SQ, SQ-N, SQE

Submersible pumps

For domestic water supply, small waterworks, irrigation and tank applications.

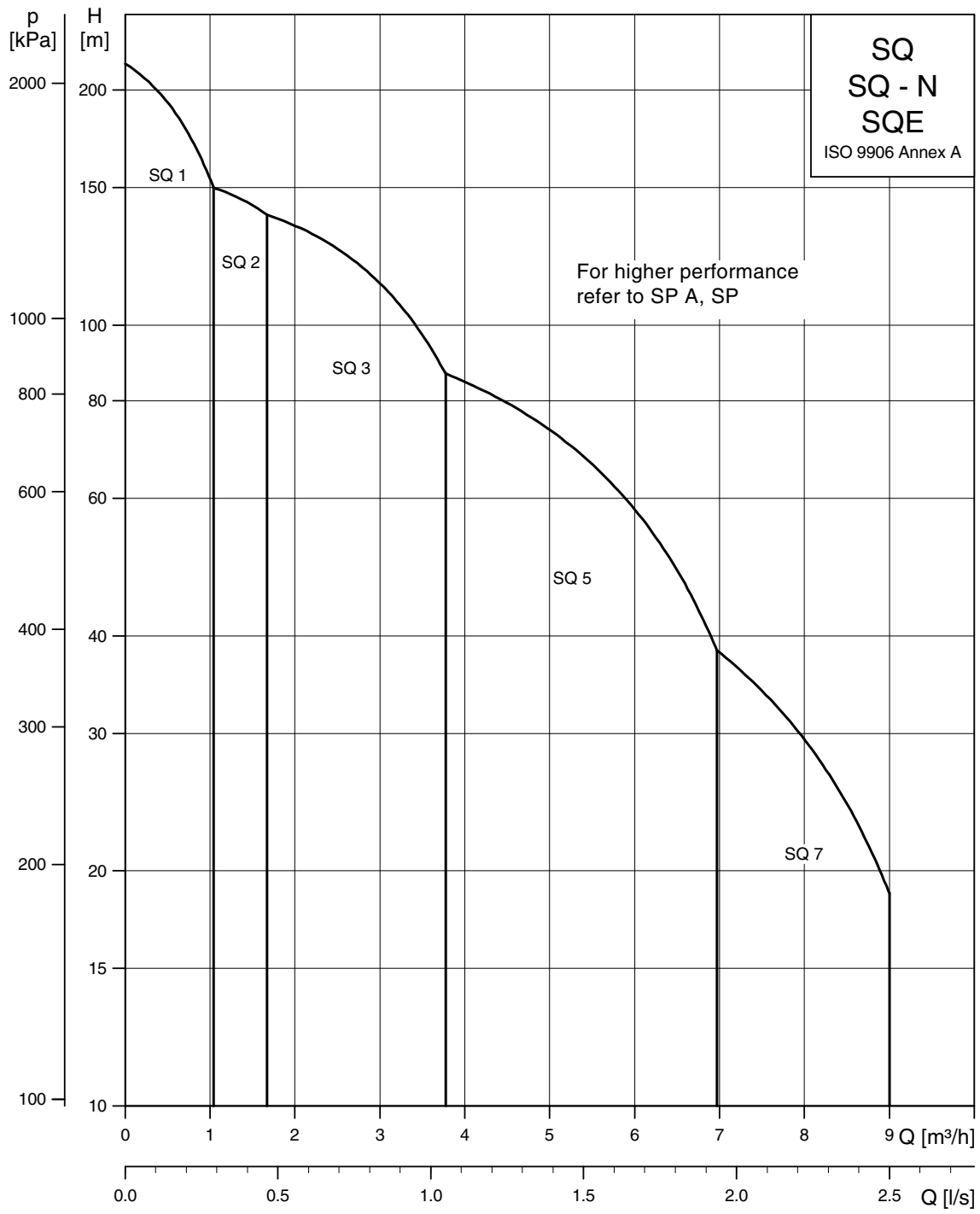
50 / 60 Hz

TM01 3139 4801

GRUNDFOS

Contents

Performance range



SQ submersible pumps

SQ pumps are suitable for both continuous and intermittent operation for a variety of applications:

- Domestic water supply
- Small waterworks
- Irrigation
- Tank applications
- Pressure boosting.

Note: For other applications, please contact Grundfos.

SQ pumps offer the following features:

- Dry-running protection
- High efficiency of pump and motor
- Wear resistance
- Protection against upthrust
- Soft starter
- Overvoltage and undervoltage protection
- Overload protection
- Overtemperature protection.

Additionally the SQE pumps offer:

- Variable speed
- Electronic control and communication.

The SQ pump is a submersible pump which can be fitted with Grundfos MS 3, MS3-NE and MSE 3 motors.

When the pump is fitted with an:

- MS 3 motor, it is called SQ,
- MS 3-NE motor it is called SQ-N, and
- MSE 3 motor it is called SQE.

Both MS 3, MS 3-NE and MSE 3 are available in three sizes of which the maximum power is 1.7 kW.

The motors are based on the most recent technology within permanent magnets. This technology is the main reason for the high efficiency of the motors. In addition the three motor versions have a built-in electronic unit containing a frequency converter featuring soft start.

The SQ pump is fitted with a single-phase Grundfos MS 3 or MS 3-NE motor and by means of the built-in frequency converter it is driven at a constant speed.

The SQE pump is fitted with a single-phase Grundfos MSE 3. The MSE 3 motor can communicate with the Grundfos control units CU 300 and CU 301, which can be operated by means of Grundfos remote control R100.

The SQE pump features variable speed which is offered through frequency control. As a consequence, the pump can be set to operate in any duty point in the range between the pump min. and max. performance curves.

The CU 301 is specially developed for applications where a constant pressure is needed.

The SQE pump can operate without the CU 300 or the CU 301. However, in this situation it will not offer all the features available when the pump is connected to a CU 300 or CU 301.

The CU 300 and CU 301 provide full control of the SQE pumps. In case of a pump fault, an alarm will be indicated on the front of the CU 300 or CU 301. The R100 enables monitoring of the installation and changing of the factory settings.

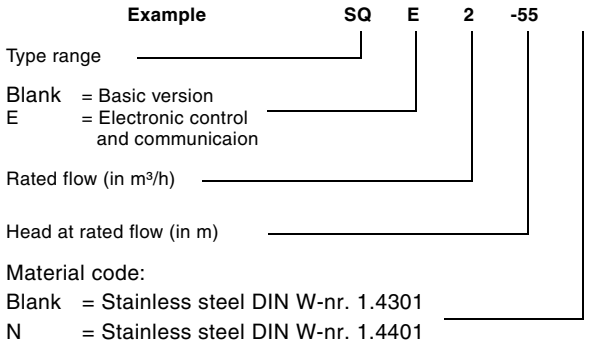
Pump and motor range

Product	Description	Material
SQ pump	(1, 2, 3, 5, and 7 m³/h)	Stainless steel DIN 1.4301, AISI 304
SQ-N pump	(1, 2, 3, 5, and 7 m³/h)	Stainless steel DIN 1.4401, AISI 316
MS 3 motor	Single-phase Max. 1.7 kW	Stainless steel DIN 1.4301, AISI 304
MS 3-NE motor	Single-phase Max. 1.7 kW	Stainless steel DIN 1.4401, AISI 316
MSE 3 motor	Single-phase Max. 1.7 kW	Stainless steel DIN 1.4301, AISI 304

Pipe connection

Pump type	Threaded connection
SQ 1, SQ 2, SQ 3	Rp 1¼
SQ 5, SQ 7	Rp 1½

Type key



Pumped liquids

SQ and SQE pumps are designed for pumping thin, clean, non-aggressive and non-explosive liquids, not containing solid particles or fibres. SQ and SQE are suitable for pumping liquids with a content of sand up to 50 g/m³. A higher content of sand will shorten pump life.

Operating conditions

Liquid temperature:

Flow velocity past motor	Max. liquid temperature
0.0 m/s (Free convection)	30°C
Min. 0.15 m/s	40°C

SQ, SQE overview

	Pump type	MS 3	MS 3-NE	MSE 3	CU 300	CU 301 + pressure sensor	Cable guard	Cable with plug
Complete unit*	SQ	●					Fitted on delivery	1.5 m***
	SQ-N		●				Fitted on delivery	1.5 m
	SQE			●	optional		Fitted on delivery	1.5 m
Flexible concept**	SQ	●					To be ordered separately	1.5 - 100 m ordered separately
	SQ-N		●				To be ordered separately	1.5 - 100 m ordered separately
	SQE			●	optional		To be ordered separately	1.5 - 100 m ordered separately
	SQE			●		optional	To be ordered separately	1.5 - 100 m ordered separately

* The pump, motor, cable and cable guard are supplied as a complete unit.
** The pump, motor, cable and cable guard are supplied unassembled.
*** Packages of SQ pumps including selected lengths of submersible drop cable, see "Order data" page 53.

Complete unit, SQ, SQ-N and SQE

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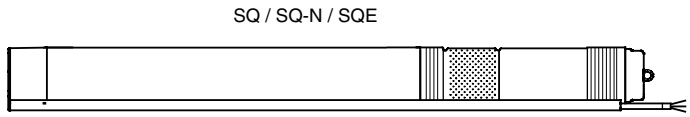

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Flexible concept, SQ , SQ-N and SQE

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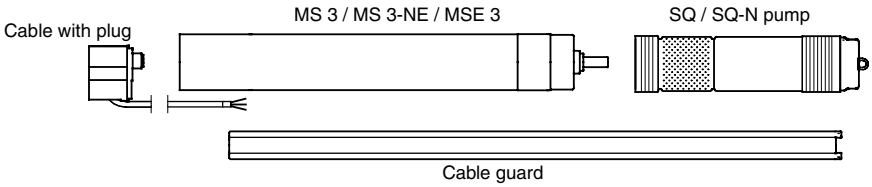

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Flexible concept, SQE with CU 300

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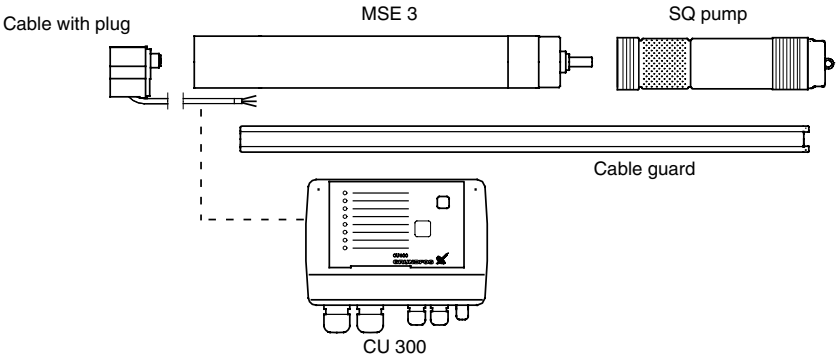

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Flexible concept, SQE with CU 301 and pressure sensor

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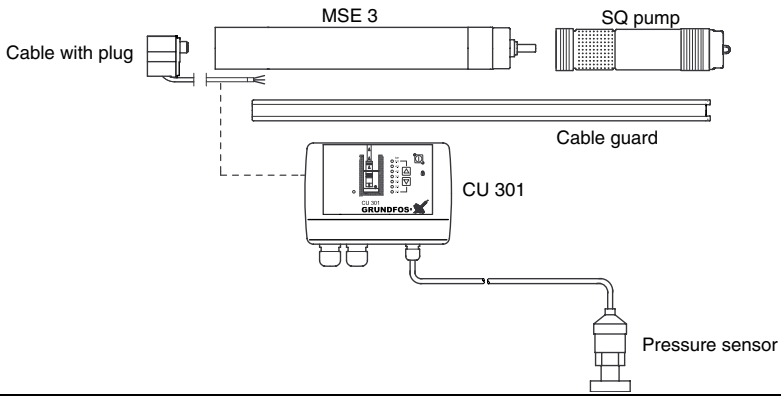

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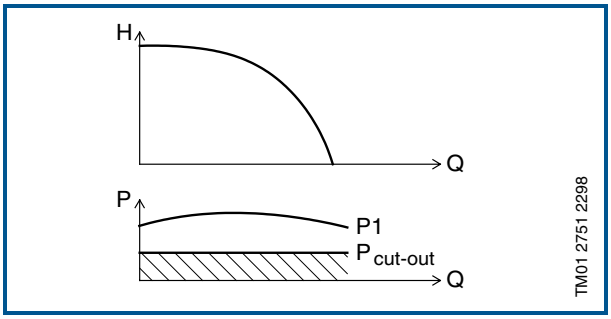
Features and benefits

Dry-running protection

The SQ and SQE pumps are protected against dry running. A value of $P_{cut-out}$ ensures cut-out of the pump in case of lack of water in the borehole thus preventing a burnout of the motor.

$P_{cut-out}$ is factory-set both for the SQ and SQE pump.



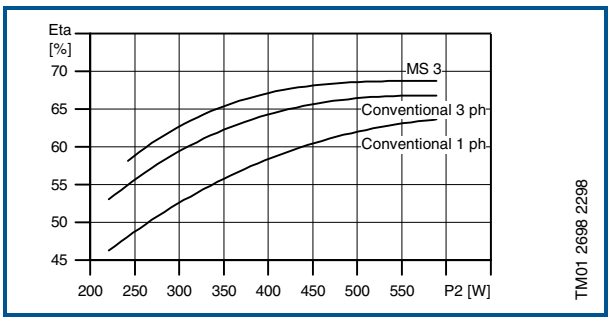
High pump efficiency

The hydraulic pump components are polyamide reinforced with 30% glass fibre. The hydraulic design gives high pump efficiency meaning low energy consumption and therefore low energy costs.

High motor efficiency

All three motor versions are based on a permanent magnet rotor (PM motor) featuring high efficiency within a wide load range.

The high, flat efficiency curve of the PM motor enables same motor to cover of a wide power range compared to conventional AC motors.



Wear resistance

The SQ pump design features impellers which are not fastened to the shaft ("floating"). Each impeller has its own tungsten carbide/ceramic bearing. The design and these materials chosen ensure high wear resistance to sand for long product life.

Protection against upthrust

Starting up a pump with a very low counter pressure involves the risk of the entire impeller stack being lifted - also called upthrust. Upthrust may cause breakdown of both pump and motor.

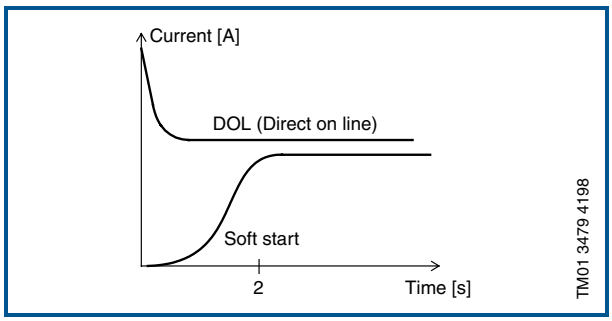
The three motor versions are fitted with a top bearing protecting both pump and motor against upthrust and thus preventing breakdown during the critical start-up phase.

Excellent starting capabilities

The integrated electronic unit of all three motor versions features soft starting. Soft start reduces the starting current and thus gives the pump a smooth and steady acceleration.

The soft starter minimizes the risk of wear of the pump and prevents overloading of the mains during start-up.

The excellent starting capabilities are a result of the high locked-rotor torque of the permanent magnet motor together with the few pump stages. The high starting reliability also applies in case of low voltage supply.



Overvoltage and undervoltage protection

Overvoltage and undervoltage may occur in case of unstable voltage supply.

The integrated protection of all three motor versions prevents damage to the motor in case the voltage moves outside the permissible voltage range.

The pump will be cut out if voltage falls below 150 V or rises above 280 V. The motor is automatically cut in again when the voltage is again within the permissible voltage range. Therefore no extra protection relay is needed.

Overload protection

Exposure of the pump to heavy load causes the current consumption to rise. The motor will automatically compensate for this by reducing the speed. If the speed drops to 65% of the nominal speed, the motor will be cut out.

If the rotor is being prevented from rotating this will automatically be detected and the power supply cut out. Consequently, no extra motor protection is needed.

Overtemperature protection

A permanent magnet motor gives off very little heat to its surroundings. In combination with an efficient internal circulation system leading the heat away from the rotor, stator and bearings, this fact ensures optimum operating conditions for the motor.

As an extra protection, the electronic unit has a built-in temperature sensor. When the temperature rises too high, the motor is cut out; when the temperature has dropped, the motor is automatically cut in again.

Reliability

All three motor versions have been designed with a view to high reliability and have the following features:

- Tungsten carbide / ceramic bearings.
- Thrust bearings protecting against downthrust.
- Product life time equal to conventional AC motors.

Features and benefits

Variable speed

The MSE 3 motor enables continuously variable speed control within the 65% - 100% performance range. The pump can be set to operate in any duty point in the range between the 65% and 100% performance curves of the pump. Consequently, the pump performance can be adapted to any specific requirement.
The variable speed control facility requires the use of the CU 300 control unit and the R100.

For the calculation of pump speed the PC tool "SQE Speed Calculation" is available on floppy disk as an accessory, see page 52. On the basis of a required head and flow the speed of the motor is calculated. Furthermore, the specific pump performance curve can be illustrated.

Installation

The SQ and SQE may be installed vertically, horizontally or in any position inbetween.
Note: The pump must not fall below the horizontal level in relation to the motor.

The following features ensure simple installation of the SQ and SQE pumps:

- Built-in non-return valve with spring,
- low weight ensuring user-friendly handling,
- installation in 3" or larger boreholes,
- only on/off switch is needed, which means that no extra motor starter / starter box is necessary, and
- SQE available with cable with a motor plug (up to 100 m).

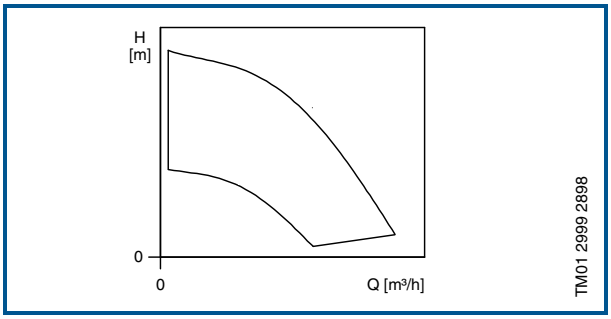
For horizontal installation a flow sleeve is recommended in order to

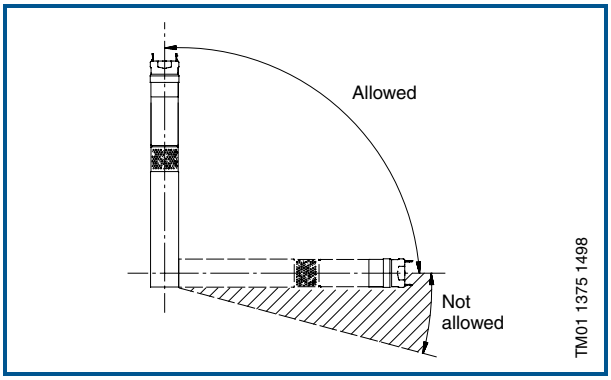
- ensure sufficient flow velocity past the motor and thus provide sufficient cooling,
- prevent motor and electronic unit from being buried in sand or mud.

Service

The modular pump and motor design facilitates installation and service. The cable and the plug are fitted to the pump with nuts which enables replacement.

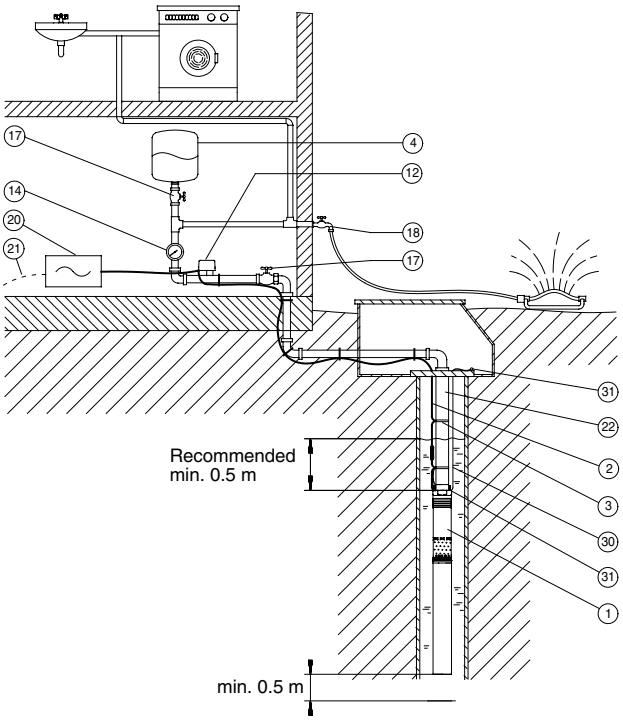
Example: SQE





SQ with pressure switch and diaphragm tank

SQ is ideally suited for domestic water supply in single-family dwellings or summer cottages which are not connected to municipal waterworks. SQ is easy to install and operate.



1 Pump, SQ
2 Cable
3 Cable clips
4 Diaphragm tank*
12 Pressure switch
14 Pressure gauge
17 Isolating valve
18 Tap
20 Mains switch
21 Mains connection, 1 x 200-240 V, 50/60 Hz
22 Riser pipe
30 Straining wire
31 Wire clamp

* For selection of diaphragm tank see page 33.

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SQ with pressure switch and diaphragm tank

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQ					
2	Cable					
3	Cable clips					
4	Diaphragm tank					
12	Pressure switch					
14	Pressure gauge					
20	Mains switch					
30	Straining wire					
31	Wire clamp					

SQ with Presscontrol (with/without diaphragm tank)

Functioning and benefits

If water is consumed the SQ pump is cut in via the Presscontrol. The diaphragm tank is fitted between the SQ and the Presscontrol. In an installation with a diaphragm tank, water is supplied as soon as the tap is opened. It means that the diaphragm tank takes over water supply during the smooth start up of the SQ pump (about 2 seconds).

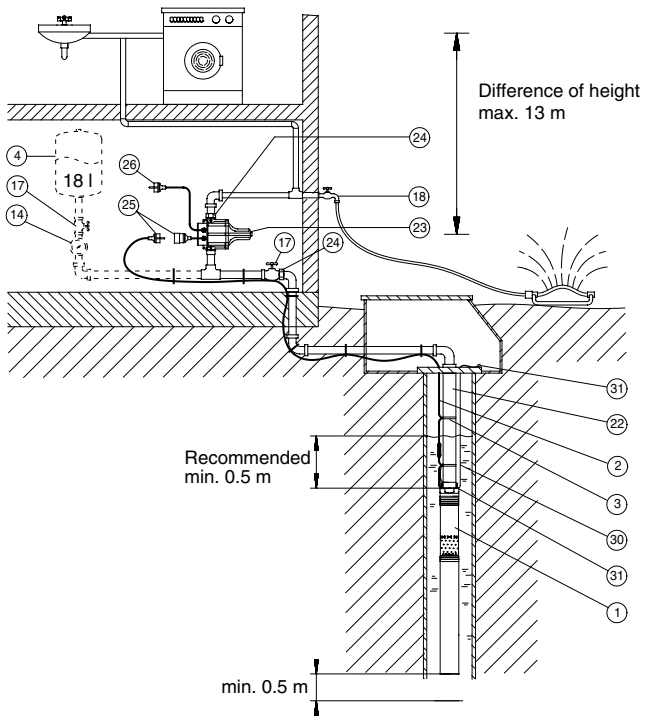
When the water consumption stops (flow = 0), the pump will continue operating for 10 seconds building up pressure in the diaphragm tank.

In the case of leakage with less than 50 l/hour the pump is not put into operation by the Presscontrol flow switch but by the pressure switch (Presscontrol PC 15, switch-on pressure = 1.5 bar). In case the water consumption is higher than 50 l/hour, the pump will be in continuous operation.

The setting of the diaphragm tank precharge pressure depends on the water level (difference of height between water level and the Presscontrol).

The setting of the flow pipe pressure at the diaphragm tank depends on the water level (difference of height between water level and Presscontrol) according to the following table:

Difference of height [m]	Flow pipe pressure in diaphragm tank [bar]
0	1.22
10	1.0
20	0.77
30	0.56



1 Pump, SQ
2 Cable
3 Cable clips
4 Diaphragm tank
14 Pressure gauge
17 Isolating valve
18 Tap
22 Riser pipe
23 Presscontrol PC 15
available with/without plug
24 Union
25 Plug
26 Mains connection, 1 x 200-240 V, 50/60 Hz for PC 15
30 Straining wire
31 Wire clamp

Note: For the Presscontrol: Back-up fuse max. 10 A. System pressure max. 10 bar. The following pump types can be used: SQ 1-65, SQ 1-80, SQ 2-35, SQ 2-55, SQ 2-70, SQ 2-85, SQ 3-40, SQ 3-55, SQ 3-65, SQ 3-80.

The installation has to be designed for maximum pump pressure.

Do not install draw-off points between the pump and the Presscontrol.

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SQ with Presscontrol (with/without diaphragm tank)

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQ					
2	Cable					
3	Cable clips					
4	Diaphragm tank	18 litres				
14	Pressure gauge					
23	Presscontrol					
30	Straining wire					
31	Wire clamp					

Constant-pressure control with CU 301 - residential water supply

Features and benefits

The system maintains a constant pressure within the maximum pump performance in spite of a varying water consumption.

The pressure is registered by the pressure sensor and transmitted to the CU 301. The CU 301 adjusts the pump performance accordingly.

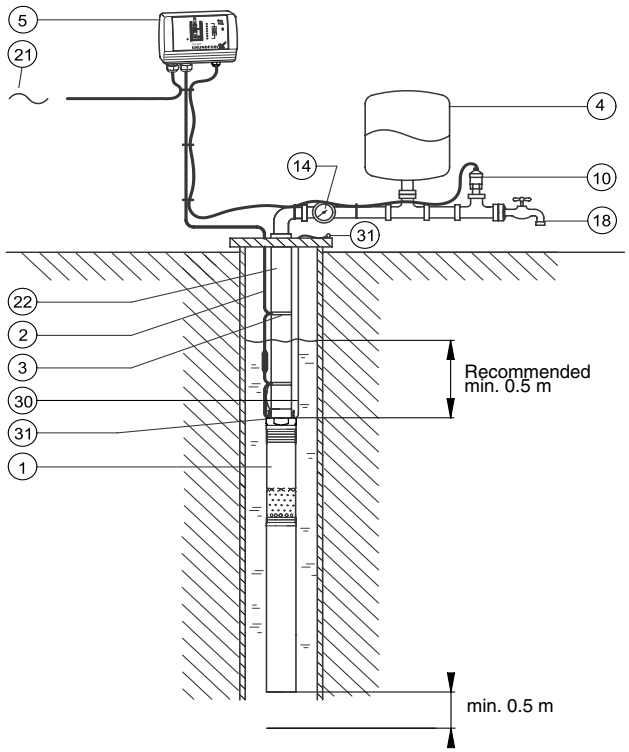
Function

When a tap is opened the pressure in the 8 l tank will start to drop.

At low flow, lower than approximately 0.18 m³/h, the pressure will drop slowly. When the pressure in the tank is 0.5 bar below setpoint, the pump will start. The pump will run until the pressure is 0.5 bar above setpoint. This way of operation is called on/off operation.

At flow higher than approximately 0.18 m³/h the pressure will drop quickly and the pump will start immediately and maintain constant pressure.

During operation the CU 301 will regulate the pump speed to maintain a constant pressure. If there is no consumption, the pump will fill up the tank and stop after a few seconds.



1 Pump, SQE
2 Cable
3 Cable clips
4 Diaphragm tank, 8 litres
5 Control unit, CU 301
10 Pressure sensor, 0-6 bar
14 Pressure gauge
18 Tap
21 Mains connection, 1 x 200-240 V, 50/60 Hz
22 Riser pipe
30 Straining wire
31 Wire clamp

If a higher constant pressure (max. 10 bar) is required use CU 300, pressure sensor and flow switch, see page 13.

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Constant pressure control with CU 301 - residential water supply

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQE					
2	Cable					
3	Cable clips					
4	Diaphragm tank	8 litres				
5	Control unit	CU 301				
10	Pressure sensor					
14	Pressure gauge					
30	Straining wire					
31	Wire clamp					

Constant-pressure control with CU 301 - irrigation

Features and benefits

The system maintains a constant pressure within the maximum pump performance in spite of a varying water consumption.

The pressure is registered by means of the pressure sensor and transmitted to the CU 301. The CU 301 adjusts the pump performance accordingly.

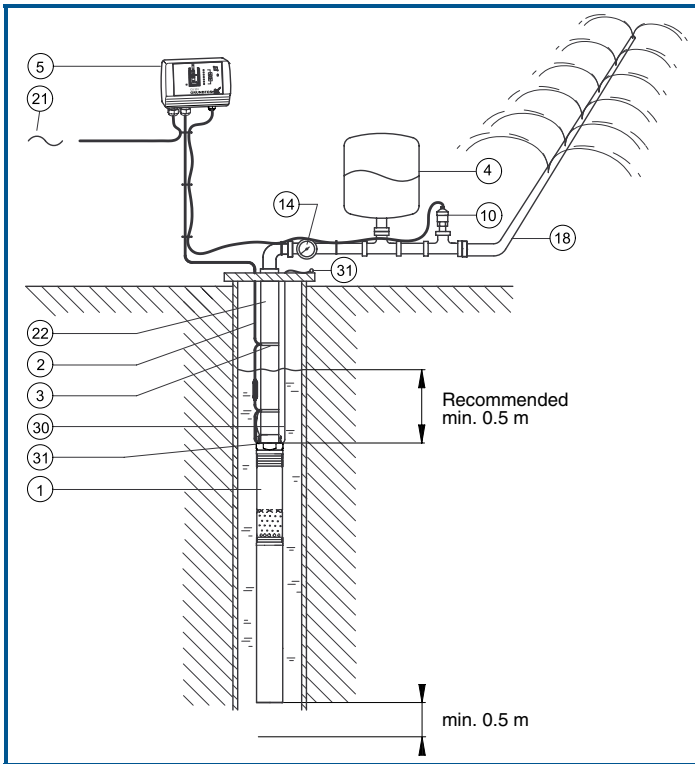
Function

When the sprinkler system is on, the pressure in the 8 l tank will start to drop.

At low flow, lower than approximately 0.18 m³/h, the pressure will drop slowly. When the pressure in the tank is 0.5 bar below setpoint, the pump will start. The pump will run until the pressure is 0.5 bar above setpoint. This way of operation is called on/off operation.

At flow higher than approximately 0.18 m³/h the pressure will drop quickly and the pump will start immediately and maintain constant pressure.

During operation the CU 301 will regulate the pump speed to maintain a constant pressure. If there is no consumption, the pump will fill up the tank and stop after a few seconds.



1 Pump, SQE
2 Cable
3 Cable clips
4 Diaphragm tank, 8 litres
5 Control unit, CU 301
10 Pressure sensor, 0-6 bar
14 Pressure gauge
18 Sprinkler system
21 Mains connection, 1 x 200-240 V, 50/60 Hz
22 Riser pipe
30 Straining wire
31 Wire clamp

If a higher constant pressure (max. 10 bar) is required use CU 300, pressure sensor and flow switch, see page 13.

TM01 7907 5099

Constant pressure control with CU 301 - irrigation

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQE					
2	Cable					
3	Cable clips					
4	Diaphragm tank	8 litres				
5	Control unit	CU 301				
10	Pressure sensor					
14	Pressure gauge					
30	Straining wire					
31	Wire clamp					

Constant-pressure control with CU 300

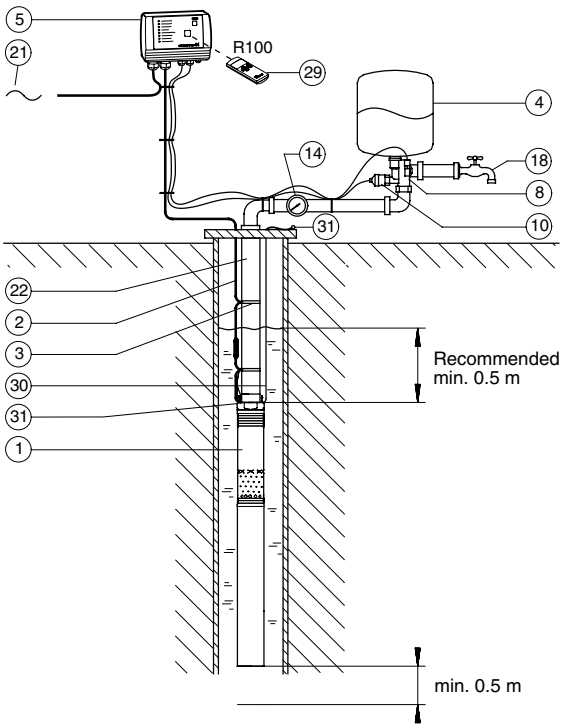
Functioning and benefits

A constant pressure can be maintained in the system. A flow switch ensures that the pump starts at once when a tap is opened. A preset pressure is maintained via the pressure sensor and the CU 300. When the flow switch is detecting no flow the tank is filled with water and the pump stops.

If consumption is below 0.18 m³/h, the CU 300 will start the pump when the pressure is equal to the setpoint minus 0.5 bar. The pump is stopped again when the actual pressure is equal to the setpoint plus 0.5 bar.

If consumption is above 0.18 m³/h, the CU 300 will control pump performance to keep the actual pressure within +/– 0.2 bar of the setpoint.

Applying the constant-pressure control mode reduces pressure variations, and as a small eight-litre tank is sufficient, little installation space is required. In installations incorporating filters, pump operation is gradually adjusted as the filter is clogging up with ochre or other materials.



1 Pump, SQE
2 Cable
3 Cable clips
4 Diaphragm tank, 8 litres
5 Control unit, CU 300
8 Flow switch
10 Pressure sensor
14 Pressure gauge
18 Tap
21 Mains connection, 1 x 200-240 V, 50/60 Hz
22 Riser pipe
29 Remote control, R100
30 Straining wire
31 Wire clamp

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Constant pressure control

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQE					
2	Cable					
3	Cable clips					
4	Diaphragm tank	8 litres				
5	Control unit	CU 300				
8	Flow switch					
10	Pressure sensor					
14	Pressure gauge					
29	Remote control	R100				
30	Straining wire					
31	Wire clamp					

Maintaining a constant water table

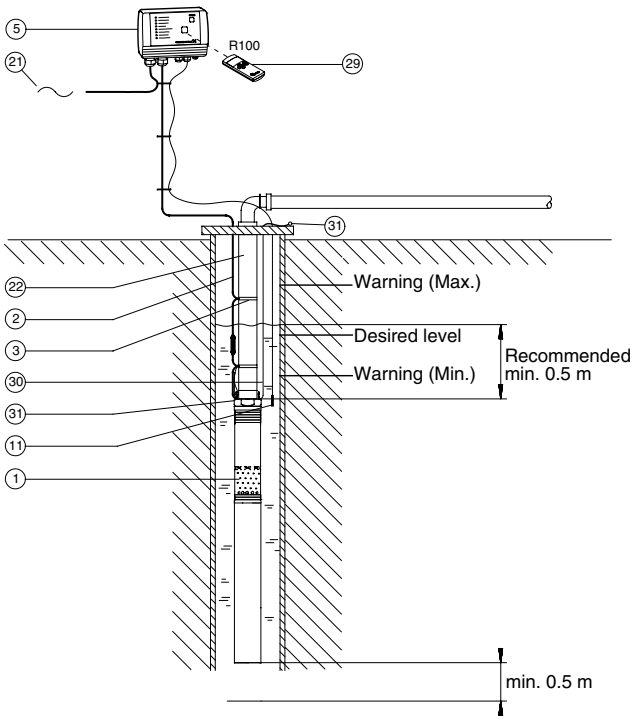
Functioning and benefits

A constant water table can be maintained by adjusting pump performance. It may be important to maintain a constant water table e.g. in connection with keeping out the groundwater of a building site or preventing the penetration of salt water into a borehole containing potable water.

The example shows how to maintain a constant water table by adjusting pump performance.

Sensors:

Level	Description	Reaction
Level sensor (pos. 11)		
Warning (Max.)	Too high water level. Possible cause: Insufficient pump capacity.	Alarm relay operates.
Desired level	The water level which should be mainained.	
Warning (Min.):	Too low water level. Possible cause: Too high pump capacity.	Alarm relay operates.



1 Pump, SQE
2 Cable
3 Cable clips
5 Control unit, CU 300
11 Level sensor
21 Mains connection, 1 x 200-240 V, 50/60 Hz
22 Riser pipe
29 Remote control, R100
30 Straining wire
31 Wire clamp

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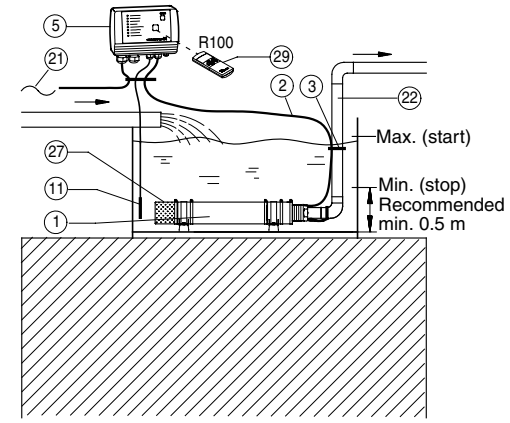
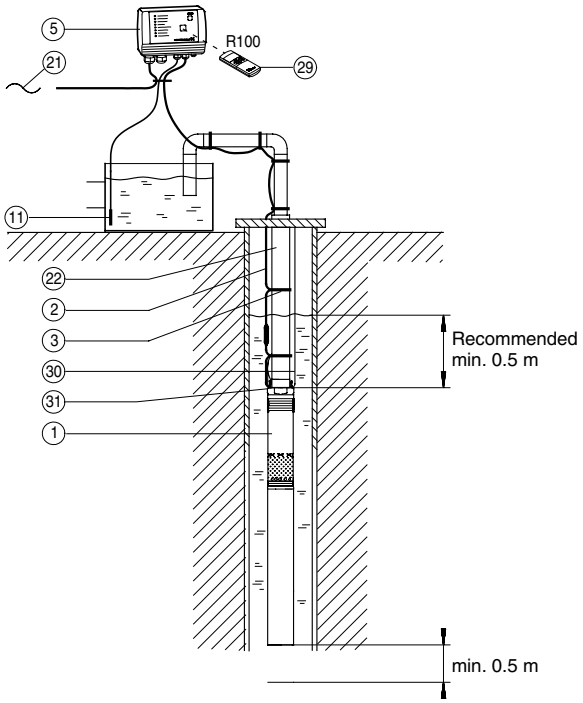
Maintaining a constant water table

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQE					
2	Cable					
3	Cable clips					
5	Control unit	CU 300				
11	Level sensor					
29	Remote control	R100				
30	Straining wire					
31	Wire clamp					

Emptying or filling a tank

The SQE pump with CU 300 are ideal for emptying or filling a tank.





1 Pump, SQE
2 Cable
3 Cable clips
5 Control unit, CU 300
11 Level sensor
21 Mains connection, 1 x 200-240 V, 50/60 Hz
22 Riser pipe
27 Flow sleeve with strainer and supporting brackets
29 Remote control, R100
30 Straining wire
31 Wire clamp

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Emptying or filling a tank

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQE					
2	Cable					
3	Cable clips					
5	Control unit	CU 300				
11	Level sensor					
22	Riser pipe					
27	Flow sleeve with strainer and supporting brackets.					
29	Remote control	R100				
30	Straining wire					
31	Wire clamp					

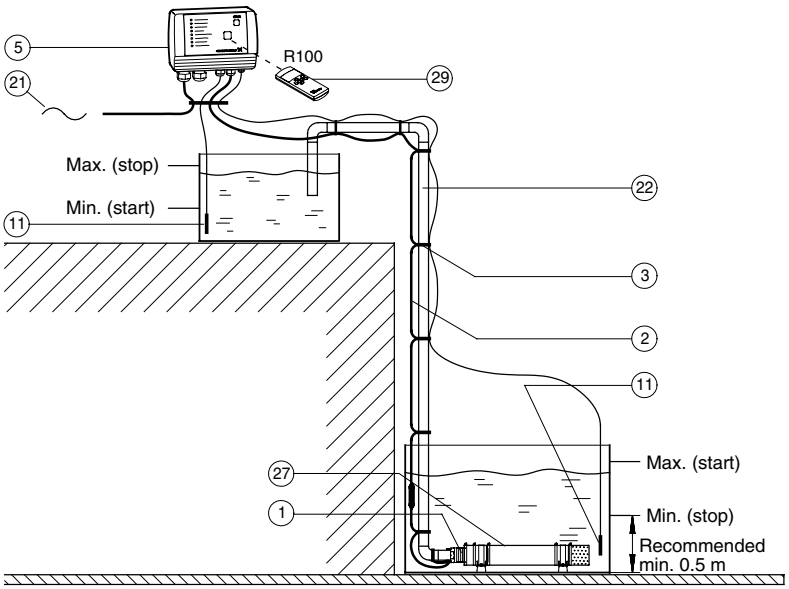
Pumping from one tank to another

Functioning and benefits

The SQE pump is ideal for pumping water from one tank to another.

Sensors:

Level	Description	Light indication on CU 300
Level sensor (pos. 11, tank at top)		
Max. (stop)	When the water has reached this level, the pump stops.	Green indicator light in on/off button is flashing.
Min. (start)	When the water has dropped to this level, the pump starts.	Green indicator light in on/off button is permanently on.
Level sensor (pos. 11, tank at bottom)		
Max. (start)	When the water has reached this level, the pump starts.	Green indicator light in on/off button is on.
Min. (stop)	When the water has dropped to this level, the pump stops.	Green indicator light in on/off button is flashing.



1 Pump, SQE
2 Cable
3 Cable clips
5 Control unit, CU 300
11 Level sensor
21 Mains connection, 1 x 200-240 V, 50/60 Hz
22 Riser pipe
27 Flow sleeve with strainer and supporting brakcets
29 Remote control, R100

TM01 2454 4801

Pumping from one tank to another

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQE					
2	Cable					
3	Cable clips					
5	Control unit	CU 300				
11	Level sensor					
27	Flow sleeve with strainer and supporting brackets					
29	Remote control	R100				

Workshop setting of operating parameters

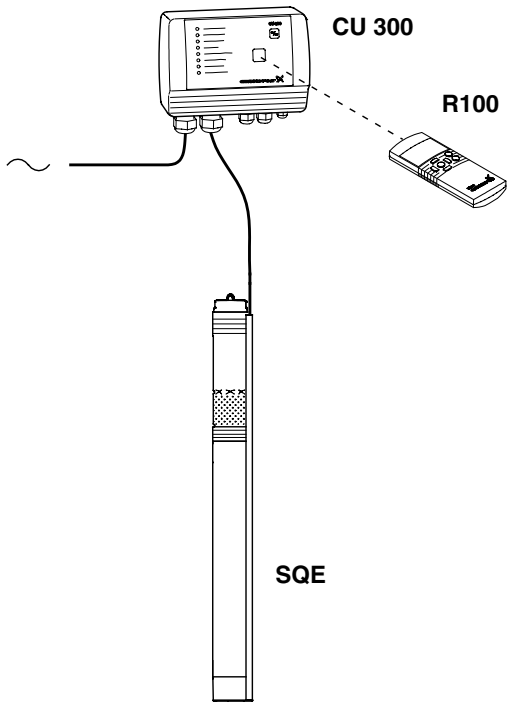
Using the R100 and the CU 300 enables change of the motor speed in a workshop and thereby setting of the pump to a specific performance.

A PC tool called "SQE Speed Calculation" has been developed for the calculation of the speed in order to obtain the required flow rate and head.

Dry-running protection

The value $P_{cut\text{-}out,}$ ensuring dry-running protection, is factory-set for the SQE pump.

If the speed of the SQE pump is reduced by more than 1000 min^{-1} the $P_{cut\text{-}out}$ value must be readjusted by means of the CU 300 and R100.



Note: The SQE pump must not be started until the pump has been completely submerged below the water table. However the change of the motor speed can be made even if the pump is not running.

TM01 8650 4801

Workshop setting of operating parameters

Part	Type	No. of units	Product number	Unit price	Total price
Pump, SQE					
Remote control	R100				
Control unit	CU 300				
PC Tool SQE					

SQE with manual speed control

Functioning and benefits

Manual speed control of the SQE pumps is possible by means of R100 and an SPP 1 potentiometer.

This application is especially suitable for sampling from groundwater monitoring wells. The monitoring well is purged at high speed and the sample is taken at a low speed (quiet flow). For contaminated groundwater the SQE-NE type range is recommended (available on request).

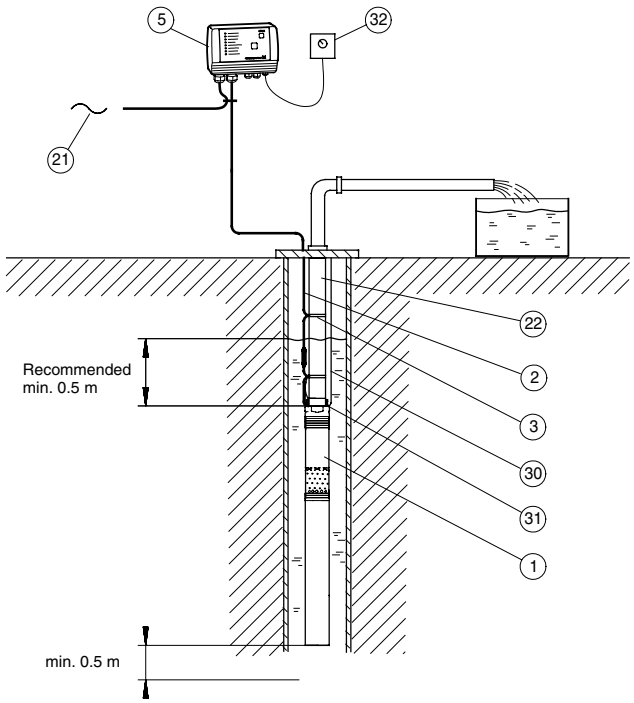
In case frequent sampling is required, dedicated installation of the pump is recommended, thus eliminating wear caused by frequent assembly and dismantling the installation.

Furthermore, dedicated installations saves the costs of assembling and dismantling the installation.

Important: Through dedicated installation the transfer of contamination from one monitoring well to another is avoided.

Dry-running protection

The value $P_{cut\ out}$, ensuring dry-running protection, is factory-set for the SQE pump. If the speed of the pump is reduced more than 1,000 rpm, the value of $P_{cut\ out}$ must be readjusted by means of CU 300 and R100.



1 SQE pump
2 Cable
3 Cable clips
5 Control unit, CU 300
21 Mains connection 1 x 220 - 240 V, 50/60 Hz
22 Riser pipe
30 Stainless steel straining wire
31 Stainless steel wire clamps, 2 per lifting eye
32 Potentiometer, SPP 1

TM01 9028 4801

Sampling /manual speed control of SQE

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	SQE pump					
2	Cable					
3	Cable clips					
5	Control unit	CU 300				
22	Riser pipe					
30	Stainless steel straining wire					
31	Stainless steel wire clamps	2 per lifting eye				
32	Potentiometer, SPP 1					

Replacement in existing installation

Functioning and benefits

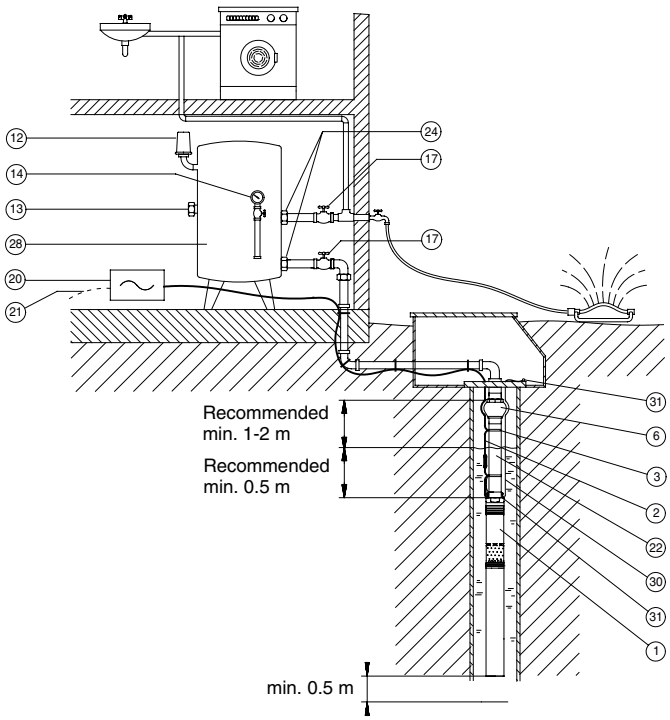
SQ can be installed as replacement of a 4" submersible pump in an existing installation.

When water is consumed, water is taken from the pressure tank without the pump being in operation. If the preset cut-in pressure ($P_{cut\text{-}in}$) is reached, the pump starts operating. The pump starts operating in the soft-start mode (run-up time approx. 2 seconds). Within this time the pressure may drop down to minimum pressure ($P_{min.}$).

When water consumption stops, the pump builds up system pressure until the preset cut-out pressure ($P_{cut\text{-}out}$) of the pressure switch is reached and the pump cut out.

At this time the riser pipe between the aerator with non-return valve and the water table is emptied of water. This water is replaced by an amount of air which is pressed to the pressure tank every time the pump starts operating. The air, which serves as an air cushion, is absorbed by the pressure tank or let out to the atmosphere through the air vent. It should be tested whether the pump chosen can reach $P_{cut\text{-}out}$ + A (see "Selection of diaphragm tank" page 33).

The system must be designed for maximum pump pressure.



1 Pump, SQ
2 Cable
3 Cable clips
6 Aerator with non-return valve
12 Pressure switch
13 Air vent
14 Pressure gauge
17 Isolating valve
20 Mains switch
21 Mains connection, 1 x 200-240 V, 50/60 Hz
22 Riser pipe
24 Union
28 Pressure tank
30 Straining wire
31 Wire clamp

Note: Do not install draw-off points between the pump and the pressure tank.

Pos. 6: If the aerator remains in the installation, the non-return valve in the SQ pump should be removed.

TM01 2988 2898

Replacement in existing installation

Pos.	Part	Type	No. of units	Product number	Unit price	Total price
1	Pump, SQ					
2	Cable					
3	Cable clips					
6	Aerator with non-return valve					
12	Pressure switch					
13	Air vent					
14	Pressure gauge					
20	Mains switch					
30	Straining wire					
31	Wire clamp					

SQ, SQE-NE in booster module sleeve

Functioning and benefits

For pressure boosting applications the SQ, SQE-NE pumps can be fitted either horizontally or vertically in a booster module sleeve.

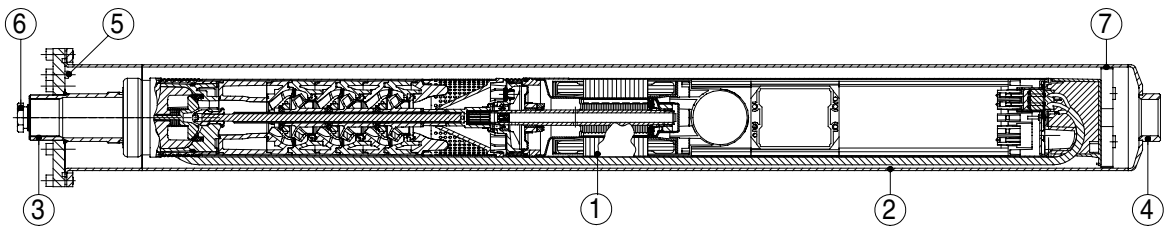
The inlet pressure must be min. 0.5 bar and max. 15 bar. System pressure: max. 25 bar.

The booster module sleeve can be supported by supporting brackets.

The sleeve can be fitted with a terminal box (IP 54) for connection of a cable leading to for instance a second module.

The system is submersible and requires no foundation. Further features are low weight, compactness (saves space) and leak proofness.

For further information about SQ, SQE-NE in booster module sleeve, please see the BMQ, BMQE-NE data booklet.



1 SQ, SQE-NE pumps
2 Booster module sleeve
3 Discharge connection
4 Suction connection
5 Air vent screw
6 Cable inlet
7 Centring guide

TM01 8892 0800

CU 301, control unit

The CU 301 is a control and communication unit especially developed for the SQE submersible pumps in constant pressure applications.
The CU 301 control unit provides:

- Full control of the SQE pumps.
- Two-way communication with the SQE pumps.
- Possibility of adjusting the pressure.
- Alarm indication (LED) when service is needed.
- The possibility of starting, stopping and resetting the pump simply by means of a push-button.
- Communication with remote control, R100

The CU 301 communicates with the pump via mains borne signalling (Power Line Communication), meaning that no extra cables are required between the CU 301 and the pump.

The CU 301 features the following indications (see drawing in right column):

1. Flow indicator
2. System pressure setting
3. System ON/OFF
4. Button lock indicator
5. Dry-running indicator
6. Service needed in case of:
   - No contact to pump
   - Overvoltage
   - Undervoltage
   - Speed reduction
   - Overtemperature
   - Overload
   - Sensor defective

The CU 301 incorporates

- external signal input for pressure sensor.

Furthermore, the CU 301 offers the possibility of remote control.

R100, remote control

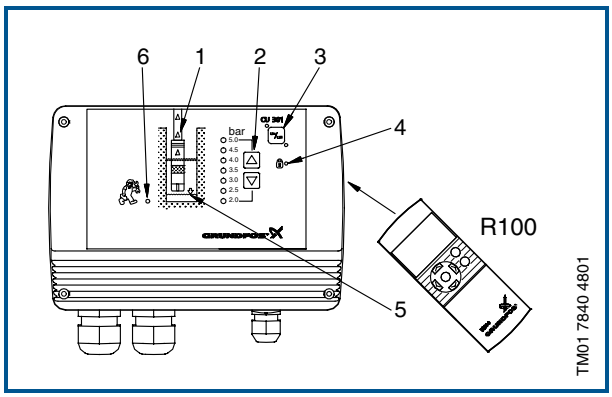
Wireless infrared remote control of the CU 301 is possible by means of the R100.
Using the R100 it is possible to ....

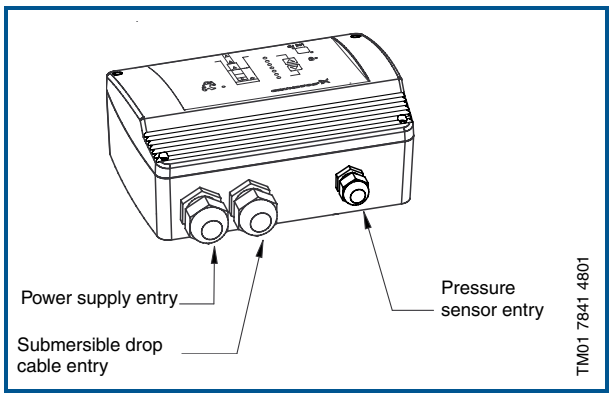
1)
monitor the installation by reading current operating parameters, such as ....

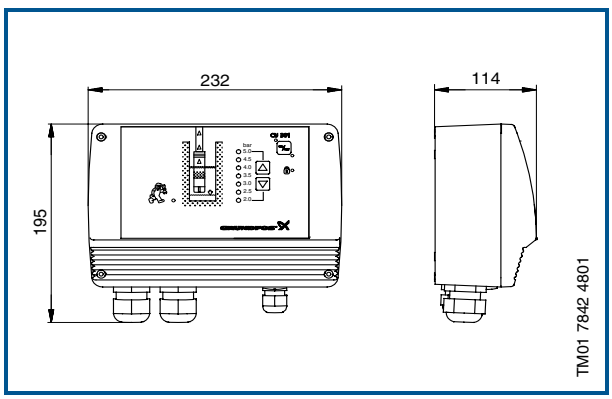
- power consumption,
- speed, and
- number of operating hours;

2)
change the factory setting, such as ....

- max. speed,
- max. pressure, and
- setpoint.

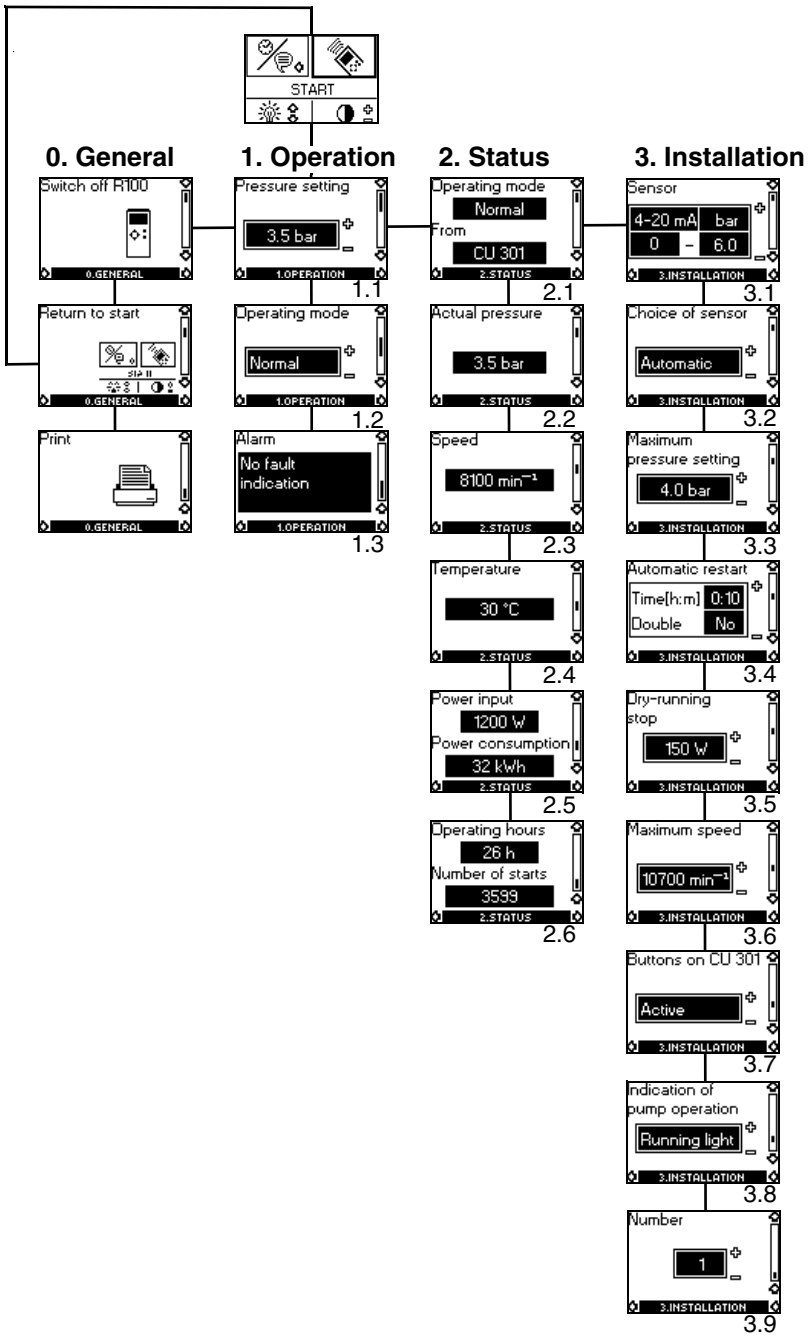






Dimensions stated in mm.

R100 menu structure for the CU 301



Note: This menu is an example, not the factory setting.

TM01 6909 0201

R100 menus for CU 301

0. General

1. Operation

1.1 Setpoint setting.
1.2 Selection of operating mode.
1.3 Alarm indication.

2. Status

The indication of:

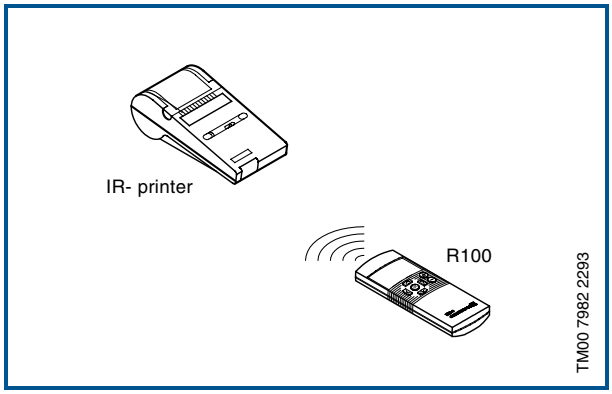
2.1 Actual operating mode.
2.2 Actual pressure.
2.3 Actual motor speed.
2.4 Actual motor temperature.
2.5 Actual power input and accumulated motor power consumption.
2.6 Accumulated number of operating hours and accumulated number of starts.

3. Installation

3.1 Sensor parameters.
3.2 Choice of sensor.
3.3 Setting of maximum pressure setpoint.
3.4 Setting of automatic restart time.
3.5 Setting of the dry-running stop limit.
3.6 Setting of the maximum motor speed.
3.7 Activating or deactivating the on/off-button and the buttons for system pressure setting on the CU 301.
3.8 Indication of pump operation.
3.9 Allocation of number.

Status report

All settings and measured values can be transferred to a portable printer via wireless infrared communication and be printed in a status report.



CU 300 Control unit

The CU 300 is a control and communication unit especially developed for the SQE submersible pumps.
The CU 300 control unit provides:

- Easy adjustment to a specific borehole.
- Full control of the SQE pumps.
- Two-way communication with the SQE pumps.
- Alarm indication of pump operation by diodes on the front, and
- The possibility of starting, stopping and resetting the pump simply by means of a push-button.

The CU 300 communicates with the pump via the power supply cable mains borne signalling or (Power Line Communication), meaning that no extra cables are required between the CU 300 and the pump.

The following alarms can be indicated by the CU 300:

- No contact
- Overvoltage
- Undervoltage
- Dry running
- Speed reduction
- Overtemperature
- Overload
- Sensor alarm

The CU 300 incorporates:

- External signal input for two analog sensors and one digital sensor.
- Relay output for external alarm indication.
- Control according to the signals received, e.g. of flow, pressure, water level and conductivity.

Furthermore, the CU 300 offers the possibility of remote control

R100 Remote control

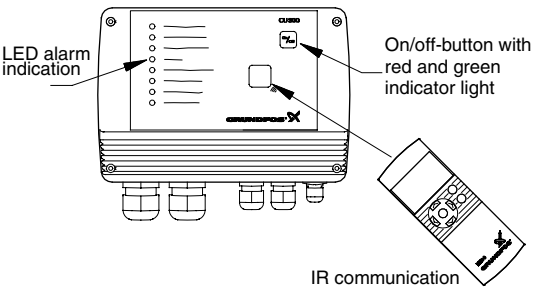
Wireless infrared remote control of the CU 300 is possible by means of the R100.
Using the R100 it is possible to ....

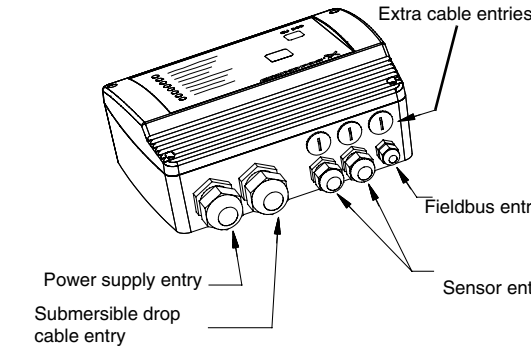
1)
monitor the installation by reading current operating parameters, such as ....

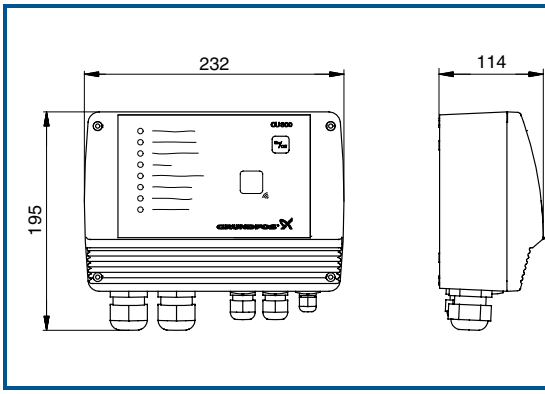
- power consumption,
- energy consumption, and
- number of operating hours;

2)
change factory settings. A number of settings can be made, such as ....

- speed (performance),
- constant-pressure control mode,
- dewatering function, and
- automatic restart time.

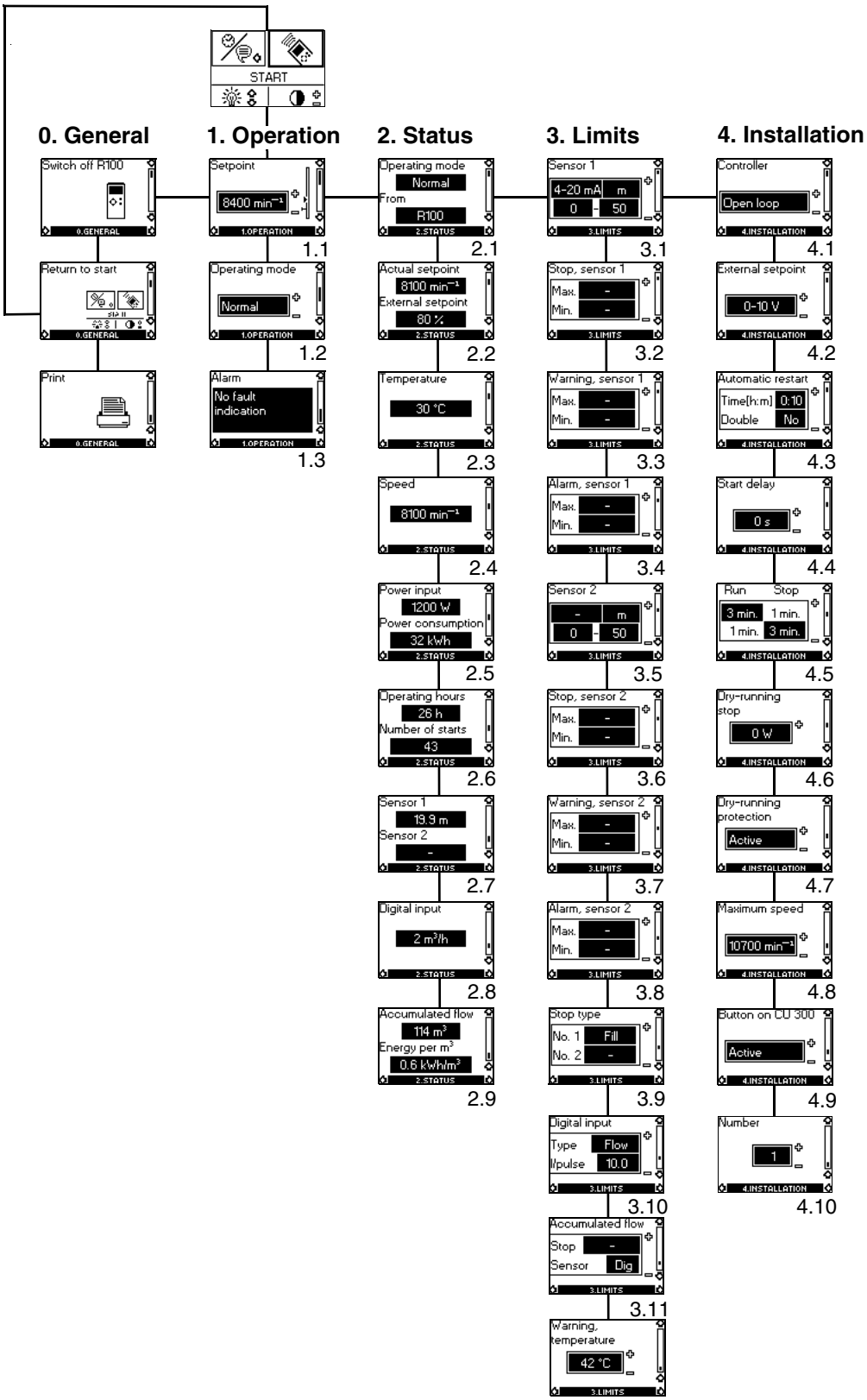






Dimensions stated in mm.

R100 menu structure for the CU 300



Note: This menu is an example, not the factory setting.

TM01 2675 0201

R100 menus for CU 300

0. General

1. Operation

1.1 Setpoint setting.
1.2 Selection of operating mode.
1.3 Alarm indication.

2. Status

The indication of:

2.1 Actual operating mode.
2.2 Actual and external setpoint.
2.3 Actual motor temperature.
2.4 Actual motor speed.
2.5 Actual power input and accumulated motor power consumption.
2.6 Accumulated number of operating hours and accumulated number of starts.
2.7 Actual values of sensors 1 and 2, respectively.
2.8 Actual values of the digital input.
2.9 Accumulated flow, and the power used to pump 1 m^3.

R100 offers possibility of making a number of settings:

3. Limits

The setting of:

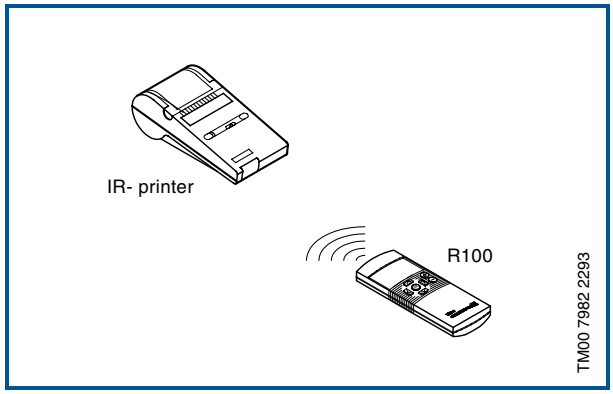
3.1 Sensor 1 parameters.
3.2 Min. and max. stop limit of sensor 1.
3.3 Min. and max. warning limit of sensor 1.
3.4 Min. and max. alarm limit of sensor 1.
3.5 Sensor 2 parameters.
3.6 Min. and max. stop limit of sensor 2.
3.7 Min. and max. warning limit of sensor 2.
3.8 Min. and max. alarm limit of sensor 2.
3.9 Filling or emptying.
3.10 Setting of the function of the digital sensor connected to the digital input.
3.11 The setting of the water quantity stop limit and the setting of the sensor to detect water quantity.
3.12 The setting of the temperature warning limits of the motor electronics.

4. Installation

4.1 Selection of controller.
4.2 Setting of external setpoint.
4.3 Setting of automatic restart time.
4.4 Allocation of individual start delays.
4.5 Setting of the stop and run times for the dewatering function.
4.6 Setting of the dry-running stop limit.
4.7 Activating or deactivating the dry-running protection.
4.8 Setting of the maximum motor speed.
4.9 Activating or deactivating the on/off-button on the CU 300.
4.10 Allocation of number where more than one CU 300 is installed.

Status report

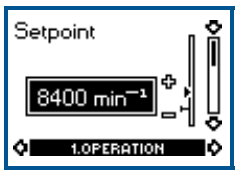
All settings and measured values can be transferred to a portable printer via wireless infrared communication and be printed in a status report.



Examples of R100 displays

Menu OPERATION

Setpoint setting



1.1

From factory, the pump is set to maximum speed, 10,700 rpm. R100 makes it possible to reduce the pump speed by changing the setpoint. The speed can be set to 7,000 - 10,700 rpm, at 100 rpm intervals.

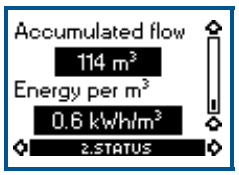
The unit of the setpoint is automatically changed according to the unit of the sensor connected to sensor input no. 1.

Example: Sensor input no. 1 is connected to a pressure sensor using the unit metre (m) and the range 0 - 60. Consequently, the setpoint of display 1.1 can be set to between 0 - 60 m.

Menu STATUS

The displays appearing in this menu are status displays only. It is not possible to change settings in this menu.

Accumulated flow



2.9

In display 2.9 the water quantity (m³) pumped is shown. The value shown is the accumulated flow registered by the sensor selected in display 3.11.

The power used to pump 1 m³ is shown in the display as energy per m³ (kWh/m³).

It is possible to read the status of the accumulated flow and energy per m³ at any time.

Accumulated number of operating hours and number of starts

2.6

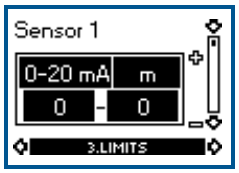
The value of operating hours and the number of starts are values accumulated from the time of installation and they cannot be reset.

Both values are stored in the motor electronics, and they are kept even if the CU 300 is replaced.

The number of operating hours is registered every two minutes of continuous operation.

Menu LIMITS

Sensor 1



3.1

The setting of sensor 1.

Depending on the type of sensor, the following settings can be made:

- Sensor outputs:
  – (not active), 0-10 V, 2-10 V, 0-20 mA, 4-20 mA.
- Setting range unit:
  m³/h, m, %, GPM, ft.
- Sensor minimum value: 0 - 249 (0,1,2,3.....249)
- Sensor maximum value: 1 - 250 (1,2,3,4.....250)

Alarm indication

The CU 300 offers the following alarm indications

Alarm	Description	The pump will be restarted automatically
No contact	No contact/communication between the CU 300 and the SQE pump. **Note:** This Alarm does not influence pump operation.	–
Overvoltage	The supply voltage exceeds the voltage range.	when voltage is within specified range.
Undervoltage	The supply voltage is below the voltage range.	when voltage is within specified range.
Dry running	The dry-running protection of the pump has been activated.	after 5 min. (default), or a period set via R100.
Speed reduction	The motor speed is reduced. **Note:** Speed resuming when cause has been remedied or has disappeared.	–
Overtemperature	The motor temperature exceeds the temperature limit.	when motor electronics have cooled down sufficiently.
Overload	The current consumption of the motor exceeds the value set.	after 5 min. (default), or a period set via R100.
Sensor alarm	Sensor alarm may be caused by: • The measured value has fallen outside the measuring range set. • The sensor is defective. • The sensor output setting made via R100 is incorrect.	after 5 min. (default), or a period set via R100.

Benefits of CU 300/R100

Alarm	Description	The following are no longer required
No contact	Provides knowledge of contact between the SQE pump and the CU 300.	–
Overvoltage	The supply voltage is measured.	Overvoltage relay.
Undervoltage	The supply voltage is measured.	Undervoltage relay.
Dry running	Provides dry-running protection of the pump.	Level relay, electrodes, cables.
Speed reduction	Ensures pump operation at a moderate undervoltage and overload, thereby ensuring that the motor is not over-loaded.	Urgent need for service.
Overtemperature	The pump is stopped at a too high temperature. When the motor electronics have cooled down sufficiently, the motor will restart automatically.	–
Overload	Provides overload protection of the motor.	Motor starter.
Sensor alarm	Sensors can be connected directly to the CU 300. The sensor signals are monitored.	External control unit.

Determining head and flow

Pump selection is based on the water demand and the required head.

1. Water demand

The water demand depends on the number of consumers connected. The manufacturers of fittings and sprinkler systems normally state this data.

Examples of water demand:

Sprinkler systems:	1.5 m³/h per sprinkler
Domestic water supply:	2-4 m³/h
Agriculture:	4-6 m³/h
Irrigation:	6-8 m³/h

2. Head

$H[m] = p_{tap} \times 10.2 + H_{geo} + H_f$

p_{tap} = Required pressure at the draw-off point (e.g. sprinkler), at least 2 bar.

H_{geo} = Difference of height between lower water level in well and draw-off point.

H_f = Loss of head in piping and tubing. Note table below.

Example of calculation: Domestic water supply.

Required flow: **2.4 m³/h**

p_{tap} = **3 bar**

H_{geo} = **30 m**

H_f = **7.7**

The tubing is made of plastic pipe, **ø25**, length **35 m**. This will give:

H_f = Value from table x length of pipe

H_f = 0.22 x 35 m = **7.7 m**

$H[m] = p_{tap} \times 10.2 + H_{geo} + H_f$

= 3 x 10.2 + 30 m + 7.7 = 68.3 m

Selected at Q = 2.4 m³/h, H = 68.3 m

For selection of the pump type best meeting the requirements, see the next page.

Head losses (H_f) in plastic pipes and ordinary water pipes:

Upper figures indicate the velocity of water in m/sec.
Lower figures indicate head loss in metres per 100 metres of straight pipes.

Quantity of water			Plastic pipes*(PELM/PEH PN 10 PELM)				Ordinary water pipes**				
			Nominal pipe diameter in inches and internal diameter in [mm]								
m³/h	Litres/min.	Litres/sec.	25 20.4	32 26.2	40 32.6	50 40.8	½" 15.75	¾" 21.25	1" 27.00	1¼" 35.75	1½" 41.25
0.6	10	0.16	0.49 1.8	0.30 0.66	0.19 0.27	0.12 0.085	0.855 9.910	0.470 2.407	0.292 0.784		
0.9	15	0.25	0.76 4.0	0.46 1.14	0.3 0.6	0.19 0.18	1.282 20.11	0.705 4.862	0.438 1.570	0.249 0.416	
1.2	20	0.33	1.0 6.4	0.61 2.2	0.39 0.9	0.25 0.28	1.710 33.53	0.940 8.035	0.584 2.588	0.331 0.677	0.249 0.346
1.5	25	0.42	1.3 10.0	0.78 3.5	0.5 1.4	0.32 0.43	2.138 49.93	1.174 11.91	0.730 3.834	0.415 1.004	0.312 0.510
1.8	30	0.50	1.53 13.0	0.93 4.6	0.6 1.9	0.38 0.57	2.565 69.34	1.409 16.50	0.876 5.277	0.498 1.379	0.374 0.700
2.1	35	0.58	1.77 16.0	1.08 6.0	0.69 2.0	0.44 0.70	2.993 91.54	1.644 21.75	1.022 6.949	0.581 1.811	0.436 0.914
2.4	40	0.67	2.05 22.0	1.24 7.5	0.80 3.3	0.51 0.93		1.879 27.66	1.168 8.820	0.664 2.290	0.499 1.160
3.0	50	0.83	2.54 37.0	1.54 11.0	0.99 4.8	0.63 1.40		2.349 41.40	1.460 13.14	0.830 3.403	0.623 1.719
3.6	60	1.00	3.06 43.0	1.85 15.0	1.2 6.5	0.76 1.90		2.819 57.74	1.751 18.28	0.996 4.718	0.748 2.375
4.2	70	1.12	3.43 50.0	2.08 18.0	1.34 8.0	0.86 2.50		3.288 76.49	2.043 24.18	1.162 6.231	0.873 3.132
4.8	80	1.33		2.47 25.0	1.59 10.5	1.02 3.00			2.335 30.87	1.328 7.940	0.997 3.988
5.4	90	1.50		2.78 30.0	1.8 12.0	1.15 3.50			2.627 38.30	1.494 9.828	1.122 4.927
6.0	100	1.67		3.1 39.0	2.0 16.0	1.28 4.6			2.919 46.49	1.660 11.90	1.247 5.972
7.5	125	2.08		3.86 50.0	2.49 24.0	1.59 6.6			3.649 70.41	2.075 17.93	1.558 8.967
9.0	150	2.50			3.00 33.0	1.91 8.6				2.490 25.11	1.870 12.53
10.5	175	2.92			3.5 38.0	2.23 11.0				2.904 33.32	2.182 16.66
90° bends, slide valves							1.0	1.0	1.1	1.2	1.3
T-pieces, non-return valves							4.0	4.0	4.0	5.0	5.0

*The table is based on a nomogram.
Roughness: K = 0.01 mm.
Water temperature: t = 10°C.

** The data are calculated in accordance with H. Lang's new formula a = 0.02 and for a water temperature of 10°C.
The head loss in bends, slide valves, T-pieces and non-return valves is equivalent to the metres of straight pipes stated in the last two lines of the table.

Pump sizing

Important: The dry-running protection is effective only within the recommended pump duty range, i.e. the bold curves. See performance curves.

Pump type	Power, pump [kW]	Flow rate Q [m³/h] / [l/s]													Max. head [m] (Q= 0 m³/h)	Full-load current $I_{1/1}$ [A]		Pipe connection Rp	Length [mm]
		0.5/ 0.14	1.0/ 0.28	1.5/ 0.42	2.0/ 0.56	2.5/ 0.70	3.0/ 0.83	3.5/ 0.97	4.0/ 1.11	5.0/ 1.39	6.0/ 1.67	7.0/ 1.95	8.0/ 2.22	9.0/ 2.50		230V	200V		
		Head [m]																	
SQ 1 - 35	0.29	38	31	18	-	-	-	-	-	-	-	-	-	-	44	2.1	2.4	1¼	745
SQ 1 - 50	0.44	57	45	26	-	-	-	-	-	-	-	-	-	-	64	2.8	3.2	1¼	745
SQ 1 - 65	0.58	76	60	37	-	-	-	-	-	-	-	-	-	-	86	3.7	4.3	1¼	772
SQ 1 - 80	0.73	96	76	47	-	-	-	-	-	-	-	-	-	-	108	4.4	5.1	1¼	826
SQ 1 - 95	0.87	115	91	58	-	-	-	-	-	-	-	-	-	-	129	5.4	6.2	1¼	826
SQ 1 - 110	1.03	135	107	68	-	-	-	-	-	-	-	-	-	-	151	6.2	7.1	1¼	853
SQ 1 - 125	1.20	154	123	79	-	-	-	-	-	-	-	-	-	-	173	7.8	9.0	1¼	943
SQ 1 - 140	1.37	173	138	90	-	-	-	-	-	-	-	-	-	-	194	8.9	10.2	1¼	943
SQ 1 - 155	1.55	193	154	100	-	-	-	-	-	-	-	-	-	-	216	10.2	-	1¼	970
SQ 2 - 35	0.45	43	42	39	35	29	19	-	-	-	-	-	-	-	45	3.2	3.7	1¼	745
SQ 2- 55	0.65	66	63	60	54	45	32	-	-	-	-	-	-	-	68	4.1	4.7	1¼	745
SQ 2 - 70	0.87	87	84	79	72	60	43	-	-	-	-	-	-	-	89	5.4	6.2	1¼	772
SQ 2 - 85	0.98	108	105	99	89	74	54	-	-	-	-	-	-	-	109	6.8	7.8	1¼	862
SQ 2 - 100	1.30	131	128	120	109	91	67	-	-	-	-	-	-	-	132	8.4	9.7	1¼	862
SQ 2 - 115	1.50	154	150	142	129	108	79	-	-	-	-	-	-	-	155	9.9	11.1	1¼	889
SQ 3 - 30	0.44	-	-	34	32	30	26	22	-	-	-	-	-	-	36	3.2	3.7	1¼	745
SQ 3 - 40	0.63	-	-	53	50	47	42	36	-	-	-	-	-	-	56	4.0	4.6	1¼	745
SQ 3 - 55	0.83	-	-	70	67	63	56	48	-	-	-	-	-	-	74	5.1	5.9	1¼	772
SQ 3 - 65	**1.02**	-	-	87	83	**78**	70	60	-	-	-	-	-	-	92	**6.2**	**7.1**	**1¼**	**826**
SQ 3 - 80	1.23	-	-	105	100	94	85	73	-	-	-	-	-	-	110	7.9	9.1	1¼	862
SQ 3 - 95	1.43	-	-	123	117	109	99	85	-	-	-	-	-	-	129	9.2	10.6	1¼	889
SQ 3 - 105	1.63	-	-	140	134	125	113	97	-	-	-	-	-	-	147	10.6	-	1¼	943
SQ 5 - 15	0.26	-	-	-	-	-	15	14	13	11	7	-	-	-	18	1.9	2.2	1½	745
SQ 5 - 25	0.54	-	-	-	-	-	31	29	28	24	18	-	-	-	36	3.4	3.9	1½	745
SQ 5 - 35	0.80	-	-	-	-	-	46	44	42	36	28	-	-	-	54	4.9	5.6	1½	826
SQ 5 - 50	1.06	-	-	-	-	-	62	59	56	49	38	-	-	-	71	7.0	8.1	1½	826
SQ 5 - 60	1.33	-	-	-	-	-	77	74	70	61	48	-	-	-	89	8.6	9.9	1½	943
SQ 5 - 70	1.60	-	-	-	-	-	93	89	85	73	58	-	-	-	106	10.4	-	1½	943
SQ 7 - 15	0.42	-	-	-	-	-	-	17	16	14	12	9	6	2	21	2.8	3.2	1½	745
SQ 7 - 30	0.84	-	-	-	-	-	-	36	35	32	29	24	18	10	42	5.2	6.0	1½	745
SQ 7 - 40	1.27	-	-	-	-	-	-	56	54	50	45	38	29	19	64	8.2	9.5	1½	862

Example:

Required: Flow rate: 2.4 m³/h => nearest higher value in table is 2.5 m³/h.
Head: 68.3 m => nearest higher value in the table is 78 m.

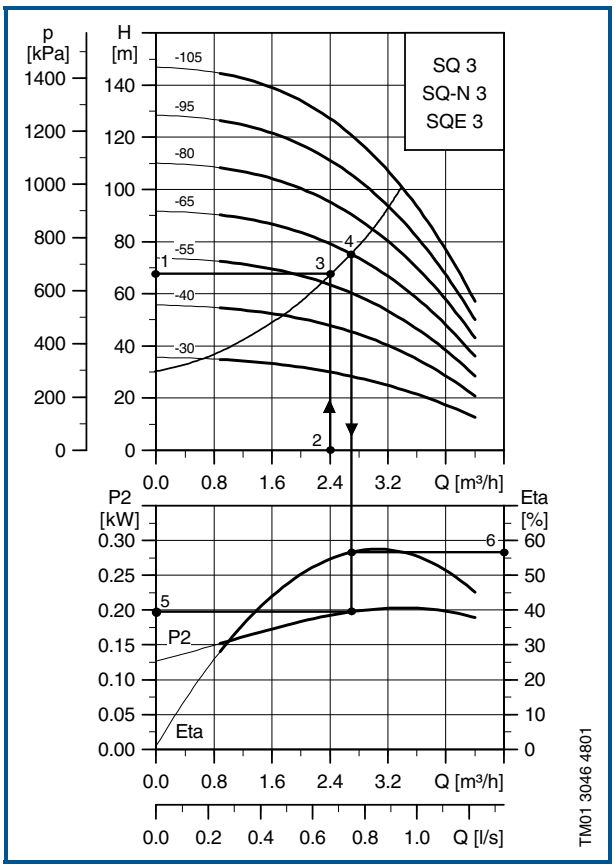
Selected: Pump type: SQ 3-65 (as it offers the best pump efficiency for the required flow and head).
Required pump power input: 1.02 kW.
Full load current: $I_{1/1}$ = 6.2 A at 230 V.
$I_{1/1}$ = 7.1 A at 200 V.
Pipe connection: Rp 1¼.
Length of pump: 826 mm

Example:
How to select an SQ pump

- A head of 68 m and a flow of 2.4 m³/h is required.
- The pump type best meeting these requirements is SQ 3. In the curve chart below, draw a rightward, horizontal line from the head required 68 m (1) to the intersection with the vertical line from the required flow (2). In this example the intersection point (3) of the two lines is not on one of the pump curves, therefore follow the pipe characteristic upwards. The intersection point of the pump curve and the pipe characteristic (4) gives the size of the pump. The size of the pump is: SQ 3 - 65.
- The pump power input per stage (P_2) can be read to be 0.20 kW (5), and the pump effiency per stage is 57% (6).
- SQ 3 - 65 has 5 stages, see page 39. With 5 stages the total pump power input for SQ 3 - 65 is 1.02 kW, (0.20 kW x 5) which means an MS 3 0.7 - 1.05 kW motor.

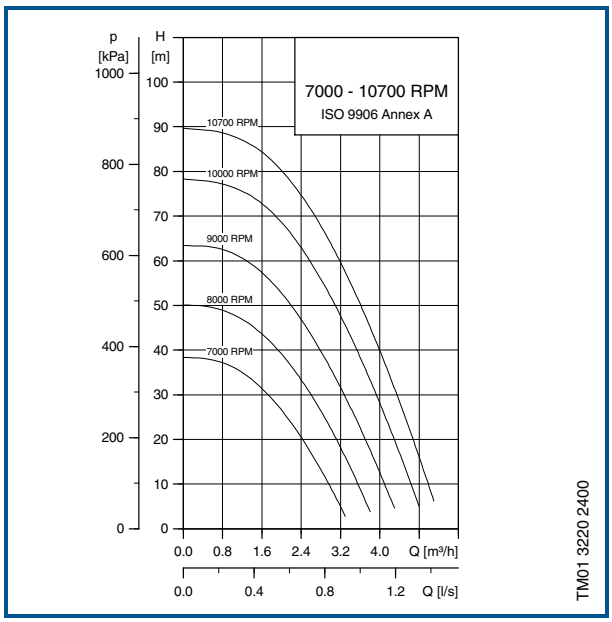
How to select an SQE pump

The procedure for selecting an SQE pump is identical to the procedure for selecting an SQ pump.



Variable speed

The performance of the SQE pump can be adjusted to a specific duty point within its performance range. This is done by means of CU 300 or CU 301 and R100.
The SQE pump is ideal especially in cases when the water consumption varies over time and when the duty point is between two pump curves as energy savings can be achieved by reducing the performance to the required speed. The curve chart below shows the performance of an SQE pump at various speeds.



Curve conditions

The guidelines below apply to the performance curves on pages page 34 to page 42:

General

- Tolerances according to ISO 9906, Annex A, i.e. all curves show mean values.
- None of the curves must be used as guarantee curves.
- The bold curves show the recommended duty range.
- The measurements were made with airless water at a temperature of 20°C.
- The conversion between head H (m) and pressure p (kPa) applies to water with a density of 1,000 kg/m³.
- The curves apply to a kinematic viscosity of 1 mm²/s (1 cSt). If the pump is used for liquids with a viscosity higher than that of water, this will reduce the head and increase the power consumption.
- **Q/H:** The curves are inclusive of valve and inlet losses at the actual speed.
- **Power curve:** P_2 shows pump power input per stage.
- **Efficiency curve:** Eta shows pump efficiency per stage.

Selecting the right pump for the SQE constant-pressure system

Dynamic head [m]	Nom. flow [m³/h]	System pressure [bar]						
		2.0	2.5	3.0	3.5 (C)	4.0	4.5	5.0
10 to 20	2			SQE 2-55				
	2						SQE 2-85	
	3				SQE 3-65			
	5		SQE 5-50					
	5					SQE 5-70		
21 to 30 **(A)**	2	SQE 2-55						
	2				SQE 2-85			
	3 **(B)**			SQE 3-65	**(D)**			
	5						SQE 3-105	
	5			SQE 5-70				
31 to 40	2			SQE 2-85				
	2						SQE 2-115	
	3		SQE 3-65					
	3					SQE 3-105		
	3		SQE 5-70					
41 to 50	2			SQE 2-85				
	3				SQE 3-105			
51 to 60	2				SQE 2-115			
	3				SQE 3-105			
61 to 70	2				SQE 2-115			
	3		SQE 3-105					
71 to 80	2			SQE 2-115				
81 to 90	2		SQE 2-115					

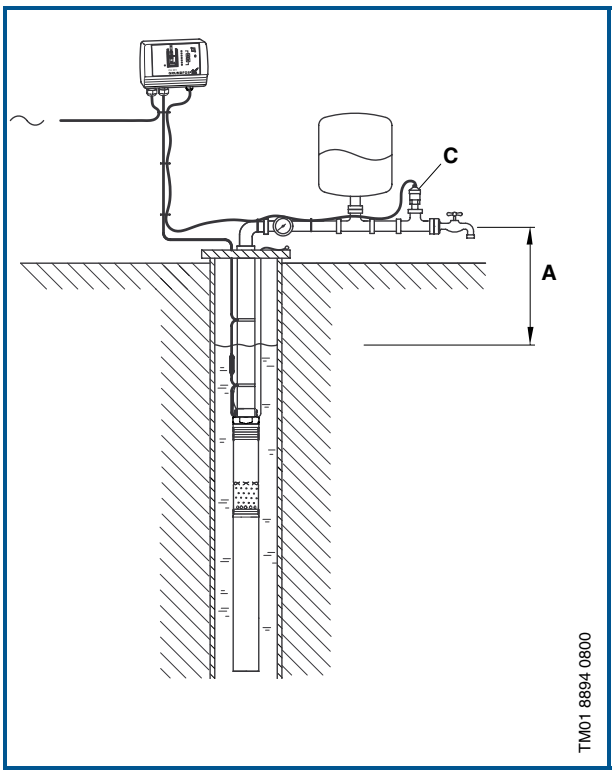
Example: How to select an SQE pump

Required:

Total head (from water level to water tap, including friction loss): 25 m **(A)**
Maximum flow rate: 3 m³/h **(B)**
System pressure: 3.5 bar **(C)**

Selected:

Pump type: SQE 3-65.
The system pressure can be adjusted to any constant pressure from 2 to 4 bar **(D)**.



Selection of diaphragm tank

The electronic unit in SQ ensures a smooth start-up. To yield sufficient pressurized water in the period when the pump is not in operation a diaphragm tank can be fitted in the water supply system.

During start-up the system pressure will fall below the cut-in pressure of the pressure switch. This value called p_{min} is to be determined before sizing the diaphragm tank.

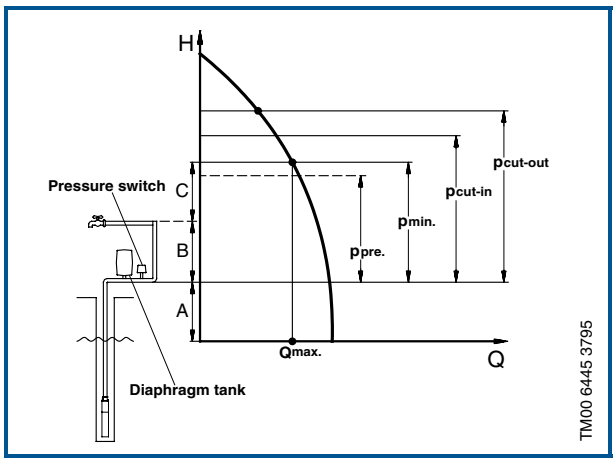
P_{min} is the required minimum pressure at the highest tap point + head and valve and friction loss from the diaphragm tank to the highest tap point (C + B).

Furthermore, the flow at p_{min} has to be determined. This is called Q_{max} and is found in the performance curve for the pump type in question.

Use p_{min} and Q_{max} in the table below to find the size of the diaphragm tank, the precharge pressure of the diaphragm tank and the cut-in and cut-out pressure setting of the pressure switch.

Note: If a minimum pressure is not required, an 18 l diaphragm tank is sufficient for all SQ pumps.

p_{pre}: Precharge pressure of the diaphragm tank.
p_{min}: Required min. pressure.
p_{cut-in}: Cut-in pressure of the pressure switch.
$p_{cut-out}$: Cut-out pressure of the pressure switch.
Q_{max}: The flow at p_{min}.



A: Head + pipe friction from dynamic water level to diaphragm tank.
B: Head + pipe friction from diaphragm tank to the top tap point.
C: Min. pressure at the highest point.

Note: Be sure that the selected pump can deliver a pressure higher than $p_{cut-out}$ + A.

p_{min} [m]	Q_{max} [m³/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			
	Diaphragm tank size [litres]																				
25	8	8	18	18	18	18	24	33	33	50	50	50	50	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		27	31	45
35	8	18	18	18	18	24	33	33	50	50	50	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				36	41	55
45	8	18	18	18	24	33	**33**	50	50	50	80	80	80	80					**40.5**	**46**	**60**
50	8	18	18	18	24	33	50	50	50	80	80	80	80						45	51	65
55	18	18	18	18	24	33	50	50	50	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

Note: The diaphragm tank sizes stated in the table are minimum requirements. The use of a tank one size bigger is recommended.

1 m head = 0.098 bar

Example:

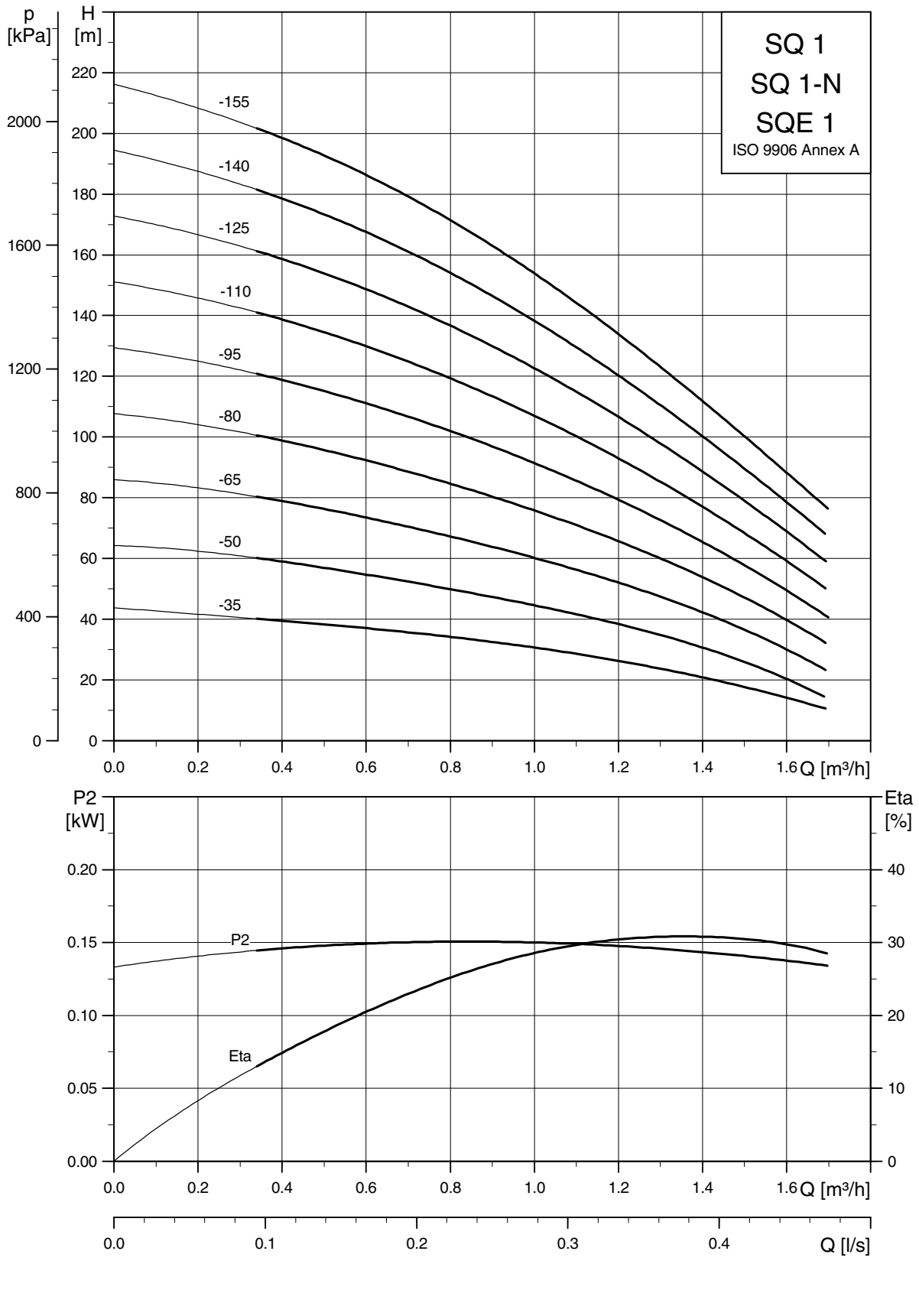
p_{min}: 45 m, Q_{max} = 2.5 m³/h

The following values are found in the table:

Minimum size of diaphragm tank = 33 litres.

p_{pre} = 40.5 m
p_{cut-in} = 46 m
$p_{cut-out}$ = 60 m

Performance curves



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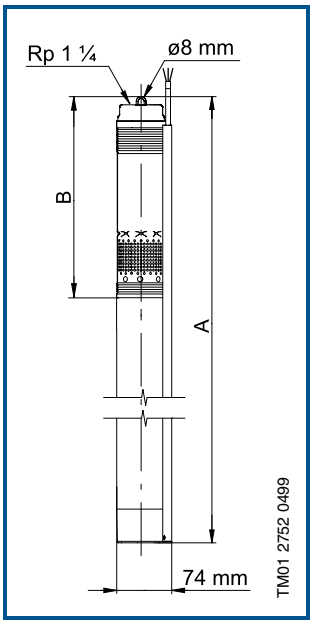
Dimensions and weights



Pump type	Number of stages	Motor		Dimensions [mm]		Net weight [kg]*	Shipping volume [m³]*
		Type	Output power (P_2) [kW]	A	B		
SQ 1 - 35 (-N) SQE 1 - 35	2	MS 3 (-NE) MSE 3	0.1-0.63	745	265	4.7	0.0092
SQ 1 - 50 (-N) SQE 1 - 50	3	MS 3 (-NE) MSE 3	0.1-0.63	745	265	4.8	0.0092
SQ 1 - 65 (-N) SQE 1 - 65	4	MS 3 (-NE) MSE 3	0.1-0.63	772	292	4.9	0.0094
SQ 1 - 80 (-N) SQE 1 - 80	5	MS 3 (-NE) MSE 3	0.7-1.05	826	346	5.6	0.0100
SQ 1 - 95 (-N) SQE 1 - 95	6	MS 3 (-NE) MSE 3	0.7-1.05	826	346	5.6	0.0100
SQ 1 - 110 (-N) SQE 1 - 110	7	MS 3 (-NE) MSE 3	0.7-1.05	853	373	5.7	0.0103
SQ 1 - 125 (-N) SQE 1 - 125	8	MS 3 (-NE) MSE 3	1.1-1.73	943	427	6.4	0.0113
SQ 1 - 140 (-N) SQE 1 - 140	9	MS 3 (-NE) MSE 3	1.1-1.73	943	427	6.5	0.0113
SQ 1 - 155 (-N) SQE 1 - 155	10	MS 3 (-NE) MSE 3	1.1-1.73	970	454	6.7	0.0116

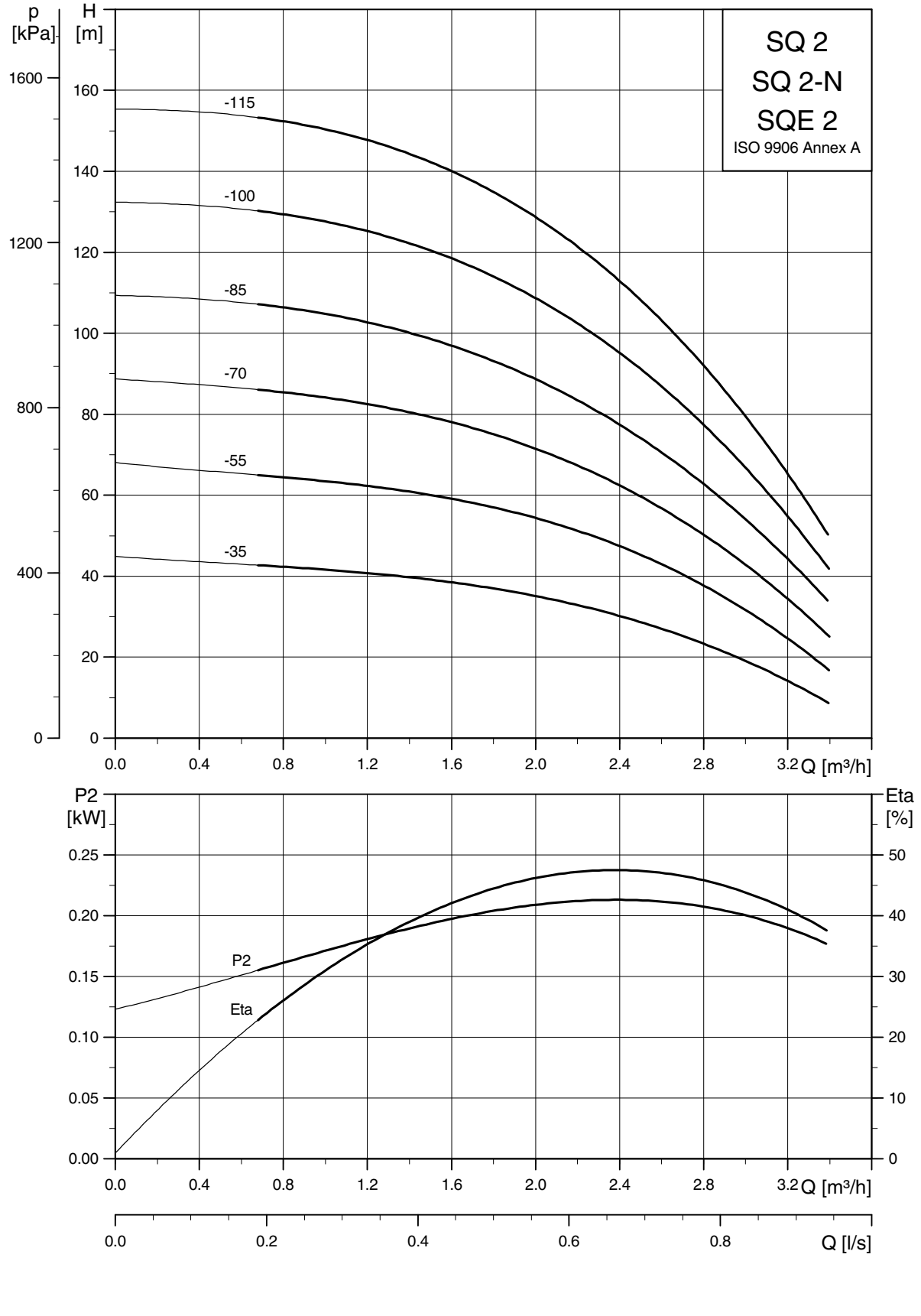
* Including pump, motor, 1.5 m cable and cable guard.

Electrical data

1 x 200 - 240 V, 50/60 Hz

Pump type	Motor type	Input power, motor (P1) [kW]	Output power motor (P2) [kW]	Required input power, pump [kW]	Full load current $I_{1/1}$ [A]		Full load motor efficiency (η) [%]
					230 V	200 V	
SQ 1 - 35 (-N) SQE 1 - 35	MS 3 (-NE) MSE 3	0.44	0.1-0.63	0.29	2.1	2.4	70
SQ 1 - 50 (-N) SQE 1 - 50	MS 3 (-NE) MSE 3	0.62	0.1-0.63	0.44	2.8	3.2	70
SQ 1 - 65 (-N) SQE 1 - 65	MS 3 (-NE) MSE 3	0.82	0.1-0.63	0.58	3.7	4.3	70
SQ 1 - 80 (-N) SQE 1 - 80	MS 3 (-NE) MSE 3	1.00	0.7-1.05	0.73	4.4	5.1	73
SQ 1 - 95 (-N) SQE 1 - 95	MS 3 (-NE) MSE 3	1.20	0.7-1.05	0.87	5.4	6.2	73
SQ 1 - 110 (-N) SQE 1 - 110	MS 3 (-NE) MSE 3	1.40	0.7-1.05	1.03	6.2	7.1	73
SQ 1 - 125 (-N) SQE 1 - 125	MS 3 (-NE) MSE 3	1.67	1.1-1.73	1.20	7.8	9.0	74
SQ 1 - 140 (-N) SQE 1 - 140	MS 3 (-NE) MSE 3	1.90	1.1-1.73	1.37	8.9	10.2	74
SQ 1 - 155 (-N) SQE 1 - 155	MS 3 (-NE) MSE 3	2.20	1.1-1.73	1.55	10.2	-	74

Performance curves



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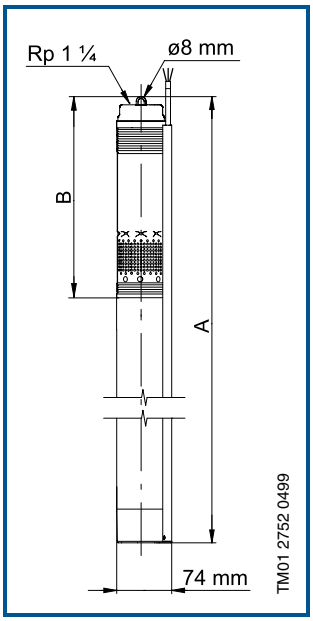
Dimensions and weights



Pump type	Number of stages	Motor		Dimensions [mm]		Net weight [kg]*	Shipping volume [m³]*
		Type	Output power (P_2) [kW]	A	B		
SQ 2 - 35 (-N) SQE 2 - 35	2	MS 3 (-NE) MSE 3	0.1-0.63	745	265	4.7	0.0092
SQ 2 - 55 (-N) SQE 2 - 55	3	MS 3 (-NE) MSE 3	0.7-1.05	745	265	5.2	0.0092
SQ 2 - 70 (-N) SQE 2 - 70	4	MS 3 (-NE) MSE 3	0.7-1.05	772	292	5.4	0.0094
SQ 2 - 85 (-N) SQE 2 - 85	5	MS 3 (-NE) MSE 3	1.1-1.73	862	346	6.2	0.0104
SQ 2 - 100 (-N) SQE 2 - 100	6	MS 3 (-NE) MSE 3	1.1-1.73	862	346	6.2	0.0104
SQ 2 - 115 (-N) SQE 2 - 115	7	MS 3 (-NE) MSE 3	1.1-1.73	889	373	6.3	0.0107

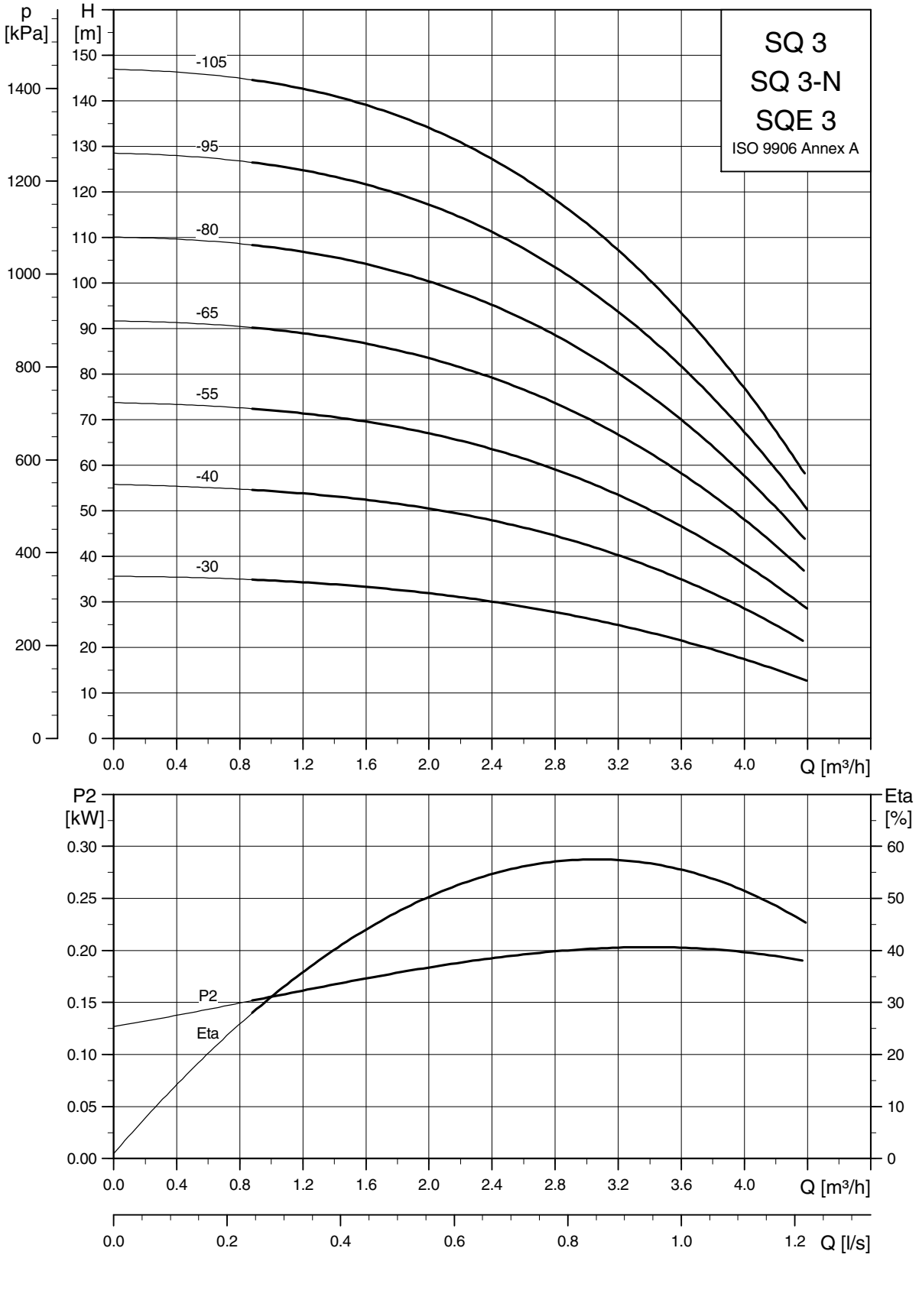
* Including pump, motor, 1.5 m cable and cable guard.

Electrical data

1 x 200 - 240 V, 50/60 Hz

Pump type	Motor type	Input power, motor (P1) [kW]	Output power motor (P2) [kW]	Required input power, pump [kW]	Full load current $I_{1/1}$ [A]		Full load motor efficiency (η) [%]
					230 V	200 V	
SQ 2 - 35 (-N) SQE 2 - 35	MS 3 (-NE) MSE 3	0.72	0.1-0.63	0.45	3.2	3.7	70
SQ 2 - 55 (-N) SQE 2 - 55	MS 3 (-NE) MSE 3	0.91	0.7-1.05	0.65	4.1	4.7	70
SQ 2 - 70 (-N) SQE 2 - 70	MS 3 (-NE) MSE 3	1.20	0.7-1.05	0.87	5.4	6.2	73
SQ 2 - 85 (-N) SQE 2 - 85	MS 3 (-NE) MSE 3	1.38	1.1-1.73	0.98	6.8	7.8	73
SQ 2 - 100 (-N) SQE 2 - 100	MS 3 (-NE) MSE 3	1.80	1.1-1.73	1.30	8.4	9.7	74
SQ 2 - 115 (-N) SQE 2 - 115	MS 3 (-NE) MSE 3	2.11	1.1-1.73	1.50	9.9	11.1	74

Performance curves



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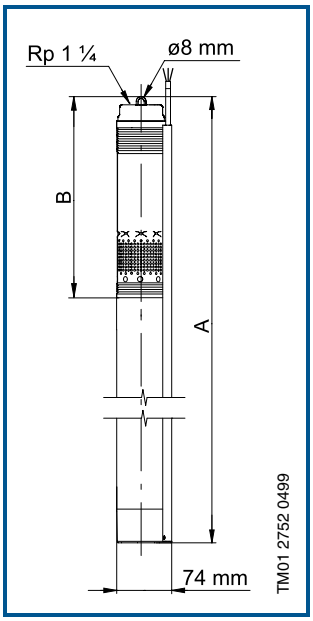
Dimensions and weights



Pump type	Number of stages	Motor		Dimensions [mm]		Net weight [kg]*	Shipping volume [m³]*
		Type	Output power (P_2) [kW]	A	B		
SQ 3 - 30 (-N) SQE 3 - 30	2	MS 3 (-NE) MSE 3	0.1-0.63	745	265	4.8	0.0092
SQ 3 - 40 (-N) SQE 3 - 40	3	MS 3 (-NE) MSE 3	0.1-0.63	745	265	4.8	0.0092
SQ 3 - 55 (-N) SQE 3 - 55	4	MS 3 (-NE) MSE 3	0.7-1.05	772	292	5.4	0.0094
SQ 3 - 65 (-N) SQE 3 - 65	5	MS 3 (-NE) MSE 3	0.7-1.05	826	346	6.1	0.0100
SQ 3 - 80 (-N) SQE 3 - 80	6	MS 3 (-NE) MSE 3	1.1-1.73	862	346	6.3	0.0104
SQ 3 - 95 (-N) SQE 3 - 95	7	MS 3 (-NE) MSE 3	1.1-1.73	889	373	6.4	0.0107
SQ 3 - 105 (-N) SQE 3 - 105	8	MS 3 (-NE) MSE 3	1.1-1.73	943	427	6.5	0.0113

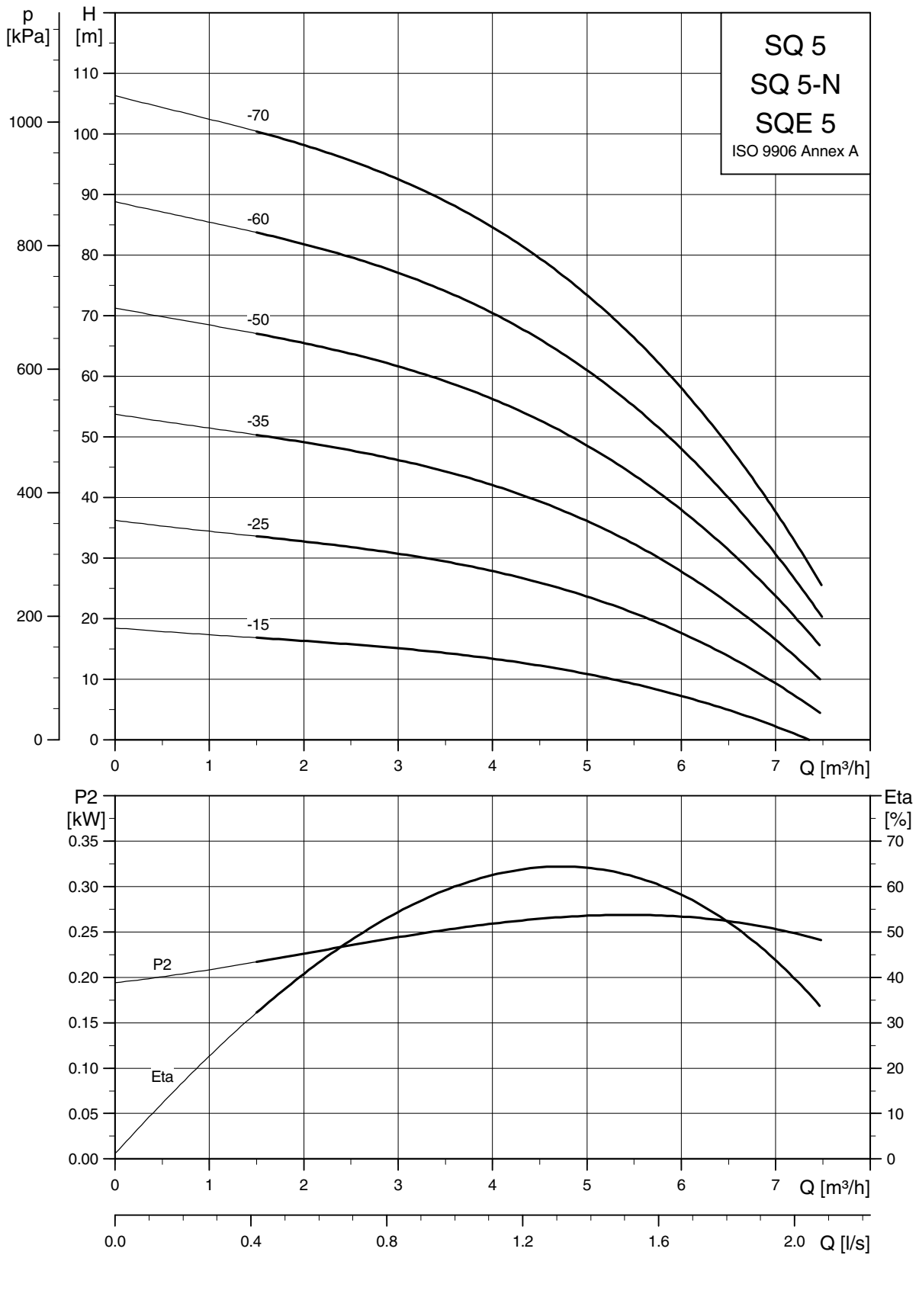
* Including pump, motor, 1.5 m cable and cable guard.

Electrical data

1 x 200 - 240 V, 50/60 Hz

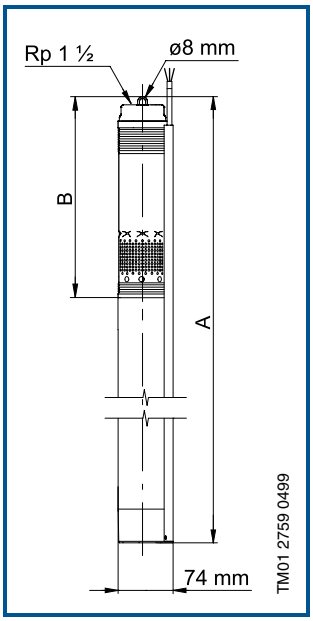
Pump type	Motor type	Input power, motor (P1) [kW]	Output power motor (P2) [kW]	Required input power, pump [kW]	Full load current $I_{1/1}$ [A]		Full load motor efficiency (η) [%]
					230 V	200 V	
SQ 3 - 30 (-N) SQE 3 - 30	MS 3 (-NE) MSE 3	0.72	0.1-0.63	0.44	3.2	3.7	70
SQ 3 - 40 (-N) SQE 3 - 40	MS 3 (-NE) MSE 3	0.88	0.1-0.63	0.63	4.0	4.6	70
SQ 3 - 55 (-N) SQE 3 - 55	MS 3 (-NE) MSE 3	1.14	0.7-1.05	0.83	5.1	5.9	73
SQ 3 - 65 (-N) SQE 3 - 65	MS 3 (-NE) MSE 3	1.40	0.7-1.05	1.02	6.2	7.1	73
SQ 3 - 80 (-N) SQE 3 - 80	MS 3 (-NE) MSE 3	1.70	1.1-1.73	1.23	7.9	9.1	74
SQ 3 - 95 (-N) SQE 3 - 95	MS 3 (-NE) MSE 3	1.98	1.1-1.73	1.43	9.2	10.6	74
SQ 3 - 105 (-N) SQE 3 - 105	MS 3 (-NE) MSE 3	2.28	1.1-1.73	1.63	10.6		74

Performance curves



GRUNDFOS

Dimensions and weights



Pump type	Number of stages	Motor		Dimensions [mm]		Net weight [kg]*	Shipping volume [m³]*
		Type	Output power (P_2) [kW]	A	B		
SQ 5 - 15 (-N) SQE 5 - 15	1	MS 3 (-NE) MSE 3	0.1-0.63	745	265	4.7	0.0092
SQ 5 - 25 (-N) SQE 5 - 25	2	MS 3 (-NE) MSE 3	0.1-0.63	745	265	4.8	0.0092
SQ 5 - 35 (-N) SQE 5 - 35	3	MS 3 (-NE) MSE 3	0.7-1.05	826	346	5.5	0.0100
SQ 5 - 50 (-N) SQE 5 - 50	4	MS 3 (-NE) MSE 3	1.1-1.73	862	346	6.2	0.0104
SQ 5 - 60 (-N) SQE 5 - 60	5	MS 3 (-NE) MSE 3	1.1-1.73	943	427	6.4	0.0113
SQ 5 - 70 (-N) SQE 5 - 70	6	MS 3 (-NE) MSE 3	1.1-1.73	943	427	6.4	0.0113

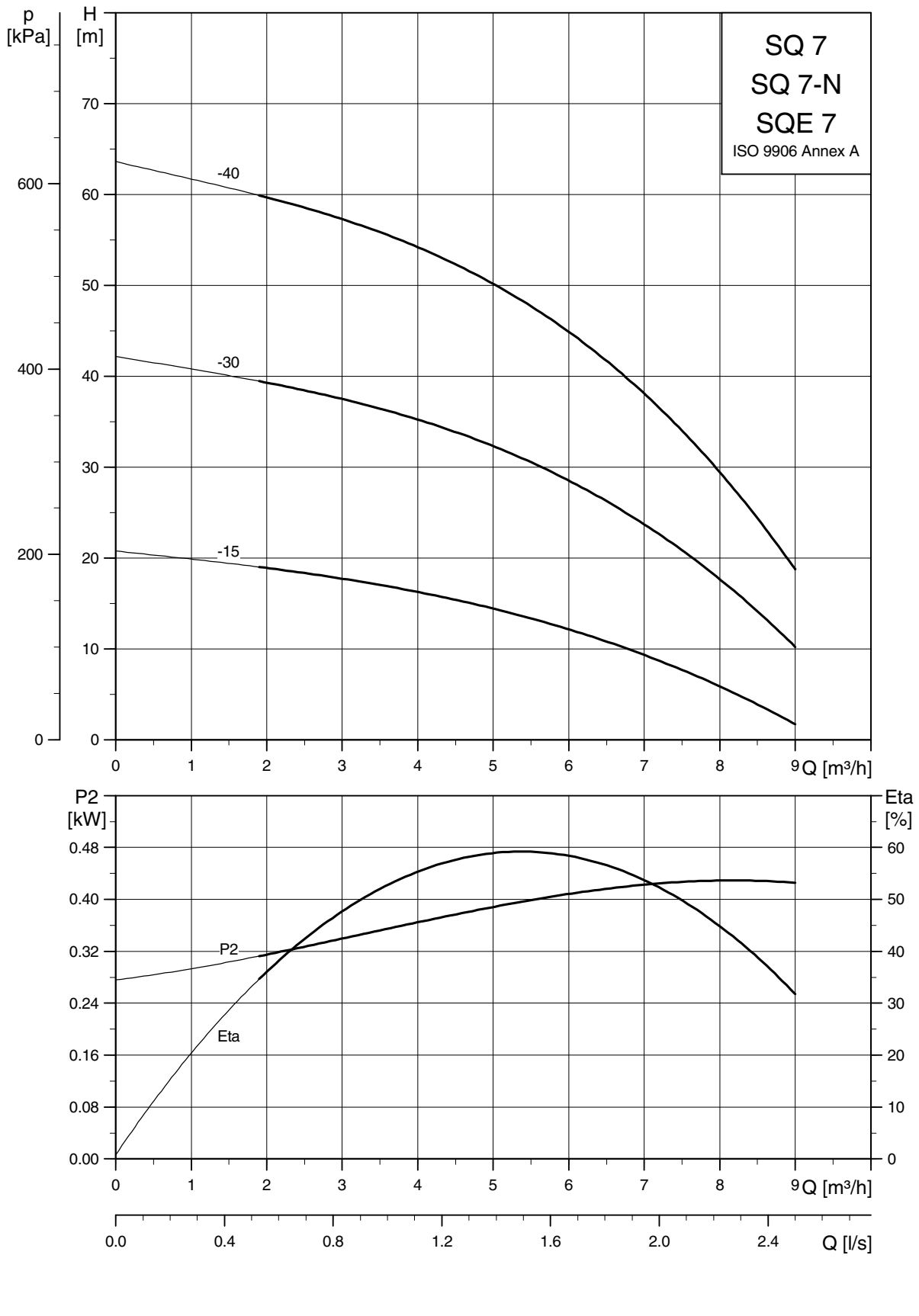
* Including pump, motor, 1.5 m cable and cable guard.

Electrical data

1 x 200 - 240 V, 50/60 Hz

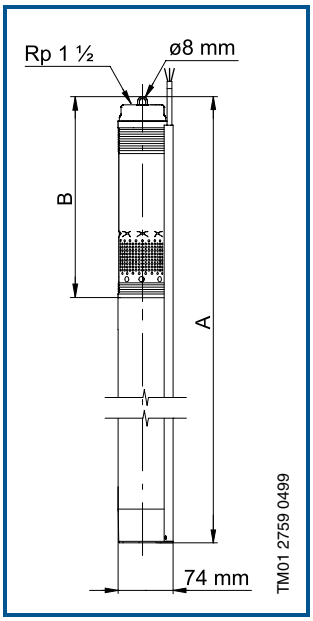
Pump type	Motor type	Input power, motor (P1) [kW]	Output power motor (P2) [kW]	Required input power, pump [kW]	Full load current $I_{1/1}$ [A]		Full load motor efficiency (η) [%]
					230 V	200 V	
SQ 5 - 15 (-N) SQE 5 - 15	MS 3 (-NE) MSE 3	0.41	0.1-0.63	0.26	1.9	2.2	70
SQ 5 - 25 (-N) SQE 5 - 25	MS 3 (-NE) MSE 3	0.76	0.1-0.63	0.54	3.4	3.9	70
SQ 5 - 35 (-N) SQE 5 - 35	MS 3 (-NE) MSE 3	1.10	0.7-1.05	0.80	4.9	5.6	70
SQ 5 - 50 (-N) SQE 5 - 50	MS 3 (-NE) MSE 3	1.49	1.1-1.73	1.06	7.0	8.1	73
SQ 5 - 60 (-N) SQE 5 - 60	MS 3 (-NE) MSE 3	1.84	1.1-1.73	1.33	8.6	9.9	74
SQ 5 - 70 (-N) SQE 5 - 70	MS 3 (-NE) MSE 3	2.23	1.1-1.73	1.60	10.4		74

Performance curves



GRUNDFOS

Dimensions and weights



Pump type	Number of stages	Motor		Dimensions [mm]		Net weight [kg]*	Shipping volume [m³]*
		Type	Output power (P_2) [kW]	A	B		
SQ 7 - 15 (-N) SQE 7 - 15	1	MS 3 (-NE) MSE 3	0.1-0.63	745	265	4.7	0.0092
SQ 7 - 30 (-N) SQE 7 - 30	2	MS 3 (-NE) MSE 3	0.7-1.05	745	265	5.2	0.0092
SQ 7 - 40 (-N) SQE 7 - 40	3	MS 3 (-NE) MSE 3	1.1-1.73	862	346	6.1	0.0104

* Including pump, motor, 1.5 m cable and cable guard.

Electrical data

1 x 200 - 240 V, 50/60 Hz

Pump type	Motor type	Input power, motor (P1) [kW]	Output power motor (P2) [kW]	Required input power, pump [kW]	Full load current $I_{1/1}$ [A]		Full load motor efficiency (η) [%]
					230 V	200 V	
SQ 7 - 15 (-N) SQE 7 - 15	MS 3 (-NE) MSE 3	0.60	0.1-0.63	0.42	2.8	3.2	70
SQ 7 - 30 (-N) SQE 7 - 30	MS 3 (-NE) MSE 3	1.16	0.7-1.05	0.84	5.2	6.0	73
SQ 7 - 40 (-N) SQE 7 - 40	MS 3 (-NE) MSE 3	1.78	1.1-1.73	1.27	8.2	9.5	74

Pump, SQ and SQE

Mains supply to pump	1 x 200-240 V –10%/+6%, 50/60 Hz, PE.
Starting	Soft starting.
Stopping	Soft stopping when stopped by the CU 300 or CU 301.
Run-up time	Maximum: 2 seconds. No limitation to the number of starts/stops per hour.
Motor protection	Built into the pump. Protection against: **Dry running.** **Overvoltage and undervoltage**, cuts out below 150 V and above 280 V. **Overload.** **Overtemperature.**
Sound pressure level	The sound pressure level is lower than the limiting values stated in the EEC Machinery Directive.
Radio noise	SQ and SQE comply with EMC Directive 89/336/EEC. Approved according to EN 50081-1 and 50082-2.
Reset function	SQE pumps can be reset via CU 300 or via CU 301 (possibly by means of R100).
Power factor	PF = 1.
Operation via generator	It is recommended that the generator output is equal to the motor input power P_1 [kW] plus 50%; min. P1 +10%, however.
Earth leakage circuit breaker	If the pump is connected to an electrical 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.
Pipe connection	SQ 1, SQ 2, SQ 3 : Rp 1¼. SQ 5, SQ 7: Rp 1½.
Borehole diameter	Minimum: 76 mm.
Installation depth	Maximum: 150 m below the static water table (15 bar). For horizontal installation flow sleeve is recommended. Installation depth below dynamic water level: Vertical installation with/without flow sleeve: 0.5 m. Horizontal installation with/without flow sleeve: 0.5 m.
NPSH	Max. 8 m.
Strainer	Holes of the strainer: ø2.3 mm.
Pumped liquids	SQ, SQE (DIN W.-Nr. 1.4301), SQ-N (DIN W.-Nr. 1.4401): pH 5 to 9. Sand content up to 50 g/m³.

Control units, CU 300 and CU 301

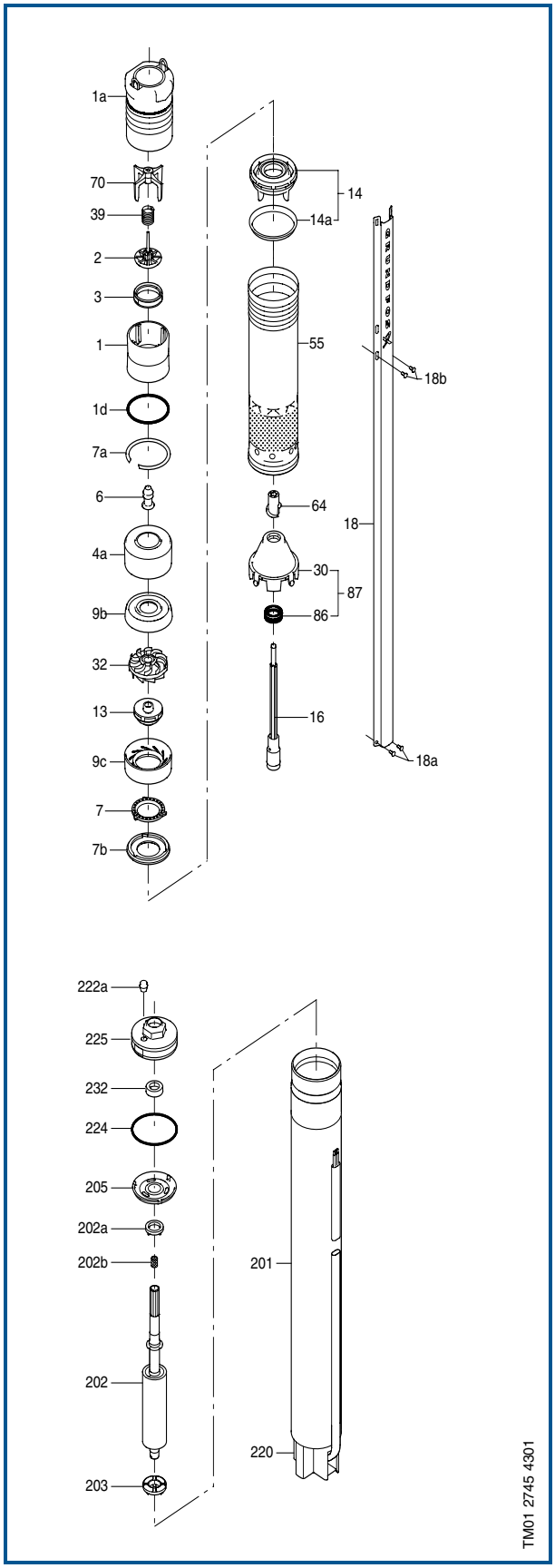
Voltage	1 x 100-240 V –10%/+6%, 50/60 Hz, PE.
Power consumption	5 W.
Current consumption	Maximum 130 mA.
Enclosure class	IP 55.
Ambient temperature	In operation: –30°C to +50°C, during storage –30°C to +60°C.
Relative air humidity	95%.
Pump cable	Maximum length between CU 300 or CU 301 and pump: 200 m.
Back-up fuse	Maximum: 16 A.
Radio noise	CU 300 and CU 301 comply with EMC Directive 89/336/EEC. Approved according to the standards EN 55 014 and 55 014-2.
Marking	CE.
Load	Max. 100 mA.

Material specification (Pump)

Pos.	Component	Material	DIN W.-Nr. SQ/SQE	AISI	DIN W.-Nr. SQ-N	AISI
1	Valve casing	Polyamide				
1a	Discharge chamber	Stainless steel	1.4301	304	1.4401	316
1d	O-ring	NBR rubber				
2	Valve cup	Polyamide				
3	Valve seat	NBR rubber				
4a	Empty chamber	Polyamide				
6	Top bearing	NBR rubber				
7	Neck ring	TPU/PBT				
7a	Lock ring	Stainless spring steel	1.4310	310	1.4401	316
7b	Neck ring retainer	Polyamide				
9b	Chamber top	Polyamide				
9c	Chamber bottom	Polyamide				
13	Impeller with tungsten carbide bearing	Polyamide				
14	Suction interconnector	Polyamide				
14a	Ring	Stainless steel	1.4301	304	1.4401	316
16	Shaft with coupling	Stainless steel	1.4301	304	1.4401	316
		Sintered steel				
18	Cable guard	Stainless steel	1.4301	304	1.4401	316
18a 18b	Screws for cable guard	Stainless steel	1.4401	316	1.4401	316
30	Cone for pressure equalisation	Polyamide				
32	Guide vanes	Polyamide				
39	Spring	Stainless spring steel	1.4406	316LN	1.4406	316LN
55	Pump sleeve	Stainless steel	1.4301	304	1.4401	316
64	Priming screw	Polyamide				
70	Valve guide	Polyamide				
86	Lip seal ring	NBR rubber				
87	Cone for pressure equalization complete	Polyamide/ NBR rubber				

Material specification (Motor)

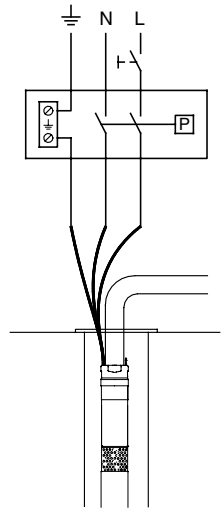
Pos.	Component	Material	DIN W.-Nr. MS 3/ MSE 3	AISI	DIN W.-Nr. MS 3-NE	AISI
201	Stator	Stainless steel	1.4301	304	1.4401	316
202	Rotor	Stainless steel	1.4301	304	1.4401	316
202a	Stop ring	PP				
202b	Filter	Polyester				
203	Thrust bearing	Carbon				
205	Radial bearing	Ceramic/ tungsten carbide				
220	Motor cable with plug	EPR				
222a	Filling plug	MS 3: NBR MSE 3: FKM				
224	O-ring	FKM				
225	Top cover	PPS				
232	Shaft seal	MS 3: NBR MSE 3: FKM				
	Motor liquid	SML-2				



Wiring diagrams

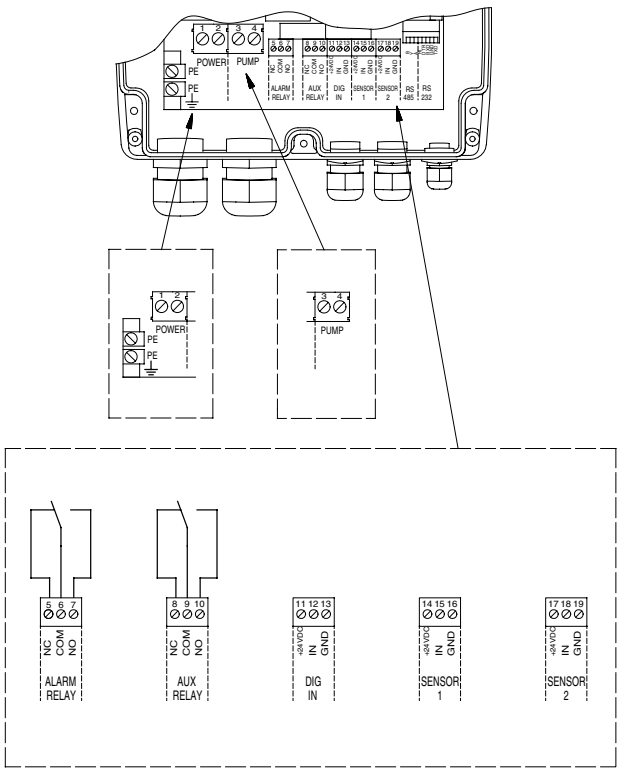
Mains connection of pump via pressure switch

The pressure switch must be rated to the max. amps of the specific pump size.



TM01 1480 4697

Electrical connection of CU 300



Alarm relay:

Potential-free changeover contact
Maximum contact load: AC 250 V, Max. current 1A
Minimum contact load: DC 5 V, 10 mA

Auxiliary relay:

Potential-free changeover contact
Maximum contact load: Safety extra-low voltage to be used only. Max. current 1A
Minimum contact load: DC 5 V, 10 mA

Digital input:

External potential-free contact
Logic "0": U_{in} > 3.2 V
Logic "1": U_{in}< 0.9 V

Sensor 1:

Voltage signal: DC 0 - 10 V/2 - 10 V, R_i = 11 kΩ. Tolerance: +/–3% at maximum voltage signal. Screened cable recommended, maximum length of cable: 500 m.

Current signal: DC 0 - 20 mA/4 - 20 mA, R_i = 500 Ω. Tolerance: +/–3% at maximum current signal. Screened cable recommended, maximum length of cable: 500 m.

Sensor 2:

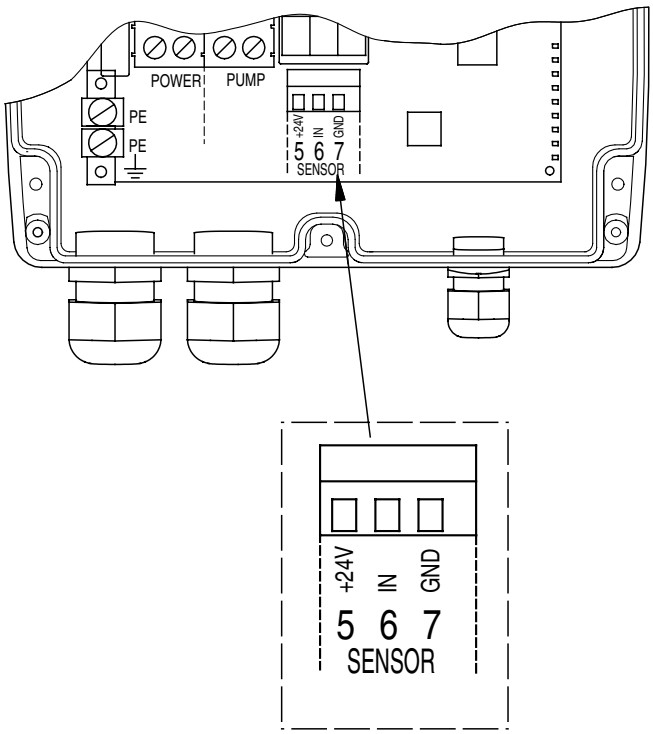
Potentiometer: DC 0 - 24 V, 10 kΩ (via internal voltage supply). Screened cable is recommended, maximum length of cable: 100 m.

Voltage signal: DC 0 - 10 V/2-10 V, R_i = 11 kΩ. Tolerance: +/–3% at maximum voltage signal. Screened cable recommended, maximum length of cable: 500 m.

Current signal: DC 0 - 20 mA/4 - 20 mA, R_i = 500 Ω. Tolerance: +/–3% at maximum current signal. Screened cable recommended, maximum length of cable: 500 m.

TM01 3008 2898

Electrical connection of CU 301



Sensor:

Voltage signal: DC 0 - 10 V/2 - 10 V, R_i = 11 kΩ. Tolerance: +/–3% at maximum voltage signal. Screened cable recommended, maximum length of cable: 500 m.

Current signal: DC 0 - 20 mA/4 - 20 mA, R_i = 500 Ω. Tolerance: +/–3% at maximum current signal. Screened cable recommended, maximum length of cable: 500 m.

Product number for the pressure sensor, 4-20 mA, 0-6 bar: 96 43 78 51

TM01 8150 5099

Constant-pressure packages incl. pump

Contents	Pump type	Cable length	Product no.
One constant-pressure package includes: - Pump, SQE incl. cable - Control unit, CU 301 - Tank, 8 litres - Pressure sensor, PT 0-6 bar - Pressure gauge, 10 bar, ø63 - Ball valve, ¾" - Cable clips, 20 pieces	SQE 2-55	40 m	96 08 07 75
	SQE 2-85	60 m	96 08 07 76
	SQE 3-65	20 m	96 08 07 63
	SQE 3-65	40 m	96 08 07 62
	SQE 5-70	40 m	96 08 07 73

Constant-pressure package excl. pump

Contents	Product no.
- Control unit, CU 301 - Tank, 8 litres - Pressure sensor, PT 0-6 bar - Pressure gauge, 10 bar, ø63 - Ball valve, ¾" - Cable clips, 20 pieces	96 08 07 74

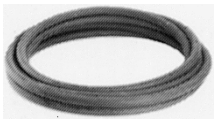
Note: The Flex package can be used with all SQE pumps.

Accessories packages

Contents	For pump type	Product no.
- Tank, 8 litres - Pressure sensor, PT 0-4 bar - Flow switch unit - Pressure gauge, 6 bar.	SQE 1, SQE 2 and SQE 3	96 03 73 30
	SQE 5 and SQE 7	96 03 75 58

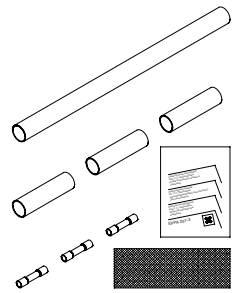
Contents	Product no.
- Tank, 18 litres - Presscontrol PC 15 - Pressure gauge, 6 bar - Tee-piece (to be used when fitting the pressure gauge).	96 03 73 31

Submersible drop cable


TM00 7882 2296

Description	Version	Nominal diameter [mm]	Product no.
3-core cable incl. earth conductor KTW approved. When ordering please state length [m]	3G 1.5 mm² (round)	9.6 - 12.5	ID 79 46
	3G 2.5 mm² (round)	11.5 - 14.5	ID 79 47
	3G 4.0 mm² (round)	13.0 - 16.0	ID 79 48
	3G 6.0 mm² (round)	14.5 - 20.0	RM 40 98
	3G x 1.5 mm² (flat)	6.5 - 13.2	RM 39 52

Cable termination kit, type KM


TM00 3838 1294

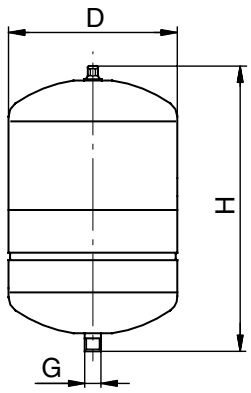
Description	Cross section of leads [mm²]	Product no.
For watertight shrink-joining of motor cable and submersible drop cable (round or flat cable). Enables the joining of: - cables of equal size. - cables of different size. - cable leads with single leads. The joint is ready for use after a few minutes and requires no long hardening time as do resin joints. The joint cannot be separated.	1.5 - 2.5 mm² 4.0 - 6.0 mm²	96 02 14 62 96 02 14 73

Cable clips


TM00 4179 1994

Description	Nominal diameter [mm]	Product no.
For fastening of cable and straining wire to the riser pipe. The clips should be fitted every 3 metres One set for approx. 45 m riser pipe.	length = 7.5 m 16 buttons	00 11 50 16

Diaphragm tank



TM00 5812 3398

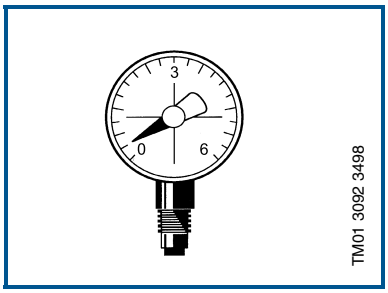
Duty range

Precharge pressure: 2 bar
Operating pressure: 6 bar
Max. liquid temperature: +70°C

Description	Connection	D [mm]	H [mm]	Weight [kg]	Product no.
8 litres	G ¾	220	305	2.5	ID 87 58
18 litres	G ¾	279	381	4.1	ID 61 62
24 litres	G ¾	279	511	5.0	ID 61 63
33 litres	G ¾	279	629	6.8	ID 61 64
50 litres*	Rp 1	381	610	12.3	ID 61 65
80 litres*	Rp 1	381	806	15.9	ID 61 66

* For installation on the floor. Fitted with 90° elbow.

Pressure gauge

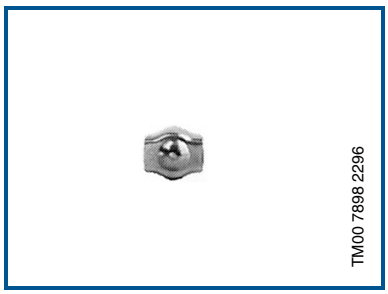


Measuring range	Connection G	Diameter [mm]	Product no.
0 - 6 bar	¼	50	ID 32 66
0 - 10 bar	¼	63	ID 80 48

Straining wire

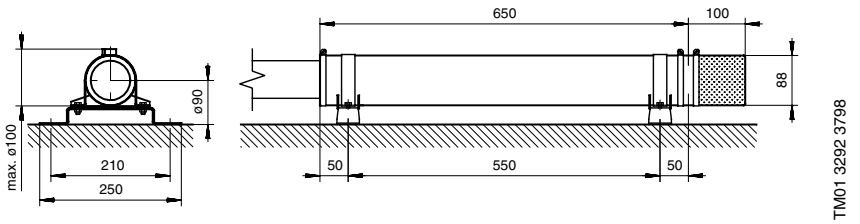
Description	Diameter	Product no.
Stainless steel DIN W.-Nr. 1.4401. Retains the submersible pump. When ordering please state length [m].	2 mm	00 ID 89 57

Wire clamp



Description	Version	Product no.
Stainless steel DIN W.-Nr. 1.4401.	Two clamps per loop	00 ID 89 60

Flow sleeve

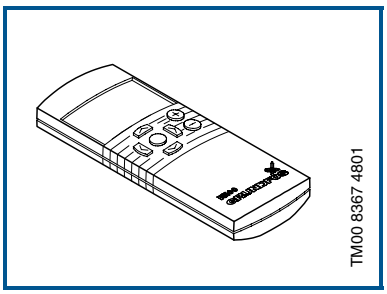


Description	Material	Product no.
Flow sleeve	DIN W.-Nr. 1.4301	91 07 19 33
Strainer	DIN W.-Nr. 1.4301	91 07 19 34
Supporting brackets	DIN W.-Nr. 1.4301	91 07 19 35

Presscontrol

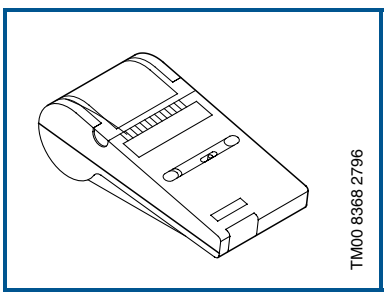
Description	Version	Product no.
Presscontrol PC 15 for automatic SQ-operation. 1.5 bar, without plug. Max. pressure: 10 bar. See page 10 for further information.	1 x 220-240 V	46 53 22

R100 remote control



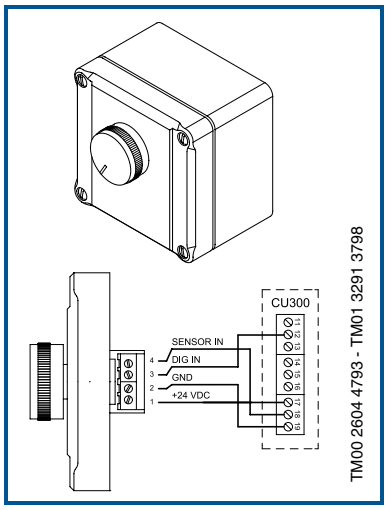
Description	Product no.
The R100 is used for wireless communication with CU 300 and CU 301. Communication takes place by means of infrared light.	62 53 33

Printer



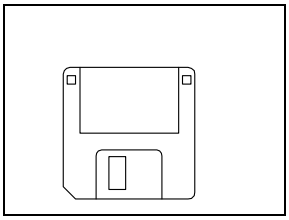
Description	Product no.
Printer for R100, infrared communication, Type: Hewlett Packard, HP 82240B.	62 04 80
Paper roll.	62 04 81

Potentiometer, SPP 1



Description	Version	Product no.
External potentiometer with cabinet for wall mounting. Screened cables, 4-wire cable. Max. length of cable: 100 m.	Grundfos potentiometer, SPP 1. Enclosure class: IP 55	62 54 68

PC Tools

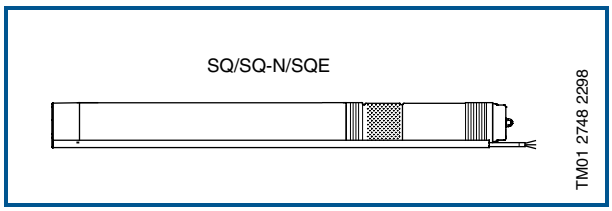


Type	Description	Product number
PC Tool SQE	Speed calculation program (Windows95), including: • Two floppy discs. • PC Tool SQE speed calculation. • Operating manual.	96 47 82 66

Sensors

Sensors	Supplier	Type	Measuring Range	Product no.
Level sensor, incl. 30 m cable	JUMO	4390-242	0 - 2.5 bar	96 03 74 89
Level sensor, incl. 65 m cable	JUMO	4390-242	0 - 6 bar	96 03 74 90
Level sensor, incl. 105 m cable	JUMO	4390-242	0 - 10 bar	96 03 74 91
Pressure switch	Condor	mdr 21/6	1 - 6 bar	ID 64 62
Flow switch unit (SQE 1, SQE 2, SQE 3)	Grundfos	mdr 21/6 1"	0 - 5 m³/h	96 03 73 32
Flow switch unit (SQE 5, SQE 7)	Grundfos	FS 200	5 - 7 m³/h	96 03 75 59
Flow meter (pulsating) 1 l/pulse	Bdr. Dahl	QN 2.5	0 - 5 m³/h	96 03 74 92
Flow meter (pulsating) 2.5 l/pulse	Bdr. Dahl	QN 6	0 - 12 m³/h	96 03 75 83
Flow meter (pulsating 5 l/pulse	Bdr. Dahl	QN 10	0 - 20 m³/h	96 03 75 84
Pressure sensor kit for CU 300 incl. 2 m cable	Danfoss	MBS 3000	0 - 4 bar	40 51 60
			0 - 6 bar	40 51 61
Pressure sensor kit for CU 301 incl. 2 m cable	Grundfos	Grundfos type	0 - 6 bar	96 43 78 51

Complete units with 1.5 m cable



Complete unit: SQ 1, SQ 1-N, SQE 1

Pump type	Motor		Product number
	Type	Output power motor (P_2) [kW]	
SQ 1 - 35	MS 3	0.1 - 0.63	96 08 01 51
SQ 1 - 35 N	MS 3 - NE	0.1 - 0.63	96 08 05 66
SQE 1 - 35	MSE 3	0.1 - 0.63	96 08 01 84
SQ 1 - 50	MS 3	0.1 - 0.63	96 08 01 52
SQ 1 - 50 N	MS 3 - NE	0.1 - 0.63	96 08 05 67
SQE 1 - 50	MSE 3	0.1 - 0.63	96 08 01 85
SQ 1 - 65	MS 3	0.1 - 0.63	96 08 01 53
SQ 1 - 65 N	MS 3 - NE	0.1 - 0.63	96 08 05 68
SQE 1 - 65	MSE 3	0.1 - 0.63	96 08 01 86
SQ 1 - 80	MS 3	0.7 - 1.05	96 08 01 61
SQ 1 - 80 N	MS 3 - NE	0.7 - 1.05	96 08 05 76
SQE 1 - 80	MSE 3	0.7 - 1.05	96 08 01 94
SQ 1 - 95	MS 3	0.7 - 1.05	96 08 01 62
SQ 1 - 95 N	MS 3 - NE	0.7 - 1.05	96 08 05 77
SQE 1 - 95	MSE 3	0.7 - 1.05	96 08 01 95
SQ 1 - 110	MS 3	0.7 - 1.05	96 08 01 63
SQ 1 - 110 N	MS 3 - NE	0.7 - 1.05	96 08 05 78
SQE 1 - 110	MSE 3	0.7 - 1.05	96 08 01 96
SQ 1 - 125	MS 3	1.1 - 1.73	96 08 01 72
SQ 1 - 125 N	MS 3 - NE	1.1 - 1.73	96 08 05 87
SQE 1 - 125	MSE 3	1.1 - 1.73	96 08 02 05
SQ 1 - 140	MS 3	1.1 - 1.73	96 08 01 73
SQ 1 - 140 N	MS 3 - NE	1.1 - 1.73	96 08 05 88
SQE 1 - 140	MSE 3	1.1 - 1.73	96 08 02 06
SQ 1 - 155	MS 3	1.1 - 1.73	96 08 01 74
SQ 1 - 155 N	MS 3 - NE	1.1 - 1.73	96 08 05 89
SQE 1 - 155	MSE 3	1.1 - 1.73	96 08 02 07

Complete unit: SQ 2, SQ 2-N, SQE 2

Pump type	Motor		Product number
	Type	Output power motor (P_2) [kW]	
SQ 2 - 35	MS 3	0.1 - 0.63	96 08 01 54
SQ 2 - 35 N	MS 3 - NE	0.1 - 0.63	96 08 05 69
SQE 2 - 35	MSE 3	0.1 - 0.63	96 08 01 87
SQ 2 - 55	MS 3	0.7 - 1.05	96 08 01 55
SQ 2 - 55 N	MS 3 - NE	0.7 - 1.05	96 08 05 70
SQE 2 - 55	MSE 3	0.7 - 1.05	96 08 01 88
SQ 2 - 70	MS 3	0.7 - 1.05	96 08 01 64
SQ 2- 70 N	MS 3 - NE	0.7 - 1.05	96 08 05 79
SQE 2 - 70	MSE 3	0.7 - 1.05	96 08 01 97
SQ 2 - 85	MS 3	1.1 - 1.73	96 08 01 65
SQ 2 - 85 N	MS 3 - NE	1.1 - 1.73	96 08 05 80
SQE 2 - 85	MSE 3	1.1 - 1.73	96 08 01 98
SQ 2 - 100	MS 3	1.1 - 1.73	96 08 01 75
SQ 2 - 100 N	MS 3 - NE	1.1 - 1.73	96 08 05 90
SQE 2 - 100	MSE 3	1.1 - 1.73	96 08 02 08
SQ 2 - 115	MS 3	1.1 - 1.73	96 08 01 76
SQ 2 - 115 N	MS 3 - NE	1.1 - 1.73	96 08 05 91
SQE 2 - 115	MSE 3	1.1 - 1.73	96 08 02 09

Complete unit: SQ 3, SQ 3-N, SQE 3

Pump type	Motor		Product number
	Type	Output power motor (P_2) [kW]	
SQ 3 - 30	MS 3	0.1 - 0.63	96 08 01 56
SQ 3 - 30 N	MS 3 - NE	0.1 - 0.63	96 08 05 71
SQE 3 - 30	MSE 3	0.1 - 0.63	96 08 01 89
SQ 3 - 40	MS 3	0.1 - 0.63	96 08 01 57
SQ 3 - 40 N	MS 3 - NE	0.1 - 0.63	96 08 05 72
SQE 3 - 40	MSE 3	0.1 - 0.63	96 08 01 90
SQ 3 - 55	MS 3	0.7 - 1.05	96 08 01 66
SQ 3 - 55 N	MS 3 - NE	0.7 - 1.05	96 08 05 81
SQE 3 - 55	MSE 3	0.7 - 1.05	96 08 01 99
SQ 3 - 65	MS 3	0.7 - 1.05	96 08 01 67
SQ 3 - 65 N	MS 3 - NE	0.7 - 1.05	96 08 05 82
SQE 3 - 65	MSE 3	0.7 - 1.05	96 08 02 00
SQ 3 - 80	MS 3	1.1 - 1.73	96 08 01 78
SQ 3 - 80 N	MS 3 - NE	1.1 - 1.73	96 08 05 93
SQE 3 - 80	MSE 3	1.1 - 1.73	96 08 02 11
SQ 3 - 95	MS 3	1.1 - 1.73	96 08 01 79
SQ 3 - 95 N	MS 3 - NE	1.1 - 1.73	96 08 05 94
SQE 3 - 95	MSE 3	1.1 - 1.73	96 08 02 12
SQ 3 - 105	MS 3	1.1 - 1.73	96 08 01 80
SQ 3 - 105 N	MS 3 - NE	1.1 - 1.73	96 08 05 95
SQE 3 - 105	MSE 3	1.1 - 1.73	96 08 02 13

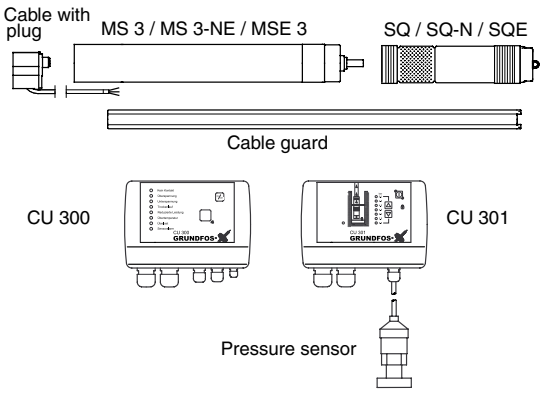
Complete unit: SQ 5, SQ 5-N, SQE 5

Pump type	Motor		Product number
	Type	Output power motor (P_2) [kW]	
SQ 5 - 15	MS 3	0.1 - 0.63	96 08 01 58
SQ 5 - 15 N	MS 3 - NE	0.1 - 0.63	96 08 05 73
SQE 5 - 15	MSE 3	0.1 - 0.63	96 08 01 91
SQ 5 - 25	MS 3	0.1 - 0.63	96 08 01 59
SQ 5 - 25 N	MS 3 - NE	0.1 - 0.63	96 08 05 74
SQE 5 - 25	MSE 3	0.1 - 0.63	96 08 01 92
SQ 5 - 35	MS 3	0.7 - 1.05	96 08 01 68
SQ 5 - 35 N	MS 3 - NE	0.7 - 1.05	96 08 05 83
SQE 5 - 35	MSE 3	0.7 - 1.05	96 08 02 01
SQ 5 - 50	MS 3	1.1 - 1.73	96 08 01 69
SQ 5 - 50 N	MS 3 - NE	1.1 - 1.73	96 08 05 84
SQE 5 - 50	MSE 3	1.1 - 1.73	96 08 02 02
SQ 5 - 60	MS 3	1.1 - 1.73	96 08 01 81
SQ 5 - 60 N	MS 3 - NE	1.1 - 1.73	96 08 05 96
SQE 5 - 60	MSE 3	1.1 - 1.73	96 08 02 14
SQ 5 - 70	MS 3	1.1 - 1.73	96 08 01 82
SQ 5 - 70 N	MS 3 - NE	1.1 - 1.73	96 08 05 97
SQE 5 - 70	MSE 3	1.1 - 1.73	96 08 02 15

Complete unit: SQ 7, SQ 7-N, SQE 7

Pump type	Motor		Product number
	Type	Output power motor (P_2) [kW]	
SQ 7 - 15	MS 3	0.1 - 0.63	96 08 01 60
SQ 7 - 15 N	MS 3 - NE	0.1 - 0.63	96 08 05 75
SQE 7 - 15	MSE 3	0.1 - 0.63	96 08 01 93
SQ 7 - 30	MS 3	0.7 - 1.05	96 08 01 70
SQ 7 - 30 N	MS 3 - NE	0.7 - 1.05	96 08 05 85
SQE 7 - 30	MSE 3	0.7 - 1.05	96 08 02 03
SQ 7 - 40	MS 3	1.1 - 1.73	96 08 01 71
SQ 7 - 40 N	MS 3 - NE	1.1 - 1.73	96 08 05 86
SQE 7 - 40	MSE 3	1.1 - 1.73	96 08 02 04

Product numbers for flexible concept



SQ, SQE, pump without motor

SQ, SQE 1

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3/MSE 3
SQ, SQE 1 - 35	96 08 03 81	0.1 - 0.63
SQ, SQE 1 - 50	96 08 03 82	0.1 - 0.63
SQ, SQE 1 - 65	96 08 03 83	0.1 - 0.63
SQ, SQE 1 - 80	96 08 03 91	0.7 - 1.05
SQ, SQE 1 - 95	96 08 03 92	0.7 - 1.05
SQ, SQE 1 - 110	96 08 03 93	0.7 - 1.05
SQ, SQE 1 - 125	96 08 04 02	1.1 - 1.73
SQ, SQE 1 - 140	96 08 04 03	1.1 - 1.73
SQ, SQE 1 - 155	96 08 04 04	1.1 - 1.73

SQ, SQE 2

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3/MSE 3
SQ, SQE 2 - 35	96 08 03 84	0.1 - 0.63
SQ, SQE 2 - 55	96 08 03 85	0.7 - 1.05
SQ, SQE 2 - 70	96 08 03 94	0.7 - 1.05
SQ, SQE 2 - 85	96 08 03 95	1.1 - 1.73
SQ, SQE 2 - 100	96 08 04 05	1.1 - 1.73
SQ, SQE 2 - 115	96 08 04 06	1.1 - 1.73

SQ, SQE 3

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3/MSE 3
SQ, SQE 3 - 30	96 08 03 86	0.1 - 0.63
SQ, SQE 3 - 40	96 08 03 87	0.1 - 0.63
SQ, SQE 3 - 55	96 08 03 96	0.7 - 1.05
SQ, SQE 3 - 65	96 08 03 97	0.7 - 1.05
SQ, SQE 3 - 80	96 08 04 08	1.1 - 1.73
SQ, SQE 3 - 95	96 08 04 09	1.1 - 1.73
SQ, SQE 3 - 105	96 08 04 10	1.1 - 1.73

SQ, SQE 5

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3/MSE 3
SQ, SQE 5 - 15	96 08 03 88	0.1 - 0.63
SQ, SQE 5 - 25	96 08 03 89	0.1 - 0.63
SQ, SQE 5 - 35	96 08 03 98	0.7 - 1.05
SQ, SQE 5 - 50	96 08 03 99	1.1 - 1.73
SQ, SQE 5 - 60	96 08 04 11	1.1 - 1.73
SQ, SQE 5 - 70	96 08 04 12	1.1 - 1.73

SQ, SQE 7

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3/MSE 3
SQ, SQE 7 - 15	96 08 03 90	0.1 - 0.63
SQ, SQE 7 - 30	96 08 04 00	0.7 - 1.05
SQ, SQE 7 - 40	96 08 04 01	1.1 - 1.73

SQ - N pump without motor

SQ 1-N

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3 - NE
SQ 1 - 35 N	96 08 07 16	0.1 - 0.63
SQ 1 - 50 N	96 08 07 17	0.1 - 0.63
SQ 1 - 65 N	96 08 07 18	0.1 - 0.63
SQ 1 - 80 N	96 08 07 26	0.7 - 1.05
SQ 1 - 95 N	96 08 07 27	0.7 - 1.05
SQ 1 - 110 N	96 08 07 28	0.7 - 1.05
SQ 1 - 125 N	96 08 07 37	1.1 - 1.73
SQ 1 - 140 N	96 08 07 38	1.1 - 1.73
SQ 1 - 155 N	96 08 07 39	1.1 - 1.73

SQ 2-N

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3 - NE
SQ 2 - 35 N	96 08 07 19	0.1 - 0.63
SQ 2 - 55 N	96 08 07 20	0.7 - 1.05
SQ 2 - 70 N	96 08 07 29	0.7 - 1.05
SQ 2 - 85 N	96 08 07 30	1.1 - 1.73
SQ 2 - 100 N	96 08 07 40	1.1 - 1.73
SQ 2 - 115 N	96 08 07 41	1.1 - 1.73

SQ 3-N

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3 - NE
SQ 3 - 30 N	96 08 07 21	0.1 - 0.63
SQ 3 - 40 N	96 08 07 22	0.1 - 0.63
SQ 3 - 55 N	96 08 07 31	0.7 - 1.05
SQ 3 - 65 N	96 08 07 32	0.7 - 1.05
SQ 3 - 80 N	96 08 07 43	1.1 - 1.73
SQ 3 - 95 N	96 08 07 44	1.1 - 1.73
SQ 3 - 105 N	96 08 07 45	1.1 -1.73

SQ 5-N

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3 - NE
SQ 5 - 15 N	96 08 07 23	0.1 - 0.63
SQ 5 - 25 N	96 08 07 24	0.1 - 0.63
SQ 5 - 35 N	96 08 07 33	0.7 - 1.05
SQ 5 - 50 N	96 08 07 34	1.1 - 1.73
SQ 5 - 60 N	96 08 07 46	1.1 - 1.73
SQ 5 - 70 N	96 08 07 47	1.1 - 1.73

SQ 7-N

Pump type	Product number	Output power motor (P_2) [kW]
		MS 3 - NE
SQ 7 - 15 N	96 08 07 25	0.1 - 0.63
SQ 7 - 30 N	96 08 07 35	0.7 - 1.05
SQ 7 - 40 N	96 08 07 36	1.1 - 1.73

MS 3 motor without pump

Motor type	Power P_2 [kW]	Full load current $I_{1/1}$ [A]	Product number
MS 3	0.1 - 0.63	1.4 - 4.9	96 03 73 06
MS 3	0.7 - 1.05	4.9 - 7.6	96 03 73 07
MS 3	1.1 - 1.73	7.6 - 11.1	96 03 73 08

MS 3 - NE motor without pump

Motor type	Power P_2 [kW]	Full load current $I_{1/1}$ [A]	Product number
MS 3 - NE	0.1 - 0.63	1.4 - 4.9	96 05 99 09
MS 3 - NE	0.7 - 1.05	4.9 - 7.6	96 05 99 10
MS 3 - NE	1.1 - 1.73	7.6 - 11.1	96 05 99 11

MSE 3 motor without pump

Motor type	Power P_2 [kW]	Full load current $I_{1/1}$ [A]	Product number
MSE 3	0.1 - 0.63	1.4 - 4.9	96 03 73 02
MSE 3	0.7 - 1.05	4.9 - 7.6	96 03 73 03
MSE 3	1.1 - 1.73	7.6 - 11.1	96 03 73 04

Submersible drop cables

The submersible drop cables for SQ, SQ-N and SQE pumps are approved for use in drinking water (KTW approved). The material of the submersible drop cable is EPR.

The table below shows the maximum length of the submersible drop cable for the different sizes of cross-section of the leads according to a 4% voltage drop IEC 3-64, HD-384 series or regulations set by the local authorities. If the pump operates at a higher voltage drop the pump performance will be reduced. The pump will be cut out if voltage falls below 150 V.

Max. cable lengths:

Output power motor (P_2) [kW]	$I_{1/1}$ [A]	Max. length [m]			
		1.5 mm²	2.5 mm²	4 mm²	6 mm²
0.1-0.63	4.15	86	144		
0.7-1.05	6.9	52	86	138	
1.1-1.73	11.1	32	53	86	129

The table values are calculated on the basis of the formula:

Max. cable length of a single-phase submersible pump:

$$L = \frac{U \times \Delta U}{I \times 2 \times 100 \times \left(PF \times \frac{\rho}{q}\right)} [m]$$

where

L = length of cable [m]
U = Rated voltage [V]
ΔU = Voltage drop [%]
I = Rated current of the motor [A]
ρ = Specific resistance: 0.02 [Ω mm²/m]
PF = 1
q = Cross-section of submersible drop cable [mm²]

Example:

Voltage supply: 230V
Voltage drop: 4%
Current of the motor: 11.1 [A]
q = 1.5 mm² cable

$$L = \frac{230 \times 4}{11.1 \times 2 \times 100 \times 1 \times \frac{0.02}{1.5}} [m]$$

L = 32 m

A product number from the table below covers the following:

- One cable length with motor plug, packed;
- 6 nuts (M4) for fitting of plug;
- 3 screws (PT 3.5 x 10) for fitting of cable guard
- 3 screws (M3 x 6) for fitting of cable guard to suction strainer.

Length [m]	Cross-section of leads			
	1.5 mm²	2.5 mm²	4 mm²	6 mm²
	Flat	Round	Round	Round
1.5	96 03 73 91			
5	96 03 73 92			
10	96 03 73 93			
15	96 03 73 94			
20	96 03 73 95			
30	96 03 73 96			
40	96 03 73 97	96 03 75 06		
50	96 03 73 98	96 03 75 07		
60	96 03 73 99	96 03 75 08		
70	96 03 74 01	96 03 75 09		
80	96 03 74 02	96 03 75 10		
90	96 03 74 03	96 03 75 11	96 03 75 13	96 03 75 15
100	96 03 74 72	96 03 75 12	96 03 75 14	96 03 75 16

For cables with the cross-sections of leads, 2.5, 4 and 6 mm², the cable consists of 1.5 m flat motor cable followed by a round submersible drop cable.

Cable guard

The cable guards are available in various lengths.

In order to select the right cable guard it is necessary to know:

1. Length of pump (without motor) "B".
2. Motor output power (P_2).

Selection criteria		Product numbers	
Pump (B) * [mm]	Motor (P_2) [kW]	DIN 1.4301/ AISI 304	DIN 1.4401/ AISI 316
265	0.1 - 0.63 0.7 - 1.05	96 03 66 75	96 03 66 85
292	0.1 - 0.63 0.7 - 1.05	96 03 66 76	96 03 66 86
346	0.1 - 0.63 0.7 - 1.05	96 03 66 77	96 03 66 87
373	0.1 - 0.63 0.7 - 1.05	96 03 66 79	96 03 66 89
346	1.1 - 1.73	96 03 66 78	96 03 66 88
373	1.1 - 1.73	96 03 66 80	96 03 66 90
427	1.1 - 1.73	96 03 66 81	96 03 66 91
454	1.1 - 1.73	96 03 66 82	96 03 66 92

* See Dimensions and weights.

CU 301

Product	Product number
CU 301	96 43 67 53 (Europe)
Installer's manual	V7 15 77 70 XX XX (English)

CU 300

Product	Product number
CU 300	96 42 27 75 (English)

Language specific CU 300 versions available on request.

Pressure sensor for CU 301

Product	Measuring range	Product no.
Pressure sensor kit incl. 2 m cable	0 - 6 bar	96 43 78 51

SQ packages

Packages of SQ pumps including selected lengths of submersible drop cable.

Pump type	Cable length (3 x 1.5 mm²) [m]	Product numbers
SQ 1 - 65	30	96 08 04 57
SQ 1 - 80	30	96 08 04 66
SQ 1 - 80	50	96 08 04 67
SQ 1 - 140	70	96 08 04 80
SQ 2 - 35	15	96 08 04 58
SQ 2 - 55	10	96 08 04 59
SQ 2 - 55	15	96 08 04 60
SQ 2 - 55	30	96 08 04 61
SQ 2 - 55	60	96 08 04 62
SQ 2 - 70	30	96 08 04 68
SQ 2 - 70	60	96 08 04 70
SQ 2 - 70	80	96 08 04 69
SQ 2 - 85	40	96 08 04 71
SQ 2 - 85	80	96 08 04 72
SQ 3 - 40	15	96 08 04 63
SQ 3 - 40	30	96 08 04 64
SQ 3 - 55	15	96 08 04 73
SQ 3 - 55	30	96 08 04 74
SQ 3 - 65	30	96 08 04 75
SQ 3 - 65	40	96 08 04 76
SQ 3 - 80	30	96 08 04 81
SQ 3 - 80	50	96 08 04 82
SQ 3 - 95	70	96 08 04 83
SQ 3 - 105	80	96 08 04 84
SQ 5 - 35	15	96 08 04 77
SQ 5 - 50	15	96 08 04 78
SQ 5 - 50	30	96 08 04 79
SQ 5 - 60	30	96 08 04 85
SQ 5 - 70	30	96 08 04 86
SQ 7 - 40	15	96 08 04 87

V7 14 10 76 11 01	GB
Repl. V7 14 10 76 03 00	

Subject to alterations.

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