

# SL1 and SLV pumps

1.5 - 15 hp, 60 Hz

Installation and operating instructions



**SL1/SLV 1.5-15 hp**  
**Installation and operating instructions**  
(all available languages)  
<http://net.grundfos.com/qr/i/97640137>



# SL1 and SLV pumps

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## English (US)

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## Original installation and operating instructions

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## 1. Limited warranty

Products manufactured by Grundfos Pumps Corporation (Grundfos) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. Grundfos' liability under this warranty shall be limited to repairing or replacing at Grundfos' option, without charge, F.O.B. Grundfos' factory or authorized service station, any product of Grundfos manufacture. Grundfos will not be liable for any costs of removal, installation, transportation, or any other charges that may arise in connection with a warranty claim. Products which are sold, but not manufactured by Grundfos, are subject to the warranty provided by the manufacturer of said products and not by Grundfos' warranty. Grundfos will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with Grundfos' printed installation and operating instructions and accepted codes of good practice. The warranty does not cover normal wear and tear. To obtain service under this warranty, the defective product must be returned to the distributor or dealer of Grundfos' products from which it was purchased together with proof of purchase and installation date, failure date and supporting installation data. Unless otherwise provided, the distributor or dealer will contact Grundfos or an authorized service station for instructions. Any defective product to be returned to Grundfos or a service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Material Authorization must be included if so instructed. Grundfos will not be liable for any incidental or consequential damages, losses, or expenses arising from installation, use, or any other causes. There are no express or implied warranties, including merchantability or fitness for a particular purpose, which extend beyond those warranties described or referred to above. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction. Products which are repaired or replaced by Grundfos or authorized service center under the provisions of these limited warranty terms will continue to be covered by Grundfos warranty only through the remainder of the original warranty period set forth by the original purchase date.

## 2. General information



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



This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved.

## 2.1 Hazard statements

The symbols and hazard statements below may appear in Peerless 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.

## 2.2 Notes

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



Observe these instructions for explosion-proof products.



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



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



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



Tips and advice that make the work easier.

## 2.3 Target groups

These installation and operating instructions are intended for professional installers.

## 3. Product introduction

### 3.1 Product description

This manual includes instructions for installation, operation and maintenance of Grundfos SL1 and SLV submersible sewage and wastewater pumps with motors of 1.5 to 15 hp (1.1 to 11 kW). The pumps are designed for pumping domestic and industrial sewage and wastewater.

The following pumps are available:

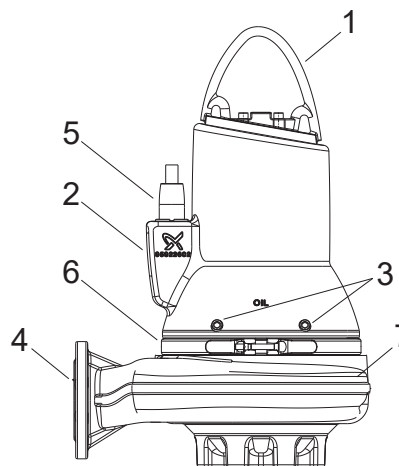
- SL1 sewage pumps with **S-tube**® impeller
- SLV sewage pumps with SuperVortex, free-flow impeller.

The pumps can be installed on an auto-coupling system or a ring stand on the bottom of a tank.

Grundfos SL1 and SLV pumps are designed with **S-tube**® and SuperVortex impellers, respectively, to ensure reliable and optimum operation.

The manual also includes specific instructions for the explosion-proof pumps.

## 3.2 Product drawing



TM042648

SL1 pump

Pos.	Description
1	Lifting bracket
2	Nameplate
3	Oil screws
4	Outlet flange
5	Cable plug
6	Clamp
7	Pump housing

### 3.3 Pumped liquids

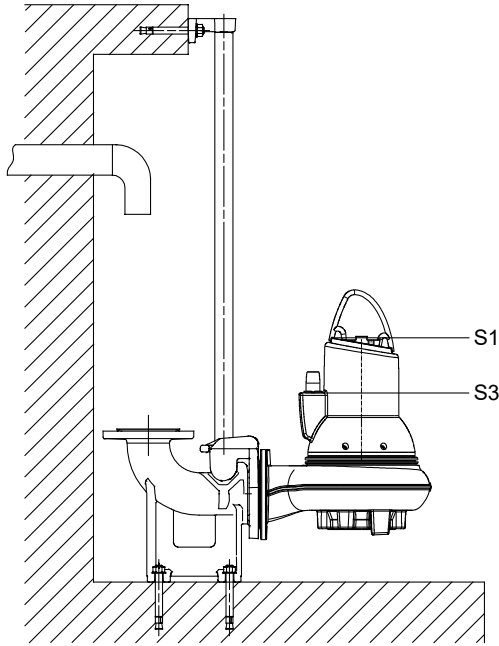
SL1 and SLV pumps are designed for pumping the following liquids:

- large quantities of drainage and surface water
- domestic wastewater with discharge from toilets
- wastewater with a high content of fibres (SuperVortex impeller)
- municipal and commercial sewage and wastewater.

### 3.4 Operating conditions

SL1 and SLV pumps are suitable for the following operating situations:

- S1 operation** (continuous operation), the pump must always be covered by the pumped liquid to the top of the motor.
- S3 operation** (intermittent operation), the pump must always be covered by the pumped liquid up to the top of the cable entry.



TM042649

**Stop levels**

**pH value**

SL1 and SLV pumps in permanent installations can be used for pumping liquids with the following pH values:

Pump type	Material variant	Material	pH value
SL1/SLV	Standard	Cast iron impeller and pump housing	6.5 -14 <sup>1)</sup>
SL1/SLV	Q	Stainless steel impeller and cast iron pump housing	6-14 <sup>1)</sup>

<sup>1)</sup> For fluctuating pH values, the range is pH 4 to 14.

**Liquid temperature**

32-104 °F (0-40 °C).

For non-explosion-proof pumps, a temperature of up to 140 °F (60 °C) is permissible for short periods (maximum 3 minutes).

**Ambient temperature**

-4 °F to +104 °F (-20 °C to +40 °C)



Explosion-proof pumps must never pump liquids of a temperature higher than +104 °F (+40 °C).

For explosion-proof pumps, the ambient temperature on the installation site must be in the range from -4 °F to +104 °F (-20 °C to +40 °C).



For explosion-proof pumps with WIO sensor, the ambient temperature at the installation site must be in the range from 32-104 °F (0-40 °C).

For non-explosion proof pumps, the ambient temperature may exceed +104 °F (+40 °C) for a short period (max. 3 minutes).

**Density and viscosity of pumped liquid**

When pumping liquids with a density and/or a kinematic viscosity higher than water, use motors with correspondingly higher outputs.

Flow velocity	Keep a minimum flow velocity to avoid sedimentation in the piping system.
	Recommended flow velocities: in vertical pipes: 2.3 ft/s (0.7 m/s) in horizontal pipes: 3.3 ft/s (1.0 m/s).
Free spherical passage	From 2" to 4" (50 to 100 mm), depending on pump size.
Operating mode	Maximum 20 starts per hour.

**Related information**

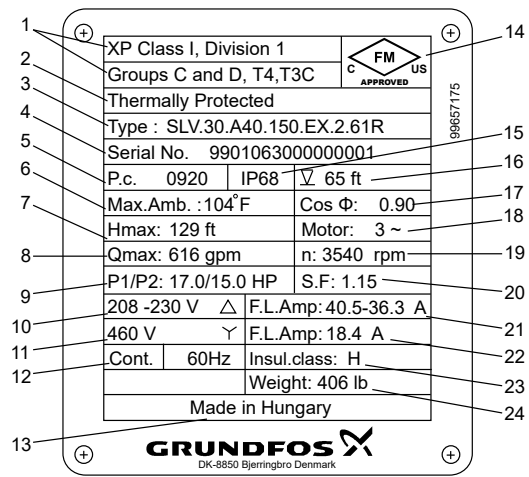
*8.2 Operating modes*

**3.5 Identification**

**3.5.1 Nameplate**

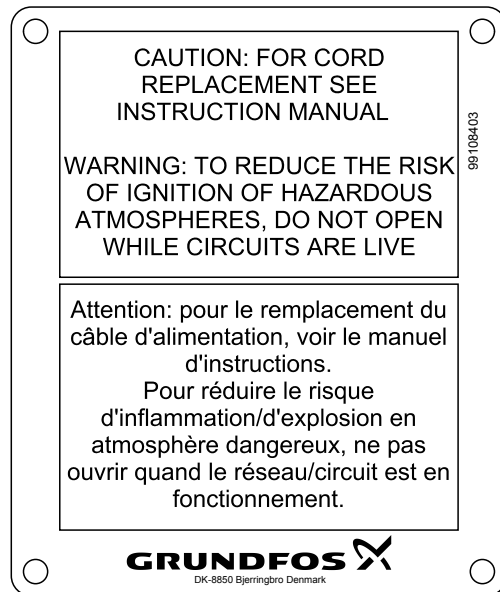
The nameplate states the operating data and approvals applying to the pump. The nameplate is fitted to the side of the stator housing close to the cable entry.

Fix the extra nameplate supplied with the pump to the cable end in the controller.



TM044187

Nameplate



TM068301

FM warning plate with restrictions

Pos.	Description
1	Ex marking
2	Thermally protected
3	Type designation
4	Serial number
5	Production code (year/week)
6	Maximum ambient temperature
7	Maximum head
8	Maximum flow rate
9	Rated input/output power
10	Rated voltage, D
11	Rated voltage, Y
12	Frequency
13	Country of production
14	FM mark
15	Enclosure class to IEC
16	Maximum installation depth
17	Power factor
18	Number of phases
19	Rated speed
20	Service factor
21	Full load current, D
22	Full load current, Y
23	Insulation class
24	Weight without cable

### 3.5.2 Type key

The pump can be identified by the type designation stated on the nameplate.

Example: SL130.A30.55.A.Ex.4.6.1HA.Q.

Code	Designation	Explanation
SL	Pump type	Grundfos wastewater pump
1	Impeller type	S-tube® impeller
V		SuperVortex impeller
20	Free spherical passage [in (mm)]	2" (50 mm)
25		2.5" (65 mm)
30		3" (80 mm)
40		4" (100 mm)
A25	Pump outlet [in (mm)]	ANSI 2.5" (DN 65)
A30		ANSI 3" (DN 80)
A40		ANSI 4" (DN 100)
A60		ANSI 6" (DN 150)
55	Power [hp (kW)]	1.5 - 15 hp (1.1 - 11 kW)
[ ]	Sensor version	Standard version
A		Sensor version
[ ]	Pump version	Standard version
Ex		Explosion-proof version
2	Number of poles	2-pole
4		4-pole
6	Frequency	60 Hz

Code	Designation	Explanation
0J	Voltage and starting method	3 × 208-230 V, direct-on-line starting
1H		3 × 460 V, star-delta starting
0L		3 × 575 V, direct-on-line starting
1L		3 × 575 V, star-delta starting
1R		3 × 230 V / 460 V, Y direct-on-line starting
[ ]	Generation	1st generation
A		2nd generation
B		3rd generation
C		4th generation
[ ]	Pump materials	Cast iron impeller, pump housing and motor housing
Q		Stainless steel impeller (according to 316/351 CF8M), cast iron pump housing and motor housing
[ ]	Customization	Pump in standard range
Z		Custom-built pump

### 3.6 Approvals

The SL1 and SLV pumps have been approved by CSA and FM Approvals. The explosion-proof versions have an FM certificate of compliance number, and a CSA certificate of compliance number. Explosion-proof pumps also have FM Certificate of Compliance number FM16US0168X and FM16CA0098X.

#### 3.6.1 Approval standards

These pump motors have been approved by FM Approvals according to FM 3600, FM 3615, FM 3650, ANSI/IEC 60529, C22.2 No. 04, C22.2 No. 30, C22.2 No. 145, C22.2 No. 60529.

#### 3.6.2 Explanation to FM approval

The SL1 and SLV pumps have the following explosion protection classification: Class I, Division 1, Groups C and D, T4, T3C <sup>2)</sup>, IP68.

Standards	Code	Description
C22.2 No. 04	Class I	= Flammable vapors and gases may be present
C22.2 No. 30	Division 1	= Flammable material present intermittently or continuously
C22.2 No. 145	Groups C and D	= Substances of vapors and gases (typically Ethylene and Propane)
C22.2 No. 60529	T4/T3C <sup>2)</sup>	= Maximum surface temperature is 275 °F (135 °C) and 392 °F (200 °C)
FM 3600		
FM 3615		
FM 3650	IP68	= Enclosure class according to IEC 60529.
ANSI/IEC 60529		

#### Related information

[5.1 Potentially explosive environments](#)

<sup>2)</sup> Motor T-code is T3C when used with frequency converter.



## 4. Receiving the product

Before installation, make sure:

- The product corresponds to the order.
- The pump is suitable for the supply voltage and frequency available at the installation site.
- Accessories and other equipment are not damaged during transportation.

### 4.1 Transporting the product

The pump may be transported and stored in a vertical or horizontal position.



#### CAUTION

##### Crushing hazard

Minor or moderate personal injury

- Make sure the pump cannot roll or fall over.

### 4.2 Handling and lifting the product

All lifting equipment must be rated for the purpose and checked for damage before lifting the pump. The lifting equipment rating must under no circumstances be exceeded. The pump weight is stated on the nameplate.

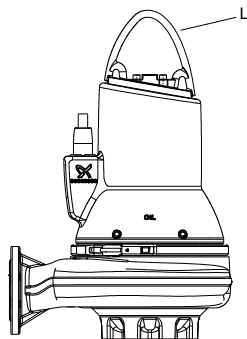


#### WARNING

##### Crushing hazard

Death or serious personal injury

- Always lift the pump by its lifting bracket or by a forklift truck if the pump is fixed on a pallet. Never lift the pump by the power cable, hose, or pipe.



TM063920

Lifting bracket

Pos.	Description
L	Lifting bracket

## 5. Safety



Pump installation in tanks must be carried out by specially trained persons.

Work in or near tanks must be carried out according to local regulations.



Persons must not work in the installation area when the atmosphere is explosive.

#### WARNING

##### Electric shock

Death or serious personal injury



- It must be possible to lock the mains switch in position 0. Type and requirements as specified in National Electrical Code and all local codes.

For safety reasons, all work in tanks must be supervised by a person outside the pump tank.



Make all maintenance and service jobs when the pump is placed outside the tank.

Tanks for submersible sewage and wastewater pumps may contain toxic or contagious substances. Wear appropriate personal protective equipment and clothing. All work on and around the pump must be carried out in strict compliance with hygiene regulations.

#### WARNING

##### Crushing hazard

Death or serious personal injury



- Make sure that the lifting bracket is tightened before lifting the pump. Carelessness during lifting or transportation may cause personal injury or damage to the pump.

The following warnings and notes also appear in a label (delivered with the pump). Place the label near the controller.

#### CAUTION

##### Electric shock

Minor or moderate personal injury



- Do not remove cable and strain relief. Do not connect conduit to the pump.
- Install only on a circuit protected by a ground-fault circuit interrupter (GFCI).

#### WARNING

##### Electric shock

Death or serious personal injury



- This pump has not been approved for use in swimming pools or marine areas.



Provide suitable motor protection based on the electrical ratings.



Enclosure type 3.



Use with approved motor-protective circuit breaker matching motor input in full-load amperes with overload element(s) selected or adjusted in accordance with control instructions.

### 5.1 Potentially explosive environments

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



SL1 and SLV pumps must under no circumstances be used to pump explosive, flammable or combustible liquids.



The classification of the installation site must be approved by the local authorities.

Specific conditions for use of SL1 and SLV explosion-proof pumps:

1. Make sure the moisture- and thermal switches are connected in the same circuit but 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 A2-70 or better according to EN/ISO 3506-1.
3. Contact the manufacturer for information on the dimensions of the flameproof joints.
4. The level of the pumped liquid must be controlled by two level switches connected to the motor control circuit. The minimum level depends on the installation type and is specified in these installation and operating instructions.
5. Make sure the permanently attached cable is suitably mechanically protected and terminated in a suitable terminal board placed outside the potentially explosive area.
6. The sewage pumps have an ambient temperature range of -4 °F to +104 °F (-20 °C to +40 °C) and a maximum process temperature of 104 °F (40 °C). The minimum ambient temperature for a pump with a WIO sensor is 32 °F (0 °C).
7. The thermal protection in the stator windings has a nominal switch temperature of 302 °F (150 °C) and must guarantee the disconnection of the power supply. The power supply must be reset manually.
8. The control unit must protect the WIO sensor against short circuit current of the supply to which it is connected. The maximum current from the control unit must be limited to 350 mA.
9. In case of frequency converter use, the maximum surface temperature of the pump can be 392 °F (200 °C).
10. The WIO sensor is intended for use only with a galvanically isolated circuit.
11. The lock nut of the cable connector must only be replaced with an identical one.
12. The WIO sensor must be connected according to these installation instructions.



6. The sewage pumps have an ambient temperature range of -4 °F to +104 °F (-20 °C to +40 °C) and a maximum process temperature of 104 °F (40 °C). The minimum ambient temperature for a pump with a WIO sensor is 32 °F (0 °C).
7. The thermal protection in the stator windings has a nominal switch temperature of 302 °F (150 °C) and must guarantee the disconnection of the power supply. The power supply must be reset manually.
8. The control unit must protect the WIO sensor against short circuit current of the supply to which it is connected. The maximum current from the control unit must be limited to 350 mA.
9. In case of frequency converter use, the maximum surface temperature of the pump can be 392 °F (200 °C).
10. The WIO sensor is intended for use only with a galvanically isolated circuit.
11. The lock nut of the cable connector must only be replaced with an identical one.
12. The WIO sensor must be connected according to these installation instructions.



EX pumps are equipped with a WIO sensor optionally.

#### Related information

[3.6.2 Explanation to FM approval](#)

## 6. Mechanical installation



Pump installation in tanks must be carried out by specially trained persons. Work in or near tanks must be carried out according to local regulations.



Persons must not work in the installation area when the atmosphere is potentially explosive.

### WARNING

#### Crushing hazard

Death or serious personal injury



- During installation, always support the pump by lifting chains or placing it in a horizontal position to secure stability.



Prior to installation, make sure the tank bottom is even.

## WARNING

### Electric shock

Death or serious personal injury



- Before installation, switch off the power supply and lock the main switch in position 0.
- Make sure that the power supply cannot be switched on unintentionally.
- Any external voltage connected to the pump must be switched off before working on the pump.

Before installation check the followings:

- The pump corresponds to order.
- The pump is suitable for the supply voltage and frequency available at the installation site.
- Accessories and other equipment are undamaged.



Further details concerning accessories can be found in the data booklet SL1, SLV pumps on [www.grundfos.us](http://www.grundfos.us).

Fix the extra nameplate supplied with the pump to the cable end in the controller.

All safety regulations must be observed at the installation site.

Prior to installation, check the oil level in the oil chamber.

## WARNING

### Crushing of hands

Death or serious personal injury



- Do not put your hands or any tool into the pump inlet or outlet port after the pump is connected to the power supply unless the pump has been switched off by removing the fuses or switching off the main switch. Make sure that the power supply cannot be switched on unintentionally. Make sure that all the rotating parts have stopped moving.



Always use Grundfos accessories to avoid malfunctions due to incorrect installation.

## CAUTION

### Crushing hazard

Minor or moderate personal injury



- Use the lifting bracket only for lifting the pump. Do not use it to hold the pump during operation.

#### Related information

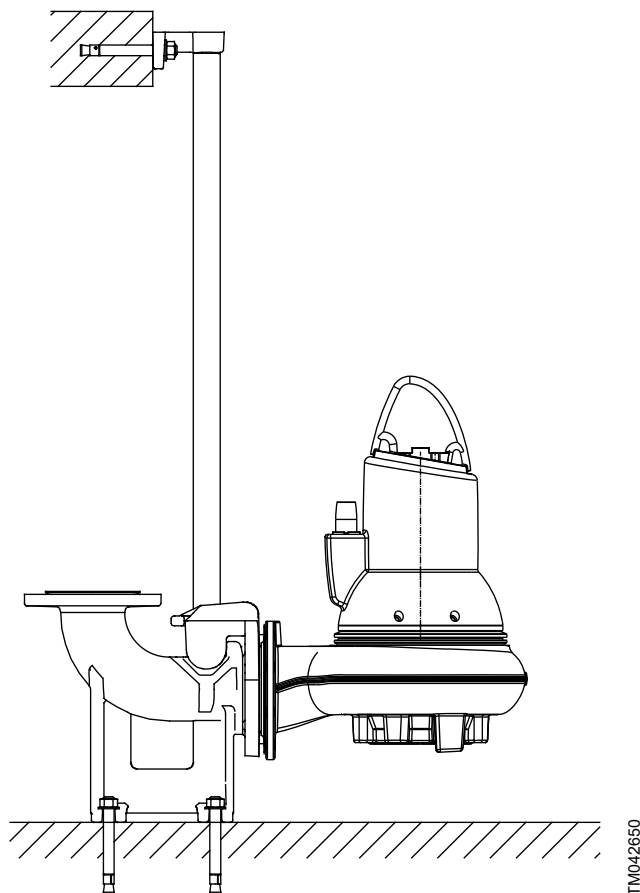
[9. Servicing the product](#)

## 6.1 Installation types

SL1 and SLV pumps are designed for the following installation types:

- submerged installation on auto coupling
- free-standing submerged installation on a ring stand.

### 6.1.1 Submerged installation on auto coupling



Submerged installation on auto coupling

Pumps for permanent installation can be installed on a stationary auto-coupling guide-rail system. The auto-coupling system facilitates maintenance and service as the pump can easily be lifted out of the tank.



Before installation, make sure that the atmosphere in the tank is not potentially explosive.

Check the oil level and condition every 3000 operating hours or at least once a year.



When the pump is new or after replacement of the shaft seal, check the oil level and water content after one week of operation.



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 flanges and bolts.



Do not use elastic elements or bellows in the pipes. These elements must never be used to align the pipes.

Proceed as follows:

1. Drill mounting holes for the guide-rail bracket on the inside of the tank and fasten the guide-rail bracket provisionally with two screws.
2. Place the auto-coupling base unit on the bottom of the tank. Use a plumb line to establish the correct positioning. Fasten the auto coupling with expansion bolts. If the bottom of the tank is uneven, the auto-coupling base unit must be supported so that it is level when being fastened.

3. Assemble the outlet pipe according to the generally accepted procedures and without 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 accurately to the guide-rail bracket at the top of the tank.
  5. Unscrew the provisionally fastened guide-rail bracket. Insert the upper guide-rail bracket into the guide-rails. Fasten the guide-rail bracket on the inside of the tank.
- !** The guide-rails must not have any axial play as this would cause noise during operation.
6. Clean out debris from the tank before lowering the pump.
  7. Fit the guide claw to the discharge port of the pump.
  8. Slide the guide claw of the pump between the guide-rails and lower the pump into the tank by a chain secured to the lifting bracket. When the pump reaches the auto-coupling base unit, it automatically connects.
  9. Hang up the end of the chain on a suitable hook at the top of the tank so that the chain cannot come into contact with the pump housing.
  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 tank. Make sure that the cables are not sharply bent or pinched.
  11. Connect the power cable.



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

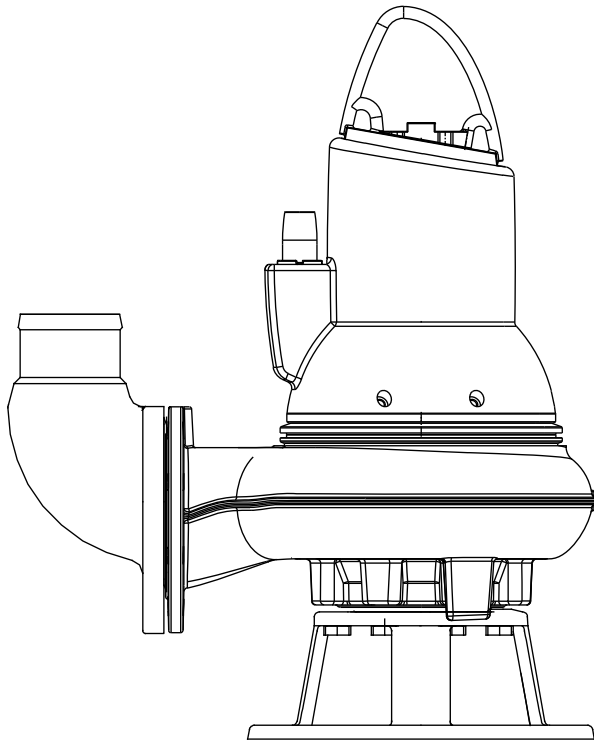
#### Size of anchor bolts in foundation

Auto-coupling base unit	Anchor bolts	Pull-out strength for a single bolt [kipf (kN)]
A30/A40 (DN 80/100)	4 × M16	0.45 (2.0)
A40 (DN 100)	4 × M16	0.56 (2.5)
A60 (DN 150)	4 × M16	0.56 (2.5)
A80 (DN 200)	4 × M24	0.45 (2.0)
A100 (DN 250)	4 × M24	0.56 (2.5)
A120 (DN 300)	4 × M24	0.67 (3.0)



The strengths given above do not include safety factor. The required safety factor depends on the materials and method used for anchoring.

### 6.1.2 Free-standing submerged installation on ring stand



TM042651

Free-standing submerged installation on a ring stand

Pumps for free-standing submerged installation must be installed on a ring stand.

The ring stand is available as an accessory.

In order to facilitate service on the pump, fit a flexible union or coupling to the elbow on the outlet port for easy separation.

**If a hose is used**, make sure the hose does not buckle and the inside diameter of the hose matches the pump outlet port.

**If a rigid pipe is used**, fit the parts in the following order:

1. union or coupling
2. non-return valve
3. isolating valve.

If the pump is installed in muddy conditions or on uneven ground, place it on a solid support.

Proceed as follows:

1. Fit a 90° elbow to the pump outlet port and connect the outlet pipe or hose.
2. Lower the pump into the liquid with a chain secured to the lifting bracket. Place the pump on a plain, solid foundation. Make sure that the pump is hanging from the chain and **not** the cable. Make sure that the pump is standing securely.
3. Hang up the end of the chain on a suitable hook at the top of the tank so that the chain cannot come into contact with the pump housing.
4. 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 tank. Make sure that the cable is not sharply bent or pinched.
5. Connect the power cable.



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

### 6.1.3 Torques for inlet and outlet flanges

#### Grade 4.6 (5) galvanized steel screws and nuts

	Nominal diameter [inch]	Pitch circle diameter [inch]	Screws	Specified tightening torques rounded off by $\pm 5$ [ft.lbs (Nm)]	
				Slightly oiled	Well lubricated
Inlet	2 1/2	5 1/2	4 × M16	50 (70)	45 (60)
	3	6	8 × M16	50 (70)	45 (60)
	4	7 1/2	8 × M16	50 (70)	45 (60)
	6	9 1/2	8 × M20	100 (140)	90 (120)
Outlet	2 1/2	5 1/2	4 × 5/8" UNC	50 (70)	45 (60)
	3	6	8 × 5/8" UNC	50 (70)	45 (60)
	4	7 1/2	8 × 5/8" UNC	50 (70)	45 (60)
	6	9 1/2	8 × 3/4" UNC	90 (120)	80 (100)

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

	Nominal diameter [inch]	Pitch circle diameter [inch]	Screws	Specified tightening torques rounded off by $\pm 5$ [ft.lbs (Nm)]	
				Slightly oiled	Well lubricated
Inlet	2 1/2	5 1/2	4 × M16	-	45 (60)
	3	6	8 × M16	-	45(60)
	4	7 1/2	8 × M16	-	45 (60)
	6	9 1/2	8 × M20	-	90 (120)
Outlet	2 1/2	5 1/2	4 × 5/8" UNC	-	45 (60)
	3	6	8 × 5/8" UNC	-	45(60)
	4	7 1/2	8 × 5/8" UNC	-	45(60)
	6	9 1/2	8 × 3/4" UNC	-	80 (100)



The gasket must be a full face, reinforced paper gasket, such as Klingsil C4300. If softer gasket material is used, torques must be reconsidered.

## 7. Electrical connection

### DANGER

#### Electric shock

Death or serious personal injury

- Connect the pump to an external mains switch which ensures all-pole disconnection with a contact separation according to National Electrical Code and all local codes.
- It must be possible to lock the mains switch in position 0. Type and requirements as specified in National Electrical Code and all local codes.
- The electrical connection must be carried out in accordance with local regulations.



The pumps must be connected to a controller with a motor protection relay with IEC trip class 10 or 15 or NEMA equivalent.

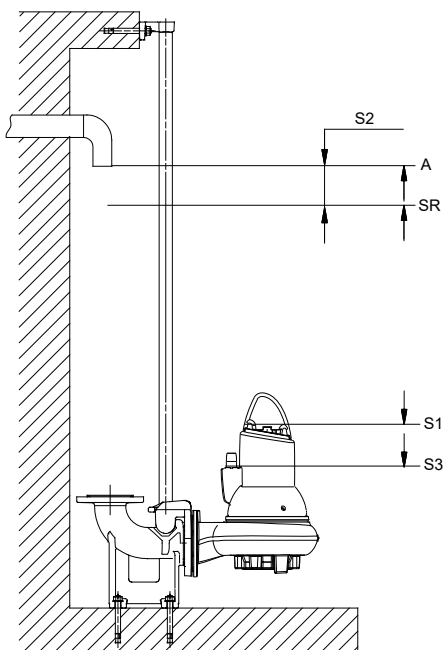


Power supply for motor-protection circuit must be low voltage, Class 2.

## 7.1 Protection and control functions

### 7.1.1 Level controllers

To prevent air intake, dry running, and vibrations, install the stop level switch so the pump is stopped before the liquid level falls below the upper edge of the clamp.



TM042654

Start and stop levels

Pos.	Description
A	Alarm
SR	Start
S1	Stop S1 operation
S2	Min. 3.9" (10 cm)
S3	Stop S3 operation

The pump must not run dry. Dry running may cause ignition hazard.



Install an independent secondary level switch to the same level to ensure that the pump is stopped in case the primary stop level switch is not working.



Stop level switches must be set to Stop S1 or Stop S3 levels depending on the operation.

### 7.1.2 Switches and sensors

Explosion-proof pumps are assembled with a WIO sensor optionally. The sensor measures the water content from 0 to 20 %. It also sends a signal if the water content is outside the normal range (warning), or if there is air in the oil chamber (alarm).



Pumps for hazardous locations must be connected to a control box with a motor protection relay with IEC trip class 10.

Do not install Grundfos pump controllers, Ex barriers, and the free end of the power cable in potentially explosive environments.

The classification of the installation site must be approved by the local fire-fighting authorities.

On explosion-proof pumps, make sure that an external earth lead is connected to the external earth terminal on the pump using a secure cable clamp. Clean the surface of the external earth connection and mount the cable clamp.



The cross-section of the earth conductor must be at least 0.0062 in<sup>2</sup> (4 mm<sup>2</sup>), such as type H07 V2-K (PVT 90°) yellow and green.

Make sure that the earth connection is protected from corrosion.

Make sure that all protective equipment is connected correctly.

Float switches used in potentially explosive environments must be approved for this application. They must be connected to the Grundfos LC 231 or LC 241 pump controller through the intrinsically safe barrier to ensure a safe circuit.

## DANGER

### Electric shock

Death or serious personal injury



- If the supply cable is damaged, it must be replaced by the manufacturer, its service agent, or similarly qualified persons.



Set the motor-protective circuit breaker to the rated current of the pump. The rated current is stated on the nameplate.



If the pump has an FM mark on the nameplate, make sure that the pump is connected in accordance with the instructions given in this manual.

The main supply voltage and frequency are marked on the pump nameplate. The voltage tolerance must be within  $\pm 10\%$  of the rated voltage. Make sure that the motor is suitable for the power supply available at the installation site.

All pumps are supplied with 32.8 ft (10 m) cable and a free cable end, except for pumps for Australia and New Zealand which have 49.2 ft (15 m) cable.

**Pumps without sensor** must be connected to one of the following controller types:

- a control box with a motor-protective circuit breaker, such as a Grundfos CU 100
- a Grundfos LC 231 or LC 241 pump controller
- a Grundfos DC, DCD pump controller.

**Pumps with sensor** must be connected to a Grundfos IO 113 and one of the following controller type is recommended:

- a control box with a motor-protective circuit breaker, such as a Grundfos CU 100
- a Grundfos LC 231 or LC 241 pump controller
- a Grundfos DC, DCD pump controller.



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

### 7.1.3 Pumps with WIO sensor

#### CAUTION

##### Electric shock

Minor or moderate personal injury



- For safe installation and operation of pumps equipped with a WIO sensor, an RC filter is recommended. If an RC filter is installed to avoid any kind of transient, the RC filter must be installed between the power connector and the pump.

The following may cause problems in case of transients in the power supply system:

- Motor power:
  - The bigger the motor, the higher the transients.
- Length of the motor cable:
  - Where power and signal conductors are running in parallel close to each other, the risk of transients causing interference between power and signal conductors increases with the length of the cable.
- Switchboard layout:
  - Power and signal conductors must be physically separated as much as possible. Close installation can cause interference in case of transients.
- Supply network "stiffness":
  - If a transformer station is located close to the installation, the supply network may be "stiff" and transient levels can be higher.

If combinations of the above aspects are present, it may be necessary to install RC filters for pumps with WIO sensors to protect against transients.

Transients can be completely eliminated if soft starters are used.

**Note:** Soft starters and variable speed drives have other Electro-Magnetic Compatibility (EMC)-related issues that must be taken into consideration.

## 7.2 Wiring diagrams



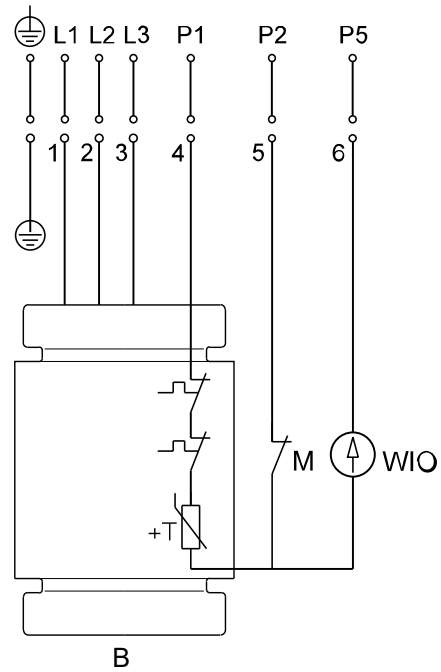
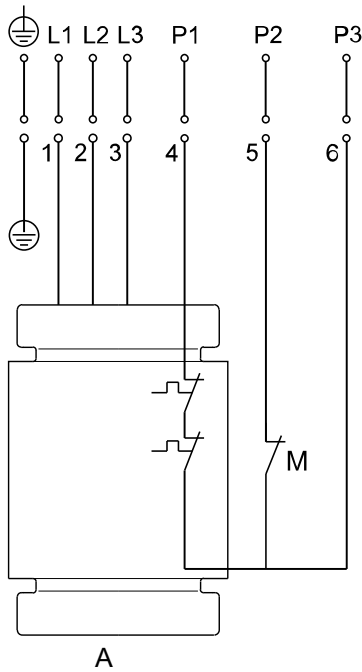
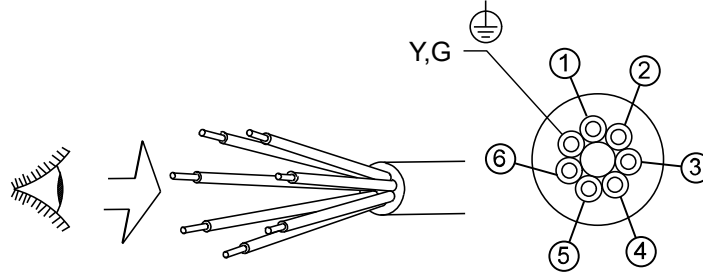
### WARNING

#### Electric shock

Death or serious personal injury

- Make sure the earth and phase conductors are not mixed up. Make sure the earth conductor is connected first. Make sure that the product is earthed properly.

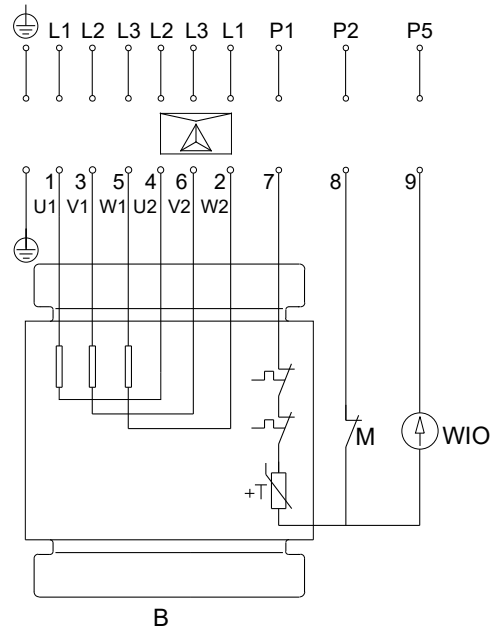
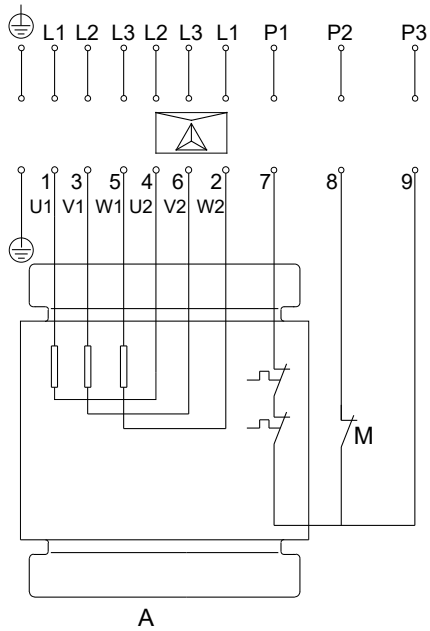
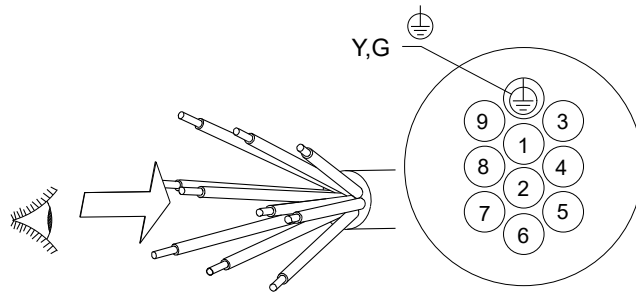
The pumps are supplied with either a 7- or a 10-core cable. See the wiring diagrams below.



Wiring diagram, 7-wire cable, Direct-On-Line (DOL) connected

Position	Description
A	Standard version with thermal switches, CSA approval, with or without FM approval
B	Sensor version with thermal switches, Pt1000, moisture switch and WIO sensor, CSA approval, with or without FM approval

TMO46689

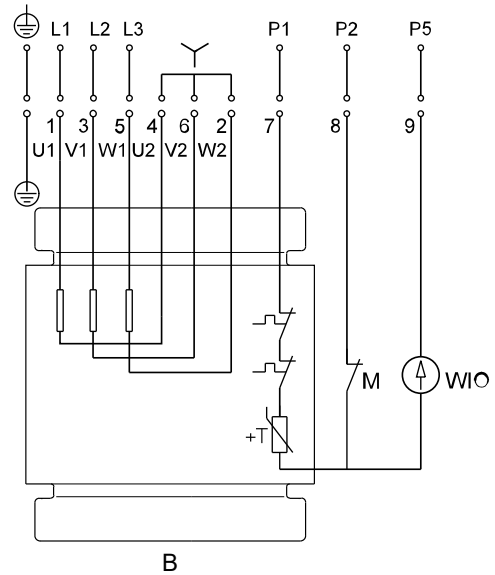
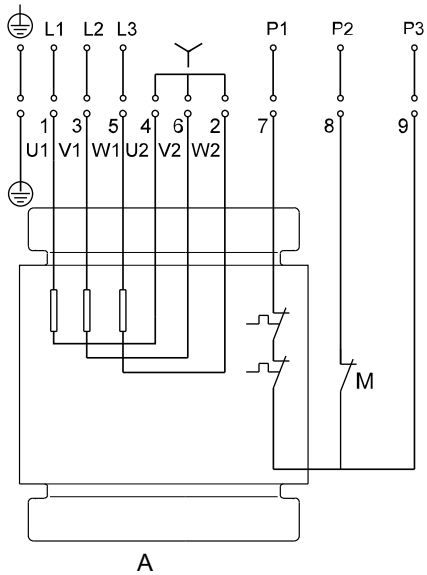
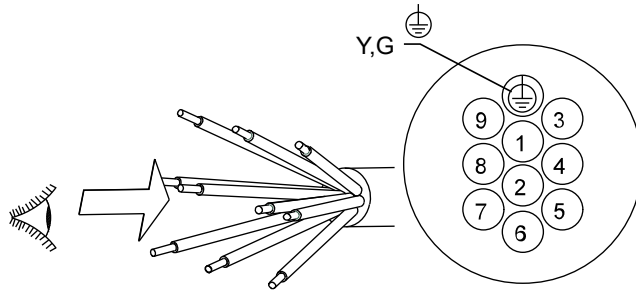


TM046690

Wiring diagram, 10-wire cable, Star/Delta (Y/D) connected

Position	Description
A	Standard version with thermal switches, CSA approval, with or without FM approval
B	Sensor version with thermal switches, Pt1000, moisture switch and WIO sensor, CSA approval, with or without FM approval

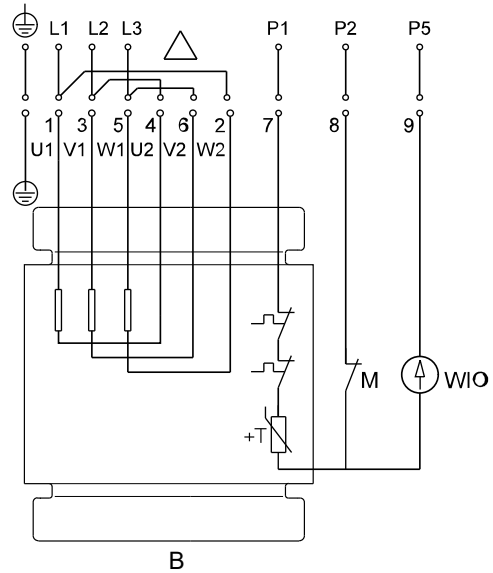
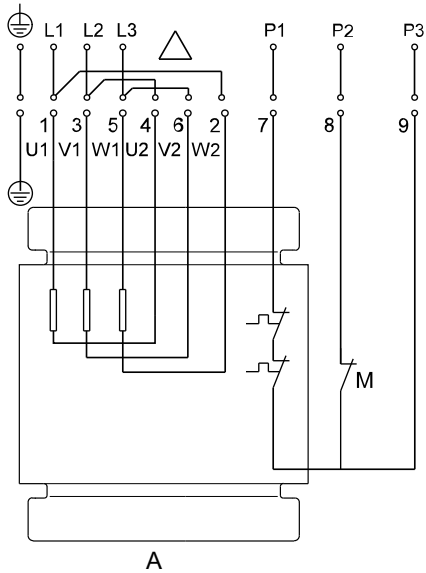
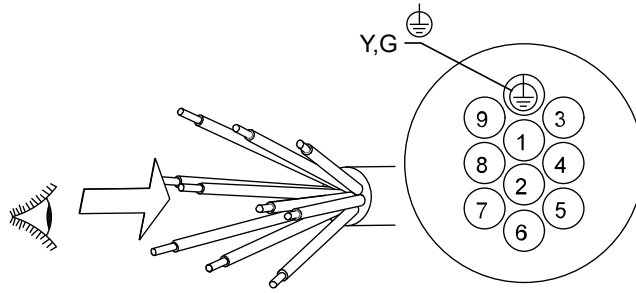




TM046691

Wiring diagram, 10-wire cable, Star-connected (Y)

Position	Description
A	Standard version with thermal switches, CSA approval, with or without FM approval
B	Sensor version with thermal switches, Pt1000, moisture switch and WIO sensor, CSA approval, with or without FM approval



TM046692

Wiring diagram, 10-wire cable, Delta-connected (D)

Position	Description
A	Standard version with thermal switches, CSA approval, with or without FM approval
B	Sensor version with thermal switches, Pt1000, moisture switch and WIO sensor, CSA approval, with or without FM approval

To find out whether the pump is fitted with a thermal switch or a PTC thermistor, measure the motor winding resistance. See the table below.

	Without cable	With 10 m cable	With 15 m cable
Thermal switch	< 50 mΩ	< 320 mΩ	< 390 mΩ
PTC thermistor	> 100 mΩ	> 370 mΩ	> 440 mΩ

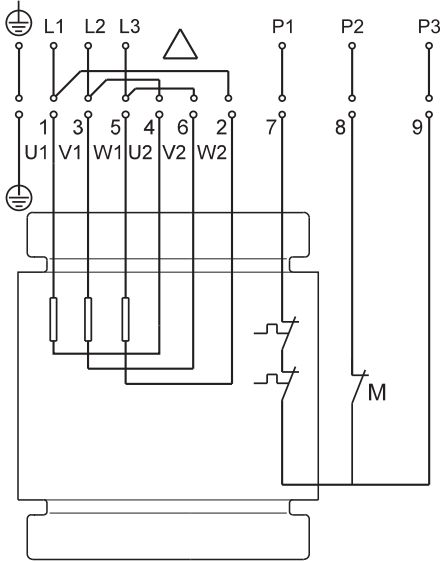
**Related information**

[8.3 Direction of rotation](#)

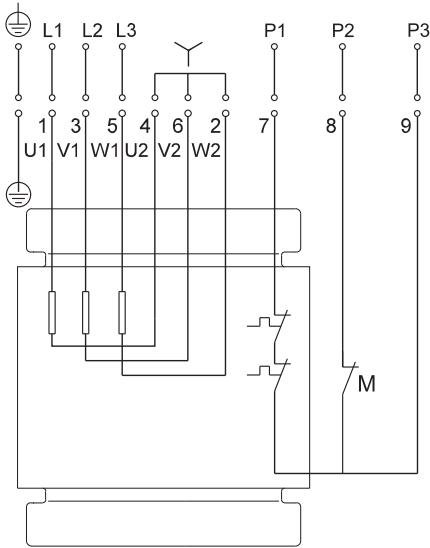
### 7.2.1 SL dual voltage concept

To standardize the SL product portfolio, a 61R voltage variant is available. It is a dual-voltage (230 V/460 V), three phase, 60 Hz Direct-On-Line (DOL) connected motor.

- Connect 230 V pumps using the low-voltage (delta) connection.
- Connect 460 V pumps using the high-voltage (star) connection.



61R 230 V DOL wired in low-voltage (delta) connection



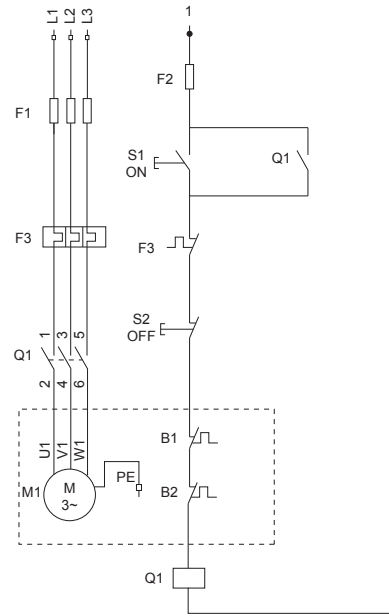
61R, 460 V DOL wired in high-voltage (star) connection

The 61R voltage variant provides a large voltage range for supply power.

Stated voltage [V]	Percentage variation	Voltage range [V]
230	± 10 %	207-253
460	± 10 %	414-506

TM057155

TM057156



TM060523

Motor-protection wiring diagram

Position	Description
S1	On switch
S2	Off switch
F1 + F2	Fuse
F3	Motor-protection switch
Q1	Contactor
B1 + B2	Thermal switch in motor
M1	Motor

### 7.3 Pump controllers

SL1 and SLV pumps can be connected to the following Grundfos pump controllers for level control:

- LC 231 or LC 241
- Grundfos DC and DCD.

For further information on controllers, see the installation and operation instructions for the selected controller or visit [www.us.grundfos.com](http://www.us.grundfos.com).

### 7.4 Thermal switch, Pt1000 and thermistor

All SL1 and SLV pumps have thermal protection incorporated in the stator windings.

#### Related information

##### 11. Fault finding

#### 7.4.1 Pumps without sensors

Pumps without sensors have a thermal switch or a PTC thermistor. Through the pump controller safety circuit, the thermal switch stops the pump by breaking the circuit in case of overtemperature (approximately 302 °F [150 °C]). The thermal switch closes the circuit after cooling. For pumps equipped with a PTC thermistor, connect the thermistor to either the PTC relay or the I/O module to break the circuit at 302 °F (150 °C).

The maximum operating current of the thermal switch is 0.5 A at 500 VAC and  $\cos \varphi$  0.6. The switch must be able to break a coil in the supply circuit.

#### 7.4.2 Pumps with WIO sensor

Pumps with a WIO sensor have either a thermal switch and a Pt1000 sensor or a PTC thermistor in the windings, depending on the installation site. Through the pump controller safety circuit, the

thermal switch or the thermistor stops the pump by breaking the circuit in case of overtemperature (approximately 302 °F [150 °C]). The thermal switch or the thermistor closes the circuit after cooling. The maximum operating current of both the Pt1000 and the thermistor is 1 mA at 24 VDC.

#### 7.4.3 Non-explosion-proof pumps

When closing the circuit after cooling, the thermal protection can restart the pump automatically through the controller. Pumps from 4 kW and above sold in Australia and New Zealand are fitted with a PTC thermistor.

#### 7.4.4 Explosion-proof pumps

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 a sensor, this is done by removing the short circuit between terminals R1 and R2 in the IO 113.



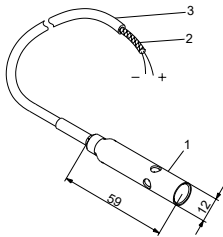
See Electrical data in the installation and operating instructions for IO 113

<http://net.grundfos.com/qr/i/98097396>

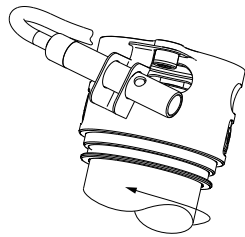
The separate motor-protective circuit breaker or controller must not be installed in potentially explosive environments.

#### 7.5 Water-in-oil sensor

The water-in-oil (WIO) sensor measures the water content in the oil and converts the value into an analog current signal. The two sensor leads are for power supply and for carrying the signal to the IO 113. The sensor measures the water content from 0 to 20 %. It also sends a signal if the water content is outside the normal range (warning), or if there is air in the oil chamber (alarm). The sensor is fitted in a stainless steel tube for mechanical protection.



TM031164



TM045238

WIO sensor

#### Related information

[Procedure \(pump with WIO sensor\)](#)

[Procedure \(pump with WIO sensor\)](#)

#### 7.5.1 Fitting the WIO sensor

Fit the sensor next to one of the shaft seal openings. The sensor must be tilted into the motor's direction of rotation to ensure that oil is led into the sensor. Make sure that the sensor is submerged in the oil.

#### 7.5.2 Technical data

Input voltage:	12-24 VDC
Output current:	3.4 - 22 mA
Power input:	0.6 W
Ambient temperature:	32-158 °F (0-70 °C)

See also the installation and operating instructions for IO 113 on [www.grundfos.us](http://www.grundfos.us).

#### 7.6 Moisture switch

All pumps are fitted with a moisture switch as standard, with the moisture switch being connected through the supply cable, and connected to a separate circuit breaker.

The moisture switch is positioned in the bottom of the motor. If there is moisture in the motor, the switch breaks the circuit and sends a signal to the IO 113.

The moisture switch is non-reversing and must be replaced after use.

The moisture switch is connected to the control cable and must be connected to the safety circuit of the separate pump controller.

### CAUTION

#### Electric shock

Minor or moderate personal injury



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

#### Related information

[11. Fault finding](#)

#### 7.7 IO 113

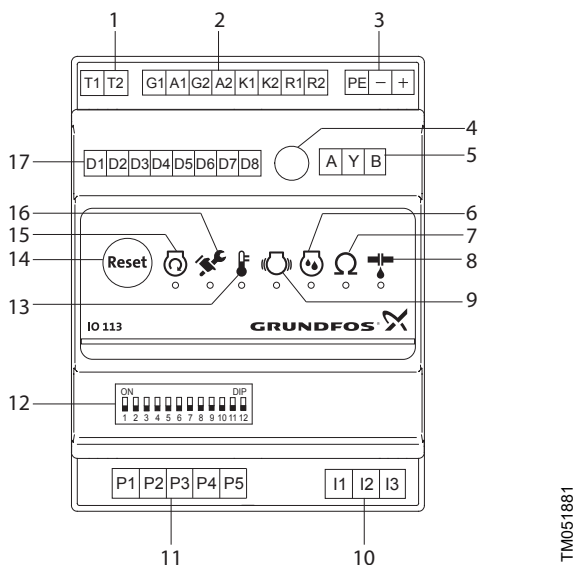
IO 113 provides an interface between a Grundfos wastewater pump equipped with sensors and the pump controller(s). The most important sensor status information is indicated on the front panel.

One pump can be connected to one IO 113 module.

Together with the sensors, the IO 113 provides a galvanic isolation between the motor voltage in the pump and the connected controller(s).

As standard, IO 113 is capable of the following:

- Protect the pump against overheating.
- Monitor the status of the following items:
  - motor winding temperature
  - leakage (WIO)
  - moisture in the pump.
- Measure the stator insulation resistance.
- Stop the pump in case of alarm.
- Remotely monitor the pump through RS-485 communication (Modbus or GENibus).
- Control the pump by frequency converter.



TM051881

IO 113 module

Pos.	Description
1	Terminals for alarm relay
2	Terminals for analog and digital inputs and outputs
3	Terminals for supply voltage
4	Potentiometer for setting the warning limit of stator insulation resistance
5	Terminals for RS-485 for GENIbus or Modbus
6	Indicator light for moisture measurement
7	Indicator light for stator insulation resistance
8	Indicator light for leakage (WIO)
9	Indicator light for vibration in the pump
10	Terminals for measurement of stator insulation resistance
11	Terminals for connection of pump sensors
12	DIP switch for configuration
13	Indicator light for motor temperature
14	Button for resetting alarms
15	Indicator light for motor running
16	Indicator light for service
17	Terminals for digital outputs

#### Related information

[8.1 General startup procedure](#)

[11. Fault finding](#)

#### 7.8 Frequency converter operation



If the motor is operated with a frequency converter, the temperature class of the explosion-proof pumps must be T3C.

All SL1/SLV pump types are designed for frequency converter operation to keep the energy consumption at a minimum.

To avoid sedimentation in the pipes, operate the speed-controlled pump at a flow rate above 3.28 ft/s (1 m/s).

In this product range, only a negligible amount of bearing currents occur during frequency converter operation.

For frequency converter operation, check the following:

- Before installing a frequency converter, calculate the lowest allowable frequency in the installation to avoid zero flow.

- Do not reduce the motor speed to less than 50 % of the rated speed.
- Keep the flow velocity 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 to avoid motor overload.
- Keep the power cable as short as possible. The peak voltage increases with the length of the power cable. See the data sheet for the frequency converter used.
- Use input and output filters on the frequency converter. See the data sheet for the frequency converter used.
- Use screened power cable if there is a risk that electrical noise can disturb other electrical equipment. See the data sheet for the frequency converter used.
- The thermal protection of the motor must be connected.
- The minimum switching frequency is 2.5 kHz.
- Variable switching frequency is accepted.
- 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.

Maximum repetitive peak voltage [V]	Maximum dU/dt U <sub>N</sub> 400 V [V/μ sec.]
850	2000

- 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 and standards must be complied with.

When operating the pump with a frequency converter, consider the following:

- Set the frequency converter for constant torque operation. Pulse width modulation should be used.
- The locked-rotor torque may be lower, depending on the frequency converter type. See the installation and operating instructions for the selected frequency converter.
- Frequency converter use can increase the wear on the shaft seal and bearings.
- The noise level may increase. See the installation and operating instructions for the frequency converter used.
- The working condition of bearings and shaft seal may be affected.



For further information on pumps operated with a frequency converter, visit the Grundfos Product Center at <https://productselection.grundfos.com>.

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

## 8. Startup

### DANGER

#### Electric shock

Death or serious personal injury



- Before starting work on the pump, make sure that the fuses are removed or the main switch is switched off.
- Make sure that the power supply cannot be switched on unintentionally.
- Make sure that all protective equipment is connected correctly.
- The pump must not run dry.

### WARNING

#### Crushing of hands

Death or serious personal injury



- Do not open the clamp during operation.

### 8.1 General startup procedure

This procedure applies to new installations as well as after-service inspections if startup takes place sometime after the pump was placed in the tank.



Check that there is positive inlet pressure before starting up the pump.

1. Remove the fuses and check that the impeller can rotate freely. Turn the impeller by hand.

### CAUTION

#### Sharp element

Minor or moderate personal injury



- Wear protective gloves as the impeller can have sharp edges.

2. Check the condition of the oil in the oil chamber.
3. Check that the system, bolts, gaskets, pipes, and valves are in correct condition.
4. Mount the pump in the system.
5. Switch on the power supply.
6. Check whether the monitoring units, if used, are operating appropriately.
7. **For pumps with WIO sensor**, switch on the IO 113 and check that there are no alarms or warnings.
8. Check the setting of air bells, float switches, or electrodes.
9. Check the direction of rotation.
10. Open the isolating valves, if fitted.
11. Check if the liquid level is above the motor for S1 operation and above the cable entry for S3 operation. Do not start the pump if the minimum level is not reached.
12. Start the pump and let the pump run briefly, and check if the liquid level is falling.
13. Check if the discharge pressure and input current are normal. If not, air may be trapped inside the pump.



To remove trapped air from the pump housing, tilt the pump by the lifting chain during operation.



In case of abnormal noise, vibration, pump failure, power supply failure or water supply failure, stop the pump immediately. Do not restart the pump until the cause of the fault has been found and eliminated.

After one week of operation or after shaft seal replacement, check the condition of the oil in the chamber. For pumps without sensor, take an oil sample.

Every time the pump is removed from the tank, go through the above procedure before restart.

### Related information

[7.7 IO 113](#)

[9. Servicing the product](#)

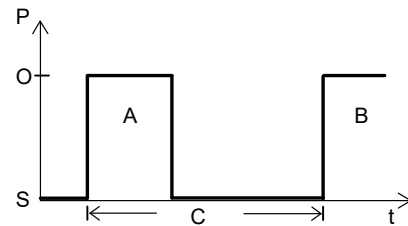
### 8.2 Operating modes

The pumps are designed for intermittent operation (S3).

When completely submerged, the pumps can also operate continuously (S1).

**S3, intermittent operation:** S3 operation is a series of 10-minute duty cycles (TC). Each cycle has a 4-minute period of constant load followed by a 6-minute period of rest. Thermal equilibrium is not reached during the cycle.

In this operating mode, the pump is partly submerged in the pumped liquid. The minimum liquid level is at the top of the cable entry.

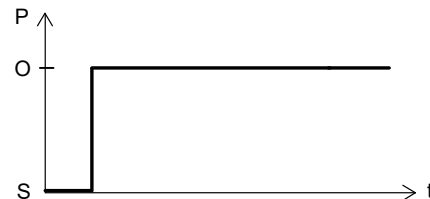


TM044527

S3, intermittent operation

Pos.	Description
O	Operation
S	Stop
A	4 min.
B	6 min.
C	10 min.

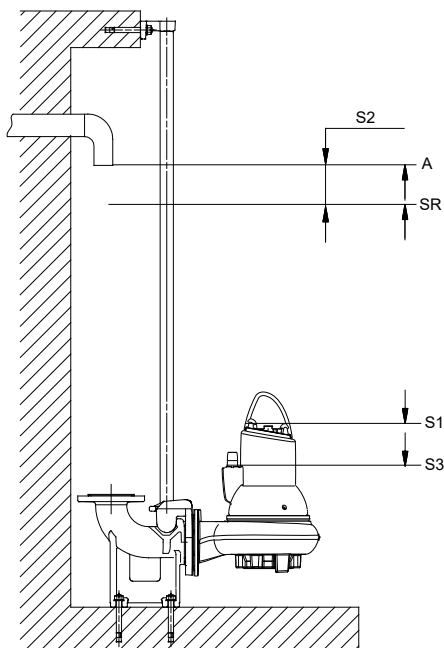
**S1, continuous operation:** In this operating mode, the pump can operate continuously without being stopped for cooling. Being completely submerged, the pump is sufficiently cooled by the surrounding liquid.



TM044528

S1, continuous operation

Pos.	Description
O	Operation
S	Stop



TM042654

Start and stop levels

Pos.	Description
A	Alarm
SR	Start
S1	Stop S1 operation
S2	Min. 3.93 in (10 cm)
S3	Stop S3 operation

**Related information**

[3.4 Operating conditions](#)

**8.3 Direction of rotation**

The pump may be started for a very short period without being submerged to check the direction of rotation.

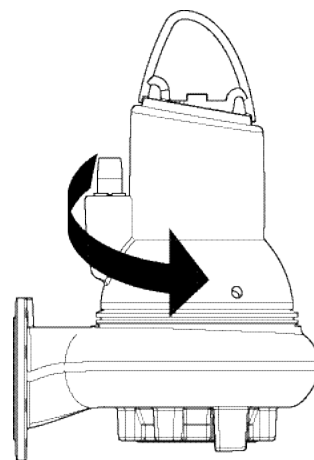
Check the direction of rotation before starting up the pump. An arrow on the stator housing indicates the correct direction of rotation. The correct direction of rotation is clockwise.

**Checking the direction of rotation**

The direction of rotation must be checked every time the pump is connected to a new installation.

**Procedure**

- Let the pump hang from a lifting device, for example, the hoist used for lowering the pump into the tank.
- Start and stop the pump while observing the movement (jerk) of the pump. If connected correctly, the impeller rotates clockwise, so the pump jerks counterclockwise.
- If the direction of rotation is wrong, interchange any two of the phases in the power supply cable.



Jerk direction

**Related information**

[7.2 Wiring diagrams](#)

[11. Fault finding](#)

**9. Servicing the product****CAUTION****Sharp element**

Minor or moderate personal injury

- Wear protective gloves when touching the impeller.

All regulations applying to pumps installed in potentially explosive environments must be observed.



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



Before installation, make sure that the atmosphere in the tank is not potentially explosive.

**CAUTION****Crushing of feet**

Minor or moderate personal injury



- Always support the pump by lifting chains or placing it in a horizontal position to secure stability.
- During maintenance and service, including transportation to service workshop, always support the pump.

**WARNING****Crushing of hands**

Death or serious personal injury



- Before starting work on the pump, make sure that the fuses are removed or the main switch is switched off.
- Make sure that the power supply cannot be switched on unintentionally.
- Make sure that all protective equipment is connected correctly.
- Do not put your hands or any tool into the pump inlet or outlet after the pump has been connected to the power supply.

**WARNING****Crushing of hands**

Death or serious personal injury



- Before starting work on the pump, make sure that the main switch is locked in position 0.
- Make sure that all rotating parts have stopped moving.

TM042657



Maintenance work on explosion-proof pumps must be carried out by Grundfos or an authorized service workshop. This applies to both electric and hydraulic components.

## WARNING



### Electric shock

Death or serious personal injury

- The cables must only be replaced by Grundfos or an authorized service workshop.

## WARNING

### Biological hazard

Death or serious personal injury



- Wear appropriate personal protective equipment and clothing.
- Check the local hygiene regulations in force.
- Flush the pump thoroughly with clean water and rinse the pump parts after dismantling.
- The product is classified as contaminated if it is used for toxic liquid.



If the pump is not in operation for some time, vent it to prevent the buildup of explosive gases.

## CAUTION

### Crushing of feet

Minor or moderate personal injury



- Make sure that the lifting bracket is tightened before lifting the pump.
- Always lift the pump by its lifting bracket or by a forklift truck if the pump is fixed on a pallet.
- Never lift the pump by the power cable, hose, or pipe.

## Related information

6. *Mechanical installation*

8.1 *General startup procedure*

## 9.1 Maintenance



When the pump is new or its shaft seal has been replaced, check the oil level and water content after one week of operation.

Pumps running normal operation should be inspected every 3000 operating hours or at least once a year. If the pumped liquid is very muddy or sandy, inspect the pump at shorter intervals.

Check the following:

- **Power consumption**

See on the nameplate.

- **Oil level and condition**

When the pump is new or its shaft seal has been replaced, check the oil level and water content after one week of operation. If there is more than 20 % extra liquid (water) in the oil chamber, the shaft seal is defective. The oil must be changed after 3000 operating hours or once a year.



Use Shell Ondina X420 oil or equivalent type with auto-ignition temperature above 356 °F (180 °C).

- **Cable entry**

Make sure that the cable entry is watertight and the cable is not sharply bent or pinched.

- **Pump parts**

Check the pump parts for possible wear. Replace the defective ones.

- **Ball bearings**

Check the shaft for noisy or heavy operation (turn the shaft by hand). Replace the 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 Grundfos or an authorized service workshop. Bearings are lubricated for a lifetime.



Defective bearings may reduce the Ex safety.

Pumps running normal operation must be inspected every 3000 operating hours or at least once a year. If the pumped liquid is muddy or sandy, inspect the pump at shorter intervals. Pumps with sensors offer the possibility of constant monitoring of key components in the pump, such as shaft seal condition, bearing- and winding temperature, insulation resistance, and moisture in the motor. Check the shaft for noisy or heavy operation (turn the shaft by hand). Replace defective ball bearings.



- **O-rings and similar parts**

During service and replacement, make sure that the grooves for the O-rings as well as the seal faces have been cleaned before the new parts are fitted. Grease O-rings and recesses before assembly.



Do not reuse rubber parts.



Explosion-proof pumps must be checked by an authorized Ex workshop once a year.

## 9.2 Dismantling the pump



See [www.grundfos.us](http://www.grundfos.us) for service videos.

### 9.2.1 Oil change

After 3000 operating hours or once a year, change the oil in the oil chamber as described below.

If the shaft seal has been replaced, the oil must be changed.



#### Warning

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

### Draining of oil

1. Place the pump on a plain surface with one oil screw pointing downwards.
2. Place an at least 1 liter capacity transparent container under the oil screw.



Used oil must be disposed of in accordance with local regulations.

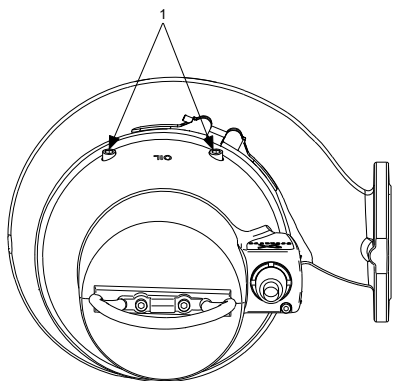
3. Remove the lower oil screw.
4. Remove the upper oil screw.  
Inspect the oil which comes out of the motor. If the color is greyish white, it contains water. If the oil contains more than 20 % water, it is an indication that the shaft seal is defective and must be replaced. If the shaft seal is not replaced, it can cause motor damage.
5. Clean the faces for the gaskets for oil screws.

### Filling with oil

1. Turn the pump so that the oil filling holes are placed opposite to each other, pointing upwards.
2. Pour oil into the chamber.



3. Fit the oil screws with new gaskets.



TM046477

Oil filling holes

Pos.	Description
1	Oil filling/venting

**Related information**

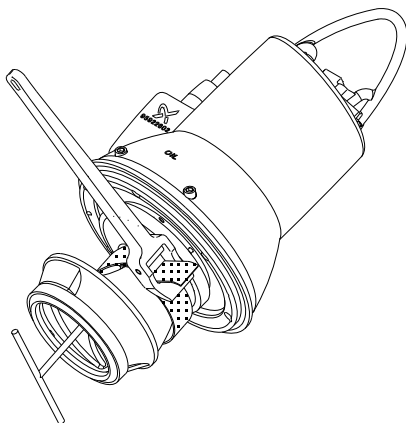
[9.4 Oil quantities](#)

**9.2.2 Removing the pump housing and impeller**

For position numbers, see the Appendix.

**Procedure**

1. Loosen the clamp (92).
2. Remove the screw (92a).
3. Remove the pump housing (50) by inserting two screwdrivers between the cooling jacket and the pump housing.
4. Remove the screw (188a). Hold the impeller with a strap wrench.
5. Loosen the impeller (49) with a light blow on the edge. Pull it off.



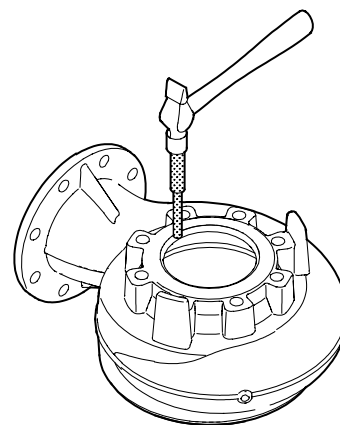
TM046476

Removing the impeller

**9.2.3 Removing the seal ring and wear ring (SL1)**

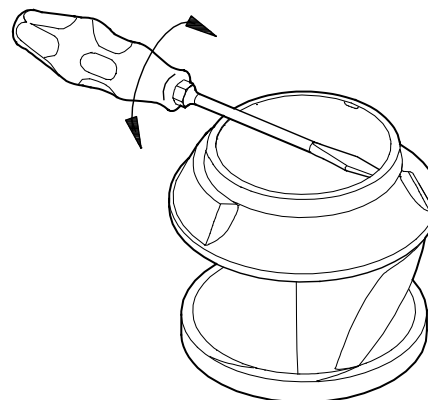
**Procedure**

1. Turn the pump housing upside-down.
2. Knock the seal ring (46) out of the pump housing using a punch.
3. Clean the pump housing where the seal ring was fitted.
4. Remove the wear ring (49c) using a screwdriver.
5. Clean the impeller where the wear ring was fitted.



TM028420

Removing the seal ring



TM028422

Removing the wear ring

**9.2.4 Removing the shaft seal**

**Procedure**

1. Remove the screws (188).
2. Remove the oil chamber cover (58) using a puller.
3. Remove the screws (186).
4. Remove the shaft seal (105) using a puller.

**Procedure (pump with WIO sensor)**

1. Remove the screws (188).
2. Remove the oil chamber cover (58) using a puller.
3. Remove the screws (186).
4. Remove the sensor (521) and holder (522) from the shaft seal.
5. Remove the shaft seal (105) using a puller.

**Related information**

[7.5 Water-in-oil sensor](#)

**9.3 Assembling the pump**

**9.3.1 Tightening torques and lubricants**

Pos.	Designation	Quantity	Dim.	Torque [ft-lb (Nm)]
92a	Screw	1		8.85 ± 1.5 (12 ± 2)
118a	Screw	2	M8	14.75 ± 1.5 (20 ± 2)
			M10	22.15 ± 2.2 (30 ± 3)
174	Screw	1		2.95 ± 0.74 (4 ± 1)

Pos.	Designation	Quantity	Dim.	Torque [ft-lb (Nm)]
181	Union nut	1	7-core cable	36.88 ± 3.7 (50 ± 5)
			10-core cable	55.32 ± 3.7 (75 ± 5)
186	Screw	2		5.2 ± 1.5 (7 ± 2)
182	Screw	4		14.75 ± 1.5 (20 ± 2)
187	Screw	4		14.75 ± 1.5 (20 ± 2)
188	Screw	2	M8	14.75 ± 1.5 (20 ± 2)
			M10	22.13 ± 2.2 (30 ± 3)
188a	Screw	2	M10	36.88 ± 3.7 (50 ± 5)
			M12	55.32 ± 3.7 (75 ± 5)
193	Screw	2		11.8 ± 1.5 (16 ± 2)



Treat the O-rings with Rocol Sapphire Aqua-Sil or with an equivalent lubricant before fitting.

### 9.3.2 Fitting the shaft seal

#### Procedure

- Slide the shaft seal (105) gently over the shaft.
- Fit and tighten the screws (186).
- Fit and lubricate the O-ring (107) in the cover of the oil chamber (58).
- Fit the oil chamber cover.
- Fit and tighten the screws (188).

#### Procedure (pump with WIO sensor)

- Slide the shaft seal (105) gently over the shaft.
- Fit the holder (522) and sensor (521) with one of the screws (186).
- Fit the second screw and tighten both screws (186).
- Fit and lubricate the O-ring (107) in the cover of the oil chamber (58).
- Check if the sensor is positioned correctly. This step is especially important in case of horizontal pumps.
- Fit the oil chamber cover.
- Fit and tighten the screws (188).

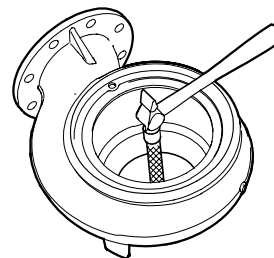
#### Related information

##### 7.5 Water-in-oil sensor

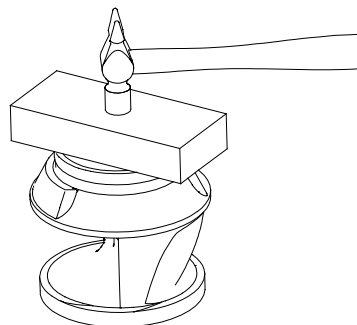
### 9.3.3 Fitting the seal ring and wear ring (SL1)

#### Procedure

- Lubricate the seal ring (46) with soapy water.
- Place the seal ring in the pump housing.
- Knock the seal ring home in the pump housing using a punch or a wooden block.
- Place the wear ring (49c) on the impeller.
- Knock the wear ring home using a wooden block.



Fitting the seal ring



Fitting the wear ring

### 9.3.4 Fitting the impeller and pump housing

#### Procedure

- Fit the spring (157). Keep the key in position while the impeller is fitted.
- Fit the impeller (49).
- Fit the washer (66), the wedge lock washer (66b), and the screw (188a).
- Tighten the screw (188a). Hold the impeller with the strap wrench.
- Mark the position of the pin on the pump housing.
- Mark the position of the pin hole on the oil chamber.
- Fit and lubricate the O-ring (37).
- Fit the stator housing in the pump housing (50).
- Fit the clamp (92).
- Tighten the screw (92a).
- Check if the impeller rotates freely and without drag.

### 9.4 Oil quantities

The table indicates the quantity of oil in the oil chamber. Oil type: Shell Ondina X420.

	Power [hp (kW)]	Oil quantity [oz (l)]
2-pole	3.0 (2.2)	20.3 (0.6)
	4.0 (3.0)	20.3 (0.6)
	5.5 (4.0)	33.8 (1.0)
	8.0 (6.0)	33.8 (1.0)
	10.0 (7.5)	33.8 (1.0)
	12.5 (9.2)	40.6 (1.2)
	15.0 (11)	40.6 (1.2)

TM028421

TM028423

	Power [hp (kW)]	Oil quantity [oz (l)]
4-pole	1.5 (1.1)	20.3 (0.6)
	1.8 (1.3)	20.3 (0.6)
	2.0 (1.5)	20.3 (0.6)
	3.0 (2.2)	20.3 (0.6)
	4.0 (3.0)	33.8 (1.0)
	5.5 (4.0)	33.8 (1.0)
	7.5 (5.5)	33.8 (1.0)
	10.0 (7.5)	40.6 (1.2)



Used oil must be disposed of in accordance with local regulations.

### Related information

#### 9.2.1 Oil change

### 9.5 Service kits

For service kits, visit [www.grundfos.us](http://www.grundfos.us) (Grundfos Product Center) or see the Service Kit Catalog.

### 9.6 Contaminated pumps



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

Contact Grundfos with details about the pumped liquid before returning the product for service. Otherwise, Grundfos can refuse to accept 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. Storage

During long periods of storage, the pump must be protected against moisture and heat.

Storage temperature: -22 °F to +140 °F (-30 °C to +60 °C)



If the pump is stored for more than a year or it takes a long time before it is put into operation after the installation, the impeller must be turned at least once a month.

If the pump is in use, the oil should be changed before storage.

After a long period of storage, the pump should be inspected before it is put into operation. Make sure if the impeller can rotate freely. Pay attention to the condition of the shaft seal, O-rings, oil, and the cable entry.

### 11. Fault finding

#### DANGER

##### Electric shock

Death or serious personal injury



- Before beginning the installation, switch off the power supply and lock the main switch in position 0. Make sure that the power supply cannot be switched on unintentionally. Any external voltage connected to the pump must be switched off before working on the pump.

#### WARNING

##### Crushing of hands

Death or serious personal injury



- Before diagnosing any fault, make sure that the fuses are removed or the main switch is switched off. Make sure that the power supply cannot be switched on unintentionally. Make sure all rotating parts have stopped moving.

All regulations applying to pumps installed in potentially explosive environments must be observed. Make sure that no work is carried out in a potentially explosive atmosphere.



For pumps with sensors, start fault finding by checking the status on the IO 113 front panel. See installation and operating instructions for IO 113.

### Related information

[7.4 Thermal switch, Pt1000 and thermistor](#)

[7.6 Moisture switch](#)

[7.7 IO 113](#)

[8.3 Direction of rotation](#)

### 11.1 The motor does not start. The fuses blow or the motor-protective circuit breaker trips immediately



Do not start again!

Cause	Remedy
<b>Supply failure; short circuit; an earth leakage fault in cable or motor winding.</b>	<ul style="list-style-type: none"> <li>• Have the cable and motor checked and repaired by a qualified electrician.</li> </ul>
<b>Wrong type of fuse.</b>	<ul style="list-style-type: none"> <li>• Fit appropriate type of fuses.</li> </ul>
<b>The impeller is blocked by impurities.</b>	<ul style="list-style-type: none"> <li>• Clean the impeller.</li> </ul>
<b>Air bells, float switches, or electrodes are out of adjustment or defective.</b>	<ul style="list-style-type: none"> <li>• Readjust or replace the air bells, float switches, or electrodes.</li> </ul>
<b>Moisture in the stator housing (alarm). IO 113 interrupts the supply voltage.</b>	<ul style="list-style-type: none"> <li>• Replace the O-rings, the shaft seal, and moisture switch.</li> </ul>
<b>The WIO sensor is not covered by oil (alarm). IO 113 interrupts the supply voltage.</b>	<ul style="list-style-type: none"> <li>• Check, and replace, the shaft seal, fill up with oil and reset IO 113.</li> </ul>
<b>Stator insulation resistance is too low.</b>	<ul style="list-style-type: none"> <li>• Reset the alarm on IO 113, see the installation and operating instructions for IO 113.</li> </ul>

### 11.2 The pump operates but the motor-protective circuit breaker trips after a short while

Cause	Remedy
Low setting of the thermal relay in the motor-protective circuit breaker.	<ul style="list-style-type: none"> <li>Set the relay in accordance with the specifications on the nameplate.</li> </ul>
Increased current consumption due to large voltage drop.	<ul style="list-style-type: none"> <li>Measure the voltage between two motor phases. Tolerance: -10 % to +6 %. Re-establish the correct voltage supply.</li> </ul>
The impeller is blocked by impurities.	<ul style="list-style-type: none"> <li>Clean the impeller.</li> </ul>
Increased current consumption in all three phases.	<ul style="list-style-type: none"> <li>Clean the impeller.</li> </ul>
Wrong direction of rotation.	<ul style="list-style-type: none"> <li>Check the direction of rotation and interchange any two of the phases in the incoming supply cable.</li> </ul>

### 11.3 The thermal switch of the pump trips after a short while

Cause	Remedy
The liquid temperature is too high.	<ul style="list-style-type: none"> <li>Reduce the liquid temperature.</li> </ul>
The viscosity of the pumped liquid is too high.	<ul style="list-style-type: none"> <li>Dilute the pumped liquid.</li> </ul>
Wrong electrical connection.	<ul style="list-style-type: none"> <li>Check and correct the electrical installation.</li> </ul>

### 11.4 The pump operates at below-standard performance and power consumption

Cause	Remedy
The impeller is blocked by impurities.	<ul style="list-style-type: none"> <li>Clean the impeller.</li> </ul>
Wrong direction of rotation.	<ul style="list-style-type: none"> <li>Check the direction of rotation and interchange any two of the phases in the incoming supply cable.</li> </ul>

### 11.5 The pump operates but gives no liquid

Cause	Remedy
The outlet valve is closed or blocked.	<ul style="list-style-type: none"> <li>Check the outlet valve and open and/or clean it.</li> </ul>
The non-return valve is blocked.	<ul style="list-style-type: none"> <li>Clean the non-return valve.</li> </ul>
Air in the pump.	<ul style="list-style-type: none"> <li>Vent the pump.</li> </ul>

### 11.6 High power consumption (SLV)

Cause	Remedy
Wrong direction of rotation.	<ul style="list-style-type: none"> <li>Check the direction of rotation and interchange any two of the phases in the incoming supply cable.</li> </ul>
The impeller is blocked by impurities.	<ul style="list-style-type: none"> <li>Clean the impeller.</li> </ul>

### 11.7 Noisy operation and excessive vibrations (SL1)

Cause	Remedy
Wrong direction of rotation.	<ul style="list-style-type: none"> <li>Check the direction of rotation and interchange any two of the phases in the incoming supply cable.</li> </ul>
The impeller is blocked by impurities.	<ul style="list-style-type: none"> <li>Clean the impeller.</li> </ul>

### 11.8 The pump is clogged

Cause	Remedy
The liquid contains large particles.	<ul style="list-style-type: none"> <li>Select a pump with a larger size of passage.</li> </ul>
A floating layer has formed on the surface of the liquid.	<ul style="list-style-type: none"> <li>Install a mixer in the tank.</li> </ul>

## 12. Technical data

Supply voltage	3 × 208 V ± 10 %, 60 Hz
	3 × 230 V ± 10 %, 60 Hz
	3 × 380 V ± 10 %, 60 Hz
	3 × 460 V ± 10 %, 60 Hz
	3 × 575 V ± 10 %, 60 Hz
Enclosure class	IP68 (according to IEC 60529)
Insulation class	H (356 °F [180 °C])
Maximum pressure	All pump housings are designed according to ASTM/ANSI B16 125 lb CLASS.
Dimensions	Outlet flange diameters:
	ANSI 2.5"
	ANSI 3"
	ANSI 4"
	ANSI 6"

### 12.1 Pump curves

Pump curves are available at [www.us.grundfos.com](http://www.us.grundfos.com).

The curves are to be considered as a guide.

Test curves for the supplied pump are available on request.

Make sure that the pump does not operate outside the recommended operating range.

### 12.2 Pump noise emission < 70 dB(A)

- Sound power is measured according to ISO 3743.
- Sound power was calculated at a distance of 1 meter according to ISO 11203.

### 13. 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 wheellie 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](http://www.grundfos.com/product-recycling).

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