SE and SL, 9-30 kW

50/60 Hz, DIN, Generation A

Installation and operating instructions

QR98142266
Installation and operating instructions
(all available languages)
http://net.grundfos.com/qr/i/98142266

GRUNDFOS

SE and SL, 9-30 kW

Original installation and operating instructions

Table of contents

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.

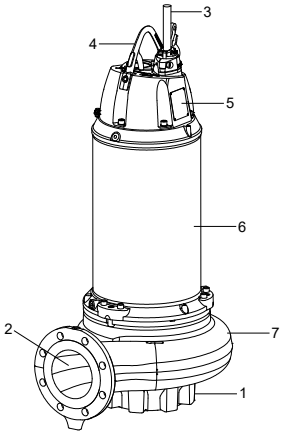
1.3 Target group

These installation and operating instructions are intended for professional installers.

2. Product introduction

2.1 Product description

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



SE, SL 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 Intended use

These pumps are designed for pumping sewage and wastewater in a wide range of municipal, private and industrial applications.

2.3 Pumped liquids

The pumps are designed for pumping:

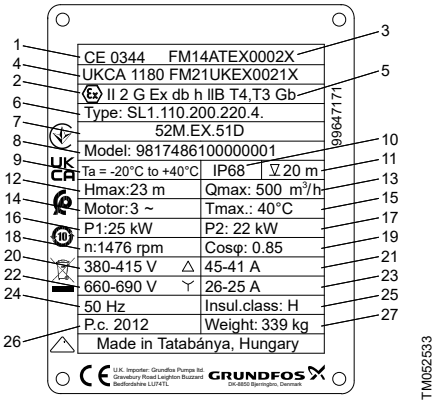
- raw sewage with short and long fibres and particles in municipal and industrial wastewater systems
- sludge with dry solids content up to 3 % for pumps with S-tube® impellers and up to 5 % for pumps with SuperVortex impellers
- surface water
- industrial wastewater with fibrous material
- domestic wastewater with toilet waste
- unscreened sewage in municipal pumping stations or inlet pumping stations in wastewater treatment plants
- raw water.

Depending on the application, the pumps can be used in submerged or dry, horizontal or vertical installations.

2.4 Identification

2.4.1 Nameplate

The pumps can be identified by the nameplate on the motor top cover.



Nameplate example for Ex-proof pump

Pos.	Description
1	EU Notified Body approving the Ex manufacturer
2	Explosion protection mark (ATEX)
3	EU Explosion protection certificate number
4	UK Approved Body approving the Ex manufacturer and UK Explosion protection certificate number

Pos.	Description
5	Explosion protection marking
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
14	Number of phases
15	Maximum liquid temperature
16	Rated power input P1
17	Rated power output P2
18	Rated speed
19	Cos φ, 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

2.4.2 Type key

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

Code	Explanation	Designation
SE	Sewage pump with cooling jacket	Pump type
SL	Sewage pump without cooling jacket	
[ ]	Open S-**tube**® impeller (semi-open)	Impeller type
1	Closed single-channel S-**tube**® impeller	
2	Closed two-channel S-**tube**® impeller	
V	SuperVortex (free-flow) impeller	
[ ]	Maximum solids size [mm]	Pump free passage [mm]
75		
80		
85		
95		
110		
125		
200	Pump outlet nominal diameter	Pump outlet [mm]
245	24.5 kW: P2 / 10	Power [kW]
[ ]	Standard pump or standard Ex pump	Sensor version
A	Sensor version 1 or sensor version 1, Ex pump	
B	Sensor version 2 or sensor version 2, Ex pump	
2	2-pole motor	Number of poles
4	4-pole motor	
6	6-pole motor	
52	Frame size of the pump	Frame size
S	Super-high pressure	Pressure range
H	High pressure	
M	Medium pressure	
L	Low pressure	
E	Extra-low pressure	

Code	Explanation	Designation
[ ]	Cast iron pump housing, cast iron impeller, cast iron suction cover, cast iron motor housing	Material code for pump housing, impeller, suction cover and motor housing
Q	Cast iron pump housing, stainless-steel impeller, cast iron suction cover, cast iron motor housing	
W	Cast iron pump housing, white cast iron impeller and suction cover, cast iron motor housing	
N	Pump without EX approval	Pump version
EX	Pump with EX approval	
5	50 Hz	Frequency
6	60 Hz	
1D	3 × 380-415D, 660-690Y (Standard)	Voltage for 50 Hz
1E	3 × 220-240D, 380-415Y	
1N	3 × 500-550D	
1F	3 × 220-230D, 380-400Y	Voltage for 60 Hz
1G [1)]	3 × 380-480D, 660-690Y (Standard)	
1M	3 × 575-600D	
11 [2)]	3 × 460D (Standard)	
15 [2)]	3 × 380D, 660Y	
[ ]	1st generation	Generation code
A	2nd generation	
Z	Custom-built products	Customisation
[ ]	Thermal switches	Thermal protection
T	PTC thermistor	

1) Only for 2- and 4-pole motors.

2) Only for 6-pole motors.

2.5 Approvals

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

2.5.1 Explanation of Ex approval

The SE, SL 9-30 kW pumps have the following explosion protection classification:

ATEX / UKEX

Direct-drive pump:	CE 0344 / UKCA 1180 Ⓔx II 2 G Ex db h IIB T4 Gb IP68
Pump driven by frequency converter:	CE 0344 / UKCA 1180 Ⓔx 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

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

Directive or standard	Code		Description
ATEX / UKEX	CE 0344 UKCA 1180	=	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 / 1180 is the number of the Notified Body / Approved Body which has certified the quality system for ATEX / UKEX.
	Ⓔx	=	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.

Directive or standard	Code		Description
Harmonised European EN and IECEx standards	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.
	T4, T3 [3)]	=	T3 [3)] = maximum surface temperature of the motor is 200 °C according to EN/IEC 60079-0. T4 = maximum surface temperature of the motor is 135 °C according to EN/IEC 60079-0.
	Gb	=	Equipment for explosive gas with "high" level of protection.
	IP68	=	Enclosure class according to EN/IEC 60529.
	X	=	The letter X in the certificate number indicates that the equipment is subject to special conditions for safe use. The conditions are described in the certificate and the installation and operating instructions.

3) When operated by a frequency converter.

2.5.2 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).

2.5.3 Potentially explosive environments

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

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

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

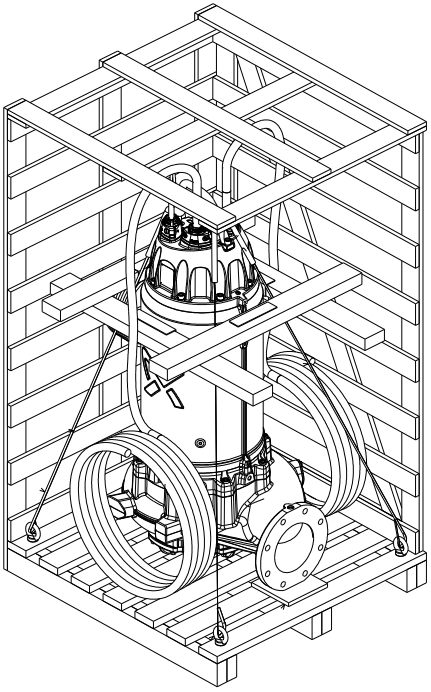
Special conditions for safe use of explosion-proof pumps:

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.

3. Receiving the product

The pump is supplied from the factory in a proper packaging in which it should remain until installation. Make sure that the pump cannot roll or fall over.



Pump packaging

3.1 Transporting the product

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

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.

3.2 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 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.

3.3 Lifting the product

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

DANGER
Crushing hazard
Death or serious personal injury
- Submersible pumps with and without cooling jacket and with pressure range S, H are delivered with a mounted lifting eye and an additional shackle, which must be used to attach the hook and the chain correctly.

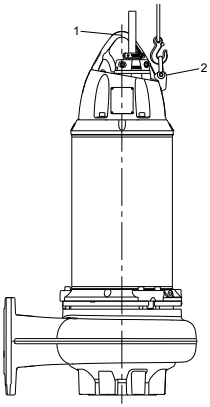
When lifting the pump, use the right lifting point to keep the pump balanced for proper installation. The table below shows the correct lifting point.

Installation type	Pressure range	Lifting bracket assembly	Lifting point
Submersible with and without cooling jacket	S, H	with lifting eye and shackle	See lifting points, vertical installation figure
	M, L, E	no lifting eye	See lifting points, vertical installation figure
Vertical, dry	S, H, M, L, E	no lifting eye	See lifting points, vertical installation figure
Horizontal, dry	S, H, M, L, E	no lifting eye	See lifting points, horizontal installation figure

The following installation types must be lifted at the lifting handle:
- submersible without cooling jacket with pressure range M, L and E
- submersible with cooling jacket with pressure range M, L and E
- vertical, dry.

The following installation types must be lifted at the lifting eye with shackle (at the back of the lifting handle):
- submersible without cooling jacket with pressure range S and H
- submersible with cooling jacket with pressure range S and H.

Pumps with horizontal, dry installation can be lifted by a hole in the flange and the middle lifting point.



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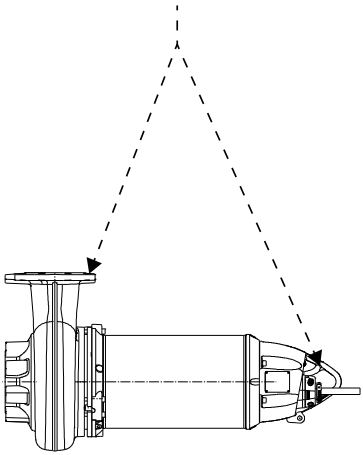
Lifting points, vertical installation



TM075108

Lifting points, horizontal installation

Pos.	Description
1	Lifting handle
2	Lifting eye

4. Mechanical installation

Fit the extra nameplate supplied with the pump at the installation site.

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.

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.

4.1 Foundation

Foundations for pumps above 15 kW

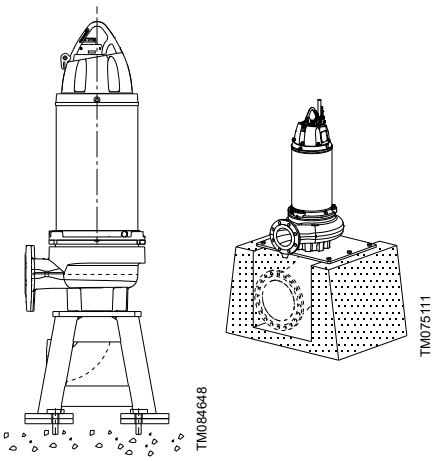
The rotating equipment generates vibrations when an impeller or rotor is turning at high speed. Proper installation and anchorage of the pumps and accessories are crucial to limit vibrations and achieve reliable installation:

- The foundation and concrete must support the weight of the pump including accessories, the liquid passing through the pump and the forces generated by the pump.

- The mass of the concrete foundation must be minimum 3-5 times heavier than the weight of the supported equipment and must have sufficient rigidity to withstand the axial, transverse, and torsional loads generated by the pump.
- The foundation must be 15 cm wider than the baseplate for pumps up to 350 kW and 25 cm wider for larger pumps.
- The concrete used in the foundation must have a minimum tensile strength of 250 N/cm^2.
- Always use epoxy grout to fasten the baseplate to the foundation.

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

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



4.2 Mounting the product

Installation type	Installation and accessories
Sewage pump without cooling jacket for vertical, submerged installation	Permanent installation on auto coupling
Sewage pump with cooling jacket for vertical, submerged installation	Permanent installation on auto coupling
Sewage pump with cooling jacket for vertical, dry installation	Permanent installation on base stand
	Permanent installation on baseplate
Sewage pump with cooling jacket for horizontal, dry installation	Permanent installation on base stand for horizontal installation

4.3 Permanent, vertical, submerged installation on auto coupling

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

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

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

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

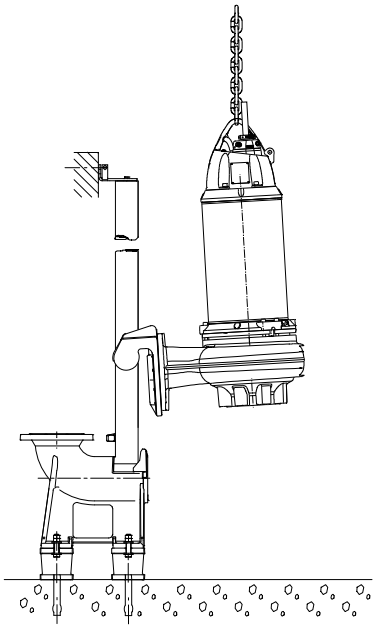
The guide rails must not have any axial play as this may cause noise during operation.

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 expansion bolts.
3. Connect the outlet pipe in accordance with the generally accepted procedures. Avoid exposing the pipe to distortion or tension.
4. Place the guide rails on the auto-coupling base unit and adjust the length of the rails to the guide-rail bracket at the top of the pit.
5. Unscrew the provisionally fastened guide-rail bracket. Insert the expansion dowels into the holes. Fasten the guide-rail bracket on the inside of the pit. Tighten the bolts in the expansion dowels.
6. Clean out debris 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. When the pump reaches the auto-coupling base unit, pull the lifting chain towards the guide rail several times to shake off any foreign substances. When the chain is unstrained, the pump connects automatically to the auto-coupling unit.
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.

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



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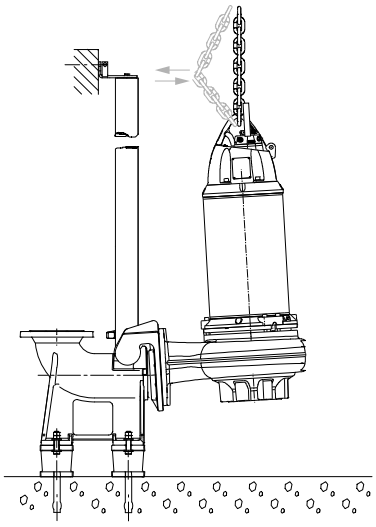
Lowering the pump along the guide rails



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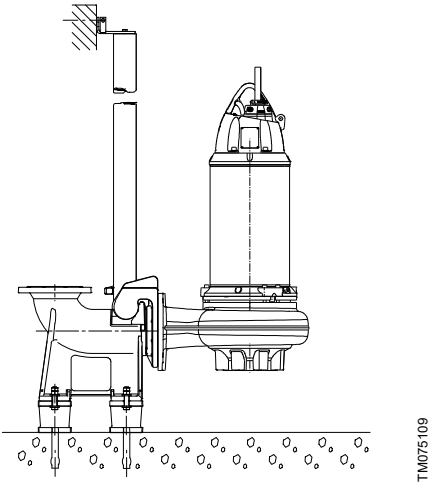
Connecting the pump to auto coupling



Submerged installation on auto coupling

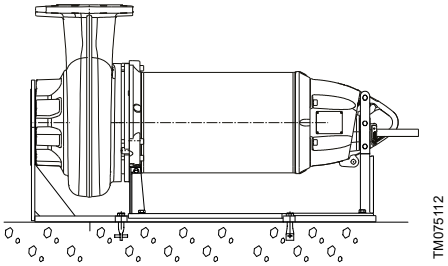
Pull-out strength for anchor bolts

Auto-coupling base unit	Bolts [mm]	Pull-out strength for a single bolt [kN]
DN 80/100	M16	10
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.

4.4 Permanent, vertical or horizontal, dry installation

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



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.

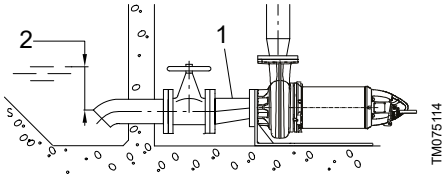
Fasten the pump to the inlet and outlet pipes with flange connections.

Pull-out strength for anchor bolts

Dry, horizontal and vertical installation	Bolts	Pull-out strength for a single bolt [kN]
-	-	5.0

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

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.



Eccentric reducer in horizontal installation

Pos	Description
1	Eccentric reducer
2	Minimum level: 0.2 m

For installing the pump on vertical base stand, see the following Quick Guide.

QR92973562

http://net.grundfos.com/qr/i/92973562

4.5 Level of pumped liquid

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.

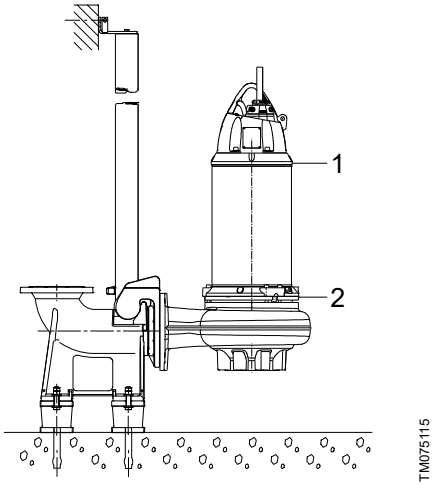
Explosion-proof, submersible SL pumps without cooling jacket must always be completely submerged in the pumped liquid to the top of the motor.

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.

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

- **Submersible installation without cooling jacket:** the pump must be completely submerged in the pumped liquid to the top of the motor.
- **Submersible installation with cooling jacket:** the pump housing must be completely covered by the pumped liquid.



Liquid levels

Position	Description
1	Top of the motor
2	Top of the pump housing

- **Dry, vertical and horizontal installation:**there are no special requirements for the level of the pumped liquid.

4.6 Torques for inlet and outlet flanges

Grade 4.6 (5) galvanised steel bolts and nuts

	Nominal diameter	Pitch circle diameter [mm]	Bolts [mm]	Torques [Nm]	
				Slightly oiled	Well lubricated
Inlet	DN 65	145	4 x M16	70	60
	DN 80	160	8 x M16	70	60
	DN 100	180	8 x M16	70	60
	DN 150	240	8 x M20	140	120
Outlet	DN 65	145	4 x M16	70	60
	DN 80	160	8 x M16	70	60
	DN 100	180	8 x M16	70	60
	DN 150	240	8 x M20	120	100

Specified tightening torques rounded off by ± 5 Nm

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

	Nominal diameter	Pitch circle diameter [mm]	Bolts [mm]	Torques [Nm]	
				Slightly oiled	Well lubricated
Inlet	DN 65	145	4 x M16	-	60
	DN 80	160	8 x M16	-	60
	DN 100	180	8 x M16	-	60
	DN 150	240	8 x M20	-	120
Outlet	DN 65	145	4 x M16	-	60
	DN 80	160	8 x M16	-	60
	DN 100	180	8 x M16	-	60
	DN 150	240	8 x M20	-	100

Specified tightening torques rounded off by ± 5 Nm

The gasket must be a full-face, reinforced paper gasket, such as Klingersil C4300. When using a softer gasket material, reconsider the torques.

5. Electrical connection

DANGER
Electric shock
Death or serious personal injury

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

DANGER
Electric shock
Death or serious personal injury

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

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.

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

Connect the pump to a motor-protective circuit breaker.

Set the motor-protective circuit breaker to the rated current of the pump +15 % service factor. The rated current is stated on the nameplate.

The supply voltage and frequency are marked on the nameplate.

The voltage tolerance at the motor terminals must be within ± 10 % of the rated voltage.

The motor is effectively 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). See Appendix.
- Star-delta starting (Y/D). See Appendix.
- Soft start.

The selection of 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 ms or according to the manufacturer's specifications.

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

5.1 Frequency converter operation

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.

In addition, large motors driven with a frequency converter are loaded by bearing currents. In this product range, only negligible amounts of bearing currents occur during the use of frequency converter.

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. Pulse width modulation should be used.

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

- The locked-rotor torque can be lower depending on the type of the frequency converter.
- The noise level may increase. See the installation and operating instructions for the selected frequency converter.

Maximum repetitive peak voltage [V]	Maximum dU/dt U_N 400 V [V/µ sec.]
850	2000

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.

5.2 Cable data

Standard H07RN-F

Cable type	Outer cable diameter [mm]		Minimum bending radius
[mm^2]	min.	max.	[mm]
7 x 4 + 5 x 1.5	21.2	22.8	70
7 x 6 + 5 x 1.5	24.5	26.1	80
7 x 10 + 5 x 1.5	25.2	26.8	110

Electromagnetic Compatibility (EMC)

Cable type	Outer cable diameter [mm]		Minimum bending radius
[mm²]	min.	max.	[mm]
3 x 6 + 4 x 2.5 + 5 x 0.5	26.3	28.3	90
3 x 10 + 4 x 2.5 + 5 x 0.5	26.3	28.3	120
3 x 16 + 4 x 4 + 5 x 0.5	26.3	28.3	140

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.

5.3 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

	Standard pump	Sensor version 1	Sensor version 2	Standard Ex	Sensor version 1 Ex	Sensor version 2 Ex
Thermal switches or PTC	●	●	●	●	●	●
Moisture switch	●	●	●	●	●	●
Level switch in leakage chamber for standard motors	●	●	●			
Leakage switch in stator housing, for Ex motors				●	●	●
Pt1000 in stator winding		●	●		●	●
Pt1000 in upper bearing			●			●
Pt1000 in lower bearing				●		●
PVS-3 vibration sensor				●		●
SM 113 module [4]				●		●
IO 113 module [5]				●		●

4) For pumps fitted with two power supply cables, the SM 113 module must be ordered separately and installed in the control cabinet. SM113 needs to be fitted with a resistor.

5) The IO 113 with communication functionality must be chosen and ordered separately.

5.3.1 Thermal switches

Three Klixon bimetallic thermal switches are built into the stator windings. A contact opens in case of overtemperature (150 °C [302 °F]). The motor insulation class is H (180 °C [356 °F]).

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 whether the circuit resistance is maximum 3 Ω per thermal switch.

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

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

5.3.2 Moisture, Leakage and Level switches

Non-Ex version:

A moisture switch and a level switch are mounted in a non-Ex pump. The moisture switch is placed in the top cover and the level switch is in the chamber above the shaft seal. See the Appendix.

Ex version:

A moisture switch and a leakage switch are mounted in an Ex pump. The moisture switch is placed in the top cover and the leakage switch is in the stator housing. 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 leakage switches are motor protection devices protecting the motor from moisture or leakage. The switches are non-reversing, and they must be replaced after being released.

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

5.3.3 Thermistors

The standard pump range has Klixon switches; however, pumps with PTC thermistors are also available as Factory Product Variants (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.

5.3.3.1 Checks after electrical connection

1. Use a multimeter to check whether the circuit resistance is below 150 Ω per thermistor.
2. Use a multimeter to check whether the insulation between circuit and stator housing is outside the range.
3. Carry out similar measurements at the end of the power cable.

5.3.4 Pt1000 temperature sensor

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

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

In case of overheating, the Pt1000 sensor trips an alarm and disconnects the power supply at a preset temperature.

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

The sensor resistance values are the following:

- 1000 Ω at 20 °C (68 °F)
- 1385 Ω at 100 °C (212 °F)
- approximately 1078 Ω at room temperature.

The temperature limits are the following:

- 90 °C (194 °F): warning for bearing temperature
- 130 °C (266 °F): pump stop caused by high bearing temperature
- 150 °C (302 °F): pump stop caused by high stator temperature.

In Ex-approved pumps, the maximum acceptable alarm temperature in the bearing sensors is 100 °C for the lower bearing (shaft end) and 120 °C for the upper bearing.

5.3.4.1 Checks after electrical connection

During the pump check, the Pt1000 sensor must be connected to a recording device.

1. Use a multimeter to check whether the resistance at room temperature (20 °C [68 °F]) is approximately 1078 Ω.
2. Use a multimeter to check whether 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.

5.3.5 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**® impellers. The S-**tube**® 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.

5.3.6 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:

- 3 current sensors, 4-20 mA
- 3 Pt1000 thermal sensors
- 1 PTC thermal sensor
- 1 digital input.

SM 113 is fitted with a 2.7 kΩ resistor to avoid false sensor alarms in the IO 113.

5.3.7 IO 113

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 IO 113.

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

IO 113 enables the following functions:

- overtemperature protection
- monitoring the sensors for analogue measurement of:
  - motor temperature
  - pump vibrations
  - stator insulation resistance
  - bearing temperature
  - moisture in motor.
- stopping the pump in case of alarm
- monitoring the pump remotely through RS485 communication (Modbus or GENIbus).

5.3.7.1 Measurement of insulation resistance

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

- resistance above 10 MΩ = OK
- resistance between 10 MΩ and 1 MΩ = warning
- resistance below 1 MΩ = alarm.

6. Startup

DANGER
Electric shock
Death or serious personal injury
- Make sure the pump is grounded.

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.

Proceed as follows:

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, then replace them, 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. For pumps in dry installation, make sure that there is liquid in the pit.
8. Open the isolating valves, if fitted.
9. Check if the system is filled with liquid and vented.

10. Check the settings of the level switches.
11. Start the pump and check the operation for abnormal noise or vibrations.
12. 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.

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

7. 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.

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.

8. Servicing and maintaining the product

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

Product numbers for service stand

Inlet flange size DN 100: 98669229.

Inlet flange size DN 150: 98669251.

WARNING
Crushing hazard
Death or serious personal injury
- Always support the pump using lifting chains or place it in horizontal position to secure stability.

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

DANGER
Electric shock
Death or serious personal injury
- Make sure the pump is grounded.

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.

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.

Pumps running normal operation must be inspected every 2000 operating hours or at least once a year. If the pumped liquid is muddy or sandy, the pump must be inspected every 1000 operating hours or every six months.

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

Check the following:

- Power consumption
- Motor liquid level.

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.

Dispose of the motor liquid must comply with local regulations.

50 Hz					Quantity of Motor liquid	
Number of poles	Generation	Power (P2) [kW]	Head Class	Impeller Type	SE [l]	SL [l]
2	1st, 2nd	All	All	All	12.5	4.1
4	1st, 2nd	All	All	All	12.5	4.1
6	1st	All	All	Single S-tube	13.8	5.1
	1st, 2nd	11, 13	All	Dual S-tube	12.5	4.1
	1st, 2nd	16, 18	E [6)]	Dual S-tube	13.8	5.1

6) Extra low pressure

60 Hz					Quantity of Motor Liquid	
Number of poles	Generation	Power (P2) [kW]	Head Class	Impeller Type	SE [l]	SL [l]
2	1st, 2nd	All	All	All	12.5	4.1
4	1st, 2nd	All	All	All	12.5	4.1
6	1st, 2nd	All	All	Dual S-tube	12.5	
	1st	All	All	Single S-tube	13.8	5.1

- **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 have been identified and removed.
- **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.

Replace the ball bearings at least every 25.000 operating hours.

8.1 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 2000 operating hours to prevent oxidation.

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

Use SML3 coolant for motor cooling.

8.1.1 Checking the motor liquid

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 percent. Always use the propylene glycol scale.

Measured freezing point	Liquid ingress percent (%)
-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.

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

QR99980918

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

http://net.grundfos.com/qr/i/99980918

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

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 has been fully relieved.

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

8.2 Inspecting and adjusting the impeller clearance

For pumps with closed S-**tube**® impeller, the impeller clearance is the distance between the bottom of the impeller and stationary wear ring mounted in the bottom of the volute.

For pumps fitted with open S-**tube**®, 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.

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

Clearance sizes for closed S-tube® impellers

Before determining the correct impeller clearance, check the pump nameplate for Production Code (P.c YYWW). Pumps manufactured before P.c 1440 have a different set of screws which require different turning angles than pumps manufactured during and after 1440.

Pressure range	Impeller clearance [mm (in)]	Turning angle of set screw [°] before P.c. 1440	Turning angle of set screw [°] after P.c. 1440.
E = Extra-low pressure single-channel S-**tube**®	0.9 ± 0.1 (0.035 ± 0.003)	170°	260°
E = Extra-low pressure two-channel S-**tube**®	0.7 ± 0.1 (0.027 ± 0.003)	140°	220°
L = Low-pressure single-channel S-**tube**®	0.9 ± 0.1 (0.035 ± 0.003)	170°	260°
L = Low-pressure two-channel S-**tube**®	0.7 ± 0.1 (0.027 ± 0.003)	140°	220°
M = Medium pressure	0.6 ± 0.1 (0.023 ± 0.003)	125°	190°
H = High pressure	0.6 ± 0.1 (0.023 ± 0.003)	125°	190°
S = Super-high pressure	0.5 ± 0.1 (0.019 ± 0.003)	110°	170°

Tightening torques for fastening screws

Pump variant	Fastening crew torque [Nm (lb-ft)]
Pumps manufactured **before** 2014 week 40 (P.c 1440), M12 set screws.	**55 ± 4 Nm (40.6 ± 3)**
Pumps manufactured **during and after** 2014 week 40 (P.c 1440), M20 set screws	**70 ± 4 Nm (51.6 ± 3)**

Clearance sizes for open S-tube® impellers

Pressure range	Impeller clearance [mm (in)]	Turning angle of set screw (degrees)
H = High pressure	0.5 ± 0.1 (0.019 ± 0.003)	110°
S = Super-high pressure	0.5 ± 0.1 (0.019 ± 0.003)	110°

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.

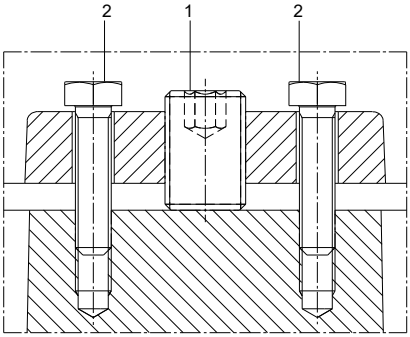
The impeller clearance of submersible installations with and without cooling jacket can be inspected directly through the pump inlet.

The impeller clearance of dry, horizontal and vertical installations can be inspected and adjusted with the pump installed on the base stand and connected to the pipes.

8.2.1 Adjusting the impeller clearance

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

The movement is 1 to 3 mm (0.039 to 0.118 in).



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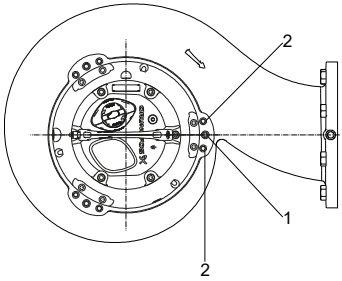


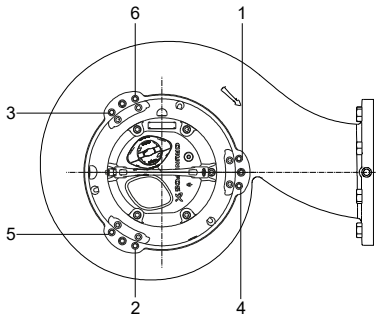
TM077793

Impeller adjusting screws

1	Set screw
2	Fastening screw

The following method is suitable for pumps in vertical position. Proceed as follows:

1. Loosen the fastening- and set screws so the impeller is sitting on the suction cover or stationary wear ring. In this position, the impeller clearance is zero.
2. Tighten the three set screws down by hand until they touch the top surface of the volute.
3. The impeller clearance is created by turning the set screws to a specific angle. Closed S-**tube**® and open S-**tube**® impellers, as well as the different head classes, have different impeller clearances. See the table in the chapter above to determine the correct impeller clearance and turning angle.
4. Once the correct angle is identified, turn the set screw clockwise by the specified angle. Use a turning gauge to ensure the set screw is tightened to the correct amount.
5. Tighten the fastening screws in two steps, according to the sequence below:
   - Tighten the screws one by one, from 1 to 6. Required torque: 40 ± 4 Nm (29.5 ± 3 lb-ft).
   - Repeat the previous sequence to the final torque of 70 ± 4 Nm (51.6 ± 3 lb-ft).



TM077792

Tightening sequence

8.3 Maintaining the explosion-proof SE, SL pumps

Overhauled and repaired explosion-proof pumps are marked with a repair plate providing the following information:

- repair symbol R
- name or registered trademark of the repairing workshop
- workshop reference number relating to the repair
- date of overhaul or repair.

In the event of subsequent repairs, the existing plate must be replaced by a new, updated one and earlier markings must be recorded.

The repair workshop must keep records of all the previously performed overhauls, repairs and possible modifications.

Copies of the detailed records of the repairing workshop must be filed by the owner or operator with the original type certificate of the explosion-proof motor.

8.3.1 Power cable

Use manufacturer-approved and compatible cables only.

8.3.2 Cable entry

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

8.3.3 Spare parts

Damaged motor parts must always be replaced by new and approved parts. Motor parts must not be reconditioned.

8.4 Contaminated pumps

The product is classified as contaminated if it is used with 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.

9. Troubleshooting

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.

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

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

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.
The pump does not start or stops. The control panel indicates that the motor-protective circuit breaker or protection equipment is tripped.	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 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 ± 10 %.
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.

Fault	Cause	Remedy
	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.	Clean or set the level switch or replace them, if required.
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.

10. Technical data

10.1 PH value

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

Material variant	Installation	pH value
Standard [7]	Dry and submerged	6 to 14 [8]
Q [9]	Dry and submerged	6 to 14 [8]

7) Cast iron impeller, pump casing and motor top cover.

8) For fluctuating pH values, the range is pH 4 to 14.

9) Stainless-steel impeller. Cast-iron pump casing and motor top cover.

10.2 Density and viscosity of the pumped liquid

Density: 1000 kg/m^3.

Kinematic viscosity: 1 mm^2/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.

10.3 Flow rate

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

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

10.4 Ambient temperature

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

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

10.5 Liquid temperatures

0 to +40 °C.

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

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

10.6 Operating mode

The pumps are designed for continuous operation.

10.7 Frequency of starts and stops

Maximum number of starts per hour is 20.

10.8 Installation depth

Maximum 20 m below liquid level.

10.9 Solids size

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

10.10 Enclosure class

IP68.

10.11 Sound pressure

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

10.12 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.

10.13 Electrical data

The supply voltage and frequency are marked on the nameplate.

The voltage tolerance at the motor terminals must be within ± 10 % of the rated voltage.

11. Disposing of the product

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

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

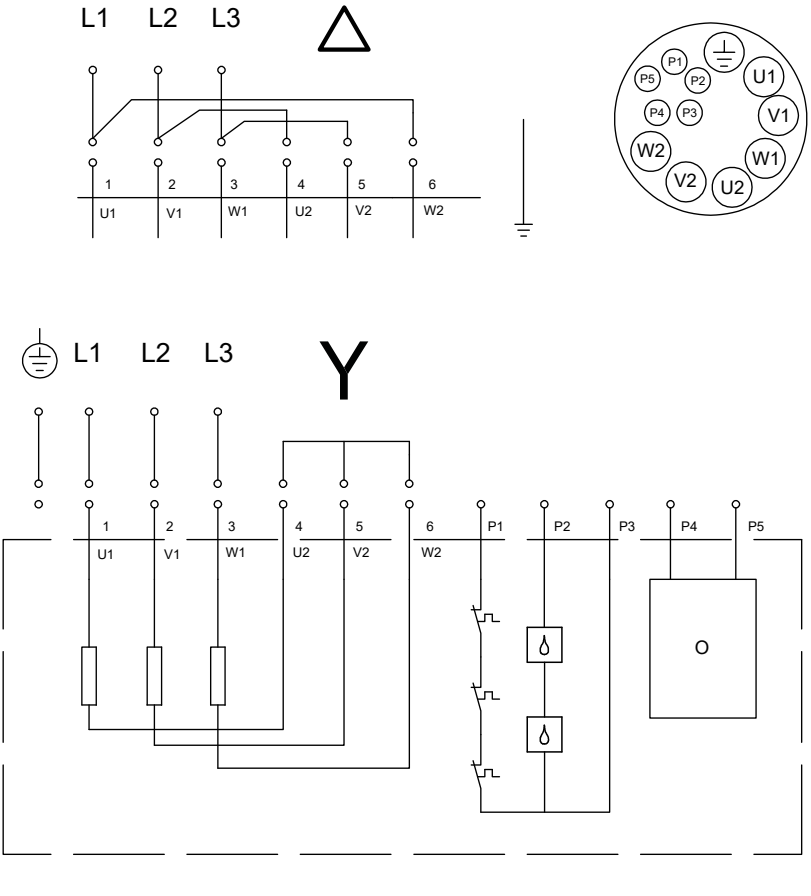
The crossed-out wheelie bin symbol on a product means that it must be disposed of separately from household waste. When a product marked with this symbol reaches its end of life, take it to a collection point designated by the local waste disposal authorities. The separate collection and recycling of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

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

Appendix A

A.1. Wiring diagrams

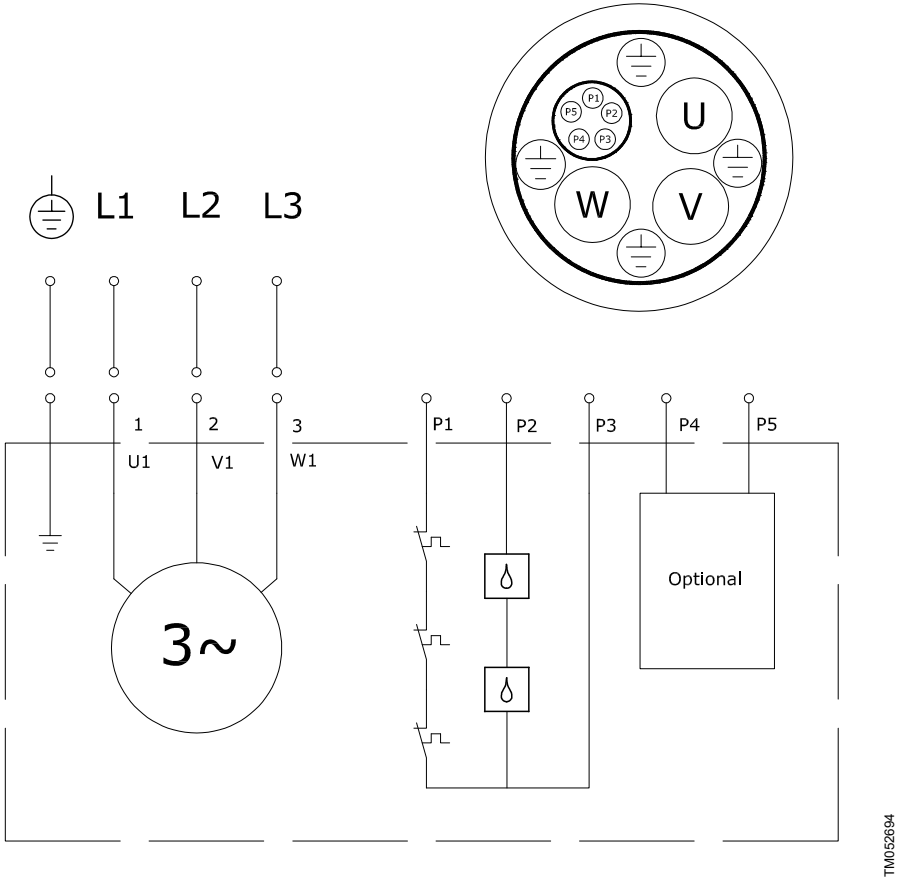
A.1.1. Single cable, star-delta connection



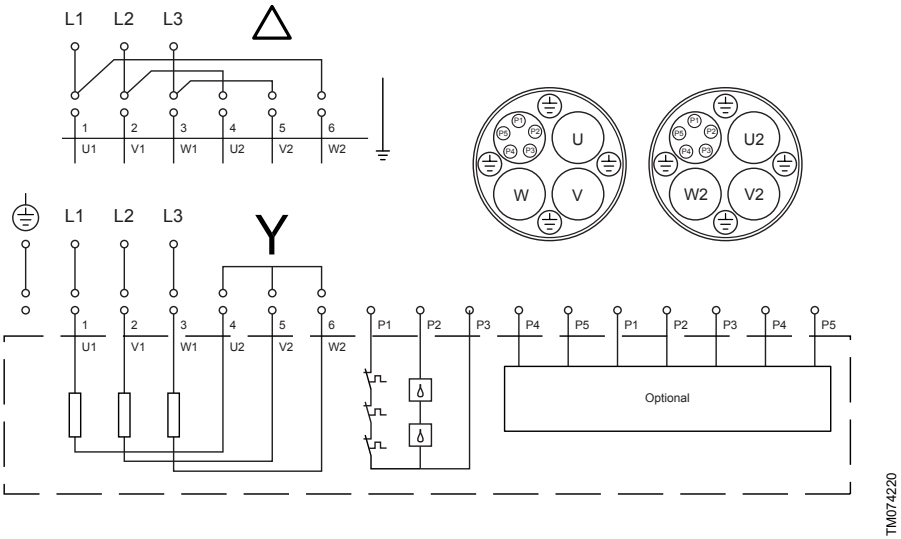
12-wire, star-delta connections (Y/D): D: connections for 3 x 460 V (1G), 3 x 208 V (0S) or 3 x 230 V (1R) Y: connections for 3 x 460 V (1R)

A.1.2. Electromagnetic cable (EMC) single cable or double cable

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



8-wire, EMC cable

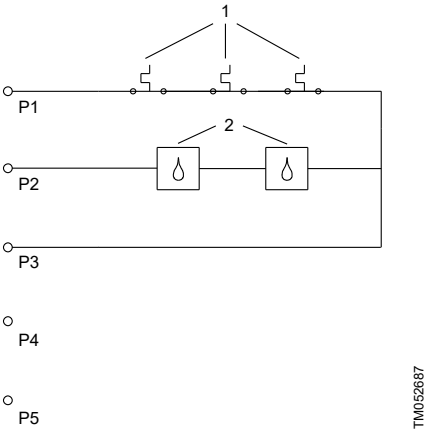


18-wire / EMC double cable

A.2. Sensor wiring

A.2.1. Sensor wiring schematics for single cable pumps

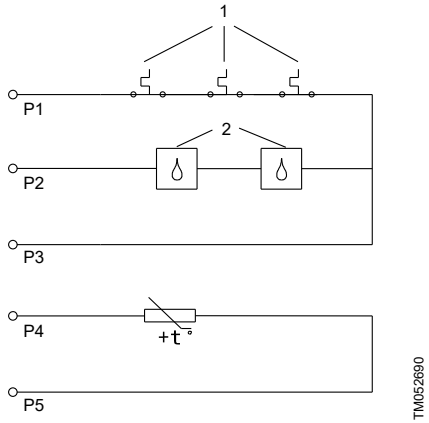
A.2.1.1. Standard, single cable



Standard and Standard Ex, single cable

Pos.	Description
1	Thermal switches / Thermistor
2	Moisture/Leakage/Level switch

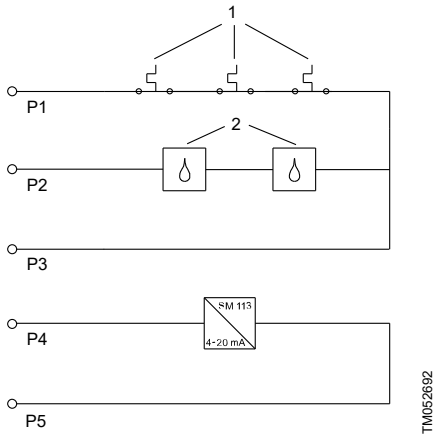
A.2.1.2. Sensor version 1, single cable



Sensor version 1 and Sensor version 1 Ex, single cable

Pos.	Description
1	Thermal switches / Thermistor
2	Moisture/Leakage/Level switch

A.2.1.3. Sensor version 2, single cable

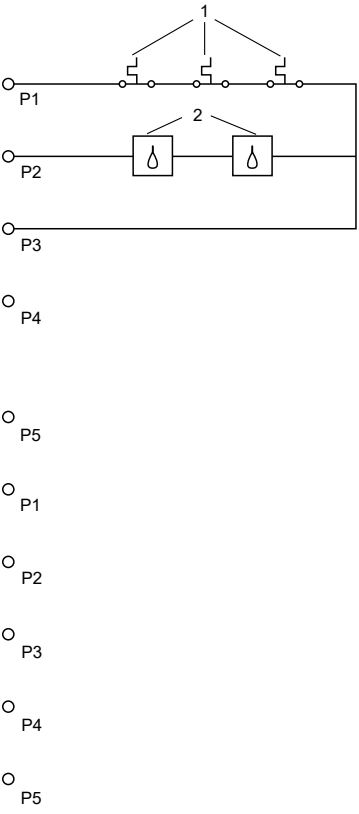


Sensor version 2 and Sensor version 2 Ex, single cable

Pos.	Description
1	Thermal switches / Thermistor
2	Moisture/Leakage/Level switch

A.2.2. Sensor wiring schematics for double cable pumps

A.2.2.1. Standard, double cable

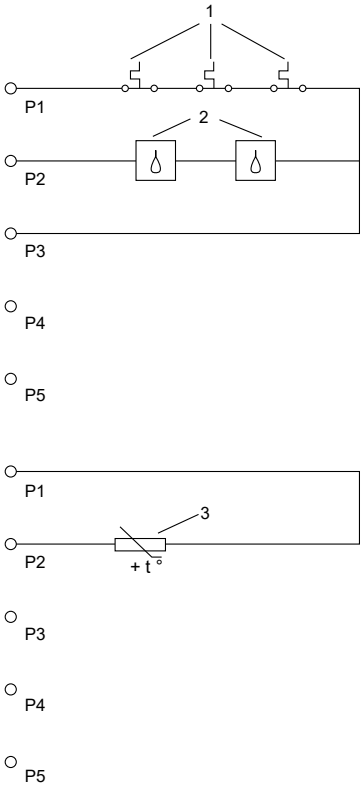


TM074214

Standard and Standard Ex, double cable

Pos.	Description
1	Thermal switches / Thermistor
2	Moisture/Leakage/Level switch

A.2.2.2. Sensor 1, double cable

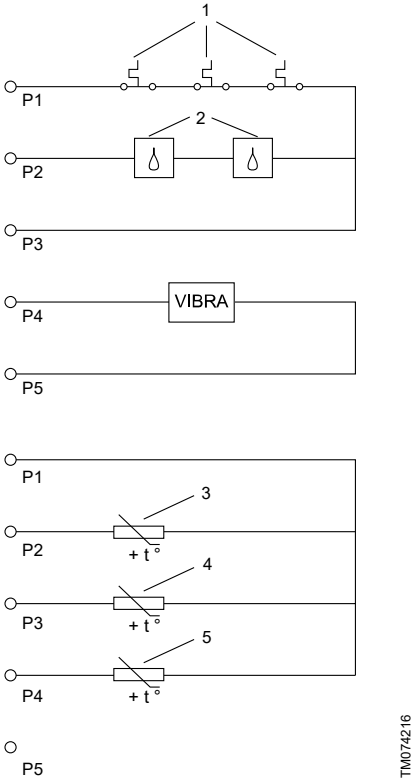


TM074218

Sensor 1 and Sensor 1 Ex, double cable

Pos.	Description
1	Thermal switches / Thermistor
2	Moisture/Leakage/Level switch
3	Pt1000 stator

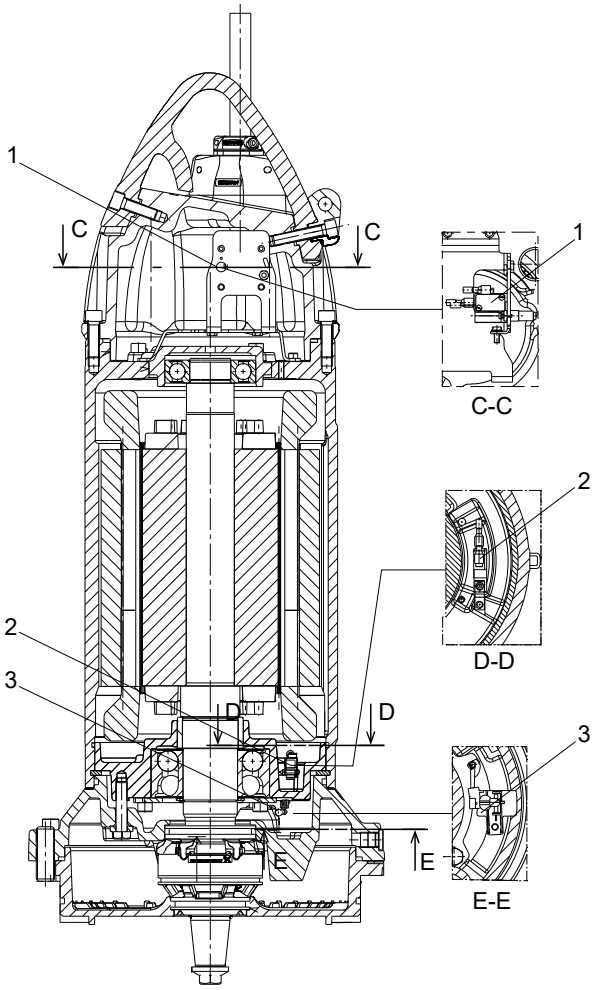
A.2.2.3. Sensor 2, double cable



Sensor 2 and Sensor 2 Ex, double cable

Pos.	Description
1	Thermal switches / Thermistor
2	Moisture/Leakage/Level switch
VIBRA	Vibration sensor
3	Pt1000 stator
4	Pt1000 upper bearing
5	Pt1000 lower bearing

A.2.3. Switch and sensor positions



Pos.	View	Description
1	C-C	Moisture switch
2	D-D	Leakage switch in stator housing, for Ex motors
3	E-E	Level switch in leakage chamber for standard motors

Argentina
Bombas GRUNDFOS de Argentina S.A.
Ruta Panamericana km. 37.500industin
1619 - Garín Pcia. de B.A.
Tel.: +54-3327 414 444
Fax: +54-3327 45 3190

Australia
GRUNDFOS Pumps Pty. Ltd.
P.O. Box 2040
Regency Park
South Australia 5942
Tel.: +61-8-8461-4611
Fax: +61-8-8340-0155

Austria
GRUNDFOS Pumpen Vertrieb
Ges.m.b.H.
Grundfosstraße 2
A-5082 Grödig/Salzburg
Tel.: +43-6246-883-0
Fax: +43-6246-883-30

Belgium
N.V. GRUNDFOS Bellux S.A.
Boomsesteenweg 81-83
B-2630 Aartselaar
Tel.: +32-3-870 7300
Fax: +32-3-870 7301

Bosnia and Herzegovina
GRUNDFOS Sarajevo
Zmaja od Bosne 7-7A
BiH-71000 Sarajevo
Tel.: +387 33 592 480
Fax: +387 33 590 465
www.ba.grundfos.com
E-mail: grundfos@bih.net.ba

Brazil
BOMBAS GRUNDFOS DO BRASIL
Av. Humberto de Alencar Castelo
Branco, 630
CEP 09850 - 300
São Bernardo do Campo - SP
Tel.: +55-11 4393 5533
Fax: +55-11 4343 5015

Bulgaria
Grundfos Bulgaria EOOD
Slatina District
Iztochna Tangenta street no. 100
BG - 1592 Sofia
Tel.: +359 2 49 22 200
Fax: +359 2 49 22 201
E-mail: bulgaria@grundfos.bg

Canada
GRUNDFOS Canada inc.
2941 Brighton Road
Oakville, Ontario
L6H 6C9
Tel.: +1-905 829 9533
Fax: +1-905 829 9512

China
GRUNDFOS Pumps (Shanghai) Co. Ltd.
10F The Hub, No. 33 Suhong Road
Minhang District
Shanghai 201106 PRC
Tel.: +86 21 612 252 22
Fax: +86 21 612 253 33

Columbia
GRUNDFOS Colombia S.A.S.
Km 1.5 vía Siberia-Cota Conj. Potrero
Chico,
Parque Empresarial Arcos de Cota Bod.
1A.
Cota, Cundinamarca
Tel.: +57(1)-2913444
Fax: +57(1)-8764586

Croatia
GRUNDFOS CROATIA d.o.o.
Buzinski prilaz 38, Buzin
HR-10010 Zagreb
Tel.: +385 1 6595 400
Fax: +385 1 6595 499
www.hr.grundfos.com

Czech Republic
GRUNDFOS Sales Czechia and Slovakia
s.r.o.
Ćajkovského 21
779 00 Olomouc
Tel.: +420-585-716 111

Denmark
GRUNDFOS DK A/S
Martin Bachs Vej 3
DK-8850 Bjerringbro
Tel.: +45-87 50 50 50
Fax: +45-87 50 51 51
E-mail: info_GDK@grundfos.com
www.grundfos.com/DK

Estonia
GRUNDFOS Pumps Eesti OÜ
Peterburi tee 92G
11415 Tallinn
Tel.: + 372 606 1690
Fax: + 372 606 1691

Finland
OY GRUNDFOS Pumput AB
Trukkikuja 1
FI-01360 Vantaa
Tel.: +358-(0) 207 889 500

France
Pompes GRUNDFOS Distribution S.A.
Parc d'Activités de Chesnes
57, rue de Malacombe
F-38290 St. Quentin Fallavier (Lyon)
Tel.: +33-4 74 82 15 15
Fax: +33-4 74 94 10 51

Germany
GRUNDFOS GMBH
Schlüterstr. 33
40699 Erkrath
Tel.: +49-(0) 211 929 69-0
Fax: +49-(0) 211 929 69-3799
E-mail: infoservice@grundfos.de
Service in Deutschland:
kundendienst@grundfos.de

Greece
GRUNDFOS Hellas A.E.B.E.
20th km. Athinon-Markopoulou Av.
P.O. Box 71
GR-19002 Peania
Tel.: +0030-210-66 83 400
Fax: +0030-210-66 46 273

Hong Kong
GRUNDFOS Pumps (Hong Kong) Ltd.
Unit 1, Ground floor, Siu Wai industrial
Centre
29-33 Wing Hong Street & 68 King Lam
Street, Cheung Sha Wan
Kowloon
Tel.: +852-27861706 / 27861741
Fax: +852-27858664

Hungary
GRUNDFOS Hungária Kft.
Tópark u. 8
H-2045 Törökbálint
Tel.: +36-23 511 110
Fax: +36-23 511 111

India
GRUNDFOS Pumps india Private Limited
118 Old Mahabalipuram Road
Thoraipakkam
Chennai 600 097
Tel.: +91-44 2496 6800

Indonesia
PT GRUNDFOS Pompa
Graha intirub Lt. 2 & 3
Jln. Cililitan Besar No.454. Makasar,
Jakarta Timur
ID-Jakarta 13650
Tel.: +62 21-469-51900
Fax: +62 21-460 6910 / 460 6901

Ireland
GRUNDFOS (Ireland) Ltd.
Unit A, Merrywell Business Park
Ballymount Road Lower
Dublin 12
Tel.: +353-1-4089 800
Fax: +353-1-4089 830

Italy
GRUNDFOS Pompe Italia S.r.l.
Via Gran Sasso 4
I-20060 Truccazzano (Milano)
Tel.: +39-02-95838112
Fax: +39-02-95309290 / 95838461

Japan
GRUNDFOS Pumps K.K.
1-2-3, Shin-Miyakoda, Kita-ku
Hamamatsu
431-2103 Japan
Tel.: +81 53 428 4760
Fax: +81 53 428 5005

Kazakhstan
Grundfos Kazakhstan LLP
7' Kyz-Zhibek Str., Kok-Tobe micr.
KZ-050020 Almaty Kazakhstan
Tel.: +7 (727) 227-98-55/56

Korea
GRUNDFOS Pumps Korea Ltd.
6th Floor, Aju Building 679-5
Yeoksam-dong, Kangnam-ku, 135-916
Seoul, Korea
Tel.: +82-2-5317 600
Fax: +82-2-5633 725

Latvia
SIA GRUNDFOS Pumps Latvia
Deglava biznesa centrs
Augusta Deglava ielā 60
LV-1035, Rīga,
Tel.: + 371 714 9640, 7 149 641
Fax: + 371 914 9646

Lithuania
GRUNDFOS Pumps UAB
Smolensko g. 6
LT-03201 Vilnius
Tel.: + 370 52 395 430
Fax: + 370 52 395 431

Malaysia
GRUNDFOS Pumps Sdn. Bhd.
7 Jalan Peguam U1/25
Glenmarie industrial Park
40150 Shah Alam, Selangor
Tel.: +60-3-5569 2922
Fax: +60-3-5569 2866

Mexico
Bombas GRUNDFOS de México
S.A. de C.V.
Boulevard TLC No. 15
Parque industrial Stiva Aeropuerto
Apodaca, N.L. 66600
Tel.: +52-81-8144 4000
Fax: +52-81-8144 4010

Netherlands
GRUNDFOS Netherlands
Veluwezoom 35
1326 AE Almere
Postbus 22015
1302 CA ALMERE
Tel.: +31-88-478 6336
Fax: +31-88-478 6332
E-mail: info_gnl@grundfos.com

New Zealand
GRUNDFOS Pumps NZ Ltd.
17 Beatrice Tinsley Crescent
North Harbour Industrial Estate
Albany, Auckland
Tel.: +64-9-415 3240
Fax: +64-9-415 3250

Norway
GRUNDFOS Pumper A/S
Strømsveien 344
Postboks 235, Leirdal
N-1011 Oslo
Tel.: +47-22 90 47 00
Fax: +47-22 32 21 50

Poland
GRUNDFOS Pompy Sp. z o.o.
ul. Klonowa 23
Baranowo k. Poznania
PL-62-081 Przeźmierowo
Tel.: (+48-61) 650 13 00
Fax: (+48-61) 650 13 50

Portugal
Bombas GRUNDFOS Portugal, S.A.
Rua Calvet de Magalhães, 241
Apartado 1079
P-2770-153 Paço de Arcos
Tel.: +351-21-440 76 00
Fax: +351-21-440 76 90

Romania
GRUNDFOS Pompe România SRL
S-PARK BUSINESS CENTER, Clădirea A2, etaj 2
Str. Tipografilor, Nr. 11-15, Sector 1, Cod 013714
Bucuresti, Romania
Tel.: 004 021 2004 100
E-mail: romania@grundfos.ro

Serbia
Grundfos Srbija d.o.o.
Omladinskih brigada 90b
11070 Novi Beograd
Tel.: +381 11 2258 740
Fax: +381 11 2281 769
www.rs.grundfos.com

Singapore
GRUNDFOS (Singapore) Pte. Ltd.
25 Jalan Tukang
Singapore 619264
Tel.: +65-6681 9688
Faxax: +65-6681 9689

Slovakia
GRUNDFOS s.r.o.
Prievozská 4D 821 09 BRATISLAVA
Tel.: +421 2 5020 1426
sk.grundfos.com

Slovenia
GRUNDFOS LJUBLJANA, d.o.o.
Leskoškova 9e, 1122 Ljubljana
Tel.: +386 (0) 1 568 06 10
Fax: +386 (0)1 568 06 19
E-mail: tehnika-si@grundfos.com

South Africa
GRUNDFOS (PTY) LTD
16 Lascelles Drive, Meadowbrook Estate
1609 Germiston, Johannesburg
Tel.: (+27) 10 248 6000
Fax: (+27) 10 248 6002
E-mail: lgradidge@grundfos.com

Spain
Bombas GRUNDFOS España S.A.
Camino de la Fuentecilla, s/n
E-28110 Algete (Madrid)
Tel.: +34-91-848 8800
Fax: +34-91-628 0465

Sweden
GRUNDFOS AB
Box 333 (Lunnagårdsgatan 6)
431 24 Mölndal
Tel.: +46 31 332 23 000
Fax: +46 31 331 94 60

Switzerland
GRUNDFOS Pumpen AG
Bruggacherstrasse 10
CH-8117 Fällanden/ZH
Tel.: +41-44-806 8111
Fax: +41-44-806 8115

Taiwan
GRUNDFOS Pumps (Taiwan) Ltd.
7 Floor, 219 Min-Chuan Road
Taichung, Taiwan, R.O.C.
Tel.: +886-4-2305 0868
Fax: +886-4-2305 0878

Thailand
GRUNDFOS (Thailand) Ltd.
92 Chaloem Phrakiat Rama 9 Road
Dokmai, Pravej, Bangkok 10250
Tel.: +66-2-725 8999
Fax: +66-2-725 8998

Turkey
GRUNDFOS POMPA San. ve Tic. Ltd. Sti.
Gebze Organize Sanayi Bölgesi
Ihsan dede Caddesi
2. yol 200. Sokak No. 204
41490 Gebze/ Kocaeli
Tel.: +90 - 262-679 7979
Fax: +90 - 262-679 7905
E-mail: satis@grundfos.com

Ukraine
ТОВ "ГРУНДФОС УКРАЇНА"
Бізнес Центр Європа
Столичне шосе, 103
м. Київ, 03131, Україна
Tel.: (+38 044) 237 04 00
Fax: (+38 044) 237 04 01
E-mail: ukraine@grundfos.com

United Arab Emirates
GRUNDFOS Gulf Distribution
P.O. Box 16768
Jebel Ali Free Zone, Dubai
Tel.: +971 4 8815 166
Fax: +971 4 8815 136

United Kingdom
GRUNDFOS Pumps Ltd.
Grovebury Road
Leighton Buzzard/Beds. LU7 4TL
Tel.: +44-1525-850000
Fax: +44-1525-850011

U.S.A.
Global Headquarters for WU
856 Koomey Road
Brookshire, Texas 77423 USA
Phone: +1-630-236-5500

Uzbekistan
Grundfos Tashkent, Uzbekistan
The Representative Office of Grundfos Kazakhstan in Uzbekistan
38a, Oybek street, Tashkent
Tel.: (+998) 71 150 3290 / 71 150 3291
Fax: (+998) 71 150 3292

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