

# SE and SL pumps, range 56

25-63 kW, 50/60 Hz

Installation and operating instructions



**QR92777903**

**Installation and operating instructions**

(all available languages)

<http://net.grundfos.com/qr/i/92777903>



# SE and SL pumps, range 56

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## English (GB)

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## English (GB) Installation and operating instructions

### 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.

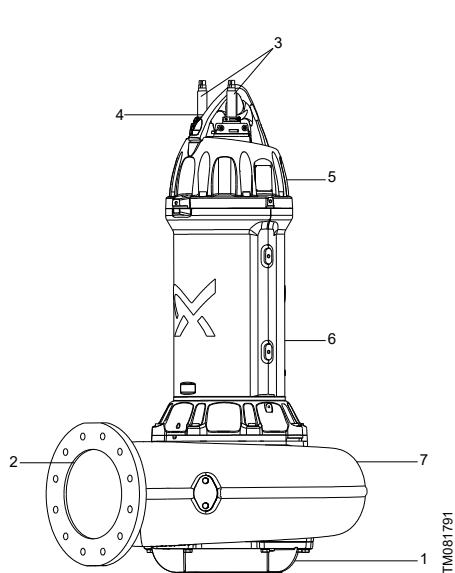
### 1.3 Target group

These installation and operating instructions are intended for professional installers.

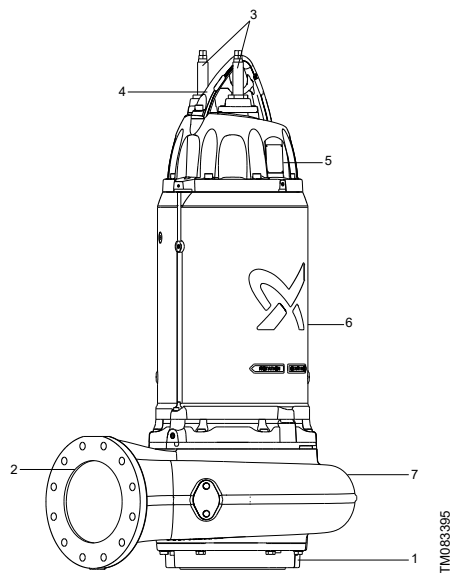
## 2. Product introduction

### 2.1 Product description

The 25-63 kW SE and SL pumps are a range of Open S-tube® impeller pumps specifically designed for pumping sewage and wastewater in a wide range of municipal and industrial applications.



SL 25-63 kW pump



SE 25-63 kW pump

Pos.	Description
1	Inlet
2	Outlet
3	Power and control cable
4	Lifting bracket
5	Terminal box
6	Submersible motor
7	Pump

### 2.2 Pumped liquids

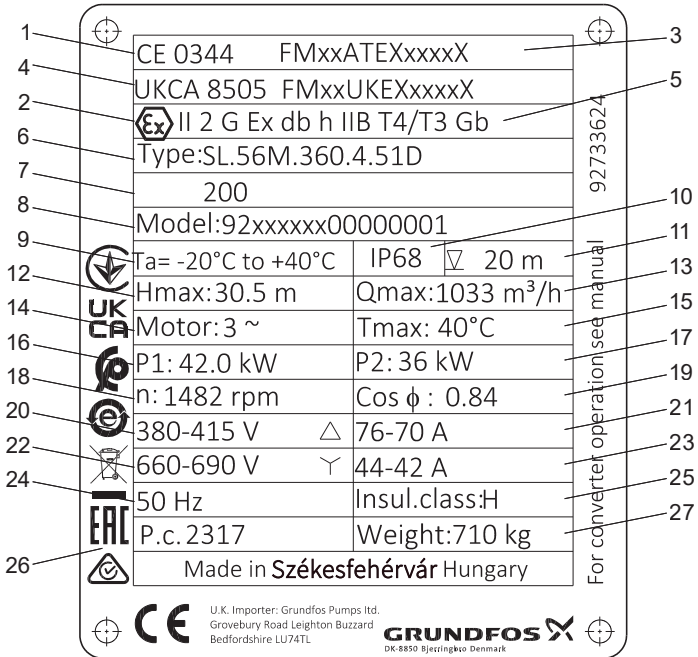
The pumps are designed for:

- raw sewage with short and long fibres and particles in municipal and industrial wastewater systems
- surface water
- industrial wastewater with fibrous material
- domestic wastewater with toilet waste

- unscreened sewage in municipal pumping stations or inlet pumping stations in wastewater treatment plants
- raw water.

### 3. Identification

#### 3.1 Nameplate



TM062259

Pos.	Description
1	EU Notified Body approving the Ex manufacturer
2	Marking of explosion protection
3	EU Explosion protection certificate No
4	UK Approved Body approving the Ex manufacturer and UK Explosion protection certificate No
5	Ex description
6	Pump type designation
7	Pump type designation (line 2)
8	Model number
9	Ambient temperature
10	Enclosure class
11	Maximum installation depth
12	Maximum head
13	Maximum flow rate



Pos.	Description
14	Number of phases
15	Maximum liquid temperature
16	Rated power input P1
17	Rated power output P2
18	Rated speed
19	Cos $\phi$ , 1/1-load
20	Rated voltage, delta connection
21	Rated current, delta connection
22	Rated voltage, star connection
23	Rated current, star connection
24	Frequency
25	Insulation class
26	Production code (YYWW)
27	Weight

### 3.2 Type key

Example: **SL.56M.210.4.51D.200**

Code	Explanation	Designation
<b>SL</b>	Sewage pump without cooling jacket	Pump type
SE	Sewage pump with cooling jacket	
<b>56</b>	Frame 56	Frame size
<b>M</b>	Medium pressure	Pressure range
L	Low pressure	
H	High pressure	
<b>210</b>	Power P2 $\times$ 10 [21 kW]	Power [kW]
<b>4</b>	4-pole motor	Number of poles
6	6-pole motor	
50D	3 $\times$ 380-415D, (DOL, EMC) 50 Hz	Voltage code for 50 Hz
<b>51D</b>	3 $\times$ 380-415D, 660-690Y (Standard) 50 Hz	
60G	3 $\times$ 380-480D (DOL, EMC) 60 Hz	Voltage code for 60 Hz
61G	3 $\times$ 380-480D, 660-690Y (Standard) 60 Hz	
100		Pump outlet [mm]
150		
<b>200</b>	Pump outlet nominal diameter (DN200 = 200)	
250		

Code	Explanation	Designation
300		
- (blank)	Standard sensor version	
1	Sensor version V1	Sensor versions
2	Sensor version V2	
Z	Custom-built products	Customisation

### 3.3 Approvals

The explosion-proof versions have been approved by FM Approvals according to the ATEX directive / UKEX regulation and IEC standards and have the following Certificates:



- FMxxATEXxxxxX
- IECEx FMG xx.xxxxX
- FMxxUKEXxxxxX.

The letter X in the certificate number indicates that the equipment is subject to specific condition of use. The conditions are described in the certificate and the installation and operating instructions.

### 3.3.1 Explanation of Ex approval


The SE/SL 25-63 kW pumps have the following explosion protection classification:

#### ATEX / UKEX

Direct-drive pump:	CE 0344 / UKCA 8505  II 2 G Ex db h IIB T4 Gb IP68
Pump driven by frequency converter:	CE 0344 / UKCA 8505  II 2 G Ex db h IIB T3 Gb IP68

#### IECEX

Direct-drive pump:	Ex db h IIB T4 Gb Ta = -20 to +40 °C
Pump driven by frequency converter:	Ex db h IIB T3 Gb Ta = -20 to +40 °C

Directive or standard	Code	Description
ATEX / UKEX	CE 0344 UKCA 8505	= CE marking of conformity according to the ATEX directive, 2014/34/EU, Annex X. UKCA marking of conformity according to the UKEX regulation, 2016. 0344 / 8505 is the number of the Notified Body / Approved Body which has certified the quality system for ATEX / UKEX.
		= The equipment conforms to the harmonised EU and UK standard.
	II	= Non-mining equipment group, according to the ATEX directive / UKEX regulation, defining the requirements applicable to the equipment in this group.
	2	= High protection equipment group, according to the ATEX directive / UKEX regulation, defining the requirements applicable to the equipment in this category.
	G	= Explosive atmospheres caused by gases, vapours or mists.
	Ex	= Marking of explosion protection.
	db	= Flame proof enclosure according to EN/IEC 60079-1.
	h	= Non-electrical equipment for explosive atmosphere, according to EN ISO 80079-36 and EN ISO 80079-37.
	IIB	= Classification of gases, see EN/IEC 60079-0, Annex A. Gas group B includes gas group A.
	Harmonised European EN and IECEX standards	T4/T3 (When operated by a frequency converter.)
Gb		= Equipment for explosive gas with "high" level of protection.
IP68		= Enclosure class according to EN/IEC 60529.

### 3.3.2 Ex certification and classification

Explosion-proof pumps are 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) and in The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (UKEX).

### 3.3.3 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 regulations.

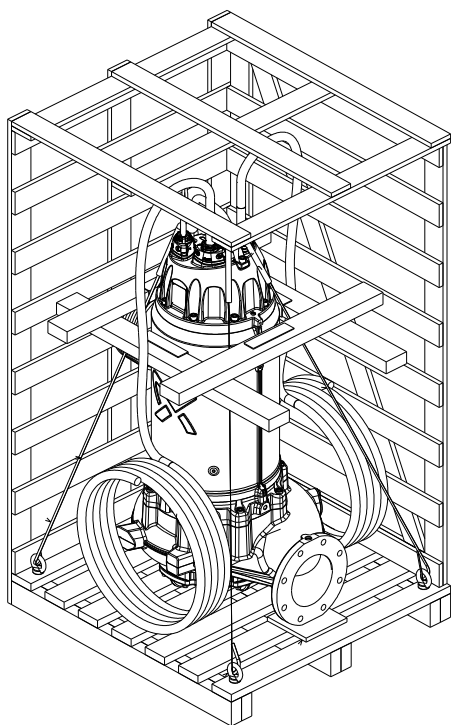
#### Specific conditions for safe use of explosion-proof pumps:

1. Make sure the moisture- 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. Contact the manufacturer if dimensional information on the flameproof joints is necessary.
4. During operation, the cooling jacket, if fitted, must be filled with cooling liquid.
5. The level of the pumped liquid must be controlled by level switches connected to the motor control circuit. Install an additional level switch to ensure that the pump is stopped in case the stop level switch is not working.
6. Dry running is not allowed.
7. Make sure the cable is mechanically protected, attached to the switchboard and 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.
9. Avoid exposing the ethylene-propylene rubber insulated cables to direct sunlight.
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 a user responsibility to regularly 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 it ensures the disconnection of the power supply. Resetting must be carried out manually.
12. To avoid electrostatic discharge, clean the cables and the painted parts of the pump with a wet fabric.
13. When the pump is operated by a frequency converter, the installation must be rated up to T3 temperature class. When the pump is operated without a frequency converter, the installation must be rated up to T4 temperature class.
14. This EU and UK 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.



## 4. 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.



*Pump packaging*

### 4.1 Inspecting the product

During periods of storage, protect the pump against moisture and heat.



If the pump is not in operation or is being stored for more than a 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.



On pumps fitted with a guide vane, be careful not to damage the guide vane when turning the impeller.

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.

TM082506

## 4.2 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.

**WARNING****Crushing hazard**

Death or serious personal injury

- Lifting and moving must be done by a trained person.

**CAUTION****Sharp element**

Minor or moderate personal injury

- Packaging parts may be pointy or sharp. Wear hand protection.

**CAUTION****Crushing hazard**

Minor or moderate personal injury

- Make sure the pump cannot roll or fall over.

**WARNING****Crushing hazard**

Death or serious personal injury

- Always lift the pump by its lifting bracket or use a forklift.

**DANGER****Electric shock**

Death or serious personal injury

- Never lift the pump by the power cable, hose, or pipe.



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

## 5. Mechanical installation

Fit the extra nameplate supplied with the pump at the installation site, where it is easy to access and read. Observe all safety regulations at the installation site. Make sure there is adequate fresh air supply in 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 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 position 0.
- Make sure that the power supply cannot be switched on unintentionally.



### WARNING

#### Biological hazard

Death or serious personal injury

- Media spraying from the pump can cause injury. Wear eye protection.



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

### 5.1 Installation types

Installation type	Description	Installation and accessories
Vertical	Sewage pump without cooling jacket for vertical, submerged installation	Permanent installation on auto coupling
Dry vertical	Sewage pump with cooling jacket for vertical installation	Permanent installation on concrete foundation
Dry horizontal	Sewage pump with cooling jacket for horizontal installation	Installation on horizontal stand

## 5.2 Vertical 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.



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.

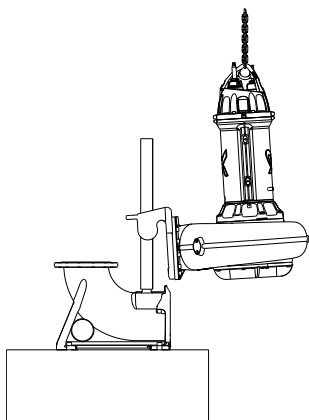


The guide rails must not have any axial play as this may cause noise during operation.

Proceed as follows:

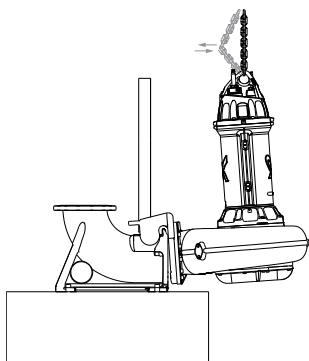
1. Drill mounting holes for the guide-rail bracket on the inside of the pit and fasten it provisionally with two screws.
2. Place the auto-coupling base unit on the bottom of the pit. If the bottom is uneven, the auto-coupling base unit must be supported. Use a plumb line to establish the correct positioning. Fasten the auto coupling with anchor 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. If the length of the guide rail exceeds 4 m, install an intermediate guide-rail holder to ensure stability.
5. Unscrew the 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 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 by a chain secured to the lifting bracket.
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- and the control cables, if any.
12. Check direction of rotation.





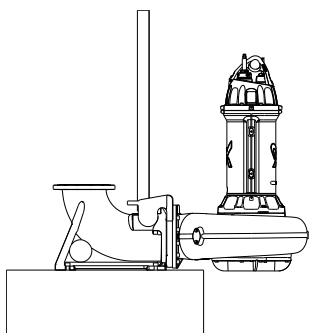
*Lowering the pump  
along the guide rails*

TM081913



*Connecting the  
pump to auto  
coupling*

TM081914



*Submerged  
installation on auto  
coupling*

TM081912

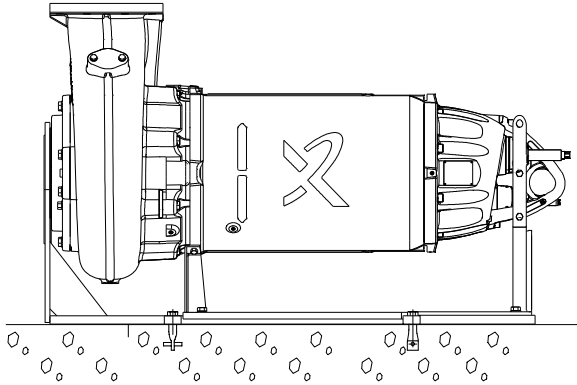


The free end of the cable must not be submerged as water may penetrate into the motor.

### 5.3 Permanent, vertical or horizontal, dry installation



Use isolating valves on either side of the pump to facilitate service on it.



TM084882

*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.

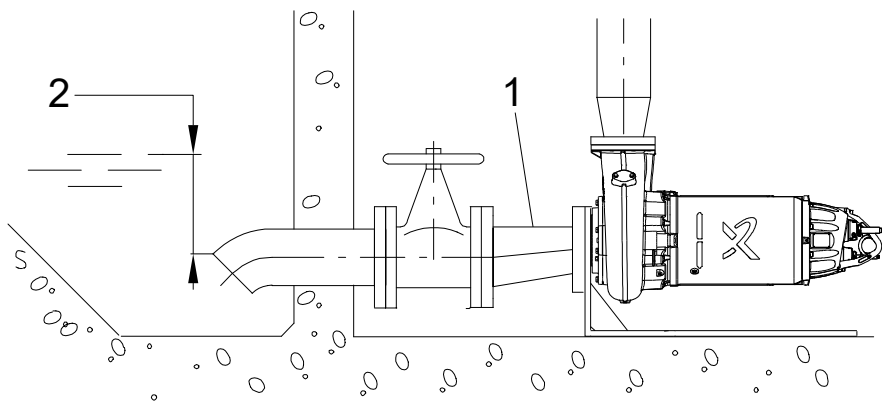
Proceed as follows:

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- and the control cables, if any.

Fasten the pump to the inlet and outlet pipes with flange connections.



In horizontal installations, use a reducer between the inlet pipe and the pump. The reducer must be eccentric and has to be installed the way its straight edge is pointing upwards. Therefore the accumulation of air in the inlet pipe, and the risk of operation disturbance are eliminated.



TM084883

*Eccentric reducer in horizontal installation*

Pos.	Description
1	Eccentric reducer
2	Minimum level: 0.2 m

#### 5.4 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 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 and control cables, if any.

## 5.5 Pullout strengths for anchor bolts

Auto-coupling base unit	Bolts [mm]	Pull-out strength for a single bolt [kN]
DN 100	M16	10
DN 150	M16	10
DN 200	M24	10
DN 250	M24	10
DN 300	M24	12



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

## 5.6 Minimum liquid level

Do not let the pump 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 the pumped liquid must be controlled by level switches connected to the motor control circuit.



Explosion-proof, submersible SL pumps without cooling jacket must always be completely submerged in the pumped liquid to the top of the motor.

The pump housing of explosion-proof, submersible SE pumps with cooling jacket must always be completely covered by the pumped liquid.



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

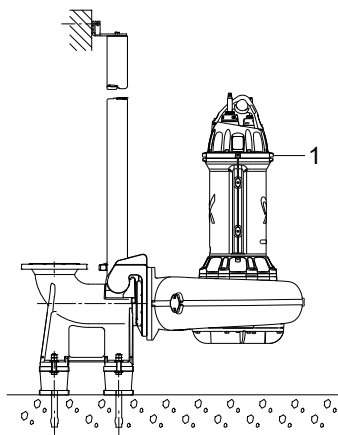


The pump must not run dry.

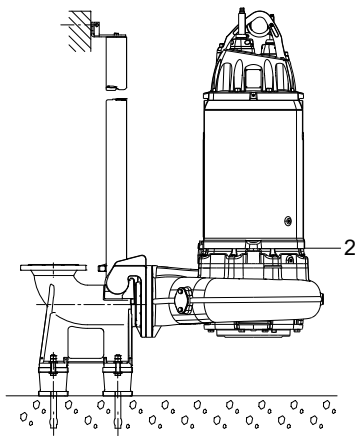
To ensure adequate motor cooling, the following minimum requirements must be met:

- **Vertical installation on auto-coupling:**

- SL pump: the pump must be completely submerged in the pumped liquid to the top of the motor. See **level 1** on the figure below.
- SE pump: the pump must be submerged in the pumped liquid until the bottom of the motor. See **level 2** on the figure below.



Liquid level, SL



Liquid levels, SE

## 6. Electrical connection



EMC shielding of power and control cables must be connected and fixed by the operator.



Connect pumps installed in hazardous locations to a control box with a motor protection relay with an IEC trip class 10.

1. Do not install pump controllers, Ex barriers or the free end of the power cable in potentially explosive environments.
2. The classification of the installation site must comply with the local rules.
3. On explosion-proof pumps, make sure that an external ground conductor is connected to the external ground terminal on the pump by a secure cable clamp. Clean the surface of the external ground connection and mount the cable clamp.



4. The ground conductor must be minimum AWG 12 type RHH, RHW, RHW-2 or similar, rated for 600 V and minimum 90 °C, yellow and green.
5. Make sure that the ground conductor is protected from corrosion.
6. Make sure that all protective equipment has been connected correctly.
7. Float switches used in potentially explosive environments must be approved for this application. They must be connected to the Grundfos Dedicated Controls, DC, DCD or the SLC, DLC controllers, by an intrinsically safe barrier to ensure a safe circuit.



### DANGER

#### Electric shock

Death or serious personal injury

- Unauthorised people must not have any access to this product.



### 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.

**WARNING****Electric shock**

Death or serious personal injury

- Before installation and startup, check the power cable for damage.

**DANGER****Electric shock**

Death or serious personal injury

- The pump must be grounded. Before connecting the pump to the voltage supply, make sure the connection to ground complies with the 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 the local regulations.



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



The power supply for the motor protection circuit must be low voltage, class 2.



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, +10 % service factor for 50 Hz motors, +15 % service factor for 60 Hz motors. 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  $\pm 10\%$  of the rated voltage.

The motor is effectively grounded with the power cable and pipes. The motor top cover is equipped with connections for external grounding or an equipotential bonding conductor.



Maintenance and service work on explosion-proof pumps must be carried out by Grundfos or an 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 following:

- Direct-on-line starting (DOL).
- Star-delta starting (Y/D).
- Soft start.

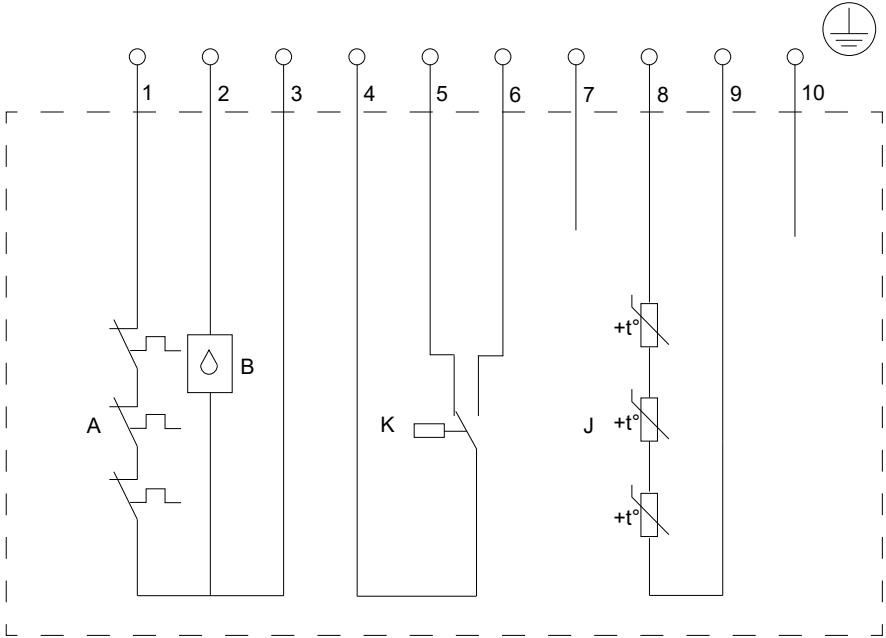
The suitable starting method depends on several considerations on usage and mains supply conditions.



When using star-delta start, 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 milliseconds, or according to the manufacturer's specifications.

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

## 6.1 Sensor wiring diagrams



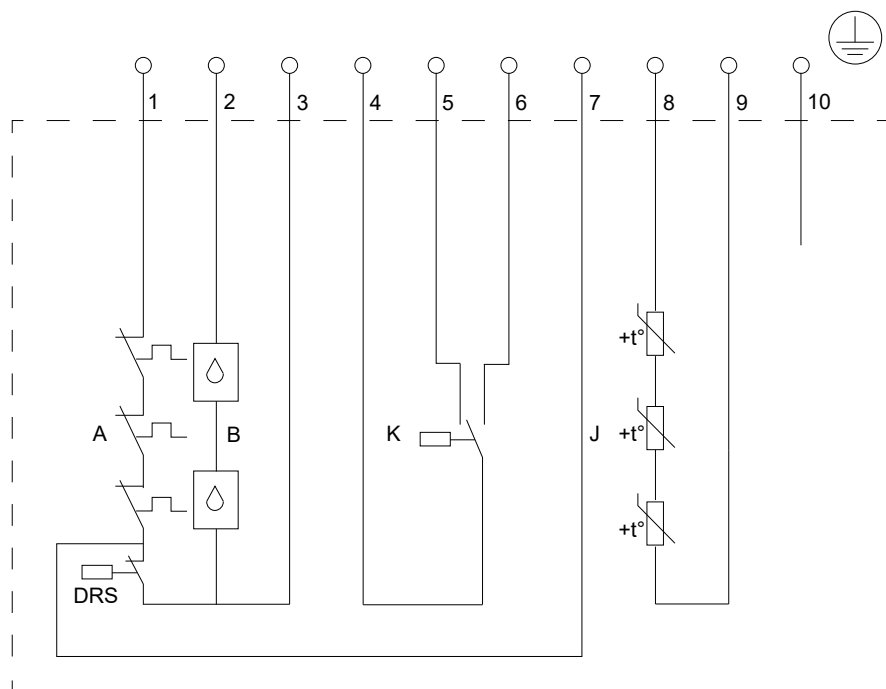
TM082723

Sensor connection, standard version

Pos.	Description
A	3 × PTO
B	Moisture switch (motor top)
K	Leakage switch
J	3 × PTC

Cable screening must be connected to the ground. To connect the leakage switch to SM113 module, use resistor kit 92726268. The resistor converts the digital signal from the leakage switch (Terminal 4, 5 and 6) must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "4" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "5" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "6" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.



TM085734

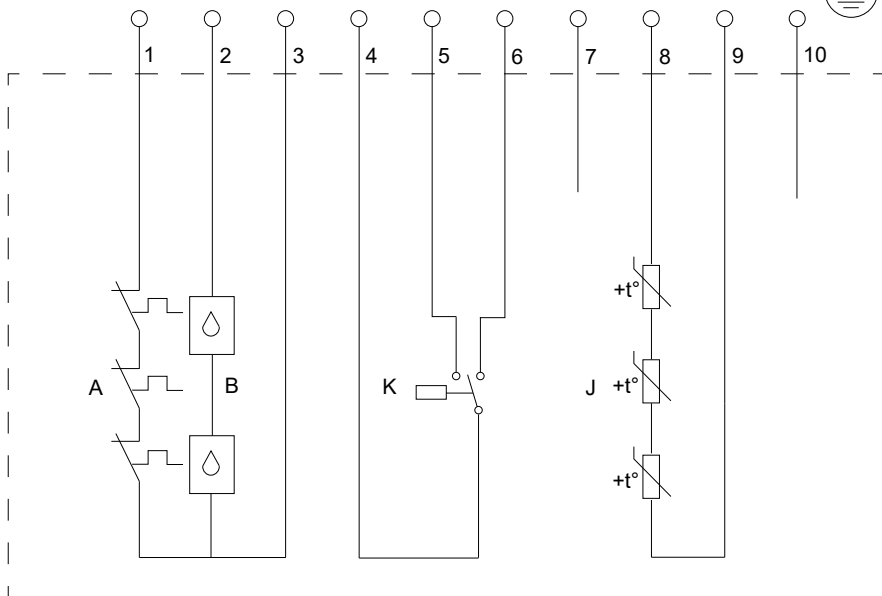
Sensor connection, standard Ex version (SE pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
K	Leakage switch
J	3 × PTC
DRS	Dry running switch

Cable screening must be connected to the ground. Sensor wire 7 is the control wire for service. If not used, then the wire end must be insulated. To connect the leakage switch to SM113 module, use resistor kit 92726268. The resistor converts the digital signal from the leakage switch (Terminal 4, 5 and 6) must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "4" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "5" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "6" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.





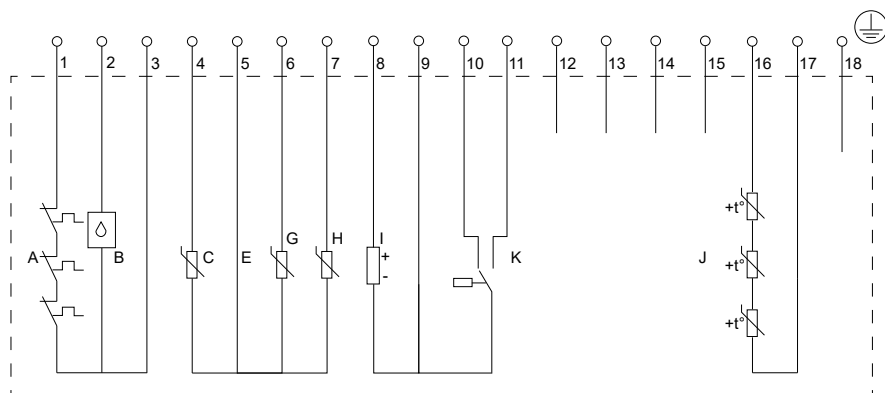
TM085736

Sensor connection, standard Ex version without Dry Running Switch (SL pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
K	Leakage switch
J	3 × PTC

Cable screening must be connected to the ground. Sensor wire 7 is the control wire for service. If not used, then the wire end must be insulated. To connect the leakage switch to SM113 module, use resistor kit 92726268. The resistor converts the digital signal from the leakage switch (Terminal 4, 5 and 6) must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "4" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "5" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "6" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.



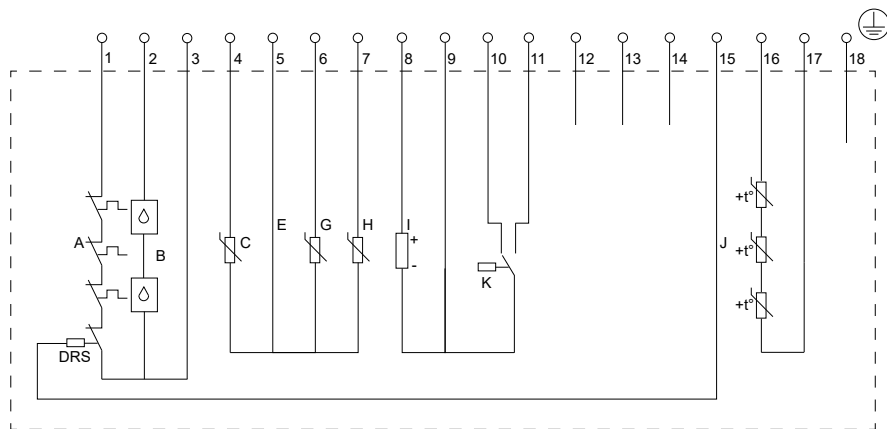
TM084630

Sensor connection, version V1

Pos.	Description
A	3 × PTO
B	Moisture switch (motor top)
C	Pt100 (lower bearing)
E	Common earthing for sensors
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Leakage switch
J	3 × PTC

Cable screening must be connected to the ground. To connect the leakage switch to SM113 module, use resistor kit 92726268. The resistor converts the digital signal from the leakage switch (Terminal 9, 10 and 11) must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "9" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "10" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "11" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.



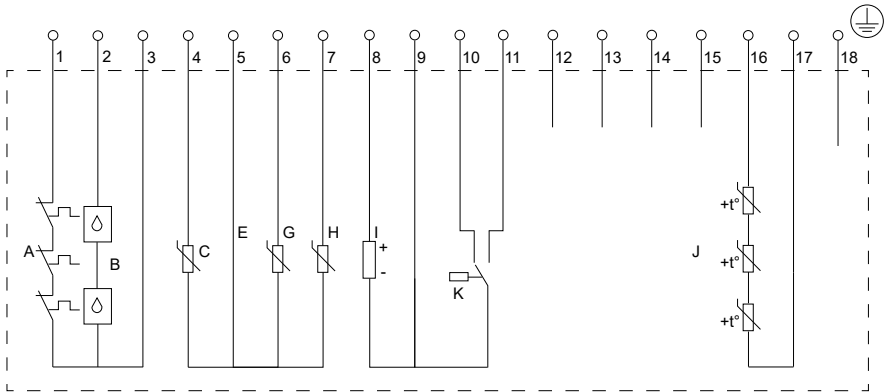
TM085739

Sensor connection, version V1 Ex (SE pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
C	Pt100 (lower bearing)
E	Common earthing for sensors
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Leakage switch
J	3 × PTC
DRS	Dry running switch

Cable screening must be connected to the ground. Sensor wire 15 is the control wire for service. If not used, then the wire end must be insulated. To connect the leakage switch to SM113 module, use resistor kit 92726268. The resistor converts the digital signal from the leakage switch (Terminal 9, 10 and 11) must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

1. Connect Sensor wire "9" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "10" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "11" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.



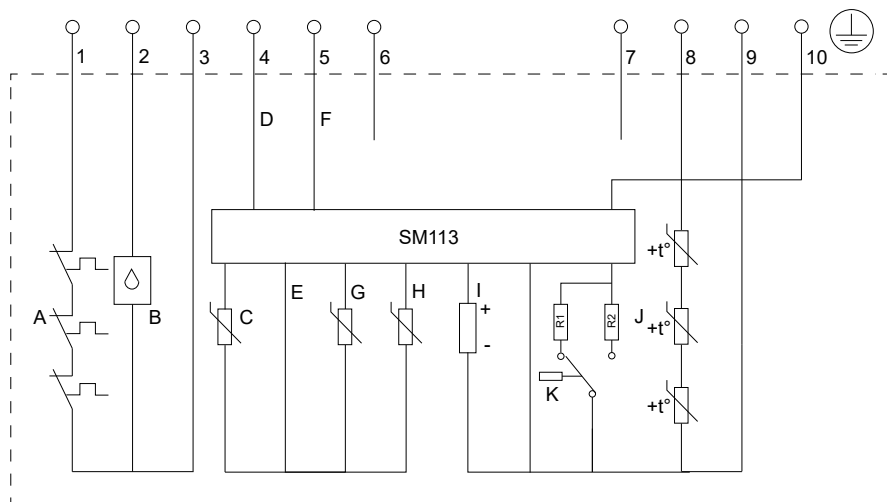
TM085737

Sensor connection, version V1 Ex without Dry Running Switch (SL pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
C	Pt100 (lower bearing)
E	Common earthing for sensors
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Leakage switch
J	3 × PTC

Cable screening must be connected to the ground. Sensor wire 15 is the control wire for service. If not used, then the wire end must be insulated. To connect the leakage switch to SM113 module, use resistor kit 92726268. The resistor converts the digital signal from the leakage switch (Terminal 9, 10 and 11) must be converted to analog 4-20 mA signal. The resistor kit must be connected as follows:

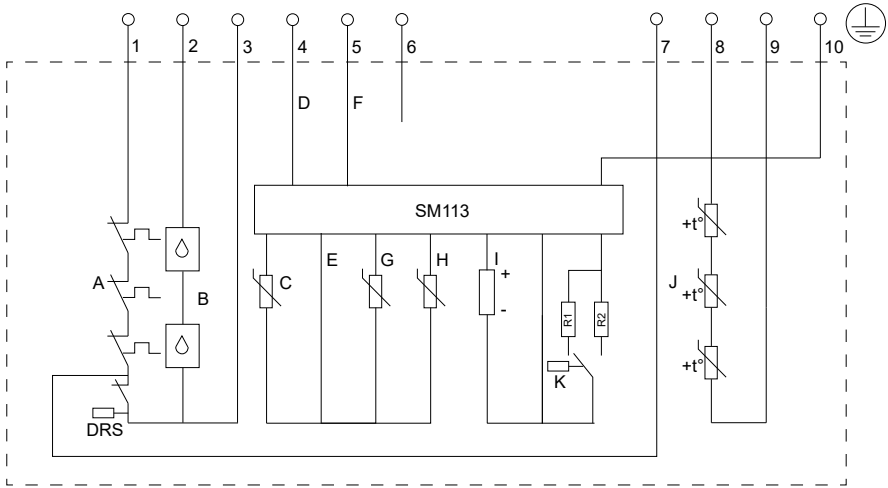
1. Connect Sensor wire "9" (common point of leakage switch) to SM113 Terminal "3".
2. Connect Sensor wire "10" (leakage switch lower position: 4-6 mA = "OK" signal) to "R1" of the resistor kit.
3. Connect Sensor wire "11" (leakage switch upper position: 16-18 mA = "Alarm" signal) to "R2" of the resistor kit.
4. Connect the common end of the resistor kit to Terminal "4" of the SM113 module.



Sensor connection, version V2

Pos.	Description
A	3 × PTO
B	Moisture switch (motor top)
C	Pt100 (lower bearing)
D	Supply input for sensor board from IO113
E	Common earthing for sensors
F	Communication signal for IO113
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Leakage switch
J	3 × PTC

Cable screening must be connected to the ground.

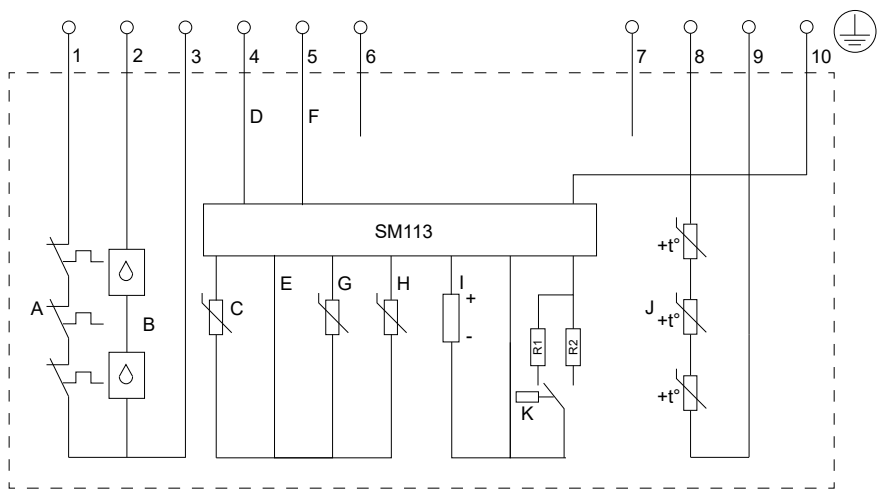


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Sensor connection, version V2 Ex (SE pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
C	Pt100 (lower bearing)
D	Supply input for sensor board from IO113
E	Common earthing for sensors
F	Communication signal for IO113
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Leakage switch
J	3 × PTC
DRS	Dry running switch

Cable screening must be connected to the ground. Sensor wire 7 is the control wire for service. If not used, then the wire end must be insulated.



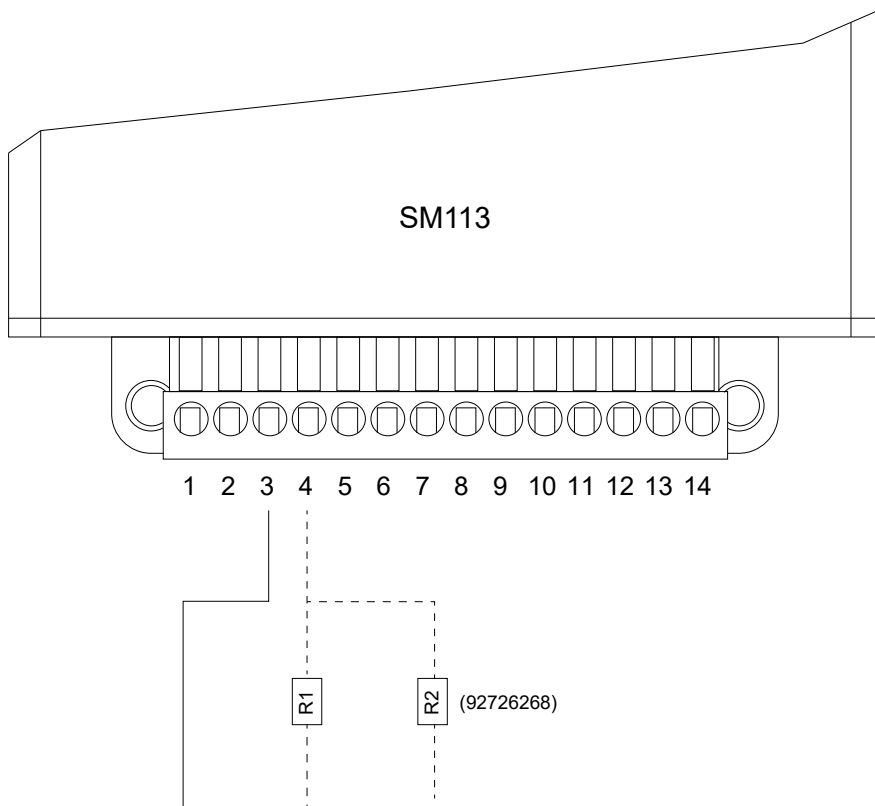
TM085740

Sensor connection, version V2 Ex without Dry Running Switch (SL pumps)

Pos.	Description
A	3 × PTO
B	2 × Moisture switch (motor top)
C	Pt100 (lower bearing)
D	Supply input for sensor board from IO113
E	Common earthing for sensors
F	Communication signal for IO113
G	Pt100 (upper bearing)
H	Pt100 (stator winding)
I	Vibration sensor
K	Leakage switch
J	3 × PTC

Cable screening must be connected to the ground. Sensor wire 7 is the control wire for service. If not used, then the wire end must be insulated.

## 6.2 SM113 connection diagram

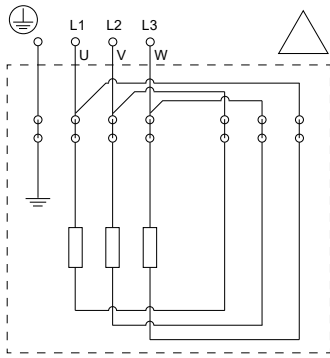


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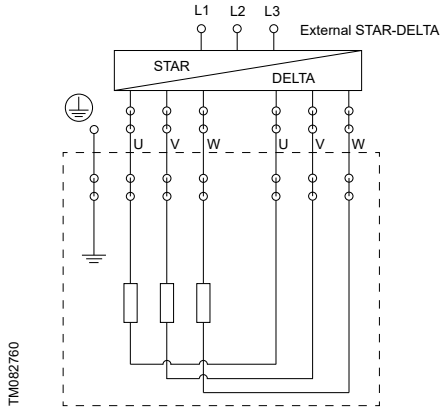
Standard version	Sensor wire 4 - 5 - 6
Sensor version V1	Sensor wire 9 - 10 - 11
Sensor version V2	Built into the motor top
92726268	Resistor kit



### 6.3 Motor wiring diagrams



*Delta connection*



TM082760

*Star-delta connection*

TM082761

## 6.4 Frequency converter operation



### CAUTION Electric shock

Minor or moderate personal injury

- Be aware of possible residual voltage being present.



If the motor is operated by a frequency converter, the temperature class of the 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 may cause the motor to be more noisy due to eddy currents caused by voltage peaks.

Large motors driven with a frequency converter may be 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.
- Before installing a frequency converter, calculate the lowest frequency allowed 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 pipe network.
- 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.
- Set the frequency converter for constant-torque operation. Use pulse width modulation.

When operating the pump with 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 selected frequency converter.

Maximum repetitive peak voltage [V]	Maximum $dU/dt$ $U_N$ 400 V [V/ $\mu$ sec.]
2.200	9.000



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

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

### 6.4.1 General conditions for frequency converter operation

All motors used with frequency converter must be protected against voltage peaks and  $dU/dT$  according to IEC60034-25 Figure 14 - Curve A.

Grundfos recommends using insulated bearing systems in installations where common mode currents can be a problem. It is generally recommended to use insulated bearings from the following performance ranges:

- 45kW / 2-pole
- 30kW / 4-pole
- 22kW / 6-pole.

Use screened cables for frequency converter operation.

- Screened **power cables** to comply with EMC regulations.
- Screened **sensor cables** to protect the signals against electromagnetic interference.

#### 6.4.2 Mains-dependent conditions for frequency converter operation

##### 200-240 V

No output filters are required for frequency converter operated pumps with up to 240 V mains voltages.

##### 380-500 V

For frequency converter operated pumps with less than 25 m power cable length and mains supply up to 460 V, no additional motor protection is required against voltage peaks.

If the power cable length is longer than 25 m, or the mains supply is higher than 460 V, sine-wave filters are required.

##### 500 V and above

Always use sine-wave filters for pumps marked for 500 V or higher voltages.



Pumps with reinforced motor insulation can be supplied as an option for motors above 22 kW. These motor stators will be according to IEC60034-25, this can eliminate the need for sine-wave filters. Protection against common mode currents is still needed according to the specification mentioned above.

## 6.5 Power cable data

	Cable type	Outer cable diameter [mm]		Minimum bending radius
	[mm <sup>2</sup> ]	min.	max.	[mm]
<b>Standard power cable</b>	4 × 10	20.9	23.4	70
	4 × 16	23.8	26.3	80
	4 × 25	28.9	31.4	100
<b>Screened EMC power cable</b>	4 × 10	23.1	25.1	100
	4 × 16	26.6	29.6	120
	3 × 25 + 3G16/3	25.3	28.3	120
	3 × 35 + 3G16/3	28.3	31.3	130
<b>Screened EMC sensor cable</b>	10 × 1.5	16.7	18.7	80
	18 × 1.5	24	27	110



The minimum size of the ground conductor must be equal to or bigger than the phase conductor.



The top cover of the explosion-proof pumps is provided with an external ground terminal to ensure the connection to the ground. The electrical installation must include an external connection from this terminal to the ground. The ground conductor must comply with all electrical safety regulations in force.



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

## 6.6 Sensors

The pumps can be equipped with various switches and sensors for protection. The specification table below indicates which switch and sensor types can be used.

### Switch and sensor specification

Ex sensor versions come with 2 moisture switches and 1 optional dry running switch.

Sensor version	Standard and Standard Ex	V1 and V1 Ex	V2 and V2 Ex
Thermal switches / PTC	•	•	•
Moisture switch	•	•	•
Float switch in leakage chamber	•	•	•
Pt100 in motor winding		•	•
Pt100 in upper bearing		•	•
Pt100 in lower bearing		•	•
PVS3 vibration sensor		•	•
SM113 (integrated in the motor top)			•
IO113 (not integrated in the motor top)			•

### Voltage tolerances

Component	Voltage	Tolerance
Motor	See the pump nameplate	± 10 %
Thermal switches	Maximum 24 V DC	± 10 %
Thermistors	2.5 - 7.5 V	-
Moisture switches	12-24 V DC	-
Other sensors (optional)	Maximum 14 V DC	± 1 V
SM 113 (optional)	Maximum 14 V DC	± 1 V

## 6.7 Thermal switches

Three bimetallic thermal switches are built into the stator windings. A contact opens in case of overtemperature (150 °C). The motor insulation 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.

Use a multimeter to check that the circuit resistance does not exceed the maximum of 1.5  $\Omega$  (including 3  $\times$  PTO and control cable) at 20 °C.



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.

## 6.8 Moisture switches and leakage switches

One moisture switch and one leakage switch are installed in the pump. The moisture switch is placed in the top cover and the leakage switch is in the chamber above the shaft seal.

### Ex version:

Two moisture switches and a level switch are mounted in an Ex pump. The moisture switches are placed in the top cover and the level switch is in the leakage chamber. See the Appendix.

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 the electric circuit. This generates both a hardware and a software alarm in IO 113, and the alarm relay opens.

Moisture- and level switches are motor protection devices protecting the motor from moisture or leakage. The moisture switch is non-reversing, and it must be replaced after being released. The level switch does not have to be replaced after being released.

The moisture- and level switches are connected in a separate circuit and to the control cable.

## 6.9 Thermistors

The standard pump range has bimetallic thermal switches connected, however, a pump with PTC thermistors connected are available as a Factory Product Variant (FPV).

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.

**After the electrical connection, use a multimeter to:**

1. check that the overall circuit resistance is between 250-750  $\Omega$ .
2. check that the insulation between the circuit and the stator housing is outside the range.
3. carry out similar measurements at the end of the power cable.

### 6.9.1 Pt100 temperature sensor

The Pt100 temperature sensor is available as an accessory or an FPV.

The Pt100 sensor is primarily used for the monitoring of bearing temperature, but it can also be used in the stator.

In case of overheating, the Pt100 sensor sends an alarm signal.



The bearing temperature monitoring system is only available as an option (based on sensor version).

The sensor resistance values are the following:

- 100  $\Omega$  at 0 °C (32 °F)
- 138.5  $\Omega$  at 100 °C (212 °F)
- approximately 107.8  $\Omega$  at room temperature.

The temperature limits are the following:

- 90 °C (194 °F): warning for bearing temperature
- 130 °C (266 °F): optional warning for high stator temperature, in case of PTC sensor used for monitoring
- 150 °C (302 °F): pump stop caused by high stator temperature (stop by thermistor / thermal switch).



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.



The thermal protection of explosion-proof pumps must not restart the pump automatically. This ensures protection against overtemperature in potentially explosive environments. In pumps with sensor, this can be done by removing the short circuit between terminals R1 and R2 in the IO 113.

See electrical data in the IO 113 installation and operating instructions.



Do not install the separate motor-protective circuit breaker or control box installed in potentially explosive environments.

## 6.10 IO 113 module

The IO 113 module is the interface between a 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 one IO 113.

With the sensors, IO 113 provides a galvanic separation between the motor voltage in the pump and the connected controller.

The IO 113 enables the following functions:

- overtemperature protection
- monitoring the sensors for analogue measurement of:

- motor temperature (with Pt100 installed in the windings)
- pump vibrations (with PVS3 vibration sensor)
- stator insulation resistance
- bearing temperature (with Pt100 installed at the bearings)
- moisture in motor
- stopping the pump in case of alarm
- monitoring the pump through RS485 communication (Modbus or GENibus).

#### Insulation resistance measurement

IO 113 measures the insulation resistance between a stator winding and ground:

- resistance above 10 M $\Omega$  = OK
- resistance between 10 M $\Omega$  and 1 M $\Omega$  = warning
- resistance below 1 M $\Omega$  = alarm.

### 6.11 SM 113 module

The SM 113 module is used for collecting and transferring sensor data. SM 113 works with IO 113 through power line communication using the Grundfos GENibus protocol.

SM 113 collects data from the following devices:

- 2 current sensors, 4-20 mA
  - Vibration sensor
  - Water-in-oil (WIO) sensor
- Maximum 3 Pt100 thermal sensors
- Maximum 4 Pt1000 thermal sensors
- 1 PTC thermal sensor
- 1 digital input.



SM 113 is fitted with a 2.7 k $\Omega$  resistor to avoid false sensor alarms in the IO 113.

### 6.12 Pump vibration sensor (PVS 3)

The PVS 3 sensor monitors the vibration level to protect the pump and the pipe network against damage.

A change in the vibration level indicates an abnormal situation. Make sure that a service inspection is carried out before the pump or the pipe network is damaged.



Pumps are fitted with S-tube<sup>®</sup> impellers. The S-tube<sup>®</sup> impellers are wet-balanced to reduce vibrations during operation. If these pumps are started with the pump housing containing air, the vibration level can be higher than in normal operation.

## 7. Startup



Pumps in dry installation must be vented.



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



Make sure that the pump is filled with the pumped liquid.  
Dry-running is not allowed.



In case of abnormal noise or vibrations, stop the pump immediately. Do not restart the pump until the cause of the fault is identified and eliminated.



Make sure the pump is connected to an overcurrent protective device.



No automatic disconnection device is applied in the product.



### **DANGER**

#### **Electric shock**

Death or serious personal injury

- Make sure the pump is grounded.



### **WARNING**

#### **Electric shock**

Death or serious personal injury

- Make sure the connections are correct.



### **CAUTION**

#### **Hearing impairment**

Minor or moderate personal injury

- Use hearing protection when working nearby an environment with a sound pressure level above 70 dB(A).



In case of abnormal noise or vibrations, stop the pump immediately. Do not restart the pump until the cause of the fault is identified and eliminated.

1. Remove the fuses or switch off the main switch.
2. Check the motor liquid level in the cooling chamber.
3. Check if the impeller can rotate freely.
4. Check if the switches are closed, replace if necessary.
5. Check whether the monitoring units, if used, are operating properly.
6. For pumps in a submerged installation, make sure that the pump is submerged in the liquid.



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 operation for abnormal noise or vibrations.
11. After startup, the actual pump duty point must be established. Make sure the operating conditions are met.



The pump may only be started for a short period without being submerged for checking the direction of rotation. The correct direction is highlighted on the pump.

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

## 8. Storage

During 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.



Do not store the product in direct sunlight.



Storage temperature is -20 °C to +55 °C. A maximum of 70 °C is allowed for short periods, not exceeding 24 hours, according to EN 60204-1.



Do not remove the cable-end protectors until the cables are installed to protect them against moisture.



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

Avoiding this may cause damage to the shaft seal and motor bearings when the pump is started.

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



### **WARNING**

#### **Crushing hazard**

Death or serious personal injury

- Do not turn the impeller by hand. Always use an appropriate tool.



On pumps fitted with guide vane, be careful not to damage the guide vane when turning the impeller.

## 9. Maintenance and service



The maintenance and service work on explosion-proof pumps must be carried out by Grundfos or an authorised service workshop.



Do not open the pump if the ambient atmosphere is explosive or dusty.



**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 it cannot be switched on unintentionally.



**CAUTION**  
**Crushing hazard**

Minor or moderate personal injury

- Make sure the pump cannot roll or fall over.



**DANGER**  
**Electric shock**

Death or serious personal injury

- Make sure the pump is grounded.



**CAUTION**  
**Sharp element**

Minor or moderate personal injury

- Be careful of sharp edges. Wear protective gloves.



Maintenance and service must be carried out by qualified persons.

Before carrying out maintenance and service, make sure that the pump is thoroughly flushed with clean water. Rinse the pump parts after dismantling.



Change the motor liquid after 12.000 operating hours or 3 years, whichever comes first.



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



When the pump is new or after replacement of the shaft seals, check the motor liquid level and its water content after one week of operation. If the motor liquid level has dropped, the shaft seal may be defective.

Pumps running normal operation must be inspected every 12.000 operating hours or once in 3 years.

Check the following during inspection:

- **Power consumption**
- **Motor liquid (glycol) level.**



Disposal of the motor liquid must comply with local regulations.

- **Cable entries:** Make sure that the cable entries are waterproof and the cables are not sharply bent or pinched.
- **Impeller clearance:** Check 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 manually. Replace defective bearings. A general overhaul of the pump is usually required in case of defective bearings or poor motor function. This work must be carried out by an authorised service workshop. Bearings are lubricated for lifetime.
- **Vibration:** If the pump is vibrating at an abnormal level, do not restart the pump until the cause of the fault is identified and eliminated.
- **General maintenance:** It is usually required in case of defective ball bearings or poor motor function. This work must be carried out by an authorised service workshop.
- **Dry-running switch:** Test the dry-running switch during inspection to make sure it functions properly. If the switch does not function properly, it must be replaced.



Replace the ball bearings at least every 25.000 operating hours.

## 9.1 Dry-running switch check

Test the dry-running switch during pump inspections. During the test, the dry-running switch must stay in place. If the sensor does not work correctly, it must be replaced. To test the sensor, measure the resistance between the wire ends and compare the values to the table below.

Value	Sensor version	Measurement points	Measurement evaluation
closed circuit (0.5 - 2 Ω depending on cable length)	Standard Ex version	Sensor wire "3" and "7"	The switch is at the upper position because of the cooling liquid. Correct function.
	Sensor V1 Ex version	Sensor wire "3" and "15"	
	Sensor V2 Ex version	Sensor wire "3" and "7"	
open circuit (no resistance can be measured)	Standard Ex version	Sensor wire "3" and "7"	Incorrect function. Change the switch.
	Sensor V1 Ex version	Sensor wire "3" and "15"	
	Sensor V2 Ex version	Sensor wire "3" and "7"	

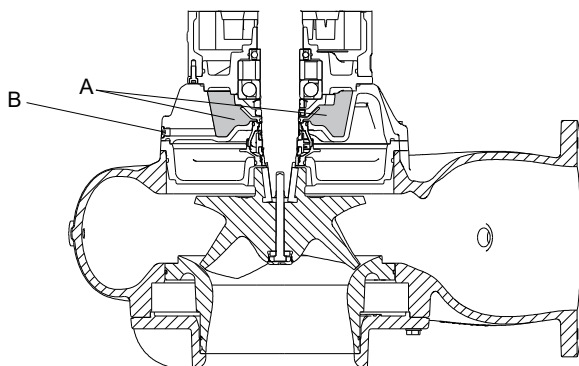
## 9.2 Drain leakage chamber on SL pumps



Drain the leakage chamber after 12.000 operating hours or three years, whichever comes first.



Normal leakage rate for the shaft seal is 2.000 ml / 12.000 operating hours. If more than 5.000 ml fluid can be drained from the leakage chamber, the shaft seal must be replaced.



TM083732

### Leakage chamber on SL pumps

Pos.	Description
A	Leakage chamber
B	Leakage chamber plug

1. Place a plastic container under the leakage chamber plug.
2. Remove the leakage chamber plug (B).
3. Drain the fluid from the leakage chamber. Tilt the pump if necessary.

### 9.3 Pump overhaul

Pumps running in normal operation require major overhaul after 24.000 operating hours or 6 years, whichever comes first. The overhaul includes the replacement of the following:

- shaft seal
- bearings
- impeller + suction cover
- moisture switch
- gaskets
- O-rings
- motor liquid.

### 9.4 Motor liquid check and change



Clean the outside of the pump regularly to retain the heat conductivity.



Change the motor liquid once a year or after 12.000 operating hours to prevent oxidation.



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



Use SML3 coolant for motor cooling.

The ingress level of the pumped liquid into the motor liquid can be checked. Use a refractometer (product no. 98676968) which shows the refractive index in percentage. Always use the propylene glycol scale.

Measured freezing point	Liquid ingress (%)
-20 °C (-4 °F)	0
-18 °C (0.4 °F)	5
-17 °C (1.4 °F)	10
-15 °C (5 °F)	15
-14 °C (6.8 °F)	20

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

Pump type	Liquid amount (l)
SL	13
SE	37

Do not exceed this level of refractive index to ensure the appropriate condition of the shaft seal and the bearings for reliable operation.



Drain the leakage chamber of the pump after 12.000 operating hours.



Normal leakage rate for the shaft seal is 2.000 ml / 12.000 operating hours. If more than 5.000 ml fluid can be drained from the leakage chamber, the shaft seal must be replaced.

#### WARNING

##### Pressurised system

Death or serious personal injury



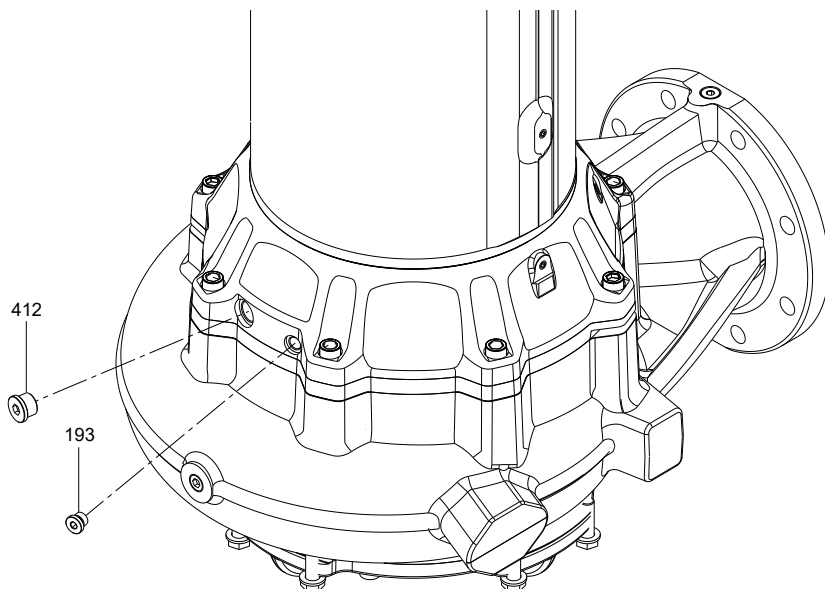
- The seal chamber may be under pressure. Loosen the screws carefully and do not remove them until the pressure is completely relieved.



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

### 9.4.1 Drain motor liquid on SL pumps

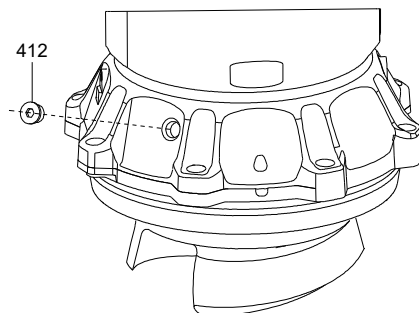
1. Place the pump in horizontal position, so the filling plug (412) is pointing downwards.



2. Place a container under the filling hole (above 13 liter capacity).
3. Remove the filling plug and drain the motor liquid from the seal housing.

### 9.4.2 Fill motor liquid on SL pumps

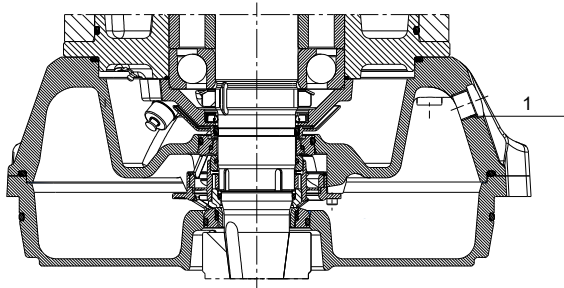
1. Place the pump in vertical position.
2. Remove the filling plug (412) from the seal housing.



TM085629

TM083647

- Fill the seal housing through the filling hole with the required motor liquid. The seal housing is full when the liquid level reaches the edge of the filling hole (1). (Approximately 13 liters of motor liquid required for full fill-up.)

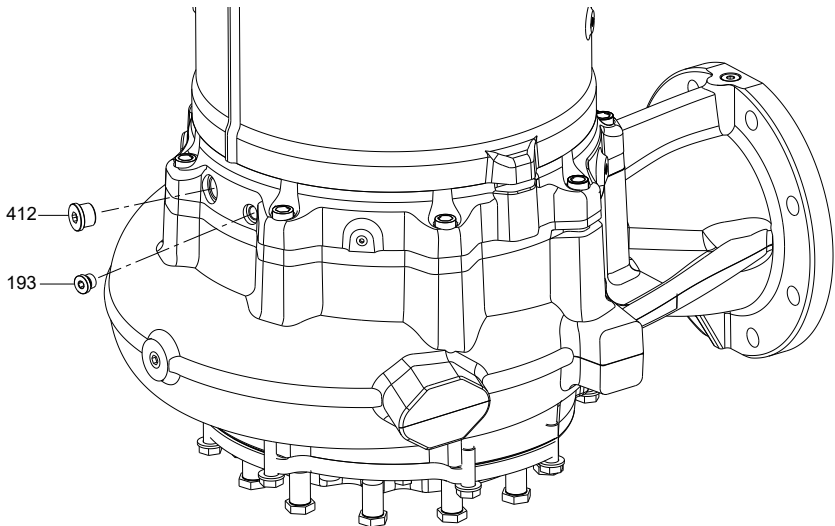


TM063648

- After the seal housing is filled up, insert the plug back into the filling hole and tighten with  $30 \pm 3$  Nm torque.

#### 9.4.3 Drain motor liquid on SE pumps

- Place the pump in horizontal position, so the filling plug (412) is pointing downwards.



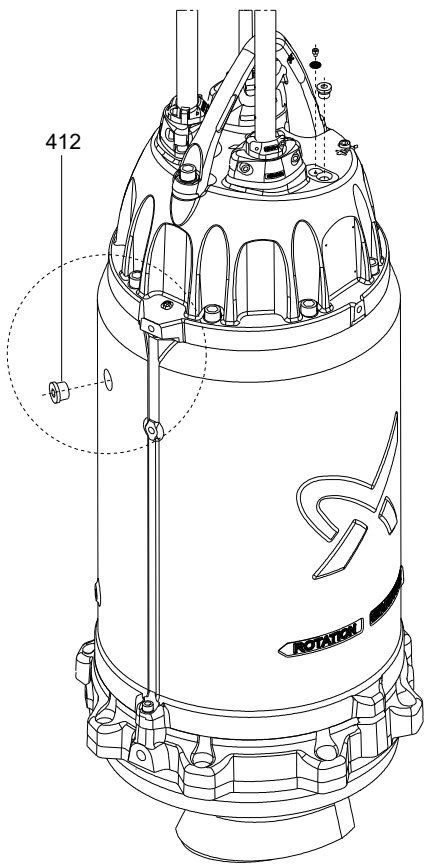
TM065626

- Place a container under the filling hole (above 37 liter capacity).
- Remove the filling plug and drain the motor liquid from the cooling jacket.



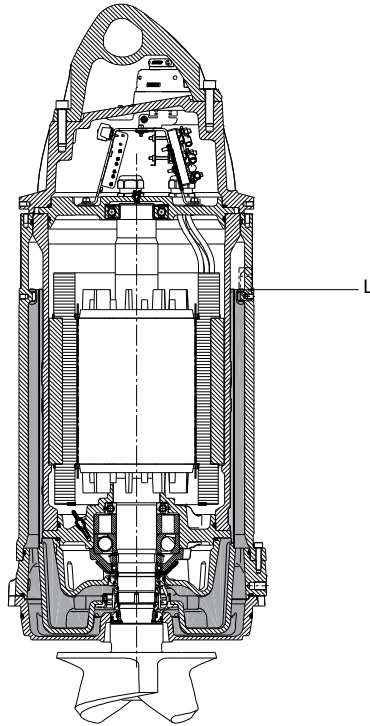
### 9.4.4 Fill motor liquid on SE pumps

1. Place the pump in vertical position.
2. Remove the filling plug (412) from the cooling jacket.



TM084959

3. Fill the cooling jacket through the filling hole with the required motor liquid. The cooling jacket is full when the liquid level reaches the edge of the filling hole (L). Approximately 37 liters of motor liquid required for full fill-up.



TM084958

4. After the cooling jacket is filled up, insert the plug back into the filling hole and tighter with  $30 \pm 3$  Nm torque.

### 9.5 Impeller clearance inspection

For pumps fitted with open S-tube<sup>®</sup>, the impeller clearance is the distance between the bottom of the impeller and the suction cover.

The correct impeller clearance is required to maintain the hydraulic performance of the pump and to prevent clogging.



**CAUTION**  
**Hot surface**

Minor or moderate personal injury

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

#### Clearance sizes for open S-tube<sup>®</sup> impellers

Pressure range	Impeller clearance [mm]
All	$0.5 \pm 0.1$



**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.

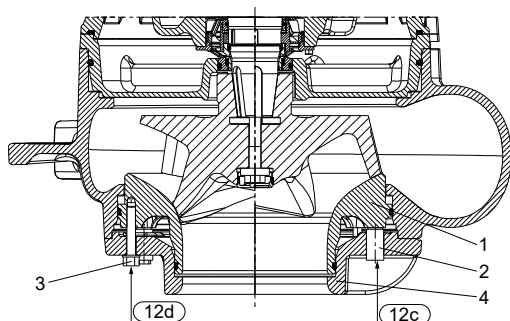


The impeller clearance of vertical, submerged installation types is inspected directly through the pump inlet.

**9.6 Impeller clearance adjustment parts**



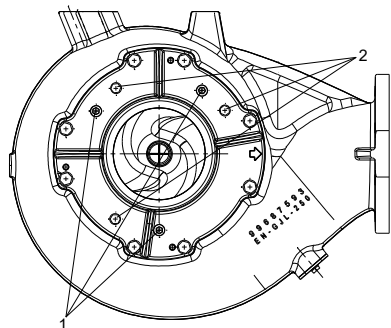
Tighten the set screws carefully to avoid damage to the bearings.



TM1040240

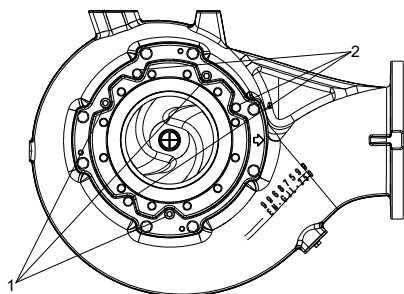
*Tip gap adjustment parts*

Pos.	Description
1	Suction cover
2	Set screw
3	Fastening screw
4	Suction flange



SL impeller clearance screws

TMT040241



SE impeller clearance screws

TMT063389

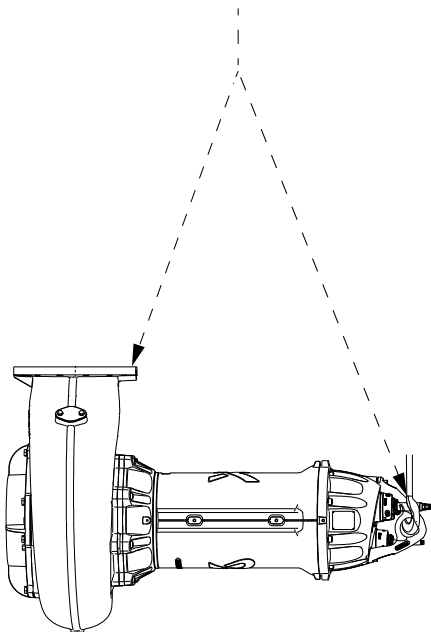
Pos.	Description
1	Set screws
2	Fastening screws

### 9.6.1 Impeller clearance adjustment - in case of major maintenance when the pump is removed from application



Tighten the set screws carefully to avoid bearing damage.

The following method is suitable for pumps in horizontal position.



#### *Horizontal lifting points for SL pumps*



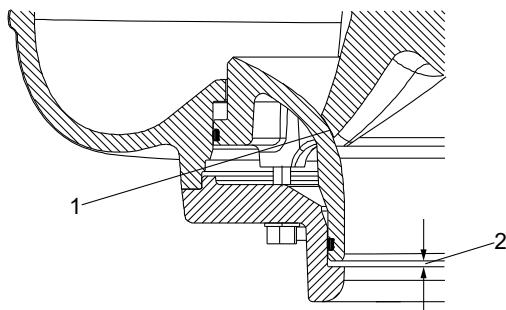
**SL pumps are not intended for horizontal installation. Only move them horizontally for maintenance purposes.**

#### **Proceed as follows:**

1. Loosen all fastening screws.
2. Slowly tighten all three set screws to a stop. Follow a circular pattern when tightening, use the same torque on each screw (torque wrench not necessary). In this case, the suction cover touches the impeller, and the impeller cannot be turned, the gap is set to 0. To make sure that the Suction Cover is not slanted in any direction, check the "Indirect Gap" around. The gap must be even all around.
3. Loosen all set screws one by one, by turning them 120° counterclockwise.
4. Tighten all fastening screws to stop. Follow a circular pattern when tightening, use the same torque on each screw (torque wrench not necessary).
5. Now the impeller clearance (gap between suction cover and impeller) should be  $0.5 \pm 0.1$  mm. Check the gap in 60° steps around by rotating the impeller and using a gap gauge.

TM083497

6. Tighten the fastening screws, required torque is  $50 \pm 5$  Nm. Impeller clearance (1) is set. Check clearance size with the gap gauge again, to ensure the setting did not alter during the tightening of screws.



### Clearance gaps

Pos.	Description
1	Tip gap between impeller and suction cover, must be $0.5 \pm 0.1$ mm.
2	Indirect gap for control measurement

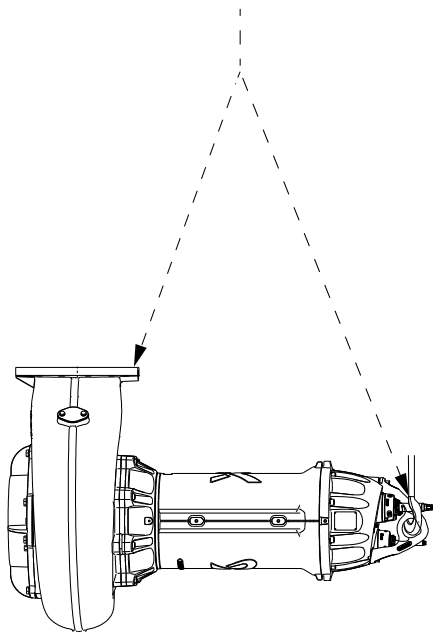
TM1040239

### 9.6.2 Impeller clearance adjustment - in case of minor maintenance when the pump remains in application



Tighten the set screws carefully to avoid bearing damage.

The following method is suitable for pumps in horizontal position.



#### *Horizontal lifting points for SL pumps*



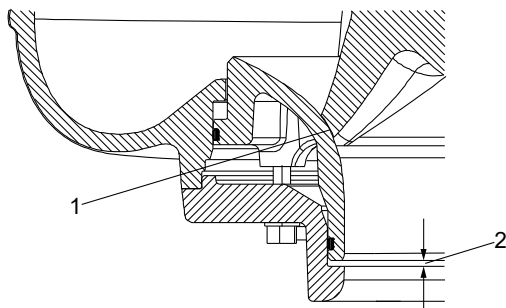
**SL pumps are not intended for horizontal installation. Only move them horizontally for maintenance purposes.**

#### **Proceed as follows:**

1. Loosen all fastening screws.
2. Slowly tighten all three set screws to a stop. Follow a circular pattern when tightening, use the same torque on each screw (torque wrench not necessary). In this case, the suction cover touches the impeller, and the impeller cannot be turned, the gap is set to 0. To make sure that the Suction Cover is not slanted in any direction, check the "Indirect Gap" around. The gap must be even all around.
3. Loosen all set screws one by one, by turning them 120° counterclockwise.

TM083497

4. Tighten the fastening screws, required torque is  $50 \pm 5$  Nm. Impeller clearance (1) is set.



#### Clearance gaps

Pos.	Description
1	Tip gap between impeller and suction cover, must be $0.5 \pm 0.1$ mm.
2	Indirect gap for control measurement

5. Start the pump and listen if there is any noise from the impeller touching the suction cover.
- If there is no noise, no further action is necessary.
  - If there is noise, stop the pump immediately, loosen all fastening screws, then loosen the set screws by rotating them  $10^\circ$  further, then finally tighten the Fixing Screws according to Step 4. If this does not solve the noise issue, start over from Step 1.

### 9.7 Contaminated pumps

The product is classified as contaminated, if it is used for contagious or toxic liquid.



#### CAUTION

##### Biological hazard

Minor or moderate personal injury

- Flush the pump thoroughly with clean water and rinse the pump parts after dismantling.

Before returning the product for service, contact Grundfos with details about the pumped liquid. Otherwise, Grundfos can deny to service the product.

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

Clean the product in the best possible way before returning it.



## 10. Troubleshooting



Observe all regulations applying to pumps installed in potentially explosive environments.  
Make sure that no work is carried out in potentially explosive atmospheres.



**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 it cannot be switched on unintentionally.



**DANGER**  
**Electric shock**

Death or serious personal injury

- The pump must be grounded.



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

Fault	Cause	Remedy
The pump does not start or stops without visible cause.	No power supply.	Re-establish the power supply. Start the pump manually.
	Missing phase.	Re-establish all phases.
	The pump is overloaded.	If the fault does not disappear automatically, find the cause and remedy the fault.
	The impeller is clogged by impurities.	Clean the impeller.
The pump does not start or stops. The control panel indicates that the motor-protective circuit breaker or protection equipment is tripped.	The motor-protective circuit breaker is set incorrectly.	Set the motor-protective circuit breaker according to the rated current.
	The thermal switches are tripped. Insufficient motor cooling.	Re-establish the motor cooling.
	The moisture switch in the motor is tripped.	Contact an authorised service workshop.
	The power cable is defective.	Contact an authorised service workshop.
	The voltage is fluctuating.	Re-establish the correct voltage supply. Permissible deviation is $\pm 10\%$ .

<b>Fault</b>	<b>Cause</b>	<b>Remedy</b>
The pump runs, but does not deliver the rated flow.	The direction of rotation is wrong.	Interchange two phases to the motor.
	The impeller is loose or worn.	Tighten or replace the impeller.
	The pump or the pipes are blocked by impurities.	Clean the pump or the pipes.
	The pump head is too high.	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.
	The valves are closed or blocked. The non-return valve is not operating.	Clean or replace the valves.
	There is air in the pump or the inlet pipe.	Vent the pump and the inlet pipe. Increase the stop level in the pit.
	The pumped liquid is too dense.	Dilute the pumped liquid.
	The pump is improperly connected to the auto coupling.	Pump down the liquid level in the pit. Lift out the pump and place it on the auto coupling again.
	There is leakage in the pipes.	Repair the pipes.
	The pit flushing system is inadvertently activated.	Check the function of the pit flushing system and repair it, if required.
The pump starts, but stops immediately.	The pump is clogged, which causes the motor-protective circuit breaker to trip.	Clean the pump.
	The motor is overheated, which causes the thermal switches to trip.	Allow the pump to cool. Clean the pump.
	The level switch is out of adjustment or defective, or the cooling liquid is leaking.	Check the level of the cooling liquid, then contact an authorised service.

Fault	Cause	Remedy
The pump is vibrating or emitting excessive noise.	The pump is partly clogged by impurities.	Clean the pump.
	The direction of rotation is wrong.	Interchange two phases to the motor.
	The pump is operating outside the specified operating range.	Re-establish proper operating conditions.
	The pump is defective.	Repair the pump or contact an authorised workshop, if necessary.
	The pump is not properly connected to the auto coupling.	Pump down the liquid level in the pit. Lift out the pump and place the pump on the auto coupling.
	The pump is cavitating.	Clean the inlet pipe.
	The impeller is not in balance.	Contact an authorised service workshop.
	The base stand, the auto coupling, the ring stand or the guide rails are installed incorrectly.	Install the components correctly.
Low motor liquid level.	The upper mechanical shaft seal is leaking.	Contact an authorised service workshop.

## 11. Technical data

### pH value

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

Material variant	Installation	pH value
Standard <sup>1)</sup>	All types	6-14 <sup>1)</sup>

1) Cast iron impeller, pump housing and motor top.

### Density and viscosity of the pumped liquid

Density: 1000 kg/m<sup>3</sup>.

Kinematic viscosity: 1 mm<sup>2</sup>/s (1 cSt).



When pumping liquids with a density and/or a kinematic viscosity higher than the values stated above, use motors with correspondingly higher outputs.

### Flow rate

Keep a minimum flow rate to avoid sedimentation in the pipe network. Recommended minimum flow rates:

- in vertical pipes: 0.7 m/s.
- in horizontal pipes: 1.0 m/s.

### Ambient temperature

The ambient temperature may exceed 40 °C, up to a maximum of 60 °C for a short period (maximum 3 minutes).

### Altitude

The product operates correctly up to 1000 m altitude above sea level.

### Liquid temperature

0 to +40 °C.

The liquid temperature may be up to 60 °C for a short period (maximum 3 minutes).

### Operating mode

The pumps are designed for continuous operation.

### Installation depth



Do not use extended power cables. Only use a single-piece power cable that is longer than the depth of installation.

Maximum 20 m below liquid level. Custom variants may be installed at maximum 30 meters depth, but not explosion-proof pumps. Power cable length must always be more than installation depth.

### Enclosure class

IP68.

### Sound Pressure



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

**Motor liquid**

The motor is factory-filled with Grundfos SML3 motor liquid which is frost-resistant until -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  $\pm 10\%$  of the rated voltage.

**Maximum number of starts per hour**

30.

**12. 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 wheeled 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.

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See also end-of-life information at [www.grundfos.com/product-recycling](http://www.grundfos.com/product-recycling).

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<b>92777903</b> 12.2023
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ECM: 1366422
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