SQ, SQE

Installation and operating instructions

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http://net.grundfos.com/qr/i/96160909

GRUNDFOS

SQ, SQE

Original installation and operating instructions

Table of contents

1. General information

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.

Children shall not play with the appliance. Cleaning and user maintenance shall not be made by children without supervision.

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

1.1 Hazard statements

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

DANGER

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

WARNING

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

CAUTION

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

The hazard statements are structured in the following way:

SIGNAL WORD

Description of the hazard

Consequence of ignoring the warning

- Action to avoid the hazard.

1.2 Notes

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

Observe these instructions for explosion-proof products.

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

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

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

Tips and advice that make the work easier.

2. Product introduction

DANGER
Electric shock
Death or serious personal injury

- The pump must not be used when people are in the water.

Fill the page in Appendix 1 with nameplate data before installing the product.

Pump and motor nameplates are in section A.1 Appendix.

2.1 Applications

The SQ and SQE pumps are designed for pumping thin, clean, non-aggressive, non-explosive liquids, not containing solid particles or fibres.

Typical applications:

- Groundwater supply for
  - private housing
  - households
  - small waterworks
  - irrigation systems.
- Liquid transfer in tanks.
- Pressure boosting.

2.2 Generator operation

It is safe to operate the SQ/SQE with a generator.

The pump can safely be operated with a generator that is sized 50 % above the P_1 (input power) values of the pump.

Motor [kW]	Min. generator size [kW]	Recommended generator output [kW]
0.7	1.2	1.5
1.15	1.9	2.5
1.55	2.6	3.2
1.85	2.8	3.50

3. Installation requirements

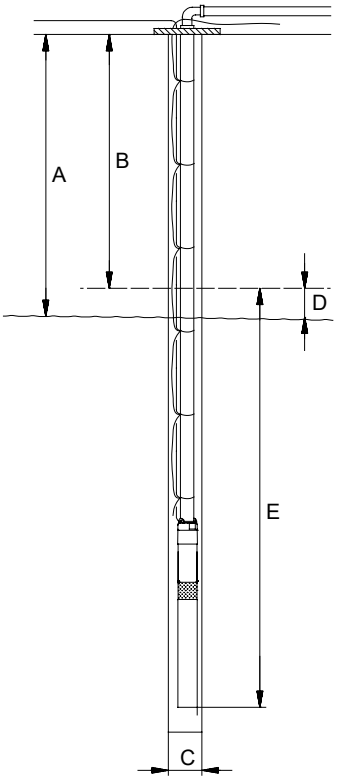
3.1 Installation depths

Maximum installation depth below the static water level is 150 metres.

See the section on pipework connections.

Minimum installation depth below the dynamic water level:

- Vertical installation: During start-up and operation, the pump must always be completely submerged in water.
- Horizontal installation: The pump must be installed and run at least 0.5 metres below the dynamic water level.
- Fit a flow sleeve if there is a risk that the pump will be covered by mud.



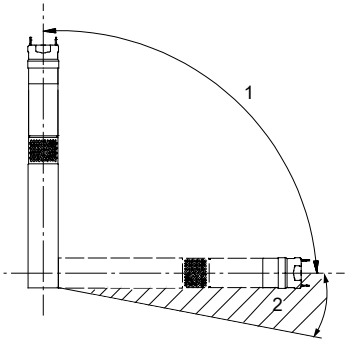
Installation depth

Dynamic water level must be above the pump.

Pos.	Description
A	Dynamic water level
B	Static water level
C	Well diameter: min. 76 mm
D	Drawdown
E	Installation depth below static water level

3.2 Positional requirements

Make sure that the pump does not fall below the horizontal plane.



Positional requirements of the pump

Pos.	Description
1	Allowed
2	Not allowed

Related information

3.1 Installation depths

3.3 Well preparation

If the pump is to be installed in a well, clear any sand and oil from it, as no pump can withstand constantly pumping sandy water.

3.4 Pumped liquid requirements

The maximum sand content of the water must not exceed 50 g/m^3. A larger sand content will result in pump lifetime reduction and in blockage.

Before pumping liquids with higher viscosity than water, contact Grundfos.

pH values:

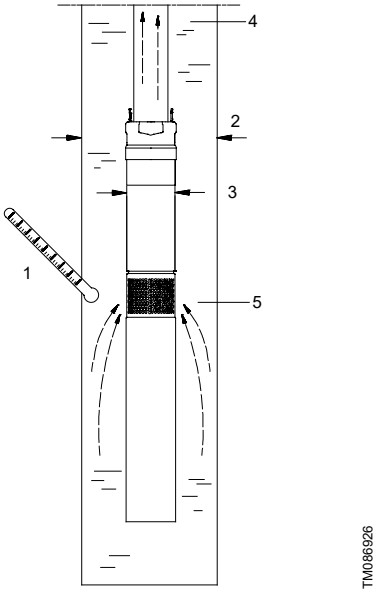
5-9.

Liquid temperature:

The temperature of the pumped liquid must not exceed 35 °C.

If the actual temperature of the pumped liquid exceeds the specified value or the operating conditions otherwise fall outside the specified conditions, the pump may stop. Contact Grundfos.

3.5 Liquid temperatures and cooling



SQ/SQE pump in a borehole

Pos.	Description
1	Liquid temperature
2	Borehole diameter
3	Pump diameter
4	Discharge flow
5	Flow past the motor to the pump suction strainer

Make sure the temperature of the pumped liquid does not exceed 35 °C for sufficient motor cooling.

The borehole diameter must be at least 76 mm.

Install the motor above the well screen. If a flow sleeve is used, the pump can be installed freely in the borehole.

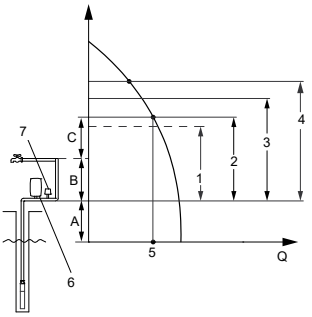
Do not run the pump against a closed valve for more than 5 minutes as there is no cooling flow which results in motor and pump overheat.

3.6 Selection of diaphragm tank, precharge pressure setting and pressure switch

WARNING
Pressurised system
Death or serious personal injury

- The installation must be designed for the maximum pump pressure.

The pump has a built-in soft starter providing 2 seconds run-up time. Therefore the pressure at the pressure switch and diaphragm tank during start is lower than the pump cut-in pressure set on the pressure switch. This lower pressure is called minimum pressure (P_{min} = B + C).



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Diaphragm tank and pressure switch

Pos.	Description	
1	P_{pre}	Precharge pressure of diaphragm tank.
2	P_{min}	Desired minimum pressure.
3	$P_{cut\text{-}in}$	Cut-in pressure set on pressure switch.
4	$P_{cut\text{-}out}$	Cut-out pressure set on pressure switch.
5	Q_{max}	Maximum flow at P_{min}.
6	Diaphragm tank	
7	Pressure switch	
A	Head + head loss from dynamic water level to diaphragm tank.	
B	Head + head loss from diaphragm tank to highest tap.	
C	Minimum pressure at highest tap.	

Make sure that the selected pump can deliver a pressure higher than $P_{cut\text{-}out}$ + A.

3.7 Well system pressure overload

To prevent overpressure, install a pressure relief valve downstream of the well head. The setpoint of the pressure relief valve must be at least 30 psi above the pressure setting.

If a relief valve is installed, make sure it is connected to an appropiate drainage point.

Using P_{min} and Q_{max}, the minimum diaphragm tank size, precharge pressure and pressure switch settings can be found in the guideline table below:

Example

P_{min} = 35 m head, Q_{max} = 2.5 m^3/h.

On the basis of this information, the following values can be found in the table:

Minimum diaphragm tank size = 33 litres.

P_{pre}	=	31.5 m head
P_{cut-in}	=	36 m head
$P_{cut-out}$	=	50 m head

P_{min} [m]	Q_{max} [m^3/h]																			P_{pre} [m]	P_{cut-in} [m]	$P_{cut-out}$ [m]
	0.6	0.8	1	1.2	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5			
	Diaphragm tank size [litres]																					
25	8	8	18	18	18	18	24	33	33	50	50	50	50	80	80	80	80	80	80	22.5	26	40
30	8	8	18	18	18	24	33	33	50	50	50	50	80	80	80	80	80	80		27	31	45
35	8	18	18	18	18	24	33	33	50	50	50	80	80	80	80	80	80			31.5	36	50
40	8	18	18	18	18	24	33	50	50	50	80	80	80	80	80	80				36	41	55
45	8	18	18	18	24	33	33	50	50	50	80	80	80	80	80					40.5	46	60
50	8	18	18	18	24	33	50	50	50	80	80	80	80	80						45	51	65
55	18	18	18	18	24	33	50	50	50	80	80	80	80							49.5	56	70
60	18	18	18	18	24	33	50	50	80	80	80	80								54	61	75
65	18	18	18	24	24	33	50	50	80	80	80	80								58.5	66	80

1 m head = 0.098 bar.

4. Installing the product

DANGER
Electric shock
Death or serious personal injury

- Before starting work on the pump, make sure that the power supply has been switched off and that it cannot be accidentally switched on.
- The pump must be earthed.
- The pump must be connected to an external mains switch with a minimum contact gap of 3 mm in all poles.
- If the motor cable is damaged, it must be replaced by Grundfos, an authorised Grundfos service workshop or similarly qualified persons to avoid a hazard.

The supply voltage, rated maximum current and power factor (PF) appear from the motor nameplate.

The required voltage for Grundfos submersible motors, measured at the motor terminals, is -10 % to +6 % of the nominal voltage during continuous operation including variation in the supply voltage and losses in cables.

DANGER
Electric shock
Death or serious personal injury

- If the pump is connected to an electric installation where an earth-leakage circuit breaker (ELCB) is used as an additional protection, this circuit breaker **must** trip out when earth fault currents with DC content (pulsating DC) occur.

The earth leakage circuit breaker **must** be marked with the following symbol:  .

DANGER
Electric shock
Death or serious personal injury

- Do not lower or lift the pump by means of the motor cable.

WARNING
Toxic material
Death or serious personal injury

- Thoroughly clean the pump before pumping drinking water.
- Do not use the pump for drinking water if the internal parts have been in contact with particles or substances not suitable for water intended for human consumption.

The electrical connection must be carried out by an authorised electrician in accordance with local regulations.

The pump must be installed according to national water regulations and standards.

The pump must never be connected to a capacitor or to another type of control box than CU 302.

The pump must never be connected to an external frequency converter.

Fix the separate nameplate supplied with the pump close to the installation site.

Supply voltage

1 × 200-240 V -10 % / +6 %, 50/60 Hz, PE.

The current consumption can only be measured by with a true RMS instrument. If other instruments are used, the value measured will differ from the actual value.

On SQ/SQE pumps, a leakage current of 3.5 mA at 230 V, 50 Hz, can typically be measured. The leakage current is proportional to the supply voltage.

The SQE pump can be connected to a control box, type CU 302.

4.1 Preparation

Grundfos MS 3 and MSE 3 submersible motors have water-lubricated slide bearings. No additional lubrication is required.

The submersible motors are factory-filled with a special Grundfos motor liquid (type SML 3), which is frost-proof down to -20 °C and preserved to prevent the growth of bacteria.

4.1.1 Motor liquid refill

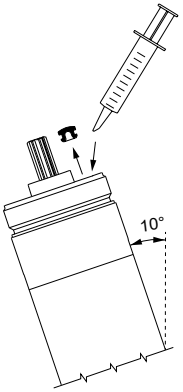
The level of motor liquid is decisive for the operating life of the bearings and consequently the life of the motor.

If for any reason the motor liquid has been drained or lost, the motor must be refilled with motor liquid.

Use Grundfos motor liquid SML 3.

To refill the motor, proceed as follows:

1. Remove the cable guard and separate the pump part from the motor.



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Refilling of motor liquid

2. Place the motor in vertical position with an inclination of approx. 10°. If placed in a vice, see the section on Assembly of pump part and motor.
3. Remove the filling plug using a screwdriver or a similar tool.
4. Inject motor liquid into the motor with a filling syringe or with a similar tool.
5. To allow possible air to escape, move the motor from side to side.
6. Refit the filling plug and make sure it is tight.
7. Assemble the pump part and the motor. See the section on Assembly of pump part and motor.
8. Refit the cable guard.

Related information

6.2 Assembly of pump part and motor

4.1.2 Cable sizing

Before installing the pump, make sure to use the right cable size for the submersible drop cable.

The cross-section of the submersible drop cable must be large enough to meet the voltage requirements.

Maximum cable length calculation

Use the following equation [1]:

$$L_{MAX} = \frac{U \bullet \Delta U}{I \bullet 2 \bullet 100 \bullet \left(\frac{\rho}{q}\right)}$$

[1] Power factor (PF) of the motor unit is 1.

Explanation of the equation

Symbol	Unit	Description
L_{MAX}	[m]	Maximum cable length
U	[V]	Supply voltage
ΔU	[%]	Maximum recommended voltage drop in percentage
I	[A]	Maximum motor current
ρ	[Ω mm^2/m]	Specific resistance of the cable
q	[mm^2]	Cross-sectional area of the individual wires in the submersible drop cable

Maximum motor current

The maximum motor current depends on the motor properties and electrical installation. According to IEC 60364-5-52:2009, the installation and cable must be dimensioned for a current that is higher than the maximum motor current.

Maximum recommended voltage drop

- According to IEC 60364-5-52:2009 for installation in domestic applications, the maximum recommended voltage drop is 5 % for cable lengths up to 100 m.
- For installation in industrial applications and in regions where the IEC standard is not applicable, local regulations may require that a different maximum value for voltage drop must be used for the calculation of the maximum cable length.

Specific resistance of the drop cables

The specific resistance of the drop cables supplied by Grundfos for SQ and SQE pumps is 0.02 Ω mm^2/m.

Maximum cable lengths for Grundfos MSF 3 motors

Calculation of maximum cable length for the different motor sizes is based on a voltage drop of 5 % and a supply voltage of 240 V.

If the calculation above cannot be used, go to Grundfos Product Center for sizing.

4.2 Motor protection

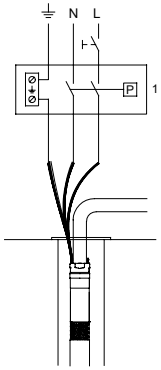
The motor incorporates thermal overload protection and requires no additional motor protection.

4.3 Connection of motor

The motor can be connected directly to the mains.

Start/stop of the pump typically done via a pressure switch.

The pressure switch must be rated for the maximum amps of the specific pump size.



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Connection of motor

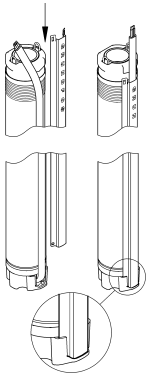
Pos.	Description
1	Pressure switch

4.4 Fitting the cable guard

To fit the cable guard, proceed as follows:

1. Make sure that the submersible drop cable lies flat in the cable guard.

2. Place the cable guard in the groove in the cable plug. The two flaps of the cable guard must engage with the upper edge of the pump sleeve.



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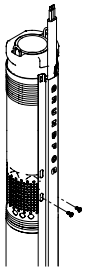
Placement of the cable guard in the cable plug

3. Fasten the cable guard to the pump suction strainer with the two self-tapping screws supplied.



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Fastening of the cable guard to the pump suction strainer

4.5 Fitting the submersible drop cable

Connect the submersible drop cable and the motor cable with a type KM Grundfos cable termination kit. Connect the submersible drop cable and the motor cable with a type KM Grundfos cable termination kit.

Cable termination kit, type KM	
Cross-sectional area	**Product number**
1.5 to 6.0 mm^2	96021473

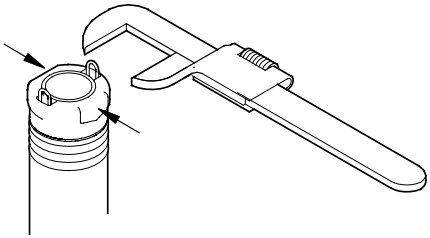
For larger cross-sections, contact Grundfos.

4.6 Pipework connection

WARNING
Pressurised system
Death or serious personal injury
- Make sure that the pipework has an adequate pressure rating.

Before determining the installation depth of the pump, take the expansion of plastic pipes into consideration.

When the riser pipe is fitted, use a chain pipe wrench. The pump must be gripped by the pump discharge chamber.



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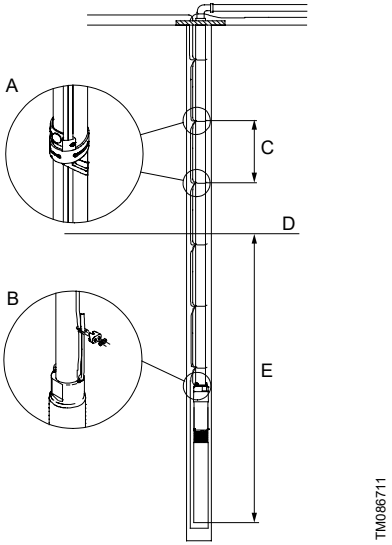
Gripping the pump

When connecting plastic pipes, use a compression coupling between the pump and the first pipe section.

Where flanged pipes are used, in case of flanged pipes, use slotted flanges so they can take the submersible drop cable.

The figure Pipework connection below shows a pump installation.



Pipework connection

Pos.	Description
A	Cable clips
B	Straining wire
C	3 m
D	Static water level
E	Maximum 150 m

4.6.1 Cable clips

Cable clips must be fitted every 3 metres.

When connecting plastic pipes, fit the cable clips loosely as plastic pipes expand when loaded.

Where flanged pipes are used, fit the cable clips above and below each joint.

4.6.2 When lowering the pump into the borehole

Secure the pump with an unloaded straining wire.

Loosen the straining wire so that it becomes unloaded and lock it to the borehole seal with wire locks.

The straining wire must not be used for pulling the pump with riser pipe out of the borehole.

5. Start-up

Do not start the pump until it is completely submerged in the liquid.

Start the pump and do not stop it until the pumped liquid is completely clean, otherwise the pump parts and the non-return valve may clog.

5.1 Minimum flow rate

Make sure that the flow rate is least 50 l/h to have proper motor cooling.

The pump dry-running protection is effective only within the recommended duty range of the pump.

5.2 Built-in protection

In case of overload, the built-in overload protection stops the pump for 5 minutes, then it restarts.

If the pump stopped because of dry running, it starts automatically after 5 minutes.

If the pump is restarted and the borehole is empty, the pump stops after 30 seconds.

To reset the pump, switch of the power supply for 1 minute.

The motor is protected in case of:

- dry running
- voltage surges (up to 6000 V) In areas with high lightning intensity, external lightning protection is required.
- overvoltage
- undervoltage
- overload
- overtemperature.

SQE pumps, MSE 3 motors

Via the CU 302, the dry-running stop limit of the MSE 3 motors can be adjusted to match the actual application.

6. Maintenance and service

Service kits, service tools and the Grundfos Service Manual are available on request from Grundfos.

The pumps can be serviced at a Grundfos service centre.

6.1 Contaminated pumps

DANGER
Toxic or radio active liquid
Death or serious personal injury

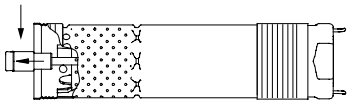
- If a pump has been used for a liquid which is injurious to health or toxic, the pump will be classified as contaminated.

Before servicing the pump make sure to notify the personnel about the pumped liquid.

If Grundfos is requested to service the pump, Grundfos must be contacted with details about the pumped liquid, etc. *before* the pump is returned for service. Otherwise, Grundfos can refuse to accept the pump for service.

6.2 Assembly of pump part and motor

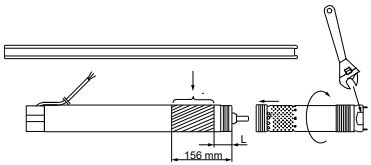
1. Place the motor horizontally in a vice and tighten it. Make sure that the vice clamps on the hatched area of the motor. See the figure Assembly of pump part and motor below.
2. Pull the pump shaft out to the position shown in figure Position of pump shaft.



Position of pump shaft

3. Grease the motor shaft end with the grease supplied with the motor.
4. Screw the pump part on the motor (55 Nm).

The pump shaft must engage with the motor shaft. Use a spanner on the clamping faces of the pump part.



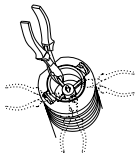
Assembly of pump part and motor, showing available area for clamping

Motor (P2) [kW]	L [mm]
0.70	120
1.15	102
1.55	84
1.85	66

Make sure there is no clearance between the pump part and the motor.

6.3 Removal of non-return valve

1. Cut off the legs of the valve guide using side-cutting pliers or a similar tool.



2. Turn the pump upside down.
3. Check that all loose parts fall out of the pump.

The non-return valve can be fitted in a Grundfos service workshop.

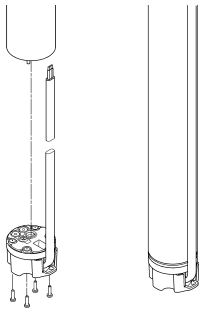
6.4 Fitting the cable plug to the motor

DANGER
Electric shock
Death or serious personal injury

- Do not remove the motor plug.
- The cable with plug must be fitted or removed by an authorised Grundfos service workshop or a similarly qualified person.

To fit the cable plug, proceed as follows:

1. Make sure of the proper type, cross section and length of the cable.
2. Make sure that the cable plug is greased correctly.
3. Make sure the power supply is properly earthed.
4. Make sure the motor socket is clean and dry, and that the loose gasket has been fitted.
5. Press the cable plug onto the motor socket.



Fitting the cable plug onto the motor socket

6. Fit and tighten the four screws (3.5 Nm).

Make sure there is no clearance between the motor and the cable plug.

Related information

4. Installing the product

7. Storage

Storage temperature: -20 °C to +60 °C.

7.1 Frost protection

Make sure that the pump is stored in a frost free location and that the motor liquid is frost proof.

Do not store the pump without motor liquid in it.

8. Fault finding

DANGER
Electric shock
Death or serious personal injury

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

8.1 The pump does not run

Cause	Remedy
The fuses in the electric installation are blown.	Replace the blown fuses. If the new ones blow too, check the electric installation and the submersible drop cable.
The ELCB or the voltage-operated ELCB has tripped out.	Cut in the circuit breaker.
No power supply.	Contact the power supply authorities.
The motor protection has cut off the power supply due to overload.	Check whether the motor/pump is blocked.
The pump/submersible drop cable is defective.	Repair/replace the pump/cable.
Overvoltage or undervoltage has occurred.	Check the power supply.
The pump is defective.	Repair/replace the pump.

8.2 The pump runs but gives no water

Cause	Remedy
The discharge valve is closed.	Open the valve.
No water or too low water level in borehole.	Increase the installation depth of the pump, throttle the pump or replace it by a smaller model to obtain a smaller capacity.
The non-return valve is stuck in its closed position.	Pull out the pump and clean or replace the valve.
The suction strainer is clogged.	Pull out the pump and clean the strainer.
The pump is defective.	Repair/replace the pump.

8.3 The pump runs at reduced capacity

Cause	Remedy
The drawdown is larger than anticipated.	Increase the installation depth of the pump, throttle the pump or replace it by a smaller model to obtain a smaller capacity.
The valves in the discharge pipe are partly closed/ blocked.	Check and clean/replace the valves, if necessary.
The discharge pipe is partly choked by impurities (ochre).	Clean/replace the discharge pipe.
The non-return valve of the pump is partly blocked.	Pull out the pump and check/replace the valve.
The pump and the riser pipe are partly choked by impurities (ochre).	Pull out the pump. Check and clean or replace the pump, if necessary. Clean the pipes.
The pump is defective.	Repair/replace the pump.

Cause	Remedy
Leakage in the pipework.	Check and repair the pipework.
The riser pipe is defective.	Replace the riser pipe.
Undervoltage has occurred.	Check the power supply.

8.4 Frequent starts and stops

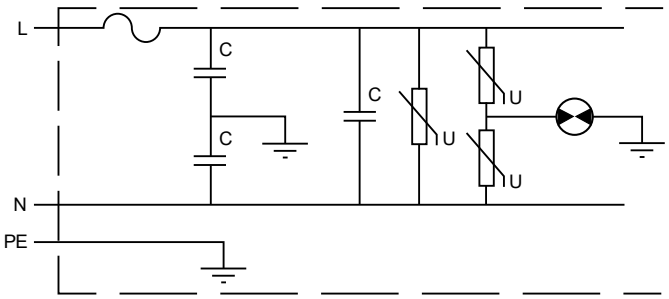
Cause	Remedy
The differential of the pressure switch between the start and stop pressures is too small.	Increase the differential. Make sure that the stop pressure does not exceed the operating pressure of the pressure tank, and the start pressure is high enough to ensure sufficient water supply.
The water level electrodes or level switches in the reservoir have not been installed correctly.	Adjust the intervals of the electrodes/level switches to ensure suitable time between the cutting-in and cutting-out of the pump. See installation and operating instructions for the automatic devices used. If the intervals between stop/start cannot be changed via the automatics, the pump capacity may be reduced by throttling the discharge valve.
The non-return valve is leaking or stuck half-open.	Pull out the pump and clean/replace the non-return valve.
The supply voltage is unstable.	Check the power supply.
The motor temperature gets too high.	Check the water temperature.

8.5 The current consumption is too high

Cause	Remedy
Poor connection in the leads, possibly in the joint.	Check the cable and the cable joint.
The supply voltage is too low.	Check the power supply.

8.6 Megging

Do not meg an installation incorporating this product as the built-in electronics may be damaged.



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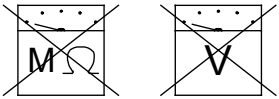
Megging

8.7 Tests not allowed

Do not use insulation or high voltage testers.



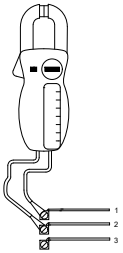
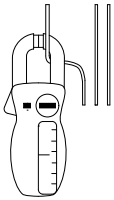
TM086678

Use a true RMS instrument.

9. Checking the power supply

DANGER
Electric shock
Death or serious personal injury

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

1. Supply voltage  TM001371 **Pos.** / **Description** 1 – L 2 – N 3 – PE	Measure the voltage (RMS) between phase and neutral. Connect the voltmeter to the terminals at the connection.	The voltage should be 1 × 200-240 V -10 % / +6 %, 50/60 Hz, PE, when the motor is loaded. Large variations in supply voltage indicate poor power supply, and the pump should be stopped until the defect has been remedied.
2. Current consumption  TM001372	Measure the current (RMS) while the pump is operating at a constant discharge head (if possible, at the capacity where the motor is most heavily loaded). For maximum current, see nameplate.	

10. Technical data

Supply voltage

1 × 200-240 V -10 % / +6 %, 50/60 Hz, PE.

Operation via generator: As a minimum, the generator output must be equal to the motor P1 [kW] + 50 %.

Starting current

The motor starting current is equal to the highest value stated on the motor nameplate.

Power factor

PF = 1.

Motor liquid

Type SML 3.

Motor cable

1.5 m, 3 × 1.5 mm^2, PE.

Liquid temperature

Maximum 35 °C.

Pump outlet size

SQ 1, SQ 2, SQ 3: Rp 1 1/4.

SQ 5, SQ 7: Rp 1 1/2.

Pump diameter

74 mm.

Borehole diameter

Minimum 76 mm.

Installation depth

Maximum 150 m below static water level.

Net weight

Maximum 6.5 kg.

Related information

3.1 Installation depths

10.1 Sound pressure level

The sound pressure level of the pump is lower than the limiting values stated in the EC Council Directive 2006/42/EC relating to machinery.

11. Disposing of hazardous or toxic materials

DANGER
Toxic or radio active liquid
Death or serious personal injury

- If a pump has been used for a liquid which is injurious to health or toxic, the pump will be classified as contaminated.

12. Disposing of the product

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

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

The crossed-out 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*.

13. Document quality feedback

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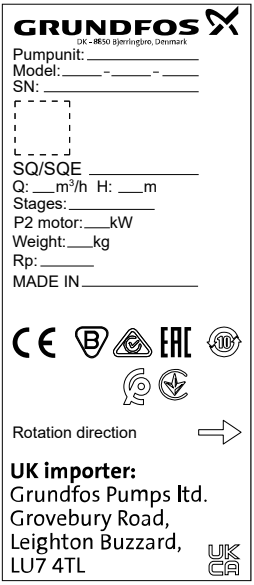
Appendix A

A.1. Appendix

Nameplates to be filled in



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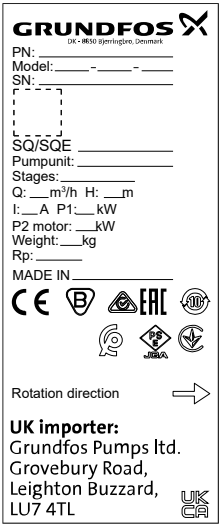

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