

## 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.

The SQ pump is a submersible pump which is available in four versions:

- SQ
- SQ-N
- SQE
- SQE-N.

SQ pumps offer the following features:

- dry-running protection
- high pump and motor efficiency
- wear resistance
- protection against upthrust
- soft starter
- overvoltage and undervoltage protection
- overload protection
- overtemperature protection.

Additionally the SQE pumps offer the following:

- variable speed
- electronic control and communication.

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.

The motors 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 or MSE 3-NE motor. Both motor types can communicate with the Grundfos CU 300 and CU 301 control units, which can be operated with the Grundfos R100 remote control.

The SQE pump features variable speed which is offered through frequency control. This means that 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 required.

The SQE pump can operate without the CU 300 or 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 m <sup>3</sup> /h)	Stainless steel EN 1.4301, AISI 304
SQ-N pump	(1, 2, 3, 5, and 7 m <sup>3</sup> /h)	Stainless steel EN 1.4401, AISI 316
MS 3 motor	Single-phase Max. 1.85 kW	Stainless steel EN 1.4301, AISI 304
MS 3-NE motor	Single-phase Max. 1.85 kW	Stainless steel EN 1.4401, AISI 316
MSE 3 motor	Single-phase Max. 1.85 kW	Stainless steel EN 1.4301, AISI 304
MSE 3-NE motor	Single-phase Max. 1.85 kW	Stainless steel EN 1.4401, AISI 316

## Pipe connection

Pump type	Threaded connection
SQ 1, SQ 2, SQ 3	Rp 1 1/4
SQ 5, SQ 7	Rp 1 1/2

## Type key

Code	Example	SQ	E	2	-55
	Type range				
E	Basic version Electronic control and communication				
	Rated flow [m <sup>3</sup> /h]				
	Head [m] at rated flow				
N	Material code: Stainless steel EN 1.4301 Stainless steel EN 1.4401				

## 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/m<sup>3</sup>. A higher content of sand will shorten pump life.

## Operating conditions

### Liquid temperature

Flow velocity past motor	Maximum liquid temperature [°C]
0.0 m/s (free convection)	30
Min. 0.15 m/s	40

## 2. Features and benefits

### Dry-running protection

The pumps are protected against dry running. A value of  $p_{\text{cut-out}}$  ensures cut-out of the pump in case of water shortage in the borehole, thus preventing a burnout of the motor.

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

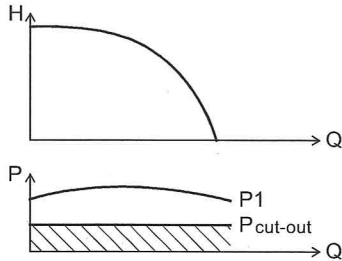


Fig. 2 Dry-running protection

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### High pump efficiency

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

### High motor efficiency

The motors are designed according to the permanent-magnet principle (PM motor) featuring high efficiency within a wide performance range.

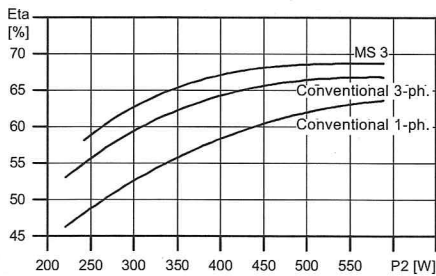


Fig. 3 Comparison of motor efficiency

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### Wear resistance

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



Fig. 4 Impellers

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### Protection against upthrust

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

The motors are fitted with an upthrust 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 the motor features soft starting. Soft starting reduces the starting current and thus gives the pump a smooth and steady acceleration.

The soft starter minimises 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.

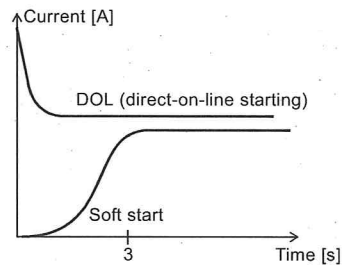


Fig. 5 Comparison of locked-rotor current

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### Overvoltage and undervoltage protection

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

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

The pump will be cut out if the voltage falls below 150 V or rises above 315 V. The motor is automatically cut in again when the voltage is again within the permissible voltage range. Therefore no extra protection relay is required.

### Overload protection

If the pump is exposed to heavy load, the current consumption will rise. The motor will automatically compensate for this by reducing the speed. If the speed falls below  $3000 \text{ min}^{-1}$ , the motor will be cut out.

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

## 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 ensures optimum operating conditions for the motor.

As an extra protection, the electronic unit has a built-in temperature sensor. When the temperature exceeds a critical limit, the motor is cut out. When the temperature has dropped, the motor is automatically cut in again.

## Reliability

The motors have been designed with a view to high reliability and have the following features:

- tungsten carbide or ceramic bearings
- thrust bearings protecting against downthrust
- product life equal to conventional AC motors.

## Variable speed

The MSE 3 motor enables continuously variable speed control within the range from 3,000 to 10,700  $\text{min}^{-1}$ .

The pump can be set to operate in any duty point within the 3,000 and 10,700  $\text{min}^{-1}$  performance range of the pump. Consequently, the pump performance can be adapted to any specific requirement.

The variable-speed control facility requires the use of a CU 300 or CU 301 control unit and the R100 remote control. See page 28.

For the calculation of pump speed, the SQE Speed Calculation program is available on CD-ROM as an accessory. See page 49. On the basis of a required head and flow, the pump speed can be calculated. Furthermore, the specific pump performance curve can be illustrated.

## Installation

The SQ and SQE may be installed vertically, horizontally or in any position in between.

**Note:** The pump must not fall below the horizontal level in relation to the motor.

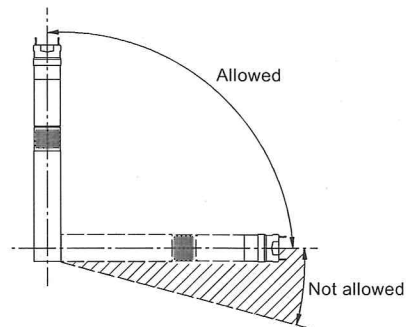


Fig. 6 Installation of SQ/SQE pumps

The following features ensure simple installation of the pump:

- Built-in non-return valve with spring.
- Low weight ensuring user-friendly handling.
- Installation in 3" or larger boreholes.
- Only an on/off switch is required. This means that no extra motor starter or starter box is necessary.
- The SQE is available with cable with a motor plug (up to 100 m).

For horizontal installation, we recommend to install the pump in a flow sleeve.

The purpose is the following:

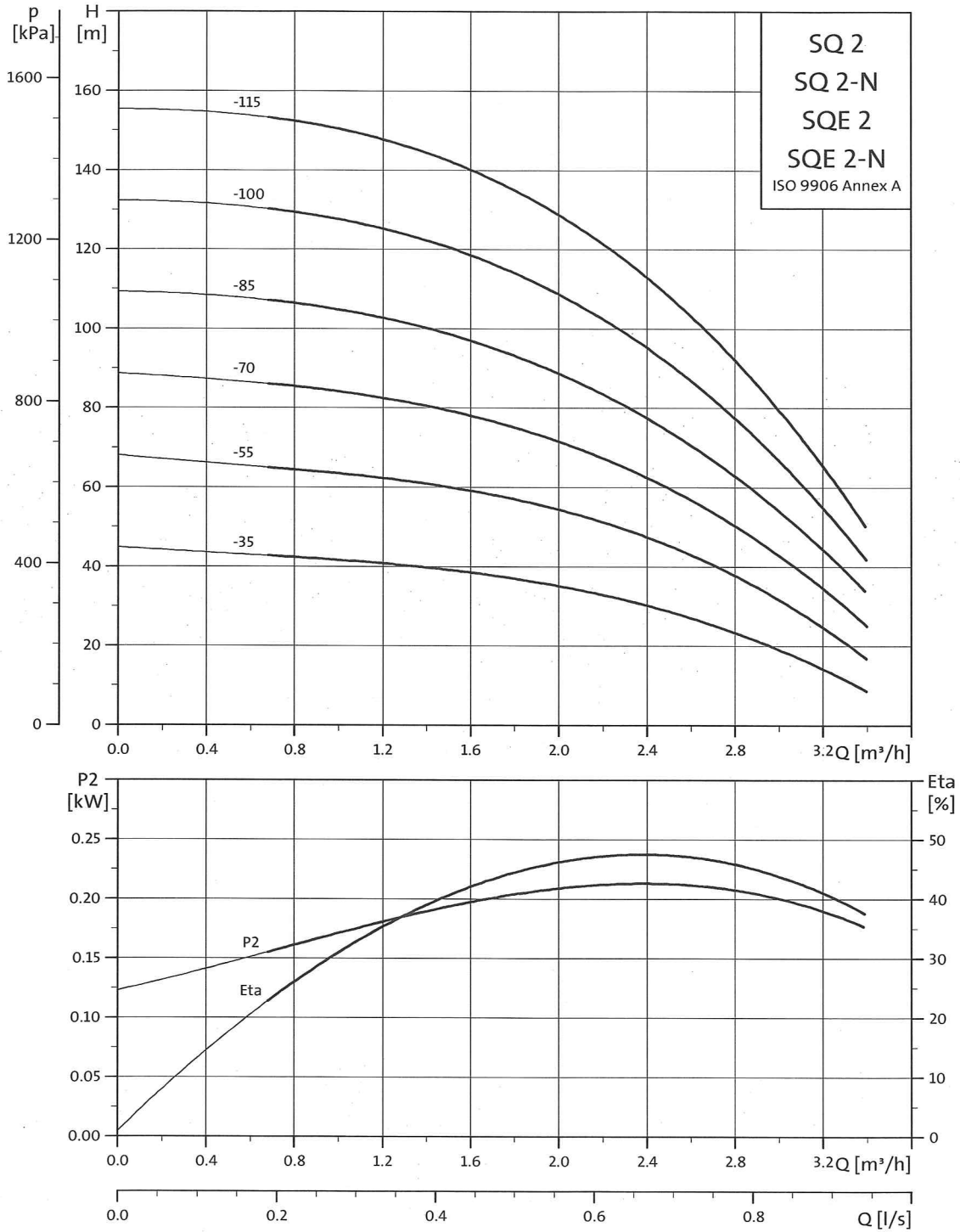
- to ensure sufficient flow velocity past the motor and thus provide sufficient cooling
- to prevent motor and electronic unit from being buried in sand or mud.

## Service

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

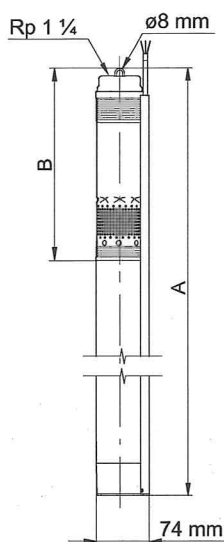
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SQ 2, SQ 2-N, SQE 2, SQE 2-N



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## Dimensions and weights



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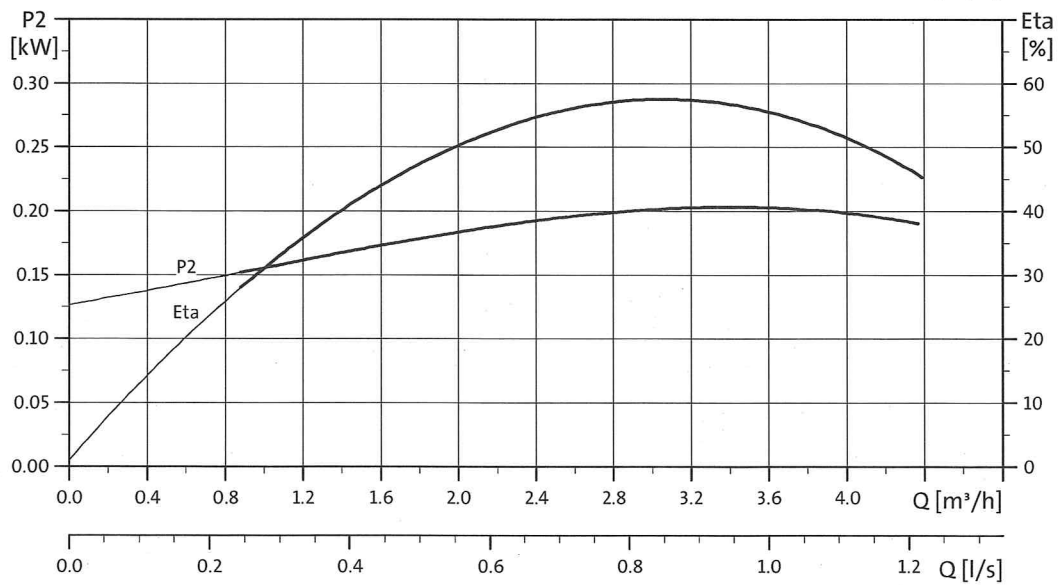
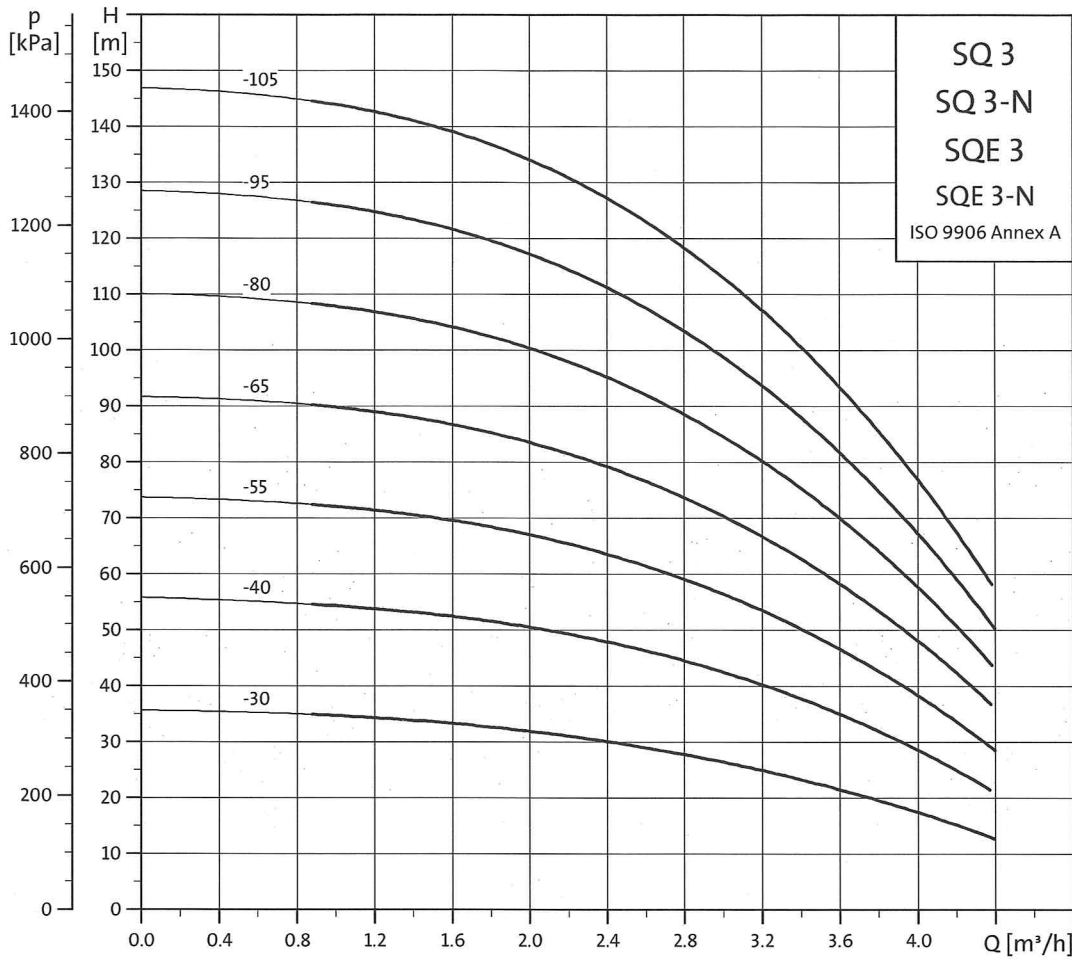
Pump type	Number of stages	Motor		Dimensions [mm]		Net weight [kg]*	Shipping volume [m <sup>3</sup> ]*
		Type	Output power (P2) [kW]	A	B		
SQ 2-35 (-N)	2	MS 3 (-NE)	0.70	741	265	4.7	0.0092
SQE 2-35 (-N)		MSE 3 (-NE)					
SQ 2-55 (-N)	3	MS 3 (-NE)	0.70	741	265	4.8	0.0092
SQE 2-55 (-N)		MSE 3 (-NE)					
SQ 2-70 (-N)	4	MS 3 (-NE)	1.15	768	292	5.4	0.0094
SQE 2-70 (-N)		MSE 3 (-NE)					
SQ 2-85 (-N)	5	MS 3 (-NE)	1.15	825	346	5.5	0.0100
SQE 2-85 (-N)		MSE 3 (-NE)					
SQ 2-100 (-N)	6	MS 3 (-NE)	1.68	861	346	6.2	0.0104
SQE 2-100 (-N)		MSE 3 (-NE)					
SQ 2-115 (-N)	7	MS 3 (-NE)	1.85	888	373	6.3	0.0107
SQE 2-115 (-N)		MSE 3 (-NE)					

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

## Electrical data, 1 x 200-240 V, 50/60 Hz

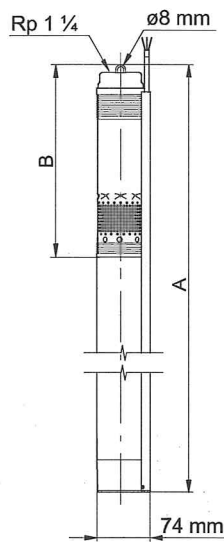
Pump type	Motor type	Input power, motor (P1) [kW]	Output power, motor (P2) [kW]	Required input power, pump [kW]	Rated current I <sub>1/1</sub> [A]		Rated motor efficiency (η) [%]
					230 V	200 V	
SQ 2-35 (-N)	MS 3 (-NE)	0.71	0.70	0.47	3.0	3.6	70
SQE 2-35 (-N)	MSE 3 (-NE)						
SQ 2-55 (-N)	MS 3 (-NE)	1.00	0.70	0.69	4.3	5.2	70
SQE 2-55 (-N)	MSE 3 (-NE)						
SQ 2-70 (-N)	MS 3 (-NE)	1.27	1.15	0.91	5.5	6.4	73
SQE 2-70 (-N)	MSE 3 (-NE)						
SQ 2-85 (-N)	MS 3 (-NE)	1.55	1.15	1.13	6.8	7.9	73
SQE 2-85 (-N)	MSE 3 (-NE)						
SQ 2-100 (-N)	MS 3 (-NE)	1.86	1.68	1.35	8.0	9.5	74
SQE 2-100 (-N)	MSE 3 (-NE)						
SQ 2-115 (-N)	MS 3 (-NE)	2.11	1.85	1.57	9.3	10.6	74
SQE 2-115 (-N)	MSE 3 (-NE)						

SQ 3, SQ 3-N, SQE 3, SQE 3-N



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## Dimensions and weights



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Pump type	Number of stages	Motor		Dimensions [mm]		Net weight [kg]*	Shipping volume [m <sup>3</sup> ]*
		Type	Output power (P2) [kW]	A	B		
SQ 3-30 (-N)	2	MS 3 (-NE)	0.70	741	265	4.8	0.0092
SQE 3-30 (-N)		MSE 3 (-NE)					
SQ 3-40 (-N)	3	MS 3 (-NE)	0.70	741	265	4.8	0.0092
SQE 3-40 (-N)		MSE 3 (-NE)					
SQ 3-55 (-N)	4	MS 3 (-NE)	1.15	768	292	5.4	0.0094
SQE 3-55 (-N)		MSE 3 (-NE)					
SQ 3-65 (-N)	5	MS 3 (-NE)	1.15	825	346	6.1	0.0100
SQE 3-65 (-N)		MSE 3 (-NE)					
SQ 3-80 (-N)	6	MS 3 (-NE)	1.68	861	346	6.3	0.0104
SQE 3-80 (-N)		MSE 3 (-NE)					
SQ 3-95 (-N)	7	MS 3 (-NE)	1.68	888	373	6.4	0.0107
SQE 3-95 (-N)		MSE 3 (-NE)					
SQ 3-105 (-N)	8	MS 3 (-NE)	1.85	942	427	6.5	0.0113
SQE 3-105 (-N)		MSE 3 (-NE)					

\* 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]	Rated current I <sub>1/1</sub> [A]		Rated motor efficiency (η) [%]
					230 V	200 V	
SQ 3-30 (-N)	MS 3 (-NE)	0.70	0.70	0.46	3.0	3.6	70
SQE 3-30 (-N)	MSE 3 (-NE)						
SQ 3-40 (-N)	MS 3 (-NE)	0.99	0.70	0.68	4.2	5.1	70
SQE 3-40 (-N)	MSE 3 (-NE)						
SQ 3-55 (-N)	MS 3 (-NE)	1.25	1.15	0.89	5.4	6.3	73
SQE 3-55 (-N)	MSE 3 (-NE)						
SQ 3-65 (-N)	MS 3 (-NE)	1.52	1.15	1.10	6.7	7.8	73
SQE 3-65 (-N)	MSE 3 (-NE)						
SQ 3-80 (-N)	MS 3 (-NE)	1.82	1.68	1.31	7.8	9.3	74
SQE 3-80 (-N)	MSE 3 (-NE)						
SQ 3-95 (-N)	MS 3 (-NE)	2.09	1.68	1.52	9.0	10.7	74
SQE 3-95 (-N)	MSE 3 (-NE)						
SQ 3-105 (-N)	MS 3 (-NE)	2.33	1.85	1.74	10.3	11.7	74
SQE 3-105 (-N)	MSE 3 (-NE)						