SE and SL, 9-30 kW
50/60 Hz, DIN
Installation and operating instructions

http://net.grundfos.com/qr/i/98142266
Original installation and operating instructions
These installation and operating instructions describe Grundfos SE and SL pumps, 9-30 kW.

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Read this document before installing the product. Installation and operation must comply with local regulations and accepted codes of good practice.
1.2 Notes
The symbols and notes below may appear in Grundfos installation and operating instructions, safety instructions and service instructions.

Ex
Observe these instructions for explosion-proof products.

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

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

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

Tips and advice that make the work easier.

1.3 Target groups
These installation and operating instructions are intended for professional installers.

2. Product introduction
2.1 Product description
The 9-30 kW SE and SL pumps are a range of SuperVortex and S-tube® impeller pumps specifically designed for pumping sewage and wastewater in a wide range of municipal, private and industrial applications.

Fig. 1  SE, SL pump

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inlet</td>
</tr>
<tr>
<td>2</td>
<td>Outlet</td>
</tr>
<tr>
<td>3</td>
<td>Power and control cable</td>
</tr>
<tr>
<td>4</td>
<td>Lifting bracket</td>
</tr>
<tr>
<td>5</td>
<td>Terminal box</td>
</tr>
<tr>
<td>6</td>
<td>Submersible motor</td>
</tr>
<tr>
<td>7</td>
<td>Pump</td>
</tr>
</tbody>
</table>
2.2 Intended use
These pumps are designed for pumping sewage and wastewater in a wide range of municipal, private and industrial applications.

2.3 Pumped liquids
The pumps are designed for pumping:
- raw sewage with short and long fibres and particles in municipal and industrial wastewater systems
- sludge with dry-solids content of up to 3 % for pumps with S-tube® impellers and up to 5 % for pumps with SuperVortex impellers
- surface water
- industrial wastewater with fibrous material
- domestic wastewater with toilet waste
- unscreened sewage in municipal pumping stations or inlet pumping stations to the wastewater treatment plant
- raw water.
Depending on the application, you can use the pumps in submerged or dry, horizontal or vertical installations.

2.4 Identification

2.4.1 Nameplate
All pumps can be identified by the nameplate on the motor top cover. See fig. 2.

Fig. 2 Nameplate example for Ex-proof pump
### 2.4.2 Type key

Example: **SL1.110.200.245.4.52.M.S.EX.6.1G.A**

<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE</td>
<td>Sewage pump with cooling jacket</td>
<td>Pump type</td>
</tr>
<tr>
<td>SL</td>
<td>Sewage pump without cooling jacket</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Closed one channel S-tube® impeller</td>
<td>Impeller type</td>
</tr>
<tr>
<td>2</td>
<td>Closed two channel S-tube® impeller</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>SuperVortex (free-flow) impeller</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>Maximum solids size</td>
<td>Pump free passage [mm]</td>
</tr>
<tr>
<td>200</td>
<td>Nominal diameter of pump outlet</td>
<td>Pump outlet [mm]</td>
</tr>
<tr>
<td>245</td>
<td>24.5 kW: P2 / 10</td>
<td>Power [kW]</td>
</tr>
<tr>
<td>[ ]</td>
<td>Standard pump or standard Ex pump</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Sensor version 1 or sensor version 1, Ex pump</td>
<td>Sensor version</td>
</tr>
<tr>
<td>B</td>
<td>Sensor version 2 or sensor version 2, Ex pump</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2-pole motor</td>
<td>Number of poles</td>
</tr>
<tr>
<td>4</td>
<td>4-pole motor</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6-pole motor</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Frame size of the pump</td>
<td>Frame size</td>
</tr>
<tr>
<td>S</td>
<td>Super-high pressure</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>High pressure</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Medium pressure</td>
<td>Pressure range</td>
</tr>
<tr>
<td>L</td>
<td>Low pressure</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Extra-low pressure</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Sewage pump without cooling jacket for vertical, submerged installation (SL)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Sewage pump with cooling jacket for vertical, submerged installation (SE)</td>
<td>Installation type</td>
</tr>
<tr>
<td>D</td>
<td>Sewage pump with cooling jacket for vertical, dry installation (SE)</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Sewage pump with cooling jacket for horizontal, dry installation (SE)</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>Cast iron pump housing; stainless-steel impeller; cast iron motor housing</td>
<td>Material code for pump housing, impeller and motor housing</td>
</tr>
<tr>
<td>W</td>
<td>Cast iron pump housing; Heavy-duty wear-resistant impeller; cast iron motor housing</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>Pump without ATEX approval</td>
<td>Pump version</td>
</tr>
<tr>
<td>EX</td>
<td>Pump with ATEX approval</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>50 Hz</td>
<td>Frequency</td>
</tr>
<tr>
<td>6</td>
<td>60 Hz</td>
<td></td>
</tr>
<tr>
<td>1D</td>
<td>380-415D, 660-690Y (Standard)</td>
<td>Voltage for 50 Hz</td>
</tr>
<tr>
<td>1E</td>
<td>220-240D, 380-415Y</td>
<td></td>
</tr>
<tr>
<td>1N</td>
<td>500-550D</td>
<td></td>
</tr>
<tr>
<td>1F</td>
<td>220-277D, 380-480Y</td>
<td></td>
</tr>
<tr>
<td>1G*</td>
<td>380-480D, 660-690Y (Standard)</td>
<td>Voltage for 60 Hz</td>
</tr>
<tr>
<td>1M</td>
<td>500-600D</td>
<td></td>
</tr>
<tr>
<td>11**</td>
<td>460D (Standard)</td>
<td></td>
</tr>
<tr>
<td>15**</td>
<td>380D, 660Y</td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td>Thermal switches</td>
<td>Thermal protection</td>
</tr>
<tr>
<td>T</td>
<td>PTC thermistor</td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td>1st generation</td>
<td>Generation code</td>
</tr>
<tr>
<td>A</td>
<td>2nd generation</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>Custom-built products</td>
<td>Customisation</td>
</tr>
</tbody>
</table>

* Only for 2- and 4-pole motors.
** Only for 6-pole motors.
2.5 Approvals
The explosion-proof versions have been approved by FM Approvals according to the ATEX directive and IEC standards.

2.5.1 Explanation of Ex approval
The SE, SL 9-30 kW pumps have the following explosion protection classification:

ATEX:

<table>
<thead>
<tr>
<th>Type of Pump</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct-drive pump</td>
<td>CE 0344  II 2 G Ex h db IIB T4 Gb IP68</td>
</tr>
<tr>
<td>Pump driven by frequency converter</td>
<td>CE 0344  II 2 G Ex h db IIB T3 Gb IP68</td>
</tr>
</tbody>
</table>

IECEx:

<table>
<thead>
<tr>
<th>Type of Pump</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct-drive pump</td>
<td>Ex db IIB T4 Gb Ta = -20 to +40 °C</td>
</tr>
<tr>
<td>Pump driven by frequency converter</td>
<td>Ex db IIB T3 Gb Ta = -20 to +40 °C</td>
</tr>
</tbody>
</table>

IEC 60079-0:2017, IEC 60079-1:2014

<table>
<thead>
<tr>
<th>Directive or standard</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATEX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE 0344  II 2 G Ex h db IIB T4 Gb</td>
<td></td>
<td>CE marking of conformity according to the ATEX directive 2014/34/EU, Annex X.</td>
</tr>
<tr>
<td>Ex</td>
<td></td>
<td>Marking of explosion protection.</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td>Equipment group according to the ATEX directive, defining the requirements applicable to the equipment in this group.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Equipment category according to the ATEX directive, defining the requirements applicable to the equipment in this category.</td>
</tr>
<tr>
<td>G</td>
<td></td>
<td>Explosive atmospheres caused by gases, vapours or mists.</td>
</tr>
<tr>
<td>db</td>
<td></td>
<td>Flame-proof enclosure according to EN/IEC 60079-1.</td>
</tr>
<tr>
<td>h</td>
<td></td>
<td>Non-electrical equipment for explosive atmosphere.</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td>Suitable for use in explosive atmospheres (not mines).</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>Classification of gases, see EN/IEC 60079-0, Annex A. Gas group B includes gas group A.</td>
</tr>
<tr>
<td>T4, T3*</td>
<td></td>
<td>T3* = maximum surface temperature of the motor is 200 °C according to EN/IEC 60079-0.</td>
</tr>
<tr>
<td>Gb</td>
<td></td>
<td>Equipment for explosive gas with &quot;high&quot; level of protection.</td>
</tr>
<tr>
<td>IP68</td>
<td></td>
<td>Enclosure class according to EN/IEC 60529.</td>
</tr>
</tbody>
</table>

* = When used with a frequency converter.
2.5.2 Ex certification and classification
Explosion-proof pumps have been approved by FM Approvals in conformity with the essential health and safety requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Council Directive 2014/34/EU (ATEX).

2.5.3 Potentially explosive environments
Use explosion-proof pumps for applications in potentially explosive environments.

The pump must not be used to pump explosive, flammable or combustible liquids.

The classification of the installation site must comply with the local rules.

Special conditions for safe use of explosion-proof pumps:

1. Make sure the moisture switches and thermal switches are connected in two separate circuits and have separate alarm outputs (motor stop) in case of high humidity or high temperature in the motor.
2. Bolts used for replacement must be class A4-80 or A2-80 according to EN/ISO 3506-1.
3. Consult the manufacturer if dimensional information on the flameproof joints is necessary.
4. During operation, the cooling jacket, when fitted, must be filled with cooling liquid.
5. The level of pumped liquid must be controlled by level switches connected to the motor control circuit.
6. Dry running is not allowed.
7. Make sure the cable is mechanically protected, attached to the switchboard and that the cable bonding cannot slip out.
8. The sewage pumps have an ambient temperature range of -20 to +40 °C and a maximum operating temperature of +40 °C.
10. Dry-installed pumps often have a higher temperature in the cable entries than submerged pumps. This may reduce the lifetime of the Ex-protection. According to IEC/EN 60079-14, it is the responsibility of the user, on a regular basis, to inspect the condition of the permanently attached cables and cable entries for any visual damage, cracks or embrittlement caused by rubber aging.

11. The thermal protector in the stator windings must have a rated switch temperature of 150 °C and must guarantee the disconnection of the power supply; resetting must be carried out manually.
12. Electrostatic discharge warning: The cables and the painted parts of the pump should be cleaned with a wet cloth.
13. When the motor is installed with a converter, the installation must be rated for no more than a T3 temperature code. When the motor is installed without a converter, the installation must be rated for no more than a T4 temperature code.
14. This EC type examination certificate is only for II 2G Ex db IIB T4, T3, Gb, Ta = -20 to +40 °C, IP68. It does not cover concept h. Concept h is manufacturer self-declaration. The manufacturer has sent to FM Approvals a copy of his assessment for concept h. This has not been reviewed and is not endorsed by FM Approvals. It is held on file for completeness only.
3. Receiving the product
The pump is supplied from the factory in a proper packaging in which it should remain until installation. Make sure that the pump cannot roll or fall over.

3.1 Transporting the product
All lifting equipment must be rated for the purpose and checked for damage before lifting the pump. The lifting equipment rating must not be exceeded. The pump weight is stated on the nameplate.

CAUTION
Crushing hazard
Minor or moderate personal injury
- Make sure the pump cannot roll or fall over.

WARNING
Tipping hazard
Death or serious personal injury
- Use a service stand to support DN 100 and DN 150 (pressure ranges S and H) in upright position.

WARNING
Crushing hazard
Death or serious personal injury
- Always lift the pump by its lifting bracket or use a fork-lift.

DANGER
Electric shock
Death or serious personal injury
- Never lift the pump from the power cable, hose or pipe.

Leave the cable-end protectors on the power cables until you start making the electrical connection. Whether insulated or not, the free cable end must never be exposed to moisture or water.

3.2 Inspecting the product
During periods of storage protect the pump against moisture and heat.
Transportation and storage temperature: -20 to +60 °C.

If the pump is not in operation or is being stored for more than one month, turn the impeller once a month.

WARNING
Crushing hazard
Death or serious personal injury
- Do not turn the impeller by hand. Always use an appropriate tool.

After a period of storage, inspect the pump before putting it into operation. Make sure that the impeller can rotate freely. Pay attention to the condition of the shaft seals, O-rings and the cable entries.

3.3 Lifting the product

DANGER
Crushing hazard
Death or serious personal injury
- Make sure the lifting bracket or lifting eye bolts are tightened before lifting the pump. Torque: 70 +/-4 Nm

DANGER
Crushing hazard
Death or serious personal injury
- Pumps with installation type S, C and pressure range S, H are delivered with mounted lifting eye and additional shackle which must be used to attach the hook and chain correctly.

When lifting the pump, use the right lifting point to keep the pump balanced for proper installation. The table below shows the correct lifting point.

<table>
<thead>
<tr>
<th>Installation type</th>
<th>Pressure range</th>
<th>Lifting bracket assembly</th>
<th>Lifting point</th>
</tr>
</thead>
<tbody>
<tr>
<td>S, C</td>
<td>S, H</td>
<td>with lifting eye and shackle</td>
<td>Pos. 2, see fig. 3</td>
</tr>
<tr>
<td></td>
<td>M, L, E</td>
<td>no lifting eye</td>
<td>Pos. 1, see fig. 3</td>
</tr>
<tr>
<td>D</td>
<td>S, H, M, L, E</td>
<td>no lifting eye</td>
<td>Pos. 1, see fig. 3</td>
</tr>
<tr>
<td>H</td>
<td>S, H, M, L, E</td>
<td>no lifting eye</td>
<td>See fig. 4</td>
</tr>
</tbody>
</table>
The following installation types must be lifted at the lifting bracket:
• types S with pressure range M, L and E
• types C with pressure range M, L and E
• type D
See fig. 3, pos. 1.
The following installation types must be lifted at the lifting eye with shackle (at the back of the lifting bracket):
• types S with pressure range S and H
• types C with pressure range S and H
See fig. 3, pos. 2.
Installation type H can be lifted by a hole in the flange and the middle lifting point. See fig. 4.

4. Mechanical installation
Fit the extra nameplate supplied with the pump at the installation site.
Observe all safety regulations at the installation site, for instance the use of blowers for fresh-air supply to the pit.

DANGER
Electric shock
Death or serious personal injury
- Before starting any work on the product, make sure that the power supply is switched off and that it cannot be switched on unintentionally.

DANGER
Crushing hazard
Death or serious personal injury
- During installation, always support the pump by lifting chains or place it in horizontal position to secure stability.

CAUTION
Crushing hazard
Minor or moderate personal injury
- Do not put your hands or any tool into the pump inlet or outlet after the pump has been connected to the power supply, unless the main switch has been locked in the 0-position.
- Make sure that the power supply cannot be switched on unintentionally.

The free end of the cable must not be submerged as water may penetrate through the cable into the motor.

Make sure that the pipes are installed without the use of undue force. No loads from the weight of the pipes must be carried by the pump. Use loose flanges to ease the installation and to avoid pipe tension at the flanges.
4.1 Foundation

Pump foundations for pumps above 15 kW

All rotating equipment generates vibrations when an impeller or rotor is turning at high speeds. Proper installation and anchorage of the pumps and installation accessories are critical to limit vibrations and achieve reliable installation:

- The foundation and concrete must be of adequate strength to support the weight of the pump including accessories, the weight of the liquid passing through the pump, and the forces generated by the pump.
- The mass of the concrete foundation must be a minimum of 3-5 times the mass of the supported equipment and must have sufficient rigidity to withstand the axial, transverse, and torsional loadings generated by the pump.
- The foundation must be 15 cm wider than the base plate for pumps up to 350 kW and 25 cm wider for larger pumps.
- The concrete used in the foundation must have a minimum tensile strength of 250 N/cm².
- Always use epoxy grout to fasten the pump base plate to the foundation.

![Image of foundation and concrete]

Pumps with DN 250 or DN 300 flanges must be installed on a concrete foundation. See fig. 5.

Fig. 5  Dry, vertical installation on vertical base stand (left) and on concrete foundation (right)

4.2 Mounting the product

<table>
<thead>
<tr>
<th>Installation type</th>
<th>Description</th>
<th>Installation and accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Sewage pump without cooling jacket for vertical, submerged installation</td>
<td>Permanent installation on auto coupling</td>
</tr>
<tr>
<td>C</td>
<td>Sewage pump with cooling jacket for vertical, submerged installation</td>
<td>Permanent installation on auto coupling</td>
</tr>
<tr>
<td>D</td>
<td>Sewage pump with cooling jacket for vertical, dry installation</td>
<td>Permanent installation on base stand</td>
</tr>
<tr>
<td>H</td>
<td>Sewage pump with cooling jacket for horizontal, dry installation</td>
<td>Permanent installation on base stand for horizontal installation</td>
</tr>
</tbody>
</table>
4.3 Permanent, vertical submerged installation on auto coupling

Pumps for permanent, vertical installation in a pit can be installed on a stationary auto-coupling unit and operated completely or partially submerged in the pumped liquid.

Make sure that the pipes are installed without the use of undue force. No loads from the weight of the pipes must be carried by the pump. Use loose flanges to ease the installation and to avoid pipe tension at the flanges.

Do not use elastic elements or bellows to connect the pipes.

In some installations, a plinth is required beneath the auto-coupling to ensure correct installation of the pump. Consider this during the design of the installation.

The guide-rails must not have any axial play as this can cause noise during pump operation.

Proceed as follows:

1. Drill mounting holes for the guide-rail bracket on the inside of the pit and fasten the guide-rail bracket provisionally with two screws.
2. Place the auto-coupling base unit on the bottom of the pit. If the bottom of the pit is uneven, the auto-coupling base unit must be supported so that it is level. Use a plumb line to establish the correct positioning. Fasten the auto coupling with expansion bolts.
3. Connect the outlet pipe in accordance with the generally accepted procedures. Avoid exposing the pipe to distortion or tension.
4. Place the guide-rails on the auto-coupling base unit and adjust the length of the rails to the guide-rail bracket at the top of the pit.
5. Unscrew the provisionally fastened guide-rail bracket. Insert the expansion dowels into the holes. Fasten the guide-rail bracket on the inside of the pit. Tighten the bolts in the expansion dowels.

6. Clean out debris from the pit before lowering the pump into the pit.
7. Fit the guide shoe to the pump.
8. Slide the guide shoe along the guide-rails and lower the pump into the pit using the chain secured to the lifting bracket of the pump (fig. 6). When the pump reaches the auto coupling base unit, pull the lifting chain towards the guide-rail several times to shake off any foreign substances (fig. 7). When the chain is unstrained, the pump connects automatically to the auto-coupling unit (fig. 8).
9. Hang up the end of the chain on a suitable hook at the top of the pit. Make sure that the chain is straight but not strained.
10. Adjust the length of the power cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook at the top of the pit. Make sure that the cables are not sharply bent or pinched.
11. Connect the power cable and the control cable, if any.

The free end of the cable must not be submerged as water may penetrate through the cable into the motor.

---

Fig. 6  Lowering the pump along the guide-rails
Fig. 7 Connecting the pump to auto coupling

Fig. 8 Submerged installation on auto coupling

Pull-out strength for anchor bolts

<table>
<thead>
<tr>
<th>Auto-coupling base unit</th>
<th>Bolts [mm]</th>
<th>Pull-out strength for a single bolt [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN 80/100 M16</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>DN 100 M16</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>DN 150 M16</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>DN 200 M24</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>DN 250 M24</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>DN 300 M24</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

The pull-out strengths stated are without safety factor. The required safety factor may depend on the materials and method used for anchoring.
4.4 Permanent, vertical or horizontal, dry installation

In order to facilitate service on the pump, use isolating valves on either side of the pump.

Fig. 9  Dry, horizontal installation on horizontal base stand

Pumps in dry installation are installed permanently in a pump room.
The pump motor is enclosed and watertight.
Proceed as follows:
1. Mark and drill mounting holes in the concrete floor or foundation.
2. Fit the bracket or base stand to the pump.
3. Fasten the pump with expansion bolts.
4. Check that the pump is vertical or horizontal.
5. Fit the inlet and outlet pipes and isolating valves, if used, and ensure that the pump is not stressed by the pipes.
6. Adjust the length of the power cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
7. Connect the power cable and the control cable, if any.
Fasten the pump to the inlet and outlet pipes with flange connections.

![Fig. 9](image)

<table>
<thead>
<tr>
<th>Installation types D and H</th>
<th>Bolts</th>
<th>Pull-out strength for a single bolt [kN]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>5.0</td>
</tr>
</tbody>
</table>

The pull-out strengths stated are without safety factor. The required safety factor may depend on the materials and method used for anchoring.

Use an eccentric reducer between the inlet pipe and the pump in horizontal installations. The reducer must be installed so that the straight part facing upwards. This avoids accumulation of air in the inlet pipe and disturbance of operation.

![Fig. 10](image)

<table>
<thead>
<tr>
<th>Pos</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Eccentric reducer</td>
</tr>
<tr>
<td>2</td>
<td>Minimum level: 0.2 m</td>
</tr>
</tbody>
</table>
4.5 Temporary, vertical, submerged installation in a pit

Use the chain to move the pump.

Proceed as follows:
1. Fit the ring stand to the pump inlet flange.
2. Fit a 90 ° elbow to the pump outlet and connect the outlet pipe or hose. If a hose is used, make sure that the hose does not buckle and the inside diameter matches the outlet diameter.
3. Lower the pump into the liquid by a chain secured to the lifting bracket of the pump. Place the pump on a level, solid foundation.
4. When the pump is placed firmly on the bottom of the pit, attach the end of the chain to a suitable hook at the top of the pit so that the chain cannot come into contact with the pump housing.
5. Adjust the length of the power cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
6. Connect the power cable and the control cable, if any.

4.6 Level of pumped liquid

Do not allow the pump to run dry. Install an additional level switch to ensure that the pump is stopped in case the stop level switch is not working.

The level of pumped liquid must be controlled by level switches connected to the motor control circuit.

Explosion-proof SL pumps (without cooling jacket), installation type S, must always be fully submerged in the pumped liquid to the top of the motor. See fig. 11, level 1.

For explosion-proof SE pumps (with cooling jacket), installation type C, the pump housing must always be fully covered by the pumped liquid. See fig. 11, level 2.

For a short period of time, the pump may be used to pump down the liquid level to remove the float layer. For explosion-proof pumps, do not go below the stop levels shown in fig. 11.

To ensure adequate motor cooling, the following minimum requirements must be met:
- Installation type S: the pump must be fully submerged in the pumped liquid to the top of the motor. See fig. 11, level 1.
- Installation type C: the pump housing must be fully covered by the pumped liquid. See fig. 11, level 2.

---

Fig. 11  Liquid levels

- Installation types D and H

There are no special requirements for the level of pumped liquid.
### 4.7 Torques for inlet and outlet flanges

#### Grade 4.6 (5) galvanised steel bolts and nuts

<table>
<thead>
<tr>
<th>Nominal diameter</th>
<th>Pitch circle diameter [mm]</th>
<th>Bolts [mm]</th>
<th>Torques [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Slightly oiled</td>
</tr>
<tr>
<td><strong>Inlet</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DN 65</td>
<td>145</td>
<td>4 x M16</td>
<td>70</td>
</tr>
<tr>
<td>DN 80</td>
<td>160</td>
<td>8 x M16</td>
<td>70</td>
</tr>
<tr>
<td>DN 100</td>
<td>180</td>
<td>8 x M16</td>
<td>70</td>
</tr>
<tr>
<td>DN 150</td>
<td>240</td>
<td>8 x M20</td>
<td>140</td>
</tr>
<tr>
<td><strong>Outlet</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DN 65</td>
<td>145</td>
<td>4 x M16</td>
<td>70</td>
</tr>
<tr>
<td>DN 80</td>
<td>160</td>
<td>8 x M16</td>
<td>70</td>
</tr>
<tr>
<td>DN 100</td>
<td>180</td>
<td>8 x M16</td>
<td>70</td>
</tr>
<tr>
<td>DN 150</td>
<td>240</td>
<td>8 x M20</td>
<td>120</td>
</tr>
</tbody>
</table>

Specified tightening torques rounded off by ± 5 Nm

#### Grade A2.50 (AISI 304) steel bolts and nuts

<table>
<thead>
<tr>
<th>Nominal diameter</th>
<th>Pitch circle diameter [mm]</th>
<th>Bolts [mm]</th>
<th>Torques [Nm]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Slightly oiled</td>
</tr>
<tr>
<td><strong>Inlet</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DN 65</td>
<td>145</td>
<td>4 x M16</td>
<td>-</td>
</tr>
<tr>
<td>DN 80</td>
<td>160</td>
<td>8 x M16</td>
<td>-</td>
</tr>
<tr>
<td>DN 100</td>
<td>180</td>
<td>8 x M16</td>
<td>-</td>
</tr>
<tr>
<td>DN 150</td>
<td>240</td>
<td>8 x M20</td>
<td>-</td>
</tr>
<tr>
<td><strong>Outlet</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DN 65</td>
<td>145</td>
<td>4 x M16</td>
<td>-</td>
</tr>
<tr>
<td>DN 80</td>
<td>160</td>
<td>8 x M16</td>
<td>-</td>
</tr>
<tr>
<td>DN 100</td>
<td>180</td>
<td>8 x M16</td>
<td>-</td>
</tr>
<tr>
<td>DN 150</td>
<td>240</td>
<td>8 x M20</td>
<td>-</td>
</tr>
</tbody>
</table>

Specified tightening torques rounded off by ± 5 Nm

The gasket must be a full-face, reinforced paper gasket like Klingersil C4300. If you use a softer gasket material, reconsider the torques.
5. Electrical connection

DANGER
Electric shock
Death or serious personal injury
- Before starting any work on the product, make sure that the power supply is switched off and that it cannot be switched on unintentionally.

DANGER
Electric shock
Death or serious personal injury
- The pump must be earthed. Before connecting the pump to the voltage supply, make sure the connection to earth complies with local regulations.

Connect the pump to an external main switch ensuring all-pole disconnection with a contact separation according to EN 60204-1, 5.3.2. It must be possible to lock the main switch in position 0.

The supply voltage and frequency are marked on the nameplate. Make sure that the motor is suitable for the power supply at the installation site.

The electrical connection must comply with local regulations.

Connect the pump to a controller with a motor protection relay with IEC trip class 10 or 15 or NEMA equivalent.

If the power cable is damaged, it must be replaced by the manufacturer, or his service agent.

Connect the pump to a motor-protective circuit breaker.

Set the motor-protective circuit breaker to the rated current of the pump +15% service factor. The rated current is stated on the nameplate.
The supply voltage and frequency are marked on the nameplate.
The voltage tolerance at the motor terminals must be within ± 10 % of the rated voltage.
The motor is effectively earthed with the power cable and pipes. The motor top cover is equipped with connections for external earthing or an equipotential bonding conductor.

Maintenance and service work on explosion-proof pumps must be carried out by Grundfos or a Grundfos- authorised service workshop.

Before installation and the first startup of the pump, check the condition of the cable to avoid short circuits.

The most commonly used startup methods are the followings:
• Direct-on-line starting (DOL). See appendix, fig. 2.
• Star-delta starting (Y/D). See appendix, fig. 1.
• Soft start.
The selection of suitable starting method depends on several considerations on usage and mains supply conditions.

When using star-delta starting, it is important to keep switching transient time to a minimum to avoid high transient torques. Use a time relay with a switching time of maximum 50 ms or according to the manufacturer's specifications.

The pump can be operated with a frequency converter according to the frequency converter manufacturer’s specifications.

5.1 Frequency converter operation

If the motor is operated by a frequency converter, the temperature class of explosion-proof pumps must be T3.

In principle, all three-phase motors can be connected 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 due to eddy currents caused by voltage peaks.

In addition, large motors driven with a frequency converter are loaded by bearing currents.

For frequency converter operation, observe the following:
• The thermal protection of the motor must be connected.
• Peak voltage and dU/dt must be in accordance with the table below. The values stated are maximum values supplied to the motor terminals. The cable influence is not taken into account. See the frequency converter data sheet regarding the actual values and the cable influence on the peak voltage and dU/dt.
• The minimum switching frequency is 2 KHz. The switching frequency can be variable.
• If the pump is an Ex-approved pump, check if the Ex certificate of the specific pump allows the use of a frequency converter.
• Set the frequency converter U/f ratio according to the motor data.
• Local regulations or standards must be complied with.

Before installing a frequency converter, calculate the lowest permissible frequency in the installation to avoid zero flow.
• Do not reduce the motor speed to less than 50 %.
• Keep the flow rate above 1 m/sec.
• Let the pump run at rated speed at least once a day to prevent sedimentation in the piping system.
• Do not exceed the frequency indicated on the nameplate as this may cause motor overload.
• Keep the power cable as short as possible. The peak voltage increases with the length of the power cable.
• Use input and output filters on the frequency converter.
• Use a screened power cable if there is a risk that electrical noise may disturb other electrical equipment.
When operating the pump by a frequency converter, consider the following:
- The locked-rotor torque can be lower depending on the type of the frequency converter.
- The noise level may increase. See the installation and operating instructions for the frequency converter of choice.

For more information about the frequency converter operation, see the data sheet and the installation and operating instructions for the frequency converter of choice.

### 5.2 Cable data
#### Standard H07RN-F

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Outer cable diameter [mm²]</th>
<th>Minimum bending radius [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 x 4 + 5 x 1.5</td>
<td>21.2</td>
<td>70</td>
</tr>
<tr>
<td>7 x 6 + 5 x 1.5</td>
<td>24.5</td>
<td>80</td>
</tr>
<tr>
<td>7 x 10 + 5 x 1.5</td>
<td>25.2</td>
<td>110</td>
</tr>
</tbody>
</table>

For more information about the frequency converter operation, see the data sheet and the installation and operating instructions for the frequency converter of choice.

#### Electromagnetic Compatibility (EMC)

<table>
<thead>
<tr>
<th>Cable type</th>
<th>Outer cable diameter [mm²]</th>
<th>Minimum bending radius [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 x 6 + 4 x 2.5 + 5 x 0.5</td>
<td>26.3</td>
<td>90</td>
</tr>
<tr>
<td>3 x 10 + 4 x 2.5 + 5 x 0.5</td>
<td>26.3</td>
<td>120</td>
</tr>
<tr>
<td>3 x 16 + 4 x 4 + 5 x 0.5</td>
<td>26.3</td>
<td>140</td>
</tr>
</tbody>
</table>

Frequency converter use may reduce the life span of the bearings and the shaft seal, depending on operating mode and other circumstances.

Before installation and the first startup of the pump, check the condition of the cable to avoid short circuits.

### 5.3 Sensors

The SE, SL pumps, 9-30 kW, can be equipped with a variety of switches and sensors for protection. The specification table below shows which switch and sensor types can be used. The wiring diagrams of the various types of switch and sensor appear from section Sensor wiring in the Appendix.

#### Switch and sensor specification

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Sensor version 1</th>
<th>Sensor version 2</th>
<th>Sensor version 1 Ex</th>
<th>Sensor version 2 Ex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal switches or PTC</td>
<td>● ● ● ● ● ●</td>
<td>Moisture switch</td>
<td>● ● ● ● ● ●</td>
<td>Leakage switch in leakage chamber for standard motors</td>
</tr>
<tr>
<td>Pt1000 in stator winding</td>
<td>● ● ● ●</td>
<td>Pt1000 in upper bearing</td>
<td>● ●</td>
<td>Pt1000 in lower bearing</td>
</tr>
<tr>
<td>Pt1000 in lower bearing</td>
<td>● ●</td>
<td>PVS3 vibration sensor</td>
<td>● ●</td>
<td>SM 113 module *</td>
</tr>
<tr>
<td>IO 113 module **</td>
<td>●**</td>
<td>IO 113 module **</td>
<td>●**</td>
<td></td>
</tr>
</tbody>
</table>

* For pumps fitted with two power supply cables, the SM 113 module must be ordered separately and installed in the control cabinet.

** The IO 113 with communication functionality has to be chosen and ordered separately.
5.3.1 Thermal switches

Three bimetallic thermal switches are built into the stator windings. A contact opens in case of overtemperature, i.e. 150 °C. However, the motor insulation class is class H (180 °C).

The supply voltage to the thermal switches must be 12-24 V DC.

The thermal switches are connected to the control cable and must be connected to the safety circuit of the separate pump controller.

The motor-protective circuit breaker of the pump controller must include a circuit which automatically disconnects the power supply in case the protective circuit is opened.

In case the thermal switches or the moisture switches are not working install an automatic circuit breaker.

5.3.2 Moisture switches and leakage switches

Non-Ex version:

One moisture switch and one leakage switch is mounted in a non-Ex pump. The moisture switch is placed in the top cover and the leakage switch is placed in the chamber above the shaft seal. See appendix, fig. 10, section C-C and E-E.

Ex version:

One moisture switch and one leakage switch is mounted in an Ex pump. The moisture switch is placed in the top cover and the leakage switch is placed in the stator housing. See appendix, fig. 10, section C-C and D-D.

All switches in both non-Ex and Ex versions are hardwired from the pump to IO 113. If moisture or a leakage is detected, they break an electric circuit. This generates both a hardware and a software alarm in IO 113, and the alarm relay opens.

Moisture and leakage switches are motor protection devices, which protect the motor from damage due to moisture or water ingress. If switches are non-reversing type and they must be replaced after they have been released.

The moisture and leakage switches are connected in a separate circuit and to the control cable. See appendix. They are also to be connected to the safety circuit of the separate pump controller.

5.3.3 Thermistors

Thermistors are available as an accessory or as a Factory Product Variant (FPV) option.

The thermistors can be used as motor protection devices to monitor stator temperature instead of thermal switches and must be connected to the thermistor relay in the control cabinet.

The operating voltage of PTC thermistors is 2.5 - 7.5 V.

Checks after electrical connection

1. By using a multimeter, check whether the circuit resistance is < 150 Ω per thermistor.
2. By using a multimeter, check whether the insulation between circuit and stator housing is outside the scale.
3. Carry out similar measurements at the end of the power cable.

Pt1000 temperature sensor

The Pt1000 temperature sensor is available as an accessory or as an FPV option.

The Pt1000 sensor is primarily used for the monitoring of bearing temperature, but it can also be used in the stator.

In case of overheating caused by wear, lack of lubricant, etc., the Pt1000 sensor trips an alarm and disconnect the power supply at a preset temperature.

The bearing temperature monitoring system is only available as an option.

The sensor resistance values are the following:

- 1000 Ω at 0 °C
- 1385 Ω at 100 °C
- approximately 1078 Ω at room temperature.

The temperature limits are the following:

- 90 °C: warning for bearing temperature
- 130 °C: pump stop caused by high bearing temperature
- 150 °C: pump stop caused by high stator temperature.

In Ex-approved pumps, the maximum acceptable alarm temperature in the bearing sensors is 100 °C for the lower bearing (shaft end) and 120 °C for the upper bearing.
Checks after electrical connection
1. Using a multimeter, check whether the resistance at room temperature (20 °C) is approx. 1078 Ω.
2. Using a multimeter, check whether the insulation between circuit and stator housing is outside the scale.
3. Carry out similar measurements at the end of the power cable.
   During pump check, the Pt1000 sensor must be connected to a recording device.

5.3.4 Pump vibration sensor (PVS 3)
The PVS 3 sensor monitors the vibration level of the pump in order to protect the pump and the pipe system against damage.
A change in the vibration level is an indication of an abnormal situation. The reason for this can be a clogged impeller, worn bearings, a closed outlet valve, etc., indicating that a service inspection must be carried out before the pump or the pipe system is damaged.

SE, SL pumps, 9-30 kW, are fitted with impellers of the S-tube® design. S-tube® impellers are wet-balanced which will reduce the vibrations during operation. If these pumps are started with the pump housing full of air, the vibration level will be higher than for normal operation.

SM 113
The SM 113 module is used for collecting and transferring sensor data. SM 113 works together with IO 113 through power line communication using the Grundfos GENIbus protocol.
SM 113 collects data from the following devices:
- 3 current sensors, 4-20 mA
- 3 Pt1000 thermal sensors
- 1 PTC thermal sensor
- 1 digital input.

IO 113
The IO 113 module forms the interface between a Grundfos sewage and wastewater pump with analogue and digital sensors and the pump controller. The most important sensor data are indicated on the front panel.
One pump can be connected to IO 113.
Together with the sensors, IO 113 forms a galvanic separation between the motor voltage in the pump and the controller connected.
IO 113 enables the following functions:
- protecting the pump against overtemperature
- monitoring the sensors for analogue measurement of:
  - motor temperature
  - pump vibrations
  - stator insulation resistance
  - bearing temperature
  - moisture in motor
- stopping the pump in case of alarm
- remotely monitoring the pump via RS485 communication (Modbus or GENIbus).

Measurement of insulation resistance
IO 113 measures the insulation resistance between a stator winding and earth:
- resistance above 10 MΩ = OK
- resistance between 10 MΩ and 1 MΩ = warning
- resistance below 1 MΩ = alarm.
6. Starting up the product

**DANGER**

**Electric shock**

Death or serious personal injury
- Make sure the pump is earthed.

Before the first startup and after a long standstill period, make sure that the pump is filled with pumped liquid.

Make sure that the pump is filled with pumped liquid.

Pumps in dry installation must be vented by the vent hole in the pump housing. Dry-running is not allowed.

Stop the pump immediately in the following cases:
- abnormal noise
- abnormal vibrations
- clogged impeller
- worn bearings
- closed outlet valve

Do not attempt to restart the pump until the cause of the fault has been found and the fault corrected.

Proceed as follows:
1. Remove the fuses or switch off the main switch.
2. Check the motor liquid level in the cooling chamber. See section **8.1.1 Checking the motor liquid**.
3. Check if the impeller can rotate freely.
4. Check whether the monitoring units, if used, are operating appropriately.
5. For pumps in a submerged installation, make sure that the pump is submerged in the liquid.
6. For pumps in dry installation, make sure that there is liquid in the pit from which the supply of pumped liquid comes.
7. Open the isolating valves, if fitted.
8. Check if the system is filled with liquid and vented.
9. Check the settings of the level switches.
10. Start the pump and check the pump operation for abnormal noise or vibrations.
11. After startup, the actual pump duty point must be established as accurately as possible so that it can be checked if the operating conditions are met.

**WARNING**

Crushing hazard

Death or serious personal injury
- Do not turn the impeller by hand.
- Always use an appropriate tool.

**Always operate the pump in accordance with established routines and scheduled checks of pump monitoring equipment and accessories. Make sure that the pump and equipment settings cannot be changed by unauthorised persons.**

7. Storing the product

For periods of storage the pump must be protected against moisture and heat.

After a period of storage, inspect the pump before putting it into operation. Make sure that the impeller can rotate freely. Pay attention to the condition of the shaft seals, O-rings and the cable entries.

Leave the cable-end protectors on the power and control cables until starting the electrical connection. Whether insulated or not, the free cable end must never be exposed to moisture or water. Non-compliance with this may cause damage to the motor.

If the pump is being stored for more than one month, turn the impeller at least every month to prevent the seal faces of the lower mechanical shaft seal from seizing up.

If you do not do this, the shaft seal may be damaged when the pump is started.

If the impeller cannot be turned, contact an authorised service workshop.

The pump may only be started for a very short period without being submerged for checking the direction of rotation.
8. Servicing and maintaining the product

Pumps with inlet flange DN 100 or DN 150 (pressure ranges S and H) in upright position do not comply with the stability requirement of standard EN 809 (stable when tilted to an angle of 10°). Use a service stand to support the pump.

**Product numbers for service stand**

Inlet flange size DN 100: 98669229.
Inlet flange size DN 150: 98669251.

**WARNING**

**Pump can tilt**

Death or serious personal injury
- During maintenance and service, including transportation to service workshop, always support the pump using lifting chains or place it in horizontal position to secure stability.

**DANGER**

**Electric shock**

Death or serious personal injury
- Before starting any work on the product, make sure that the power supply is switched off and that it cannot be switched on unintentionally.

- **Cable entries**
  Make sure that the cable entries are waterproof and that the cables are not sharply bent or pinched. See section 5.2 Cable data.

- **Impeller clearance**
  Check the impeller clearance. See section 8.2.1 Adjusting the impeller clearance.

- **Pump parts**
  Check the pump housing and other parts for possible wear. Replace defective parts.

- **Ball bearings**
  Check the shaft for noisy or heavy operation (turn the shaft by hand). Replace defective ball bearings. A general overhaul of the pump is usually required in case of defective ball bearings or poor motor function. This work must be carried out by an authorised service workshop.

Replace the ball bearings at least every 25,000 operating hours.

**Dispose of the motor liquid must comply with local regulations.**

<table>
<thead>
<tr>
<th>Number of poles</th>
<th>Quantity of motor liquid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SE [ltr]</td>
</tr>
<tr>
<td>2</td>
<td>12.8</td>
</tr>
<tr>
<td>4</td>
<td>12.8</td>
</tr>
<tr>
<td>6</td>
<td>14.1</td>
</tr>
</tbody>
</table>

- Frequency converter use may reduce the life span of the bearings and the shaft seal, depending on operating mode and other circumstances.
8.1 Checking and changing the motor liquid

Clean the outside of the pump at regular intervals to retain the heat conductivity.

Change the motor liquid once a year or after 2000 operating hours to prevent oxidation.

Lack of motor liquid may cause overheating and damage of the mechanical seals.

Use cooling liquid SML3 for motor cooling. Cooling liquids with lower specific heat capacity than SML3 may cause overheating of the motor.

8.1.1 Checking the motor liquid

It is possible to check the ingress level of pumped liquid into the motor liquid. Use a refractometer (product no. 98676968) which will show the refractive index in percent of ingress, see the table below.

<table>
<thead>
<tr>
<th>Liquid ingress refractive index (%)</th>
<th>Measurement temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-22 °F (-30 °C)</td>
</tr>
<tr>
<td>5</td>
<td>-17 °F (-27 °C)</td>
</tr>
<tr>
<td>10</td>
<td>-13 °F (-25 °C)</td>
</tr>
<tr>
<td>15</td>
<td>-10 °F (-23 °C)</td>
</tr>
<tr>
<td>20</td>
<td>-8 °F (-22 °C)</td>
</tr>
</tbody>
</table>

If the refractive index is higher than 20 %, change the motor liquid.

Do not exceed this level of refractive index to ensure the shaft seal and the bearings are in the best possible condition for reliable operation. For further information, see service instruction for SE, SL pumps.

For draining and changing the motor liquid refer to the SE/SL 9-30 kW Service instructions

http://net.grundfos.com/qr/i/98248406

Drain the leakage chamber of the pump after 2000 operating hours.

---

**WARNING**

Pressurized system

Death or serious personal injury

- The oil chamber may be under pressure. Loosen the screws carefully and do not remove them until the pressure has been fully relieved.

There must be minimum 10 % air in the seal housing due to thermal expansion of the motor liquid during operation.

---

**8.2 Inspecting and adjusting the impeller clearance**

Check the impeller clearance every time service is carried out to prevent hot surfaces in the hydraulic parts.

**Impeller clearance for closed S-tube®**

<table>
<thead>
<tr>
<th>Pressure range</th>
<th>Impeller clearance X [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>E = Extra-low pressure one-channel S-tube®</td>
<td>0.9 ± 0.1</td>
</tr>
<tr>
<td>E = Extra-low pressure two-channel S-tube®</td>
<td>0.7 ± 0.1</td>
</tr>
<tr>
<td>L = Low-pressure one-channel S-tube®</td>
<td>0.9 ± 0.1</td>
</tr>
<tr>
<td>L = Low-pressure two-channel S-tube®</td>
<td>0.7 ± 0.1</td>
</tr>
<tr>
<td>M = Medium pressure</td>
<td>0.6 ± 0.1</td>
</tr>
<tr>
<td>H = High pressure</td>
<td>0.6 ± 0.1</td>
</tr>
<tr>
<td>S = Super-high pressure</td>
<td>0.5 ± 0.1</td>
</tr>
</tbody>
</table>

---

**DANGER**

Electric shock

Death or serious personal injury

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

The impeller clearance of installation types S and C can be inspected directly through the pump inlet.

Installation types D and H can be inspected and adjusted with the pump installed on the base stand and connected to the pipes.
8.2.1 Adjusting the impeller clearance

1. Loosen each screw by two full turns.
2. Close the impeller clearance by gently tightening the fastening screws diagonally until the impeller touches the pump housing.
3. Loosen the fastening screws to make the correct gap under the heads of the fastening screws. See fig. 12, and use the clearance stated in the impeller clearance table above.
4. Tighten the set screws: See the service instruction for torques.
5. Tighten the fastening screws diagonally.

Fig. 12 Impeller clearance adjustment

8.3 Maintaining explosion-proof SE, SL pumps

Overhauled and repaired explosion-proof pumps are marked with a repair plate giving the following information:
- the repair symbol R
- name or registered trademark of the repairing workshop
- workshop reference number relating to the repair
- date of overhaul or repair.
In the event of subsequent repairs, the existing plate must be replaced by a new updated plate and earlier markings must be recorded.
The repairing workshop must keep records of performed overhauls and repairs together with records of all previous overhauls, repairs and possible modifications. Copies of the repairing workshop’s detailed records must be filed by the owner or operator together with the original type certificate of the explosion-proof motor.

8.3.1 Power cable

Use only cables which are approved by the manufacturer and suitable for the cable entry as to diameter, number of conductors, conductor cross section and sheath material.

8.3.2 Cable entry

Use only Ex cable entry parts corresponding to the cable diameter. The corresponding cable dimension marking is stamped on the inlet or the cable entry.

8.3.3 Spare parts

Damaged motor parts, such as top cover and cable entry, must always be replaced by new and approved parts. Motor parts must not be reconditioned by machining, re-tapping, welding, etc.

8.4 Returning the product for service

The product will be classified as contaminated if it is used for a liquid which is contagious or toxic.

CAUTION

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

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

Any application for service must include details about the pumped liquid.

Clean the product in the best possible way before you return it.
9. Fault finding

DANGER
Electric shock
Death or serious personal injury
- Before starting any work on the product, make sure that the power supply is switched off and that it cannot be switched on unintentionally.

DANGER
Electric shock
Death or serious personal injury
- The pump must be earthed.

Before attempting diagnosing any fault, make sure that all rotating parts have stopped moving.

Observe all regulations applying to pumps installed in potentially explosive environments.

Make sure that no work is carried out in potentially explosive atmosphere.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The pump does not start or stops without visible cause.</td>
<td>a) No power supply.</td>
<td>Reestablish the power supply. Start the pump manually.</td>
</tr>
<tr>
<td>2. The pump does not start or stops. The control panel indicates that the motor-protective circuit breaker or protection equipment is tripped.</td>
<td>a) Missing phase.</td>
<td>Reestablish all phases.</td>
</tr>
<tr>
<td></td>
<td>b) The pump is momentarily overloaded.</td>
<td>If the fault does not disappear automatically, find the cause and remedy the fault.</td>
</tr>
<tr>
<td></td>
<td>c) The impeller is clogged by impurities.</td>
<td>Clean the impeller as required.</td>
</tr>
<tr>
<td></td>
<td>d) The motor-protective circuit breaker is not set correctly.</td>
<td>Set the motor-protective circuit breaker as required according to the rated current.</td>
</tr>
<tr>
<td></td>
<td>e) The thermal switches are tripped. Insufficient motor cooling.</td>
<td>Reestablish the motor cooling.</td>
</tr>
<tr>
<td></td>
<td>f) The moisture switch in the motor is tripped.</td>
<td>Contact an authorised service workshop.</td>
</tr>
<tr>
<td></td>
<td>g) The power cable is defective.</td>
<td>Contact an authorised service workshop.</td>
</tr>
<tr>
<td></td>
<td>h) The voltage is fluctuating.</td>
<td>Reestablish correct voltage supply. Permissible deviation is ± 10%.</td>
</tr>
<tr>
<td>Fault</td>
<td>Cause</td>
<td>Remedy</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>3. The pump runs, but does not deliver the rated flow.</td>
<td>a) The direction of rotation is wrong.</td>
<td>Alter two phases to the motor.</td>
</tr>
<tr>
<td></td>
<td>b) The impeller is loose or worn.</td>
<td>Tighten or replace the impeller.</td>
</tr>
<tr>
<td></td>
<td>c) The pump or the pipes are blocked by impurities.</td>
<td>Clean the pump or the pipes as required.</td>
</tr>
<tr>
<td></td>
<td>d) The pump head is too high.</td>
<td>Measure the differential pressure and compare the value with the pump curve. Check that all valves are open or remove any blockage in the outlet pipe.</td>
</tr>
<tr>
<td></td>
<td>e) The valves are closed or blocked. The non-return valve is not operating.</td>
<td>Clean or replace the valves as required.</td>
</tr>
<tr>
<td></td>
<td>f) There is air in the pump or the inlet pipe.</td>
<td>Vent the pump and the inlet pipe. Increase the stop level in the pit.</td>
</tr>
<tr>
<td></td>
<td>g) The pumped liquid is too dense.</td>
<td>Dilute the pumped liquid.</td>
</tr>
<tr>
<td></td>
<td>h) The pump is not properly connected to the auto coupling.</td>
<td>Pump down the liquid level in the pit. Lift out the pump and relocate the pump on the auto coupling.</td>
</tr>
<tr>
<td></td>
<td>i) There is leakage in the pipes.</td>
<td>Repair the pipes.</td>
</tr>
<tr>
<td></td>
<td>j) The pit flushing system is inadvertently activated.</td>
<td>Check the function of the pit flushing system and repair as required.</td>
</tr>
<tr>
<td>4. The pump starts, but stops immediately.</td>
<td>a) The pump is clogged which causes the motor-protective circuit breaker to trip.</td>
<td>Clean the pump.</td>
</tr>
<tr>
<td></td>
<td>b) The motor is overheated which causes the thermal switches to trip.</td>
<td>Allow the pump to cool. Clean the pump.</td>
</tr>
<tr>
<td></td>
<td>c) The level switch is out of adjustment or defective.</td>
<td>Clean or set the level switch or replace them as required.</td>
</tr>
<tr>
<td>5. The pump is vibrating or emitting excessive noise.</td>
<td>a) The pump is partly clogged by impurities.</td>
<td>Clean the pump.</td>
</tr>
<tr>
<td></td>
<td>b) The direction of rotation is wrong.</td>
<td>Interchange two phases to the motor.</td>
</tr>
<tr>
<td></td>
<td>c) The pump is operating outside the specified operating range.</td>
<td>Reestablish proper operating conditions.</td>
</tr>
<tr>
<td></td>
<td>d) The pump is defective.</td>
<td>Repair the pump or contact an authorised workshop, if necessary.</td>
</tr>
<tr>
<td></td>
<td>e) The pump is not properly connected to the auto coupling.</td>
<td>Pump down the liquid level in the pit. Lift out the pump and place the pump on the auto coupling.</td>
</tr>
<tr>
<td></td>
<td>f) The pump is cavitating.</td>
<td>Clean the inlet pipe.</td>
</tr>
<tr>
<td></td>
<td>g) The impeller is not in balance.</td>
<td>Contact an authorised service workshop.</td>
</tr>
<tr>
<td></td>
<td>h) The base stand, the auto coupling, the ring stand or the guide-rails are not installed correctly.</td>
<td>Install the components correctly.</td>
</tr>
<tr>
<td>6. Low motor liquid level.</td>
<td>a) The upper mechanical shaft seal is leaking.</td>
<td>Contact an authorised service workshop.</td>
</tr>
</tbody>
</table>
10. Technical data

**pH value**
Pumps in permanent installations can cope with the following pH values:

<table>
<thead>
<tr>
<th>Material variant</th>
<th>Installation</th>
<th>pH value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard¹)</td>
<td>Dry and submerged</td>
<td>6-14³)</td>
</tr>
<tr>
<td>Q²)</td>
<td>Dry and submerged</td>
<td>6-14³)</td>
</tr>
</tbody>
</table>

¹) Cast iron impeller, pump housing and motor top.
²) Stainless-steel impeller. Cast iron pump housing and motor top.
³) For fluctuating pH values, the range is pH 4 to 14.

**Flow rate**
Keep a minimum flow rate to avoid sedimentation in the piping system. Recommended flow rates:
- in vertical pipes: 0.7 m/s.
- in horizontal pipes: 1.0 m/s.

**Ambient temperature**
For explosion-proof pumps, the ambient temperature on the installation site must be in the range from -20 to +40 °C.
For non-explosion proof pumps, the ambient temperature may exceed +40 °C for a short period (maximum 3 minutes).

**Liquid temperature**
0 to +40 °C.
For non-explosion proof pumps, the liquid temperature may be up to 60 °C for a short period (maximum 3 minutes).

Explosion-proof pumps must never pump liquids of a temperature higher than +40 °C.

**Operating mode**
The pumps are designed for continuous operation.

**Frequency of starts and stops**
Maximum number of starts per hour is 20.

**Installation depth**
Maximum 20 m below liquid level.

**Solids size**
From 35 to 125 mm, depending on the pump size.

**Enclosure class**
IP68.

**Sound Pressure**
Use hearing protection when working nearby an installation in operation with a sound pressure level above 70 dB(A).

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**Motor liquid**
The motor is factory-filled with Grundfos motor liquid SML3 which is frost-proof down to -20 °C. The motor liquid helps to transfer the heat generated by the motor to the cooling chamber and to the pumped liquid to pass on the outside of the pump.

**Electrical data**
The supply voltage and frequency are marked on the nameplate.
The voltage tolerance at the motor terminals must be within -10 %/+10 % of the rated voltage.

**11. 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.
Wiring diagrams

Single cable, star-delta connection

Fig. 1 12-wire, star-delta connections (Y/D):
D: connections for 3 x 460 V (1G), 3 x 208 V (0S) or 3 x 230 V (1R)
Y: connections for 3 x 460 V (1R)
EMC single cable or double cable

Main supply voltage must be stated since the pump will be connected according to this from factory.

Fig. 2 8-wire, EMC cable
Fig. 3  18-wire / ECM double cable
Sensor wiring

Sensor wiring schematics for single cable pumps

Standard, single cable

![Image of Standard and Standard Ex, single cable](image1)

**Fig. 4** Standard and Standard Ex, single cable

Sensor version 1, single cable

![Image of Sensor version 1 and Sensor version 1 Ex, single cable](image2)

**Fig. 5** Sensor version 1 and Sensor version 1 Ex, single cable

Sensor version 2, single cable

![Image of Sensor version 2 Sensor version 2 Ex, single cable](image3)

**Fig. 6** Sensor version 2 Sensor version 2 Ex, single cable
Sensor wiring schematics for double cable pumps

Standard, double cable

**Fig. 7** Standard and Standard Ex, double cable

Sensor 1, double cable

**Fig. 8** Sensor 1 and Sensor 1 Ex, double cable
Sensor 2, double cable

Fig. 9  Sensor 2 and Sensor 2 Ex, double cable
Fig. 10  Sensor positions

<table>
<thead>
<tr>
<th>Pos.</th>
<th>View</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C-C</td>
<td>Moisture switch</td>
</tr>
<tr>
<td>2</td>
<td>D-D</td>
<td>Leakage switch in stator housing, for Ex motors</td>
</tr>
<tr>
<td>3</td>
<td>E-E</td>
<td>Leakage switch in leakage chamber for standard motors</td>
</tr>
<tr>
<td>Firma</td>
<td>Adres</td>
<td>Telefon</td>
</tr>
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<td>-------------------</td>
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<td>MAKSOM OTOMASYON SAMSUN</td>
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<td>BARIŞ BOBİNAJ K.K.T.C.</td>
<td>LARNACA YOLU ÜZERİ,PAPATYA APT.NO:3-4 GAZIMAGUSA</td>
<td>0542 884 06 62</td>
</tr>
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