600-500-610D, LS 700-500-667D, LS 700-500-725E, LS 700-500-585F, LS 800-600-683B, LS 800-600-667C, LS 1000-700-815C, LS 1000-700-770E, LS 500-300-490E, LS 500-300-508F, LS 500-400-423A, LS 500-400-458C, LS 500-400-530B, LS 500-400-498C.

14.2 Structure type 2

Balanced mechanical shaft seal (or stuffing box with shaft sleeve), bearing with bearing sleeve in the non-drive end, deep groove ball bearing in the drive end.



Sectional drawing, structure type 2

Pos.	Description	Pos.	Description	Pos.	Description
A1	Lower pump case	D2	Seal housing	D30	Distribution ring
A2	Upper pump case	D3	Mechanical shaft seal	D31	Packing
B1	Impeller	D4	Bearing housing	D32	Retainer for packing
B2	Key	D5	Bearing cap, non-drive end	D33	Stuffing box gland
B3	Wear ring	D6	Deep groove ball bearing, non-drive end	E1	Cross connection
B5	Lock sleeve	D8	O-ring	E3	Flushing pipe
C1	Sleeve nut	D9	Slinger	E4	Flushing pipe
C2	Bearing sleeve	D11	Oil seal	F1	Shaft
C5	Key	D14	Lock nut	F2	Key, coupling

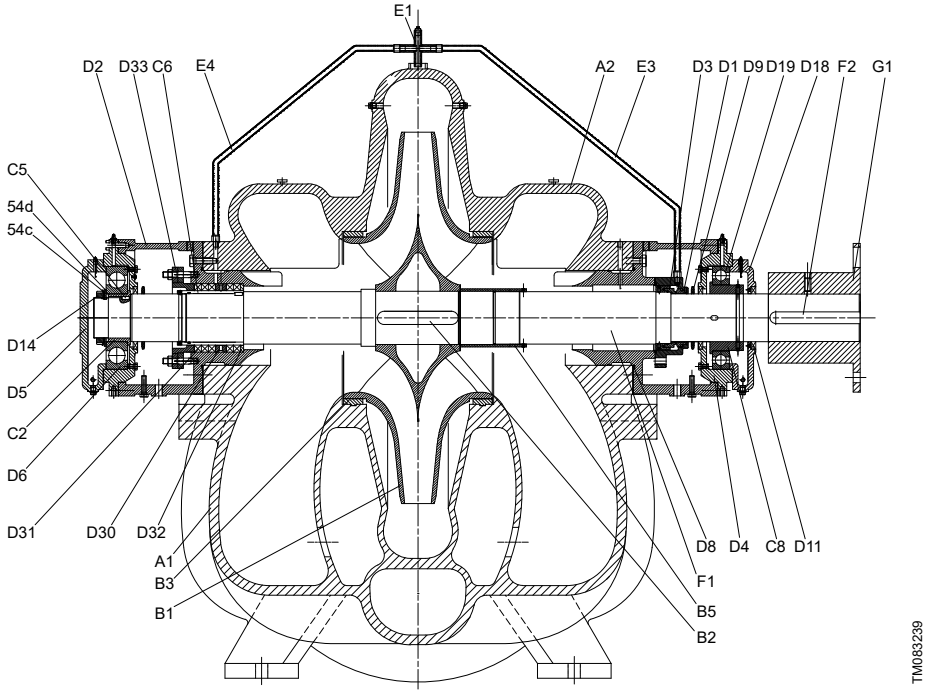
Pos.	Description	Pos.	Description	Pos.	Description
C6	Sleeve	D18	Bearing cap, drive end	G1	Coupling half
C8	Bearing sleeve	D19	Deep groove ball bearing, drive end	54c	Lock washer
D1	Seal cover			54d	Tab washer

Applicable types:

LS 500-300-710B, LS 500-300-680C, LS 600-400-722A, LS 600-450-625A, LS 600-500-610B, LS 600-500-610D, LS 700-500-667D, LS 700-500-670A, LS 700-500-725E, LS 700-500-730A, LS 700-450-1010A, LS 700-450-950B, LS 700-500-585F, LS 800-600-683B, LS 800-600-667C, LS 1000-700-815C, LS 1000-700-770E.

14.3 Structure type 3

Multi-spring mechanical seal with shaft sleeve (or stuffing box with shaft sleeve), bearing with bearing sleeve in the non-drive end, deep-groove ball bearing with bearing sleeve in the drive end.



Sectional drawing, structure type 3

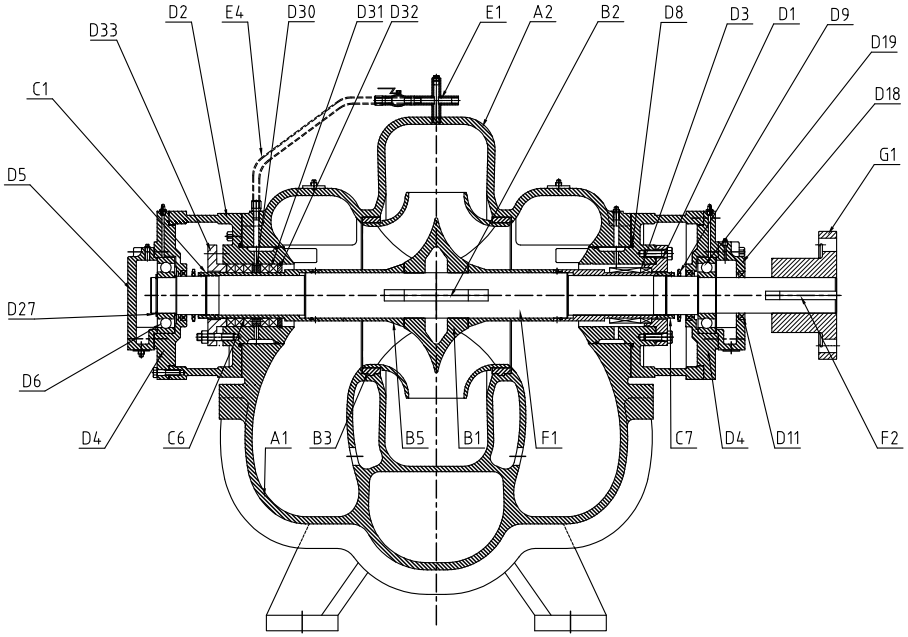
Pos.	Description	Pos.	Description	Pos.	Description
A1	Lower pump case	D1	Seal cover	D19	Deep groove ball bearing, drive end
A2	Upper pump case	D2	Seal housing	D30	Distribution ring
B1	Impeller	D3	Mechanical shaft seal	D31	Packing
B2	Key	D4	Bearing Housing	D32	Retainer for packing
B3	Wear ring	D5	Bearing cap, non-drive end	D33	Stuffing box gland
B5	Lock sleeve	D6	Deep groove ball bearing, non-drive end	E1	Cross connection
C1	Sleeve nut	D8	O-ring	E3	Flushing pipe
C2	Bearing sleeve	D9	Slinger	E4	Flushing pipe
C5	Key	D11	Oil seal	F1	Shaft
C6	Sleeve	D14	Lock nut	F2	Key

Pos.	Description	Pos.	Description	Pos.	Description
C8	Bearing sleeve	D18	Bearing cap, drive end	G1	Coupling half
				54c	Lock washer
				54d	Tab washer

Applicable types:
LS 700-450-1010A, LS 700-450-950B.

14.4 Structure type 4

Bellows balanced mechanical shaft seal with shaft sleeve (or stuffing box with shaft sleeve), bearing without bearing sleeve in the non-drive end, deep-groove ball bearing in the drive end.



Sectional drawing, structure type 4

Pos.	Description	Pos.	Description	Pos.	Description
A1	Lower pump case	D2	Seal housing	D27	Circlip
A2	Upper pump case	D3	Mechanical shaft seal	D30	Distribution ring
B1	Impeller	D4	Bearing housing	D31	Packing
B2	Key	D5	Bearing cap, non-drive end	D32	Retainer for packing
B3	Wear ring	D6	Deep groove ball bearing, non-drive end	D33	Stuffing box gland
B5	Inner sleeve	D8	O-ring	E1	Cross connection
C1	Sleeve nut	D9	Slinger	E4	Flushing pipe
C6	Sleeve	D11	Lip seal	F1	Shaft
C7	Sleeve	D18	Bearing cap, drive end	F2	Key
D1	Seal cover	D19	Deep groove ball bearing, drive end	G1	Coupling half

Applicable types: LS 450-350-397B, LS 500-400-458C.

15. Fault finding the product

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.

15.1 The pump delivers no liquid

Cause	Remedy
The pump is not primed, lack of priming liquid, incomplete priming.	• Fill the pump and inlet pipe completely with pumped liquid.
Loss of priming liquid.	• Mend possible leaks in the inlet pipe, joints and fittings. Vent the pump housing to remove accumulated air.
The suction lift or static lift is too high.	• Reduce the difference in height between the water reservoir or water supply and the pump.
The outlet pressure is too high.	• Make sure that valves in the outlet pipe are fully open. • For parallel operation, this indicates that the outlet pressure is higher than designed friction losses in the pipes. Review system design and actual pressure developed in the system with parallel operation.
The speed is too low.	1. Make sure that the motor receives full voltage. 2. Make sure that the frequency is correct. 3. Make sure that all phases are connected.
Wrong direction of rotation.	• Compare the direction of rotation with the directional arrow on the pump housing. If required, change the direction of rotation by interchanging two phases in the motor.
The impeller is completely clogged.	• Dismantle the pump and clean the impeller.

15.2 The pump does not deliver enough liquid

Cause	Remedy
The suction lift or static lift is too high.	• Reduce the difference in height between the water reservoir or water supply and the pump.
The outlet pressure is too high.	• Make sure that valves in the outlet pipe are fully open. • For parallel operation, this indicates that the outlet pressure is higher than designed friction losses in the pipes. Review system design and actual pressure developed in the system with parallel operation.
The speed is too low.	1. Make sure that the motor receives full voltage. 2. Make sure that the frequency is correct.

Cause	Remedy
	3. Make sure that all phases are connected.
Wrong direction of rotation.	• Compare the direction of rotation with the directional arrow on the pump housing. If required, change the direction of rotation by interchanging two phases in the motor.
The impeller is completely clogged.	• Dismantle the pump and clean the impeller.
The inlet pipe is partially blocked.	• Remove any obstructions in the inlet pipe.
Air leak in the inlet pipe or flange.	• Replace or repair the defective pipe section or flange.
Air leak in the stuffing box.	• Clean the flushing pipe. Replace the stuffing box packing rings, if necessary.
Cavitation; insufficient NPSH (depending on installation).	1. Increase the net positive suction head by placing the pump in a lower position. 2. Pressurise the inlet vessel.
The impeller or wear rings are worn.	• Replace the impeller and/or wear rings. If necessary, also replace the bearings and the shaft.
Defective packing rings.	• Replace the packing rings.
The non-return valve is too small or partially obstructed.	• Replace or clean the non-return valve.
The non-return valve is too small or partially obstructed.	• Replace or clean the non-return valve.
The inlet pipe is not immersed deeply enough.	• Extend the inlet pipe so that the risk of sucking air is eliminated.

15.3 The pump does not create enough pressure

Cause	Remedy
The speed is too low.	1. Make sure that the motor receives full voltage. 2. Make sure that the frequency is correct. 3. Make sure that all phases are connected.
Air leak in the inlet pipe or flange.	• Replace or repair the defective pipe section or flange.
The impeller or wear rings are worn.	• Replace the impeller and/or wear rings. If necessary, also replace the bearings and the shaft.
Defective packing rings.	• Replace the packing rings.
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 overload the motor.
Obstruction in pump housing.	• Dismantle the pump and remove the obstruction.
Air or gases in the liquid.	• Remove the gas or air from the pumped liquid. • See remedy in Cavitation; insufficient NPSH (depending on installation) above.

Cause	Remedy
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.

15.4 The pump loses liquid after running for a short time

Cause	Remedy
The suction lift or static lift is too high.	• Reduce the difference in height between the water reservoir or water supply and the pump.
Air leak in the inlet pipe or flange.	• Replace or repair the defective pipe section or flange.
Air leak in the stuffing box.	• Clean the flushing pipe. Replace the stuffing box packing rings, if necessary.
Cavitation; insufficient NPSH (depending on installation).	1. Increase the net positive suction head by placing the pump in a lower position. 2. Pressurise the inlet vessel.
The inlet pipe is not immersed deeply enough.	• Extend the inlet pipe so that the risk of sucking air is eliminated.
Air or gases in the liquid.	• Remove the gas or air from the pumped liquid. • See remedy in Cavitation; insufficient NPSH (depending on installation) above.

15.5 The pump consumes too much power

Cause	Remedy
Cavitation; insufficient NPSH (depending on installation).	1. Increase the net positive suction head by placing the pump in a lower position. 2. Pressurise the inlet vessel.
The impeller or wear rings are worn.	• Replace the impeller and/or wear rings. If necessary, also replace the bearings and the shaft.
Air or gases in the liquid.	• Remove the gas or air from the pumped liquid. • See remedy in Cavitation; insufficient NPSH (depending on installation) above.
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.
The viscosity or specific gravity of the pumped liquid is higher than that of water.	• Use a larger motor. Consult Grundfos for recommended size. • Test the liquid for viscosity and specific gravity.
The shaft is bent due to damage.	• Check the deflection of the shaft. The total indicator runout must not exceed 0.05 mm.

Cause	Remedy
	• Possibly replace the shaft.
Mechanical failure of bearing and/or impeller.	• Check the bearings and the impeller for damage. • Replace the bearings or the impeller, if necessary.
Misalignment.	• Realign the pump and the motor.
Electrical defects.	• Check that the voltage and frequency of the power supply are correct. • Remedy the possible defects in the motor. • Check that the motor is properly cooled.
The speed is too high.	• Check that the frequency of the power supply corresponds to the frequency stated on the motor nameplate.

15.6 The motor is overloaded

Cause	Remedy
The viscosity or specific gravity of the pumped liquid is higher than that of water.	• Use a larger motor. Consult Grundfos for recommended size. • Test the liquid for viscosity and specific gravity.
The shaft is bent due to damage.	• Check the deflection of the shaft. The total indicator runout must not exceed 0.05 mm. • Possibly replace the shaft.
Mechanical failure of bearing and/or impeller.	• Check the bearings and the impeller for damage. • Replace the bearings or the impeller, if necessary.
Electrical defects.	• Check that the voltage and frequency of the power supply are correct. • Remedy the possible defects in the motor. • Check that the motor is properly cooled.
The speed is too high.	• Check that the frequency of the power supply corresponds to the frequency stated on the motor nameplate.

15.7 Vibrations

Cause	Remedy
The shaft is bent due to damage.	• Check the deflection of the shaft. The total indicator runout must not exceed 0.05 mm. • Possibly replace the shaft.
Mechanical failure of bearing and/or impeller.	• Check the bearings and the impeller for damage. • Replace the bearings or the impeller, if necessary.
Misalignment.	• Realign the pump and the motor.
The foundation is not rigid enough.	• Retighten the anchor bolt nuts. Make sure that the foundation is made according to the installation and operating instructions.

15.8 Cavitation noise

Cause	Remedy
Air leak in the inlet pipe or flange.	• Replace or repair the defective pipe section or flange.
Cavitation; insufficient NPSH (depending on installation).	1. Increase the net positive suction head by placing the pump in a lower position. 2. Pressurise the inlet vessel.
The inlet pipe is not immersed deeply enough.	• Extend the inlet pipe so that the risk of sucking air is eliminated.
Air or gases in the liquid.	• Remove the gas or air from the pumped liquid. • See remedy in Cavitation; insufficient NPSH (depending on installation) above.
The speed is too high.	• Check that the frequency of the power supply corresponds to the frequency stated on the motor nameplate.

15.9 The pump bearings are overheated

Cause	Remedy
The shaft is bent due to damage.	• Check the deflection of the shaft. The total indicator runout must not exceed 0.05 mm. • Possibly replace the shaft.
Mechanical failure of bearing and/or impeller.	• Check the bearings and the impeller for damage. • Replace the bearings or the impeller, if necessary.
Misalignment.	• Realign the pump and the motor.
The lubricating oil or grease is dirty or contaminated.	• Clean the bearings and bearing housings according to the instructions and relubricate the bearings.

15.10 The pump operates for a short time and then stops

Cause	Remedy
The pump is not primed, lack of priming liquid, incomplete priming.	• Fill the pump and inlet pipe completely with pumped liquid.
The suction lift or static lift is too high.	• Reduce the difference in height between the water reservoir or water supply and the pump.
Air leak in the inlet pipe or flange.	• Replace or repair the defective pipe section or flange.
Air leak in the stuffing box.	• Clean the flushing pipe. Replace the stuffing box packing rings, if necessary.

16. Disposing of the product

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

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

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

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

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