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# SQFlex pumping systems

Service instructions





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**1. Symbols used in this document**



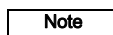
**Warning**

*If these safety instructions are not observed, it may result in personal injury!*



**Caution**

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



**Note**

*Notes or instructions that make the job easier and ensure safe operation.*

**2. The SQFlex system**

The SQFlex pumping system is a reliable water supply system especially suitable for remote locations not connected to the electricity supply grid. The SQFlex system is equipped with the SQFlex submersible pump. The SQFlex system is powered by renewable energy sources.

### 3. SQFlex components

#### 3.1 Pumps

Two pump types are used, the helical rotor pump type and the centrifugal pump type.

##### 3.1.1 Nameplate, helical rotor pump

The nameplate is engraved into the pump sleeve.



TM02 6973 2103

Fig. 1 Nameplate, helical rotor pump

#### Key to nameplate, helical rotor pump

Pos.	Code	Description
1	PROD. NO. 96078012	Product number
	MODEL A	Pump generation
	P1 0110	Production code - Bjerringbro (P1) + production year and week
2	xx SQF - x	Type designation, see Section 3.1.3 Type key on page 5.
3	• Weight: x,x kg	• Pump net weight
	• MADE IN MEXICO	• Country of origin
	• CE	• Mark of approval.
4	Rp 1 1/4	Type and size of connecting thread

### 3.1.2 Nameplate, centrifugal pump

The nameplate is attached to the suction interconnector.

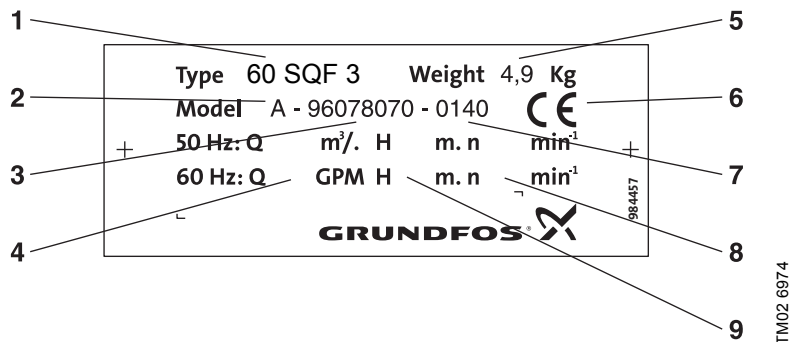


Fig. 2 Nameplate, centrifugal pump

### Key to nameplate, centrifugal pump

Pos.	Code	Description
1	Type 60 SQF -3	Type designation, see Section 3.1.3 <i>Type key</i> on page 5.
2	MODEL A	Pump generation
3	96078070	Product number
4	Q m <sup>3</sup>	Rated flow rate (not indicated)
5	Weight 4.9 kg	Pump net weight in kg
6	CE	Mark of approval
7	0140	Production year and week
8	n min <sup>-1</sup>	Speed (not indicated)
9	H	Head at rated flow rate (not indicated)

### 3.1.3 Type key

The type key is common for helical rotor pumps and centrifugal pumps.

**Example:**

X SQF - X

Rated flow rate in US GPM at 3000 min<sup>-1</sup> (approximate value)

- 3 = helical rotor pump
- 6 = helical rotor pump
- 11 = helical rotor pump
- 16 = centrifugal pump
- 25 = centrifugal pump
- 40 = centrifugal pump
- 60 = centrifugal pump

Type range

Number of stages

Centrifugal pumps come in two main types: with splined pump shaft and with cylindrical pump shaft.

16 SQF-10, 25 SQF-3 and 25 SQF-6 have a splined pump shaft. 40 SQF-3 and 60 SQF-3 have a cylindrical shaft.

### 3.2 Motor

The MSF 3 motor is a sealed construction made of stainless steel. It is a brushless, electronically commutated DC-motor with a permanent-magnet rotor.

#### 3.2.1 Nameplate, motor

The nameplate is engraved into the stator sleeve.

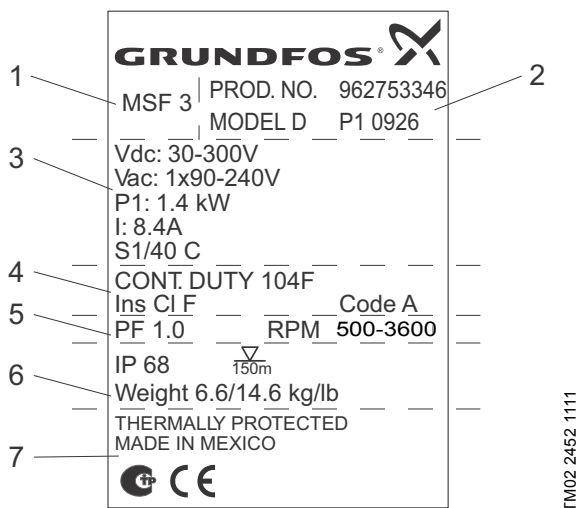


Fig. 3 Nameplate, motor\*

#### Key to nameplate, motor

Pos.	Code	Description
1	MSF 3	Type designation
	PROD. NO. 962753346	Product number
2	MODEL D	Motor generation
	P1 0926	Production code - manufacturing location code + production year and week
3	VDC: 30-300 V VAC: 1 x 90-240 V	The motor can be supplied with either DC or AC voltage: • DC: 30-300 V or • AC: 1 x 90-240 V
	P1: 1.4 kW	Maximum input power [kW]
	I: 8.4 A	Maximum input current [A]
	S1/40 C	Suitable for continuous operation up to 40 °C
4	CONT. DUTY 104F	Suitable for continuous operation at 104 °F
	Ins Cl F Code A	Insulation class F. Start-kVA is 0-3.15 per hp
5	PF 1.0 RPM 500 - 3600	Power factor = 1. Rated speed 500 - 3600 rpm
6	IP 68 $\nabla$ 150 m	Enclosure class: IP 68. Max submerged depth: 150 m (492 ft)
	Weight 6.55/14.4 kg/lb	Motor net weight in kg and pounds
	THERMALLY PROTECTED	Temperature sensor built into the electronic unit
7	MADE IN MEXICO	Country of origin
	CE	Mark of approval

\* Note: Motor data is an example only. Actual data may be different.

### 3.3 Control and switch boxes

#### 3.3.1 CU 200 SQFlex control unit



The CU 200 SQFlex control unit offers:

- system monitoring on the basis of sensor signals
- system control on the basis of sensor signals
- monitoring of pump operation and alarm indication.

#### Technical data

$U_N$ : 30-300 VDC, 1 x 90-240 V  $\pm$ 10% / +6 %, 50/60 Hz, PE.

- Maximum load: 130 mA.
- $P_{max.}$ : 5 W.
- Enclosure class: IP55 and NEMA 3R.

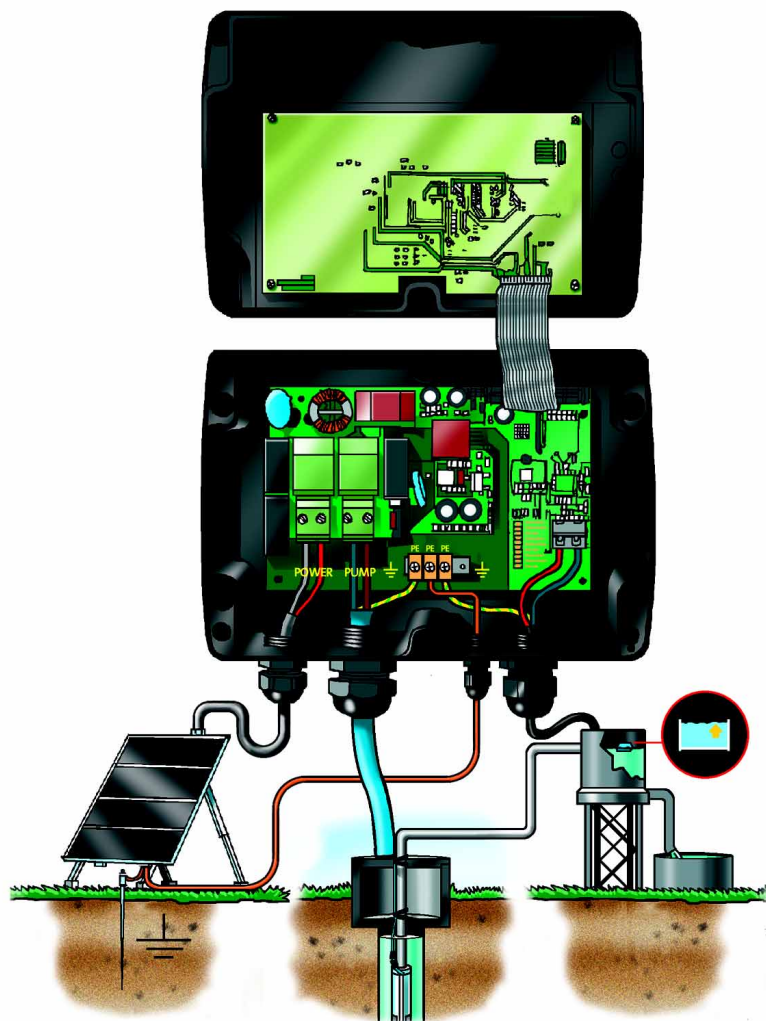


Fig. 4 Internal (and external) wiring of CU 200 SQFlex control unit

## CU 200 SQFlex display and indicator lights

The front cover of CU 200 features a button and various indications:

### Pump operation

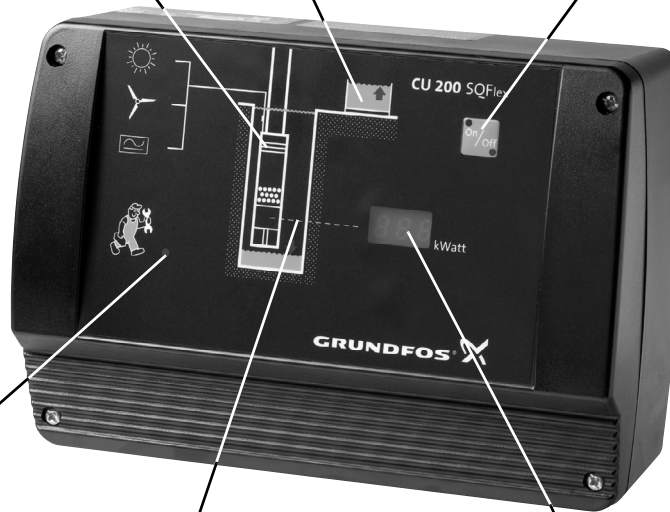
A running green light indicates that the pump is operating at more than 500 rpm.

### Full water reservoir

The yellow light indicates that the water reservoir is full.

### On/OFF button

- Green light on: The system has been switched on.
- Red light on: The system has been switched off.
- Both lights off: The system lacks the required power to light the display.
- Flashing green light: The system has adequate power to light the display, but lacks sufficient power to start the pump.



### Fault indicator

Red light indicates a fault.

### Dry running

Red light indicates lack of water.

### Power and fault codes

The display indicates 0 W until the power supply is sufficient to run the pump at 500 rpm.

Upon start-up, the power consumption of the pump is indicated in kW.

When the fault indicator is on, the display indicates fault codes.

See Section *Troubleshooting by means of CU 200* on page 9.

F1=overvoltage

F2=overtemperature

F3=no contact to pump

F4=overload.

TM05 2436 5111



## Troubleshooting by means of CU 200

Indication/Fault	Possible cause	Remedy
1. No light in front cover. Pump does not deliver water.	a) No voltage supply. b) Position of ribbon cable connector is wrong or cable is defective.	<ul style="list-style-type: none"> <li>• Reestablish the voltage supply.</li> <li>• Correct the position of the cable or replace it.</li> </ul>
2. No light in front cover, and pump does not deliver water. But the LEDs inside CU 200 indicating 5 V, 10 V and 24 V internal supply voltage are on, and the "CONTROL INDICATOR" LED is not flashing.	a) CU 200 is defective.	<ul style="list-style-type: none"> <li>• Replace the CU 200.</li> </ul>
3. Pump does not start. Green indicator light in ON/OFF button is on. No fault indicated.	a) CU 200 or pump is defective.	<ul style="list-style-type: none"> <li>• Check that the 'CONTROL INDICATOR' LED is flashing. If not, replace the CU 200.</li> <li>• Check that there is sufficient voltage on the PUMP terminals. If no voltage can be measured, replace the CU 200.</li> </ul> <p>If a supply voltage to the pump can be detected, continue as follows:</p> <ul style="list-style-type: none"> <li>• Switch off the energy supply and wait for one minute.</li> <li>• Switch on the energy supply and observe what happens: If the green indicator light in the ON/OFF button is on and the pump still does not start, the pump or pump cable is defective.</li> <li>• Repair or replace pump or cable.</li> </ul>
4. Off light in the ON/OFF button is on.	a) Pump has been stopped.	<ul style="list-style-type: none"> <li>• Press the ON/OFF button on the CU 200 to start the pump.</li> </ul>
5. CU 200 indicates "F3 = no contact to pump".	a) Pump cable or connections defective. b) CU 200 defective. c) Pump is defective.	<ul style="list-style-type: none"> <li>• Check <ul style="list-style-type: none"> <li>- the connection in the CU 200</li> <li>- the pump cable</li> <li>- the end cover with socket on the pump.</li> </ul> </li> <li>• Repair or replace the pump.</li> </ul>
6. CU 200 indicates "F1 = overvoltage"	a) Supply voltage is above permissible range.	<ul style="list-style-type: none"> <li>• Disconnect the solar modules to allow the voltage to drop.</li> <li>• Reconfigure the modules and reconnect them. If a different supply source is used, check that the voltage is within the recommended voltage range.</li> </ul> <p>Note: As the voltage is detected at the motor, allow for the voltage drop in the pump cable.</p>
7. CU 200 indicates "F2 = overtemperature".	a) Too high water temperature. b) Incrustations on motor. c) Pump is defective.	<ul style="list-style-type: none"> <li>• Ensure that the water temperature is below the maximum permissible level.</li> <li>• Remove incrustations on the motor.</li> <li>• Repair or replace the pump.</li> </ul>
8. CU 200 indicates "F4 = overload".	a) Too low input voltage. b) Pump is defective. c) <b>Only helical rotor pumps.</b> Pumped liquid is contaminated with oil or similar substance. d) Motor liquid low / Missing.	<ul style="list-style-type: none"> <li>• Increase the supply voltage, to 30 VDC or higher.</li> <li>• Repair or replace the pump.</li> <li>• Clean the liquid and replace the pump.</li> <li>• Check or refill motor liquid.</li> </ul>
9. Green indicator light in ON/OFF button is flashing.	a) Insufficient power supply. b) Pump has seized up.	<ul style="list-style-type: none"> <li>• Increase the number of solar modules or connect an alternative energy supply, such as wind turbine, batteries or generator.</li> <li>• Clean the pump.</li> </ul>
10. Running light on CU 200 but low wattage.	a) System not grounded. b) Pump is defective.	<ul style="list-style-type: none"> <li>• Check system for adequate grounding</li> <li>• Repair or replace the pump. If a centrifugal pump is used: Check that the riser pipe is not blocked.</li> </ul>
11. No light in front cover. Pump delivers water.	a) Ribbon cable not mounted. b) CU 200 is defective.	<ul style="list-style-type: none"> <li>• Mount the ribbon cable.</li> <li>• Replace the CU 200.</li> </ul>

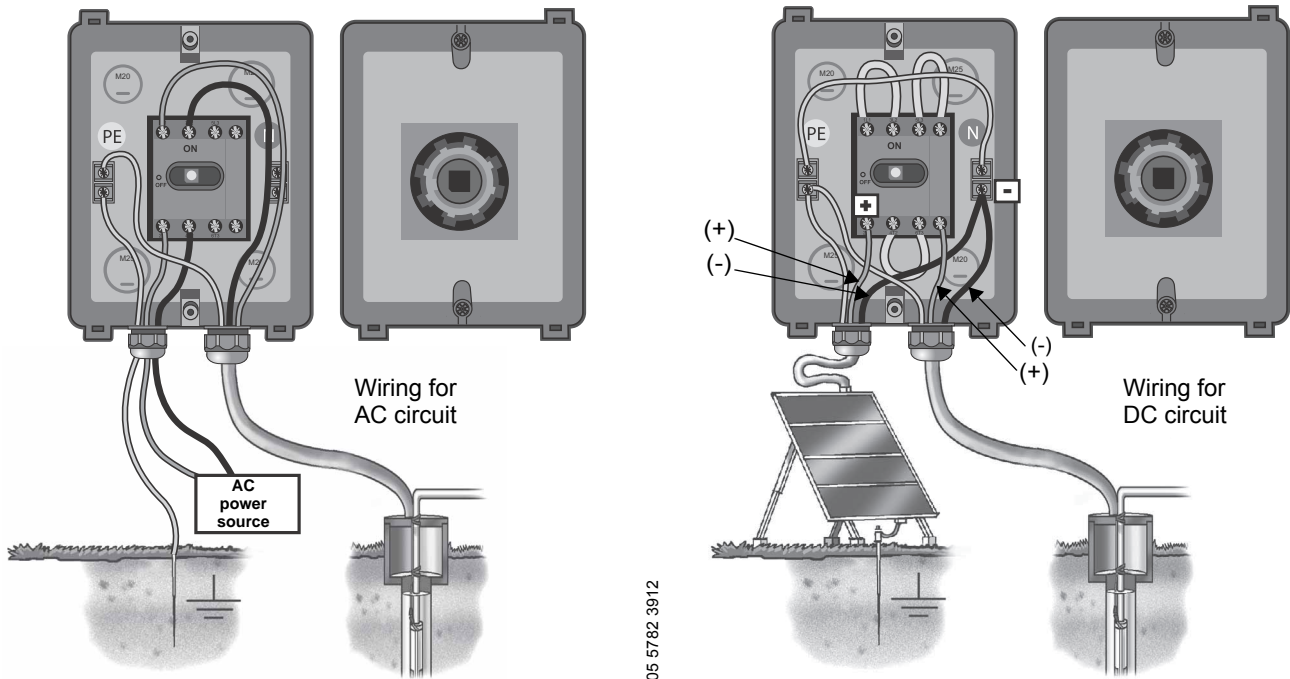
Indication/Fault	Possible cause	Remedy
12. Pump does not stop when water reservoir is full. Fault indicator light on CU 200 is off.	a) Level switch is dirty or defective.	• Clean or replace the level switch.
	b) Cable on level switch is damaged.	• Replace the cable.
13. Pump does not stop when water reservoir is full. Fault indicator light on CU 200 is on.	a) CU 200 is defective.	• Replace the CU 200.
14. Pump does not start when water reservoir is empty. Water reservoir indicator is on.	a) Level switch is defective.	• Replace the level switch.
	b) Cable on level switch is damaged.	• Replace the cable.
	c) CU 200 is defective.	• Replace the CU 200.

### 3.3.2 IO 50 SQFlex switch box

The IO 50 enables manual starting and stopping of the pump in a solar-powered SQFlex system. In addition, the IO 50 functions as a connection point for all necessary cables.



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TM05 5782 3912

TM05 5783 3912

**Fig. 5** Internal (and external) wiring of IO50 SQFlex switch box.

**Technical data:**

DC: Max. 300 V, PE.

AC: Max. 254 V, 50/60 Hz, PE.

Max. current: 8.4A

Ambient temperature: -22 °F to 122 °F (-30 °C to 50 °C)

Enclosure: NEMA 3R

### 3.3.3 IO 101 SQFlex switch box



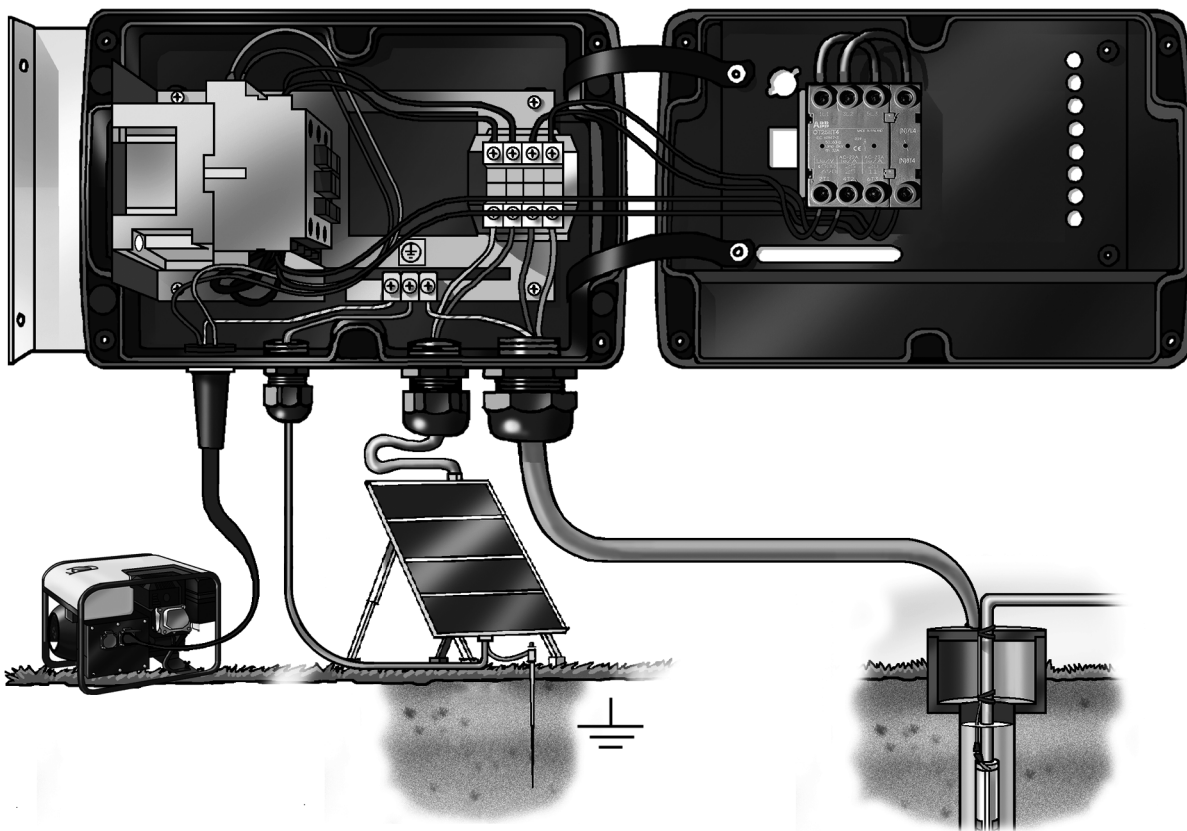
TM04 5694 3809

The IO 101 SQFlex switch box makes it possible to

- switch off the power supply to the pump
- connect a back-up generator.

A back-up generator is useful in periods of insufficient solar energy or in case of an immediate requirement for water supply or a need for water at night.

Fig. 6 IO 101 SQFlex switch box



TM04 5081 2609

Fig. 7 Internal (and external) wiring of the IO 101 SQFlex switch box

#### Technical data

- $V_{\text{contact max.}}$ : 225 VDC, PE.
- $V_{\text{contact max.}}$ : 254 VAC, 50/60 Hz, PE.
- $I_{\text{contact max.}}$ : 8.4 A.
- $I_c < 5$  kA.
- Enclosure class: IP55 and NEMA 3R.
- Ambient temperature: -22 °F to 122 °F (-30 °C to +50 °C).
- $P_{\text{max.}}$ : 4 W.
- $I_{\text{fuse}}$ : 16 A.

The internal relay in the IO 101 has the following rated voltage:

- 230 V - 15 %/+ 10 %, 50/60 Hz, PE
- 115 V - 15 %/+ 10 %, 50/60 Hz, PE.

### 3.3.4 IO 102 SQFlex breaker box



The IO 102 SQFlex breaker box is applicable in SQFlex systems powered by a wind turbine.

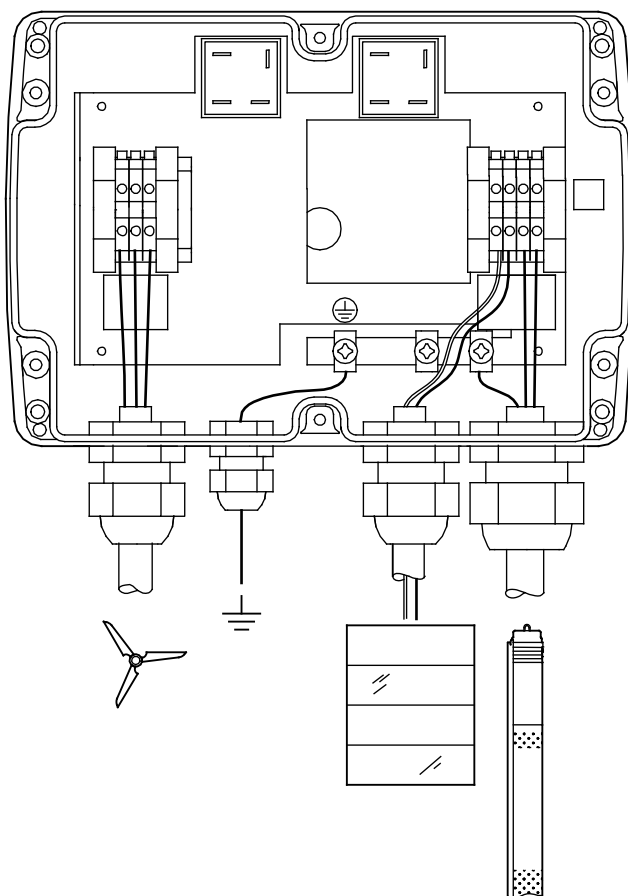
The IO 102 makes it possible to

- switch off the power supply to the pump
- stop the wind turbine blades
- connect solar modules as well as a wind turbine.

The IO 102 is applicable in SQFlex systems provided the system voltages mentioned below are not exceeded.

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Fig. 8 IO 102 SQFlex breaker box



TM02 4500 1102

Fig. 9 Internal (and external) wiring of the IO 102 SQFlex breaker box

#### Technical data

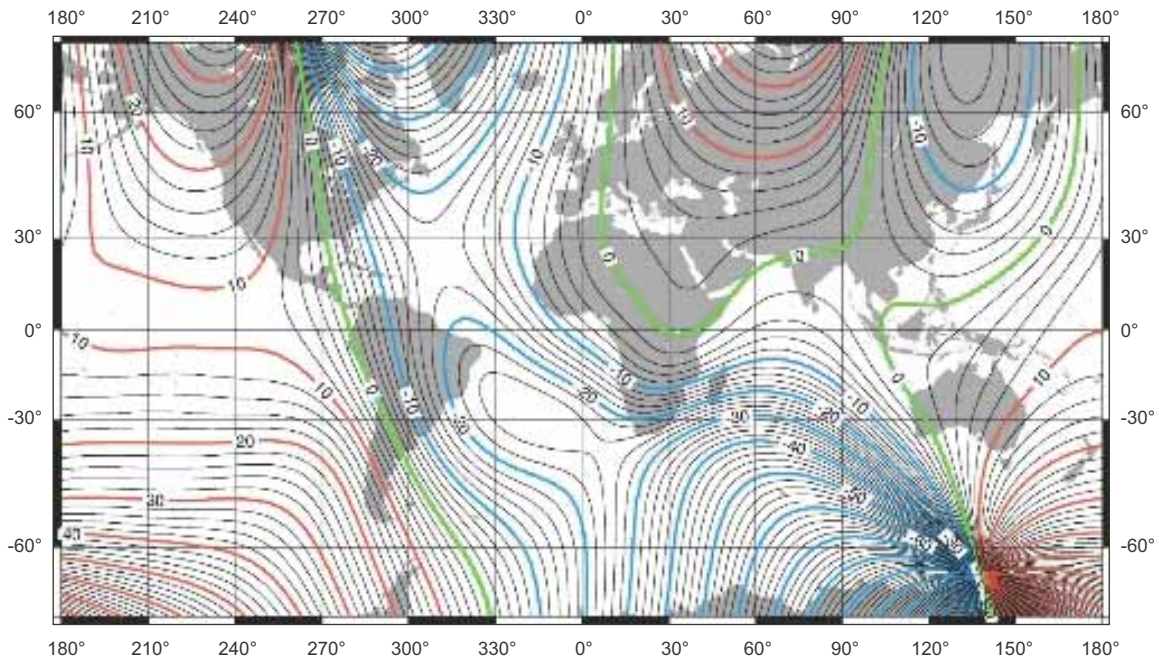
- $V_{\text{contact max.}}$ : 300 VDC, PE.
- $V_{\text{contact max.}}$ : 254 VAC, 50/60 Hz, PE.
- $I_{\text{contact max.}}$ : 8.4 A.
- Enclosure class: IP55 and NEMA 3R.
- Ambient temperature: -22 °F to 122 °F (-30 °C to +50 °C).

### 3.4 Solar modules

#### Positioning

Solar modules located in the **northern hemisphere** should face south. Use a compass to position the modules as precisely as possible. Due to the magnetic declination it may be necessary to turn the modules some degrees away from the direction of the compass. In case of positive declination, turn the modules some degrees to the west, in case of negative declination, turn the modules some degrees to the east. See fig. 10.

Solar modules located in the **southern hemisphere** should face north. Use a compass to position the modules as precisely as possible. Due to the magnetic declination it may be necessary to turn the modules some degrees away from the direction of the compass. In case of positive declination, turn the modules some degrees to the east, in case of negative declination, turn the modules some degrees to the west. See fig. 10.



**Fig. 10** The map illustrates the differences in magnetic declination in different parts of the world. Declination is caused by the fact that the geographic north pole and the magnetic north pole are not located in the same place. Depending on your location on the globe you must turn the solar modules away from the direction of the compass. How much appears from the map.

#### Mounting

The solar modules must be mounted on a support structure.

When mounting the solar modules, make sure that the module frames overlap in order to allow for rain water to run off.

For further information on the installation of solar modules, see installation and operating instructions for the modules.

#### Tilt angle

For maximum utilization of the solar radiation the tilt angle of the support structure can normally be adjusted from 15° to 45°.

### 3.5 GF 43 and GF 50 solar modules



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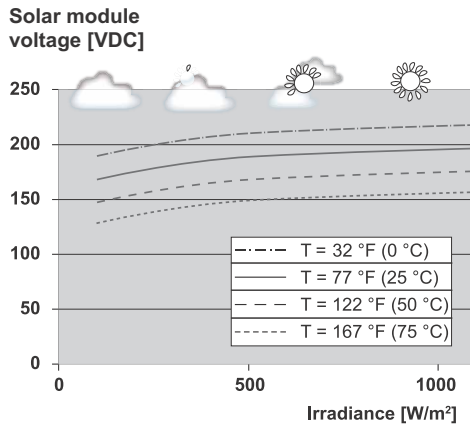
The GF 43 and GF 50 solar modules consist of amorphous silicon thin-film solar cells.

Each solar module is equipped with plugs and sockets for easy connection of several modules in parallel. The solar modules must be mounted on a support structure, tilted at an angle ensuring optimum utilization of the solar energy.

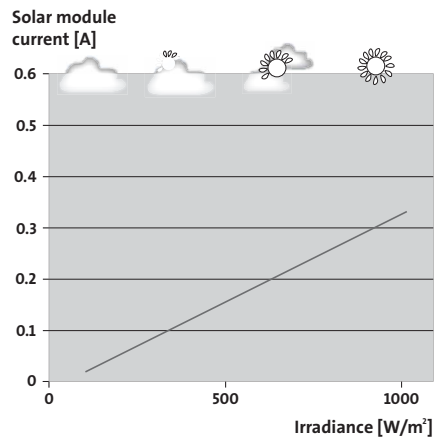
#### Characteristics

Solar module	GF 43	GF 50
Peak power ( $P_{max.}$ )	43 W	50 W
Warranted minimum $P_{max.}$	38.7 W	45 W
Voltage ( $V_{mp}$ )	140 V	156 V
Current ( $I_{mp}$ )	0.31 A	0.32 A
Open-circuit voltage ( $V_{OC}$ )	194 V	202 V
Short-circuit current ( $I_{SC}$ )	0.40 A	0.41 A
Minimum bypass diode	6 A	6 A
Maximum bypass diode	15 A	-

Fig. 11 GF 43 and GF 50 solar modules



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TM02 6882 1903

A = Current read on the graph must be multiplied by the number of solar modules.

Fig. 12 Weather influence on the output

Fig. 13 Weather influence on the output

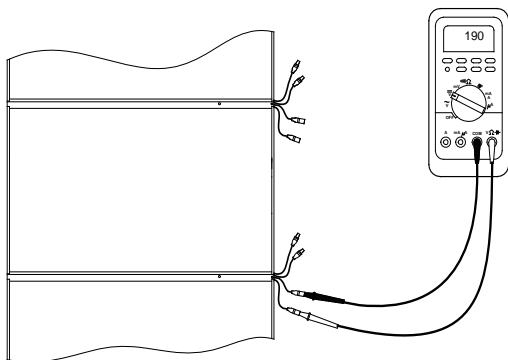


Fig. 14 Measurement of voltage with a multimeter

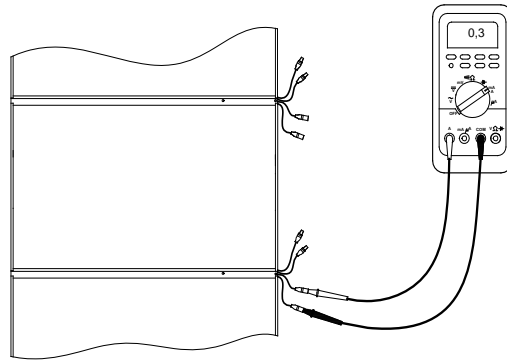


Fig. 15 Measurement of current with a multimeter

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#### Visual inspection of solar modules

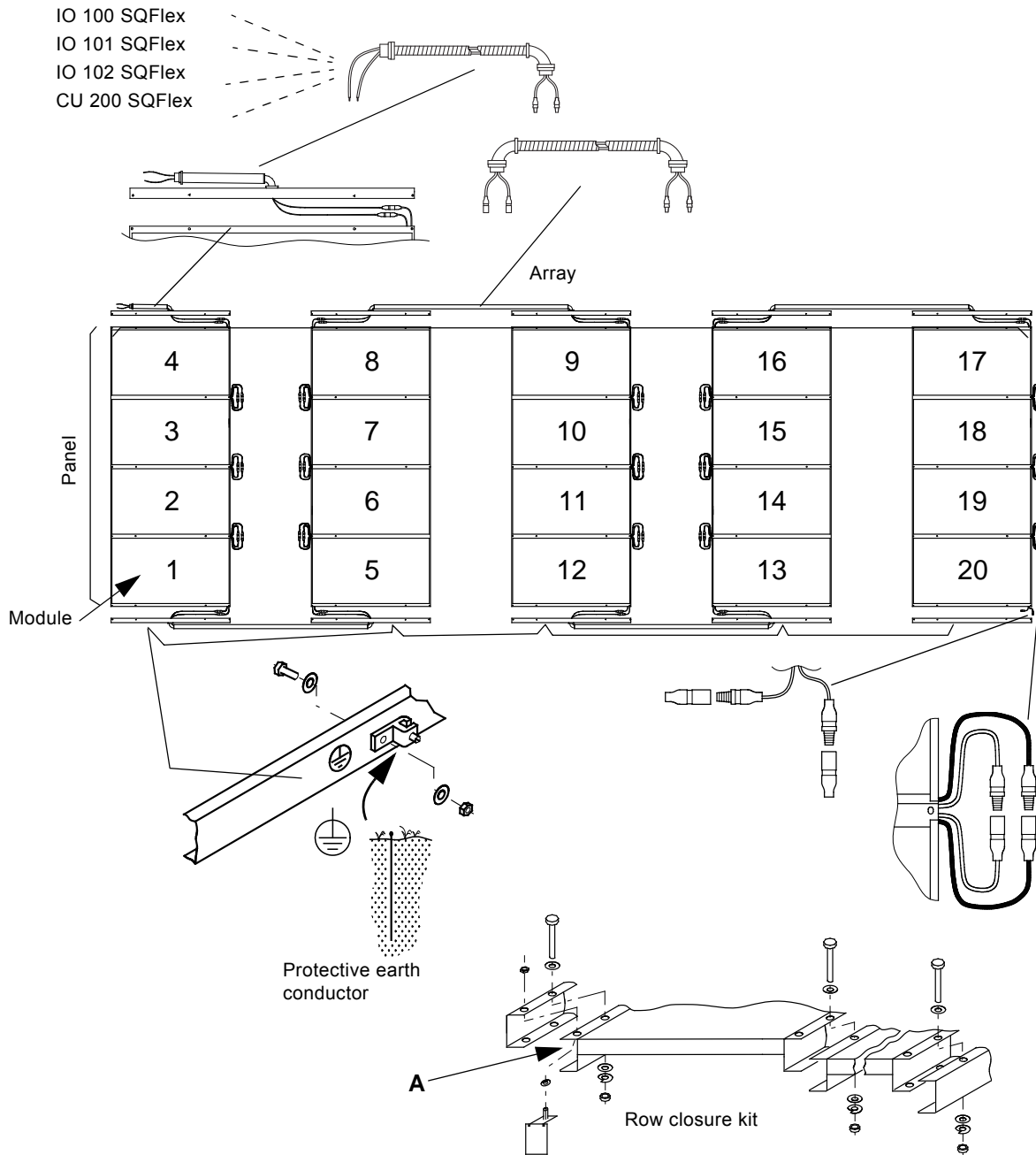
- Check that the solar modules are intact.
- Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.

Electrical connection of GF 43 and GF 50 solar modules

**Note** Before making any electrical connections, make sure that the solar modules are covered with a non-transparent covering material to prevent the modules from producing electricity.

- The cover **must** be removed before the measurement is made.
- Measurements must be made when the solar modules are not connected.
- The current to be measured is the short-circuit current  $I_{SC}$ .

**Note** The Grundfos GF solar modules must not be connected in series.



TM02 4235 0302 - TM02 2553 4501 - TM02 2552 4501 - TM02 4237 0302 - TM02 4230 0302 - TM00 5827 1795 -  
 TM02 4395 0902 - TM02 4239 0302 - TM02 4236 0302 - TM02 4229 0302

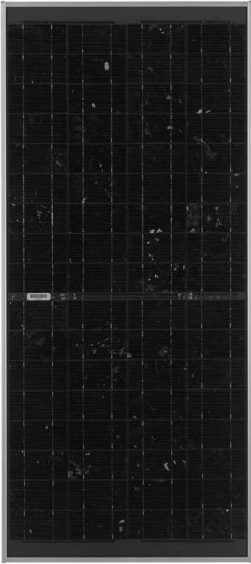
Fig. 16 Accessories needed to connect a PE conductor

The solar panels must be connected to earth via the Protective Earth (PE) conductor supplied with the row closure kit. The PE conductor is connected to the row closure by means of a screw terminal.

**Note** To achieve good earth connection and thus to protect persons, it is of decisive importance to fit the ground clips (pos. A) and ground terminals supplied with the row closure kit.



### 3.6 GF 70 and GF 80 solar modules



The GF 70 and GF 80 solar modules consist of 68 multicrystalline silicon solar cells in series with bypass diodes. The solar cells are laminated between sheets of ethylene vinyl acetate (EVA) and 3 mm high-transmissivity low-iron tempered glass.

Each solar module is equipped with plugs and sockets for easy connection of several modules in parallel or series. The solar modules must be mounted on a support structure, tilted at an angle ensuring optimum utilization of the solar energy.

#### Characteristics

Solar module	GF 70	GF 80
Peak power ( $P_{max.}$ )	70 W	80 W
Voltage ( $V_{mp}$ )	31.8 V	33.3 V
Current ( $I_{mp}$ )	2.2 A	2.4 A
Open-circuit voltage ( $V_{OC}$ )	40.4 V	41.5 V
Short-circuit current ( $I_{SC}$ )	2.4 A	2.6 A
Reference cell temperature ( $T_{cref}$ )	77 °F (25 °C)	77 °F (25 °C)
Solar irradiation at reference cell temperature ( $I_{tref}$ )	1000 W/m <sup>2</sup>	1000 W/m <sup>2</sup>
Net weight	17.0 lbs / 7.7 kg	17.0 lbs / 7.7 kg
Shipping volume	2.12 ft <sup>3</sup> / 0.06 m <sup>3</sup>	2.12 ft <sup>3</sup> / 0.06 m <sup>3</sup>

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Fig. 17 GF 70 and GF 80 solar modules

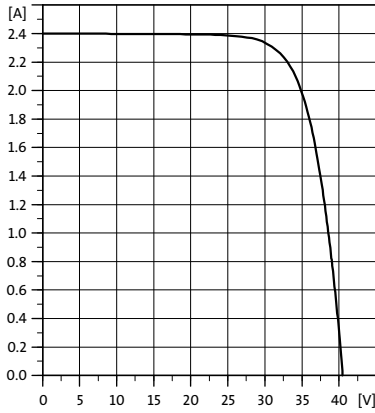


Fig. 18 GF 70 performance at 1000 W/m<sup>2</sup>, 77 °F (25 °C)

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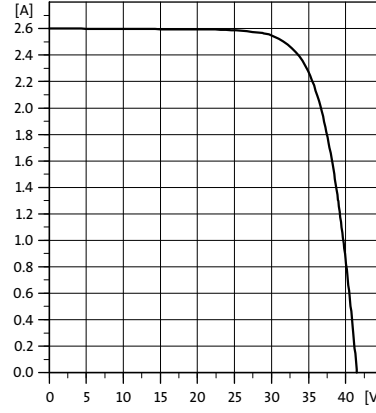


Fig. 19 GF 80 performance at 1000 W/m<sup>2</sup>, 77 °F (25 °C)

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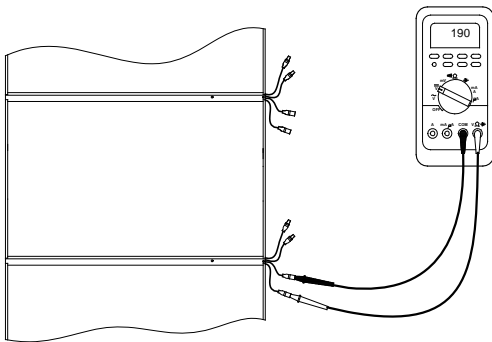


Fig. 20 Measurement of voltage with a multimeter

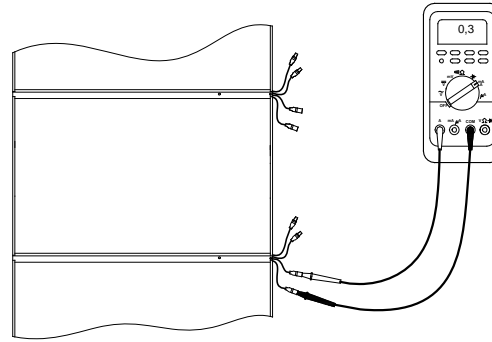


Fig. 21 Measurement of current with a multimeter

TM02 4368 0702

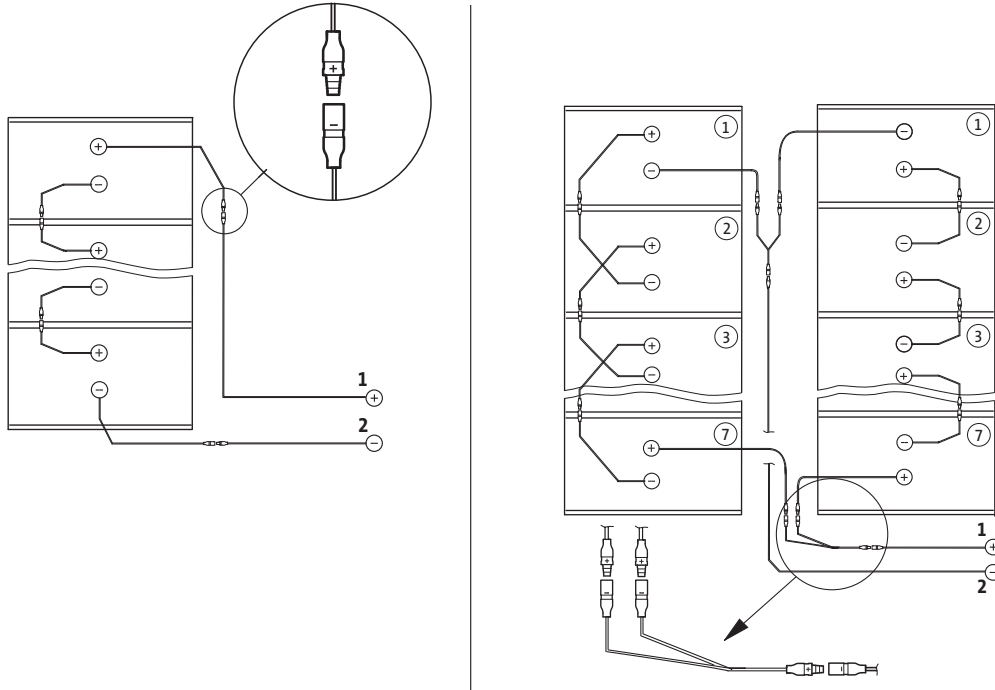
#### Visual inspection of solar modules

- Check that the solar modules are intact.
- Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.

**Electrical connection of GF 70 and GF 80 solar modules**

**Note** *Before making any electrical connections, make sure that the solar modules are covered with a non-transparent covering material to prevent the modules from producing electricity.*

- The cover **must** be removed before the measurement is made.
- Measurements must be made when the solar modules are not connected.
- The current to be measured is the short-circuit current  $I_{SC}$ .



**Fig. 22** Electrical connection of GF 70 and GF 80 solar modules

The solar panels must be connected to earth via a **Protective Earth (PE)** conductor.

**Note** *To achieve good earth connection and thus to protect persons, it is of decisive importance to fit the ground clips and ground terminals.*

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### 3.7 SX-110 solar modules



Gr4943

The SX-110 solar modules consist of 72 multicrystalline silicon solar cells in series with bypass diodes installed.

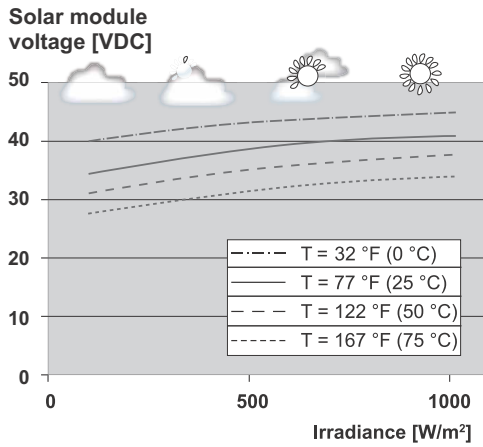
Each solar module is equipped with plugs and sockets for easy connection of several modules in parallel or series. The solar modules must be mounted on a support structure, tilted at an angle ensuring optimum utilization of the solar energy.

This module is UL-, TÜV- and IEC 61215-approved.

#### Characteristics

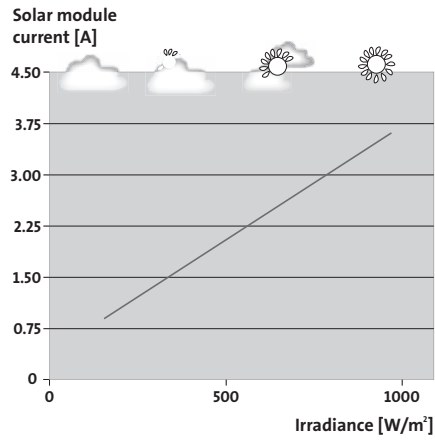
Solar module	SX-110
Peak power ( $P_{max.}$ )	110 W
Voltage ( $V_{mp}$ )	32.9 V
Current ( $I_{mp}$ )	3.34 A
Open-circuit voltage ( $V_{OC}$ )	41.2 V
Short-circuit current ( $I_{SC}$ )	3.69 A
Reference cell temperature ( $T_{cref}$ )	25 °C
Solar irradiation at reference cell temperature ( $I_{tref}$ )	1000 W/m <sup>2</sup>

Fig. 23 SX-110 solar modules



TM05 5290 3612

Fig. 24 Weather influence on the output



TM02 6960 2203

Fig. 25 Weather influence on the output

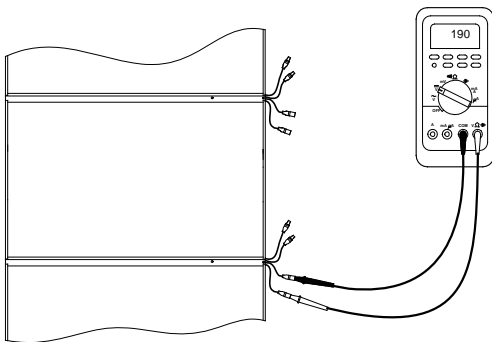


Fig. 26 Measurement of voltage with a multimeter

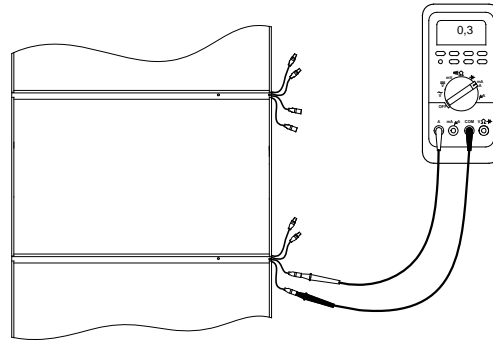


Fig. 27 Measurement of current with a multimeter

TM02 4368 0702

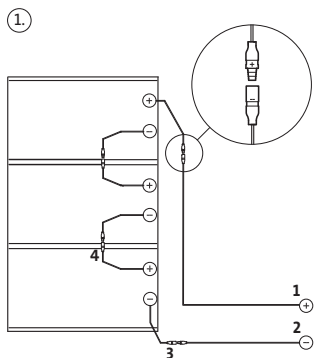
#### Visual inspection of solar modules

- Check that the solar modules are intact.
- Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.

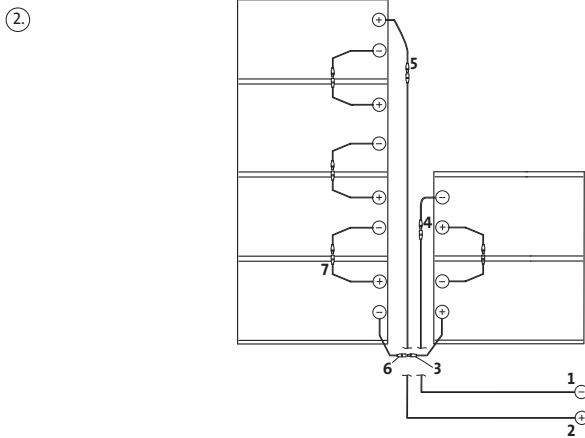
### 3.8 Electrical connection of SX-110 solar modules

**Note** Before making any electrical connections, make sure that the solar modules are covered with a non-transparent covering material to prevent the modules from producing electricity.

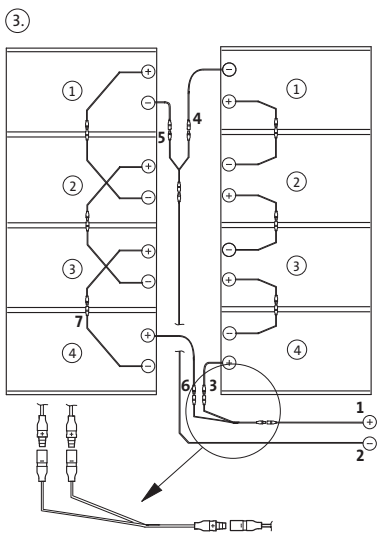
- The cover **must** be removed before the measurement is made.
- Measurements must be made when the solar modules are not connected.
- The current to be measured is the short-circuit current  $I_{SC}$ .



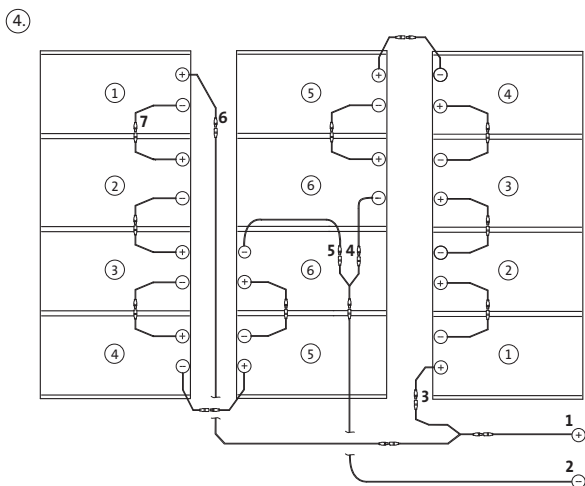
Plug	Modules	Voltage [v]	Current [A]
1 - 2	4	164	3,7
	3	123	3,7
	2	82	3,7
	1	41	3,7
3 - 4	1	41	3,7



Plug	Modules	Voltage [v]	Current [A]
1 - 2	7	288	3,7
	6	247	3,7
	5	206	3,7
3 - 4	2	82	3,7
	1	41	3,7
5 - 6	4	165	3,7
6 - 7	1	41	3,7



Plug	Modules	Voltage [v]	Current [A]
1 - 2	8	165	7,4
3 - 4	4	165	3,7
	5 - 6	1	41
6 - 7	1	41	3,7



Plug	Modules	Voltage [v]	Current [A]
1 - 2	12	247	7,4
3 - 4	6	247	3,7
	5 - 6	1	41
6 - 7	1	41	3,7

**Fig. 28** Electrical connection of SX-110 solar modules

The solar panels must be connected to earth via a Protective Earth (PE) conductor.

### 3.9 FS-50-D solar modules

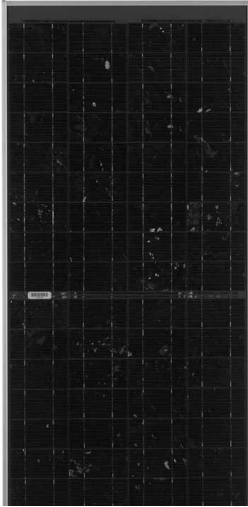


Fig. 29 FS-50-D solar modules

TM04 5085 2609

The FS-50-D solar modules consist of thin-film of semiconductor material on glass. Each solar module is equipped with plugs and sockets for easy connection of several modules in parallel or series. The solar modules must be mounted on a support structure, tilted at an angle ensuring optimum utilization of the solar energy. This module is UL- and IEC 61646-approved.

Characteristics	
Solar module	FS-50-D
Peak power ( $P_{max.}$ )	50 W
Voltage ( $V_{mp}$ )	65 V
Current ( $I_{mp}$ )	0.77 A
Open-circuit voltage ( $V_{OC}$ )	90 V
Short-circuit current ( $I_{SC}$ )	1 A
Maximum series fuse rating	2 A
Reference cell temperature ( $T_{cref}$ )	25 °C
Solar irradiation at reference cell temperature ( $I_{tref}$ )	1000 W/m <sup>2</sup>

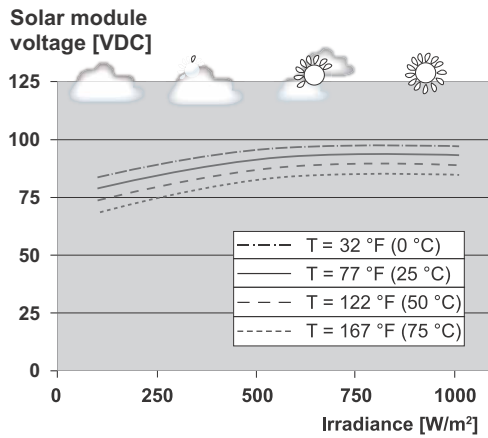


Fig. 30 Weather influence on the output

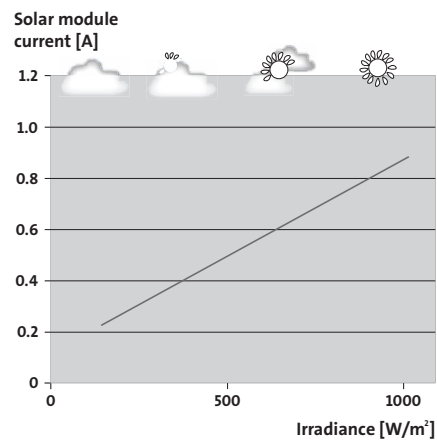


Fig. 31 Weather influence on the output

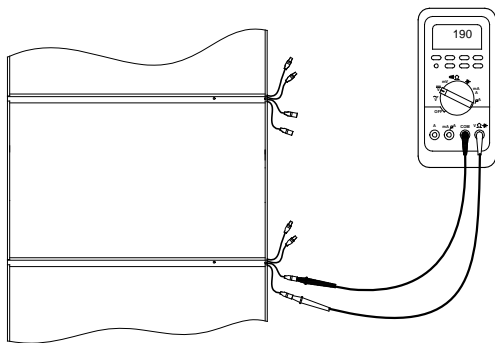


Fig. 32 Measurement of voltage with a multimeter

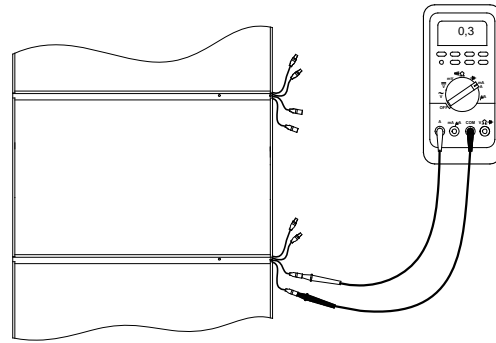


Fig. 33 Measurement of current with a multimeter

#### Visual inspection of solar modules

- Check that the solar modules are intact.
- Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.

TM02 6962 2003

TM02 4368 0702

Electrical connection of FS-50-D solar modules

**Note** Before making any electrical connections, make sure that the solar modules are covered with a non-transparent covering material to prevent the modules from producing electricity.

- The cover **must** be removed before the measurement is made.
- Measurements must be made when the solar modules are not connected.
- The current to be measured is the short-circuit current  $I_{SC}$ .

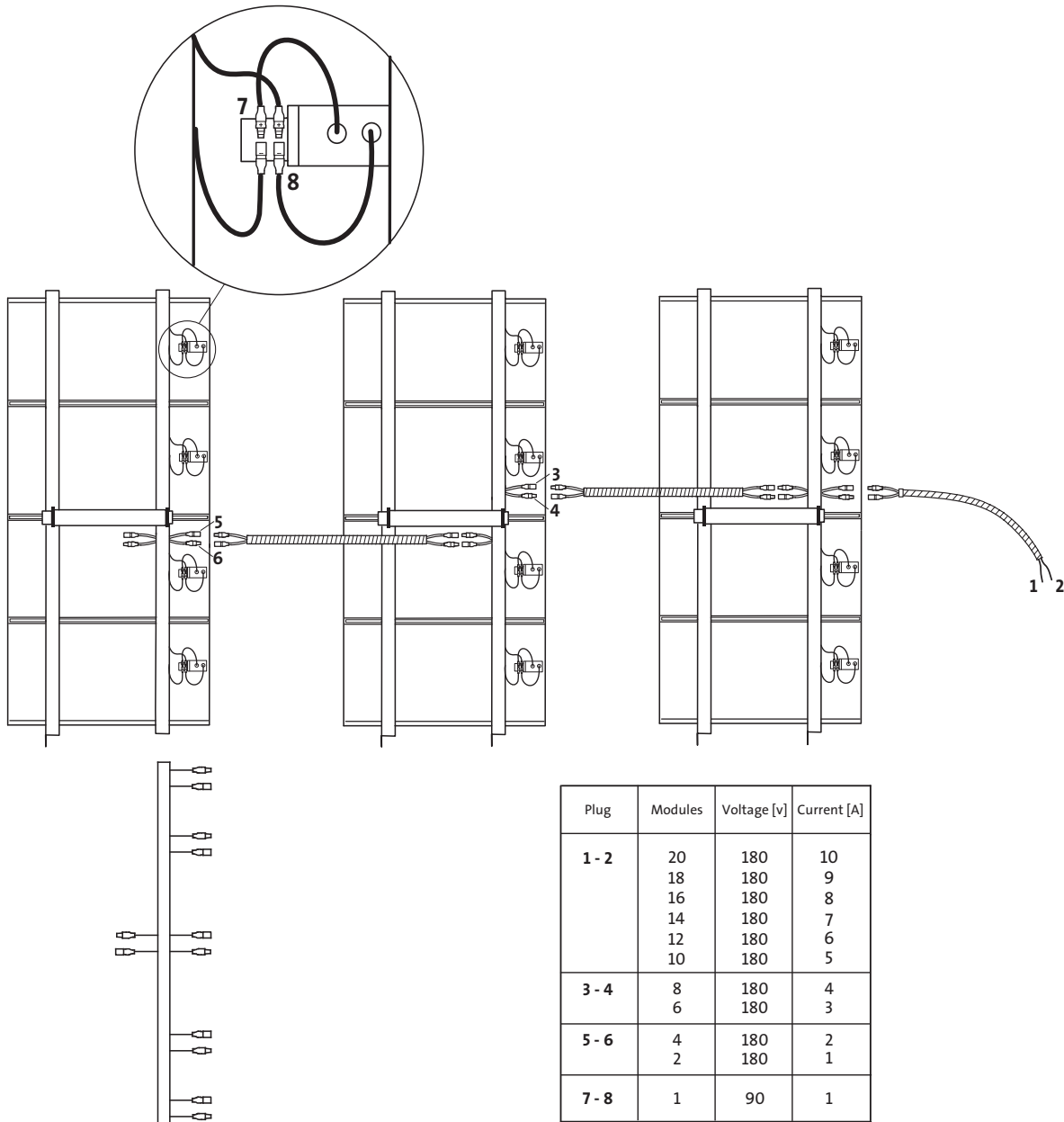


Fig. 34 Electrical connection of FS-50-D solar modules

The solar panels must be connected to earth via a Protective Earth (PE) conductor.

TM02 6874 1903

### 3.10 GF 55C and GF 65C solar modules

The GF 55C and GF 65C solar modules consist of 68 multicrystalline silicon cells in series. Each solar module is equipped with plugs and sockets for easy connection of several modules in parallel or series. The solar modules must be mounted on a support structure, tilted at an angle ensuring optimum utilization of the solar energy. This module is UL-, TÜV- and IEC 61215-approved.

Characteristics		
Solar module	GF 55C	GF 65C
Peak power ( $P_{max.}$ )	55 W	65 W
Voltage ( $V_{mp}$ )	30.6 V	31.4 V
Current ( $I_{mp}$ )	1.8 A	2.1 A
Open-circuit voltage ( $V_{OC}$ )	39.0 V	39.7 V
Short-circuit current ( $I_{SC}$ )	2.0 A	2.3 A
Reference cell temperature ( $T_{cref}$ )	25 °C	25 °C
Solar irradiation at reference cell temperature ( $I_{tref}$ )	1000 W/m <sup>2</sup>	1000 W/m <sup>2</sup>

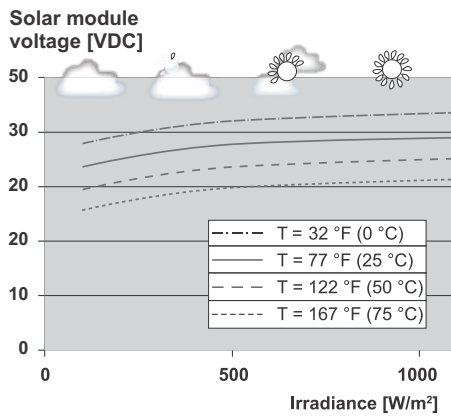


Fig. 35 Weather influence on the output (GF 55C)

TM05 5364 3612

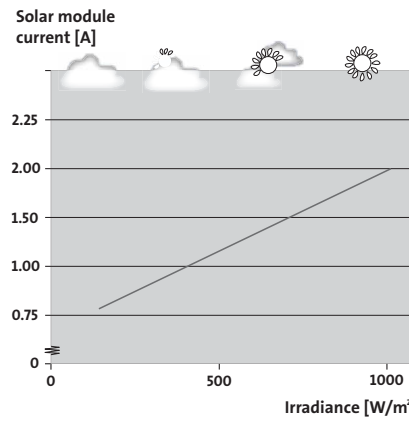


Fig. 36 Weather influence on the output (GF 55C)

TM02 8822 0904

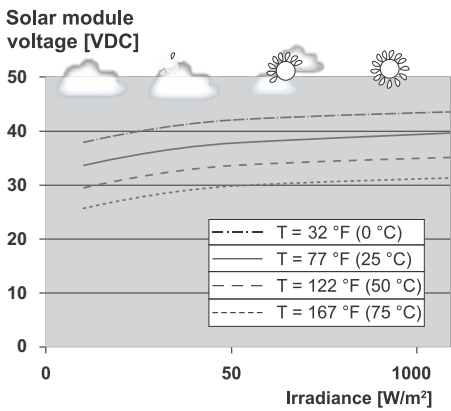


Fig. 37 Weather influence on the output (GF 65C)

TM05 5365 3612

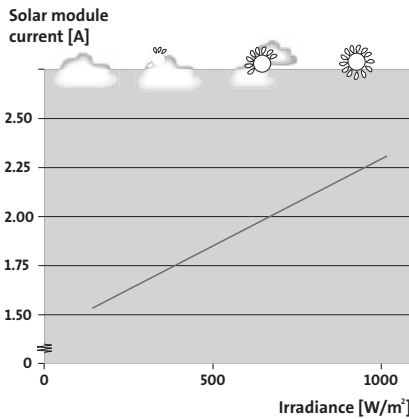
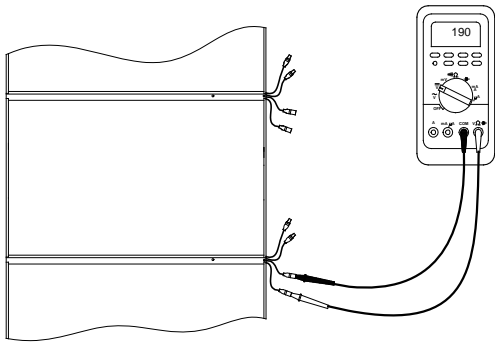
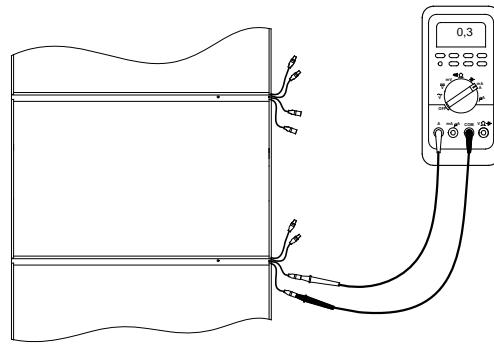


Fig. 38 Weather influence on the output (GF 65C)

TM02 8821 0904



**Fig. 39** Measurement of voltage with a multimeter



**Fig. 40** Measurement of current with a multimeter

TM02 4368 0702

#### Visual inspection of solar modules

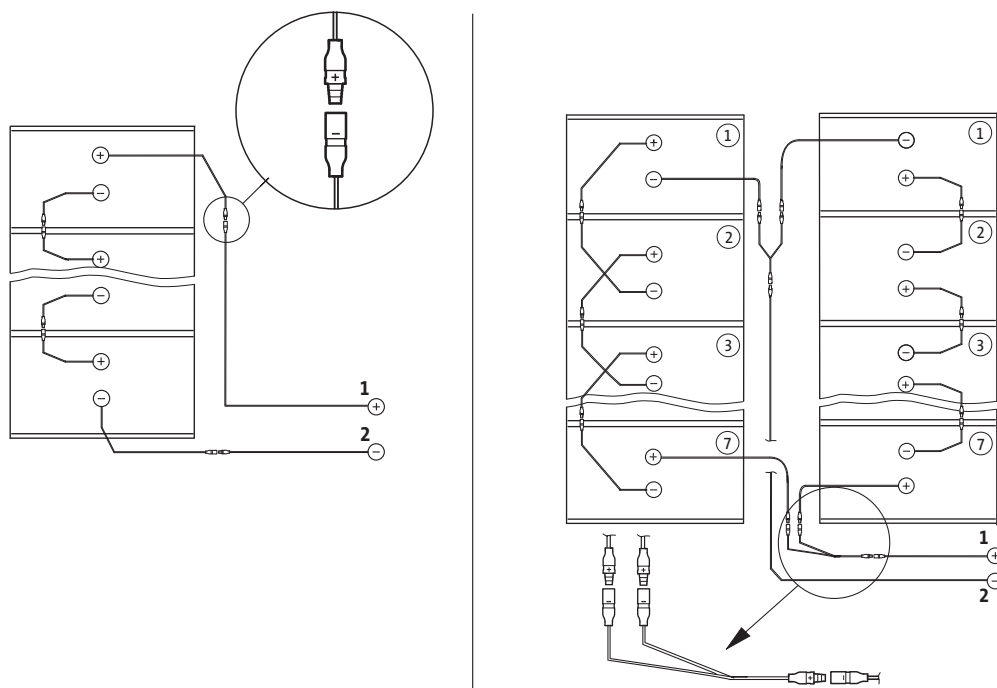
- Check that the solar modules are intact.
- Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.



### 3.11 Electrical connection of GF 55C and GF 65C solar modules

**Note** Before making any electrical connections, make sure that the solar modules are covered with a non-transparent covering material to prevent the modules from producing electricity.

- The cover **must** be removed before the measurement is made.
- Measurements must be made when the solar modules are not connected.
- The current to be measured is the short-circuit current  $I_{SC}$ .



TM02 9039 1604

**Fig. 41** Electrical connection of GF 55C and GF 65C solar modules

The solar panels must be connected to earth via a Protective Earth (PE) conductor.

**Note** To achieve good earth connection and thus to protect persons, it is of decisive importance to fit the ground clips and ground terminals.

Modules	Series	Parallel	GF 55C		GF 65C	
			$V_{OC}$ [V]	$I_{SC}$ [A]	$V_{OC}$ [V]	$I_{SC}$ [A]
2	2	1	39	2	79.4	2.3
3	3	1	117	2	119.1	2.3
4	4	1	156	2	158.8	2.3
5	5	1	195	2	198.5	2.3
6	6	1	234	2	238.2	2.3
7	7	1	273	2	277.9	2.3
8	4	2	156	4	158.8	4.6
9	3	3	117	6	119.1	6.9
10	5	2	195	4	198.5	4.6
12	6	2	234	4	238.2	4.6
14	7	2	273	4	277.9	4.6
15	5	3	195	6	198.5	6.9
16	4	4	156	8	158.8	9.2
18	6	3	234	6	238.2	6.9
20	5	4	195	8	198.5	9.2

### 3.12 GTF 55 solar modules



The GTF 55 solar modules consist of thin-film of semiconductor material on glass substrates. The module is equipped with cost-effective aluminium mounting frame.

Low temperature coefficients provide more power at actual operating conditions.

Proven durability eliminates the need for expensive frames to prevent delamination in the field.

Architecturally aesthetic uniform black appearance.

Weatherproof connectors and cord plate eliminate the need for a junction box and module-to-module field wiring.

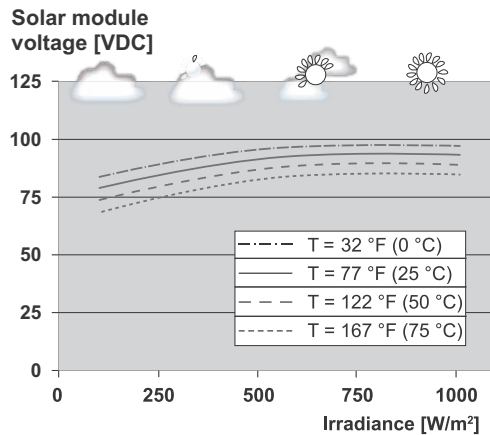
Each solar module is equipped with plugs and sockets for easy connection of several modules in parallel or series. The solar modules must be mounted on a support structure, tilted at an angle ensuring optimum utilization of the solar energy.

This module is UL- and IEC 61646-approved.

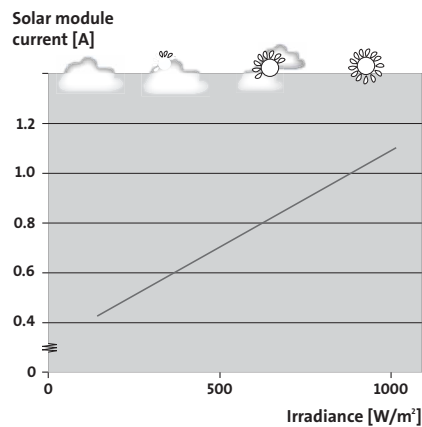
TM02 8296 4903

Characteristics	
Solar module	<b>GTF 55</b>
Peak power ( $P_{max.}$ )	55 W
Voltage ( $V_{mp}$ )	63 V
Current ( $I_{mp}$ )	0.87 A
Open-circuit voltage ( $V_{OC}$ )	89 V
Short-circuit current ( $I_{SC}$ )	1.1 A
Reference cell temperature ( $T_{cref}$ )	25 °C
Solar irradiation at reference cell temperature ( $I_{tref}$ )	1000 W/m <sup>2</sup>

Fig. 42 GTF 55 solar modules



TM05 5363 3612



TM02 8823 0904

Fig. 43 Weather influence on the output

Fig. 44 Weather influence on the output

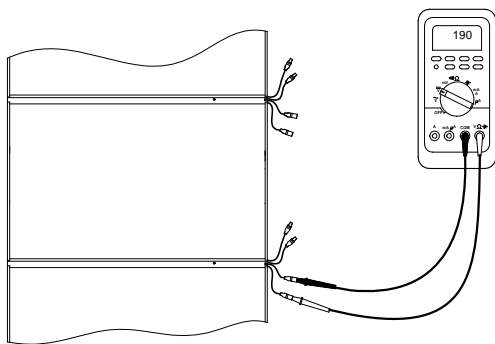


Fig. 45 Measurement of voltage with a multimeter

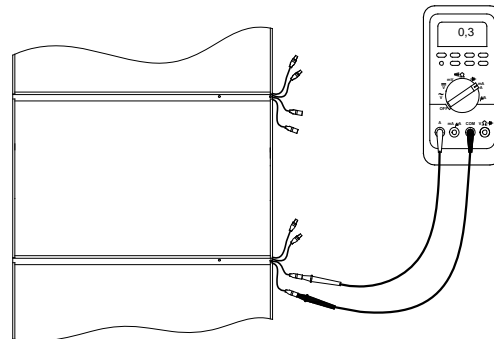


Fig. 46 Measurement of current with a multimeter

TM02 4368 0702

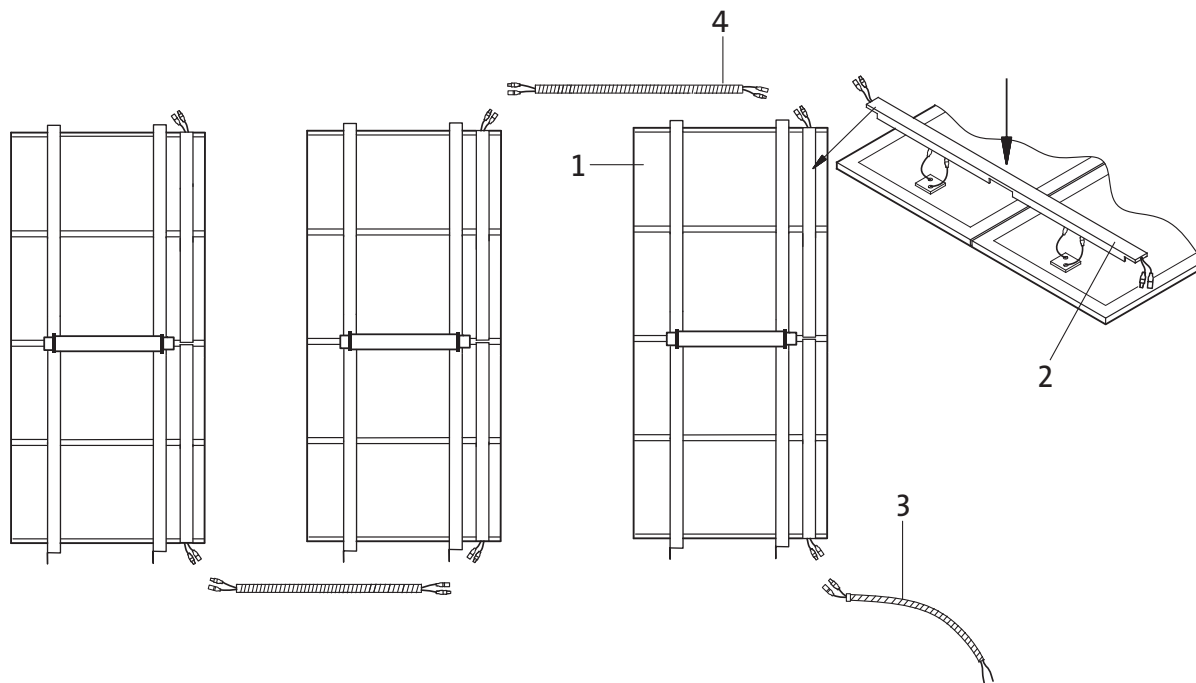
#### Visual inspection of solar modules

- Check that the solar modules are intact.
- Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.

**Electrical connection of GTF 55 solar modules**

**Note** Before making any electrical connections, make sure that the solar modules are covered with a non-transparent covering material to prevent the modules from producing electricity.

- The cover **must** be removed before the measurement is made.
- Measurements must be made when the solar modules are not connected.
- The current to be measured is the short-circuit current  $I_{SC}$ .



TM02 6874 1903

**Fig. 47** Electrical connection of GTF 55 solar modules

Pos.	Product
1	Solar module GTF 55
2	Cable guards and connection wire kit
3	Array-to-controller wire kit
4	Array-to-array wire kit

The solar panels must be connected to earth via a Protective Earth (PE) conductor.

**Note** To achieve good earth connection and thus to protect persons, it is of decisive importance to fit the ground clips and ground terminals.

Modules	Series	Parallel	GTF 55	
			V <sub>oc</sub> [V]	I <sub>sc</sub> [A]
4	2	2	126	1.7
6	2	3	126	2.6
8	2	4	126	3.5
10	2	5	126	4.4
12	2	6	126	5.2
14	2	7	126	6.1
16	2	8	126	7.0
18	2	9	126	7.8
20	2	10	126	8.7

### 3.13 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules

Option 1: For protection of array-to-controller wire.

Options 1 and 2: Full protection of all wires.

Solar module		Array-to-controller wire kit	Array-to array wire kit	Option 1	Option 2	Connection	
GF 70 (96616395)	GF 80 (96616391)			Conduit for array-to-controller wire	Cable guard		Array-to-array wire kit with conduit
		91126024	91126023	96521496	96537654	96537655	
2 modules		1	0	1	2	0	2 in series, 1 in parallel
3 modules		1	0	1	3	0	3 in series, 1 in parallel
4 modules		1	0	1	4	0	4 in series, 1 in parallel
5 modules		1	0	1	5	0	5 in series, 1 in parallel
6 modules		1	0	1	6	0	6 in series, 1 in parallel
7 modules		1	0	1	7	0	7 in series, 1 in parallel
8 modules		1	0	1	8	0	8 in series, 1 in parallel
9 modules		1	2	1	9	2	3 in series, 3 in parallel
10 modules		1	1	1	10	1	5 in series, 2 in parallel
12 modules		1	1	1	12	1	6 in series, 2 in parallel
14 modules		1	1	1	14	1	7 in series, 2 in parallel
15 modules		1	2	1	15	2	5 in series, 3 in parallel
16 modules		1	1	1	16	1	8 in series, 2 in parallel
18 modules		1	2	1	18	2	6 in series, 3 in parallel
20 modules		1	3	1	20	3	5 in series, 4 in parallel
24 modules		1	2	1	24	2	8 in series, 3 in parallel

Solar module					Array-to-controller wire kit	Array-to-array wire kit	Option 1	Option 2	
GF 90 (96622741)	GF 101 (96616699)	GF 110 (96620115)	GF 120 (96640652)	GF 130 (96643057)			Conduit for array-to-controller wire	Cable guard	Array-to-array wire kit with conduit
					91126024	91126023	96521496	96613607	96537655
1 module					1	0	1	1	0
2 modules					1	0	1	2	0
3 modules					1	0	1	3	0
4 modules					1	1	1	4	1
6 modules					1	1	1	6	1
8 modules					1	3	1	8	3
9 modules					1	2	1	9	2
10 modules					1	4	1	10	4
12 modules					1	3	1	12	3
14 modules					1	6	1	14	6
15 modules					1	4	1	15	4
16 modules					1	7	1	16	7
18 modules					1	5	1	18	5

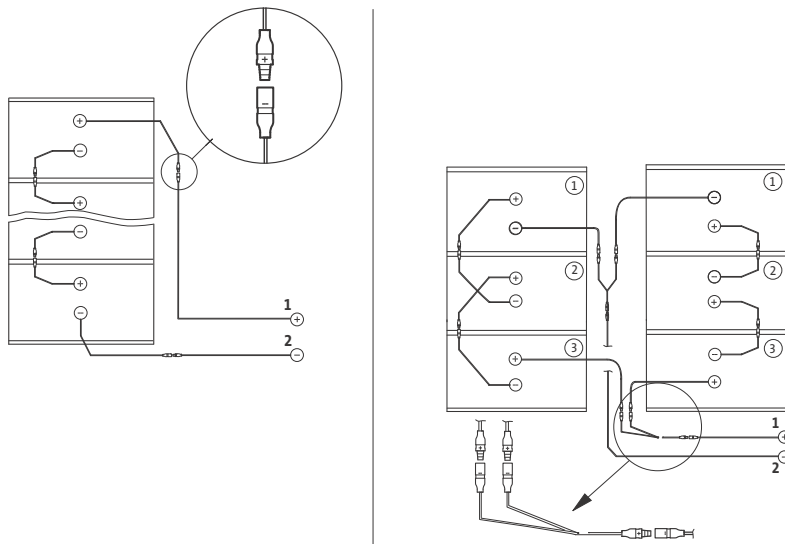
#### Mounting

1. Place the modules on a flat, clean surface with the front downwards.
2. Place the support structure rails on the modules, and fasten the rails.
3. Connect the array-to-controller wire.
4. Fasten the modules to the pole or the feet of the support structure.
5. Cover the modules with an opaque cover, carpet or similar to prevent the modules from producing electricity during the installation.
6. Cut the array-to-controller wire to size.
7. **Option 1 only:** Fit the conduit to the array-to-controller wires.
8. Connect the wires to the terminals in the switch box/CU 200.
9. Connect all the wires according to the selected configuration, i.e. in series/parallel.

**If options 1 and 2 are selected:**

1. Place the modules on a flat, clean surface with the front downwards.
2. Place the support structure rails on the modules, and fasten the rails.
3. Remove one knockout wire entry in the cable guard at the first module where the conduit and the array-to-controller wire are to be fitted.
4. Cut the array-to-controller wire to size.
5. Fit the conduit to the array-to-controller wire, and connect the array-to-controller wire to the module wires.
6. Connect the array-to-array wire, if used.
7. Connect all the wires according to the selected configuration, i.e. in series/parallel.
8. Fit the cable guards to the back of the modules with the screws supplied.  
Take care not to damage the wires when the cable guards are fitted.
9. Fasten the modules to the pole or the feet of the support structure.
10. Cover the modules with an opaque cover, carpet or similar to prevent the modules from producing electricity during the installation.
11. Connect the wires to the terminals in the switch box/CU 200.

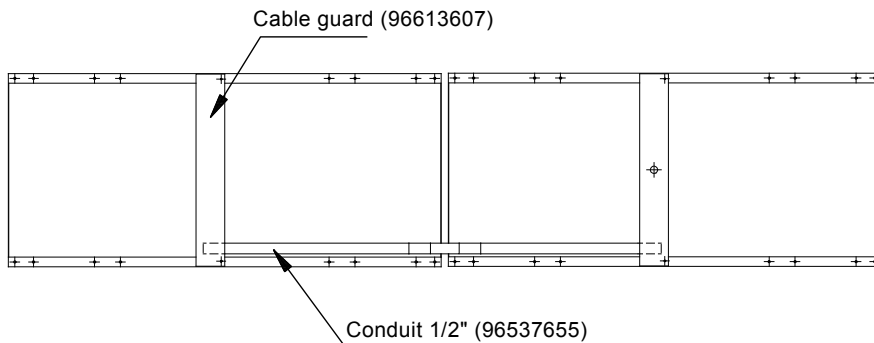
Modules	In series	In parallel
2	2	1
3	3	1
4	2	2
6	3	2
8	2	4
9	3	3
10	2	5
12	3	4
14	2	7
15	3	5
16	2	8
18	3	6



TM03 3531 0606

**Fig. 48** Two or three GF solar modules connected in series

If more than three GF solar modules are required, the modules must be connected in parallel.



TM02 9038 1604

**Fig. 49** Example of option 2

### 3.14 GF100TF solar modules

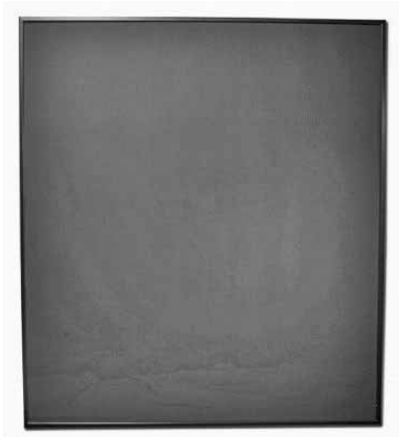


Fig. 50 GF100TF solar module

The GF100TF solar modules are equipped with plugs and sockets for easy connection of several modules in parallel or series. The solar modules must be mounted on a support structure, tilted at an angle ensuring optimum utilization of the solar energy.

This module is UL, CE and IEC 646 and 61730 approved.

Characteristics	GF100TF
Peak power ( $P_{Max}$ )	100 W
Voltage ( $V_{mp}$ )	70 V
Current ( $I_{mp}$ )	1.43 A
Open circuit voltage ( $V_{oc}$ )	96 V
Short circuit current ( $I_{sc}$ )	1.7 A
Reference cell temperature ( $T_{cref}$ )	77 °F (25 °C)
Solar irradiation at reference cell temperature ( $I_{tref}$ )	1000 W

TM05 0052 0611

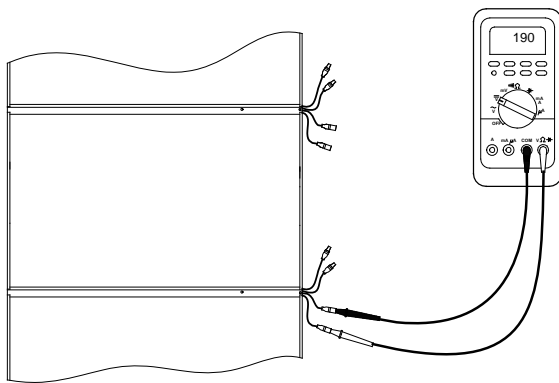


Fig. 51 Measurement of voltage with a multimeter.

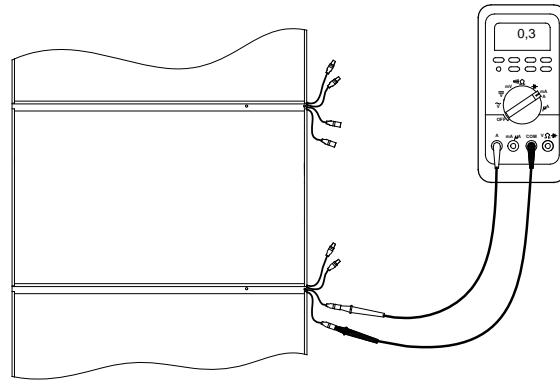


Fig. 52 Measurement of current with a multimeter.

TM02 4368 0702

#### 3.14.1 Visual inspection of GF100TF solar modules

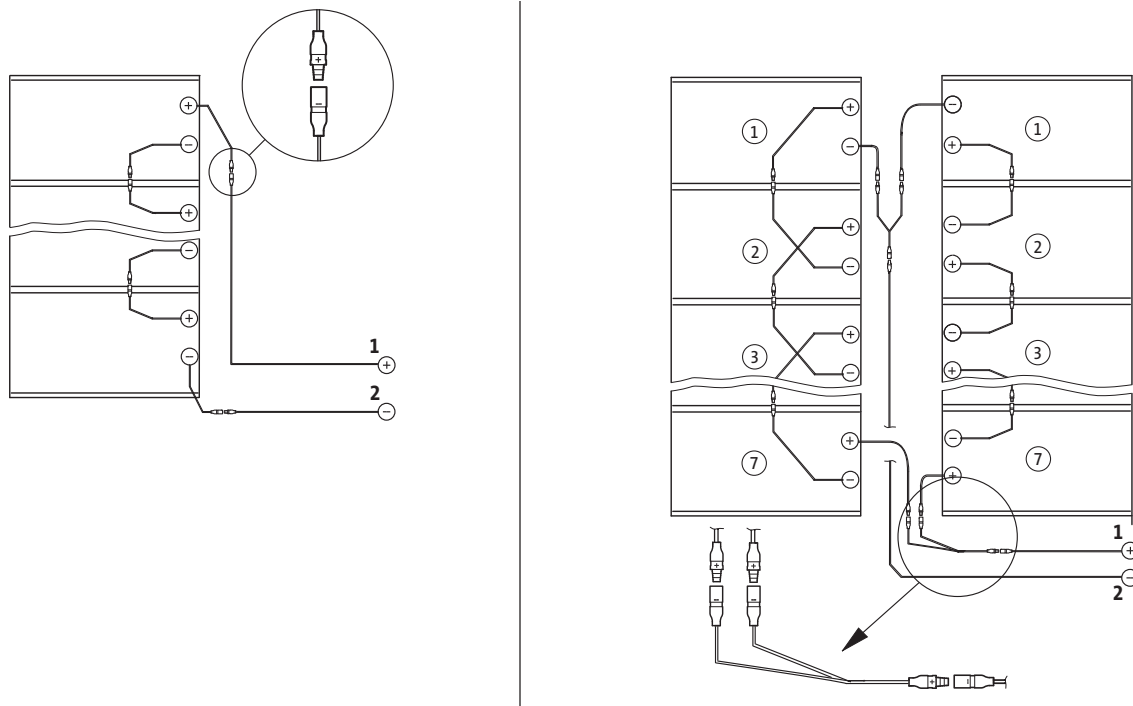
- Check that the solar modules are intact.

**Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.**

### 3.14.2 Electrical connection GF100TF solar modules

Note: Before making any electrical connections, make sure that the solar modules are covered with a non-transparent covering material to ensure that the modules are dead.

- The cover must be removed before measuring is made.
- Measurements must be made when the solar modules are not connected.
- The current to be measured is the short-circuit current  $I_{SC}$ .



TM02 8643 0604

**Fig. 53** The solar panels must be grounded via a Protective Earth (PE) conductor.

**Note:** To achieve good ground connection and thus to protect personnel, it is very important to fit the ground clips and ground terminals.

### Cable sizing chart

Since the SQFlex motor operates at peak efficiency with 120V or greater applied, we strongly recommend configuring panels to achieve 120V or greater.

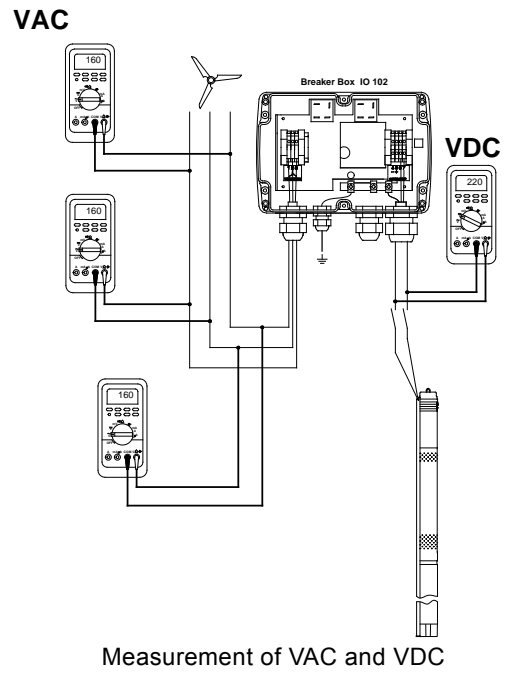
Lower voltages result in greater losses in the drop cable, and it is important to the customer to make efficient use of every watt generated. Additionally, significant savings in drop cable costs can be realized by configuring for higher voltages.

Panels	Power [Wp]	Voltage [Vmp]	14 AWG	12 AWG	10 AWG	Amps [Imp]	Series	Parallel
1	100	70	290	461	733	1.4	1	
2	200	140	580	922	1466	1.4	2	
3	300	210	871	1383	2199	1.4	3	
4	400	280	1161	1844	2932	1.4	4	
6	600	210	435	692	1099	2.9	3	2
6	600	140	193	307	489	4.3	2	3
8	800	280	580	922	1466	2.9	4	2
8	800	140	145	231	366	5.7	2	4
9	900	210	290	461	733	4.3	3	3
10	1000	140	116	184	293	7.1	2	5
12	1200	280	387	615	977	4.3	4	3
15	1500	210	174	277	440	7.1	3	5
16	1600	280	290	461	733	5.7	4	4
18	1800	210	145	231	366	8.6	3	6
20	2000	140	58	92	147	14.3	2	10

**Notes:** Max. cable length in ft; uses a max. 3 % voltage drop.  
Based on the Grundfos GF100TF panel.  
Max. cable length between CU200 and SQFlex = 650 ft (198 m).



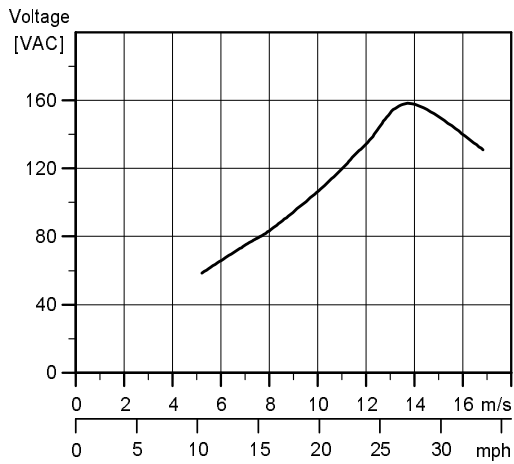
### 3.15 Wind turbine



TM04 5087 2609

TM02 4367 4902

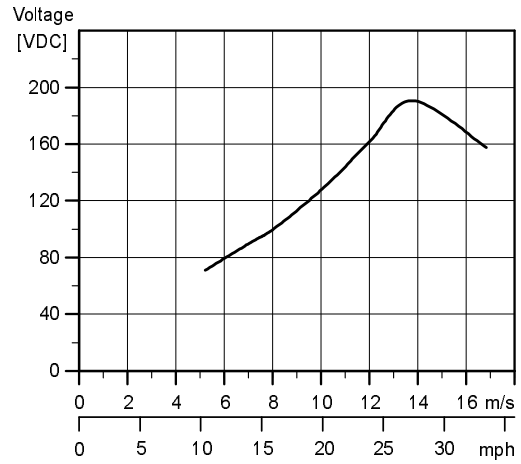
**Wind turbine voltage [VAC]**



TM04 5525 3309

**Fig. 54** Measurement of VAC

**IO 102 voltage [VDC]**



TM04 5526 3309

**Fig. 55** Measurement of VDC

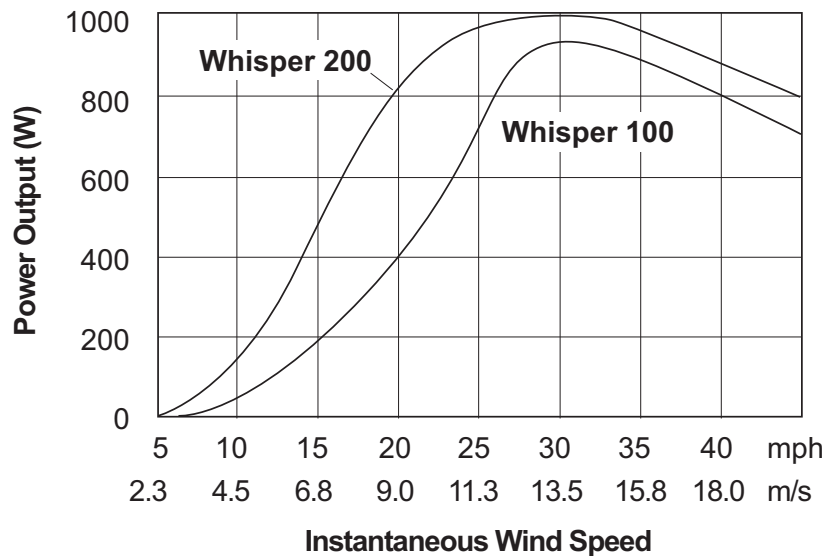
Note: The values measured between the three phases must be identical.

### 3.15.1 Troubleshooting

- Find out if the problem is mechanical or electrical.
  - Propeller cannot turn = Mechanical problem, see *3.15.2 Mechanical troubleshooting table* on page 35.
  - Propeller turns slowly = Electrical problem, see *3.15.3 Electrical troubleshooting table* on page 36. Electrical problems may be in the wind turbine or the IO 102 breaker box. Determine which as follows:
- Disconnect the three wires from the wind turbine one at a time at the IO 102 breaker box. If the propeller starts, the wire that allowed it to start leads to a defective rectifier in the IO 102 breaker box. Replace the breaker box, see *Overview of possible system combinations* on page 43.
- If the propeller still does not start, the problem is in the tower wiring or the wind turbine.
  - The propeller is running, but may have an electrical problem. Using a voltmeter, read the voltage across the leads and see the list below as a guide to possible problems.
    - The voltage increases and decreases slowly with wind speed and equally across all wires = Everything OK.
    - No voltage across two wires = One wire from wind turbine is not carrying power. Check in order:
      - the tower wiring to ensure it is properly wired.
      - slip rings and brushes,
      - stator connections and stator windings for obvious damage.
    - The voltage is significantly higher across two wires than the others = Contact the distributor or the factory.
    - Voltage is produced even after ON/OFF switch is activated = Possibly a faulty ON/OFF switch or a wire has been short circuited to the other two wires or an internal fault has occurred in the IO 102 breaker box.
    - The voltage is significantly lower across two wires than the others = Bad connection at the wind turbine voltage connections or faulty stator winding.
  - Should these steps not solve the problem, proceed directly to *3.15.3 Electrical troubleshooting table* on page 36.

### Wind turbine power output

#### Instantaneous speed



TM05 2574 0212

## 3.15.2 Mechanical troubleshooting table



**Note: Always be aware of the danger of high voltage. Do not directly touch the wires.**

Fault	Possible cause	Remedy
1. Propeller is stationary, even in high winds.	a) Ice in wind turbine, or uneven ice on propeller.	• Remove ice, or wait for warm weather.
	b) Debris between rotor and stator.	• Turn propeller gently by hand, and blow or use piece of paper to dislodge debris.
	c) Loose magnet.	• Contact distributor.
	d) Worn-out bearing.	• Contact distributor.
2. Propeller will not turn at all except in high wind.	a) Ice in wind turbine, or uneven ice on propeller.	• Remove ice, or wait for warm weather.
3. Scraping or rubbing sound at low speed.	a) Debris between rotor and stator.	• Turn the propeller gently by hand, and blow or use a piece of paper to dislodge debris.
4. The propeller always stops in the same position	a) Swelled wire keepers due to high moisture.	• Contact distributor.
5. Propeller is difficult to start.	a) Ice on blade.	• Remove ice, or wait for warm weather.
6. Output is low.	a) Dirty blade.	• Clean with soap or bug cleaner.
7. More propeller noise than usual.	a) Split, warped or damaged blade.	• Replace broken or damaged blade.
8. Propeller seems out of balance.	a) One or more blades fitted wrongly.	• Fit blade(s) correctly.
9. Propeller turns a little, but never starts properly.	a) Blades fitted wrongly.	• Fit blades correctly. Leading edge should move clockwise when viewing propeller from the front.
10. Tail, wind turbine and tower vibrate.	a) Blade out of balance.	• Contact distributor.
	b) Blade not tracking.	
11. Rattling or clunking sound from wind turbine.	a) wind turbine loose in tower.	• Retighten mounting screws. Use Loctite or equivalent thread-locking compound.
	b) Loose rotor (magnet can) on shaft, loose tail, missing rubber bumper, wires slapping inside of mast, governor pivot bolt loose.	• Repair as required.
	c) Worn bearings.	• Contact distributor.
	d) Shaft broken.	• Contact distributor.

## 3.15.3 Electrical troubleshooting table



**Note:** Always be aware of the danger of high voltage. Do not directly touch the wires.

Fault	Possible cause	Remedy
1. Pump does not operate and propeller do not turn or turns slowly even in high winds.	a) The wind speed is too slow.	• Wait for the wind speed to increase.
	b) The IO 102 ON/OFF switch is set to OFF.	• Set the IO 102 ON/OFF switch to ON.
	c) Pump defective or pump cable short circuit.	• Set IO 102 ON/OFF switch to OFF. Disconnect the pump from IO 102. Set ON/OFF switch to ON. If the propeller starts to turn, either the pump or the pump cable is defective. Set IO 102 ON/OFF switch to OFF. Replace the defective part and reconnect to IO 102. Set ON/OFF switch to ON.
	d) IO 102 is defective.	• Set IO 102 ON/OFF switch to ON. Disconnect the three wires from the wind turbine one at the time at the IO 102. if the propeller starts to turn the IO 102 is defective. Replace the IO 102.
2. Pump does not operate and propeller turns fast.	a) Wires between IO 102 and pump may be disconnected.	• Set IO 102 ON/OFF switch to OFF. Reconnect the wires. Set IO 102 ON/OFF switch to ON.
	b) Pump defective.	• Set IO 102 ON/OFF switch to OFF. Replace the pump. Set IO 102 ON/OFF switch to ON.
3. The pump does not operate. The propeller turns fast and does not slow down when the IO 102 ON/OFF switch is set to OFF.	a) One or more wires between wind turbine and IO 102 may be disconnected.	• Set IO 102 ON/OFF switch to OFF. Reconnect the wires. Set IO 102 ON/OFF switch to ON.
	b) IO 102 defective.	• Try to disconnect the three wires from the wind turbine in the IO 102 and short circuit them. If the propeller slows down or stops, the IO 102 is defective. Replace the IO 102.
	c) Wind turbine defective.	• Set IO 102 ON/OFF switch to OFF. Replace wind turbine. Set IO 102 ON/OFF switch to ON.

## 4. Charge controller

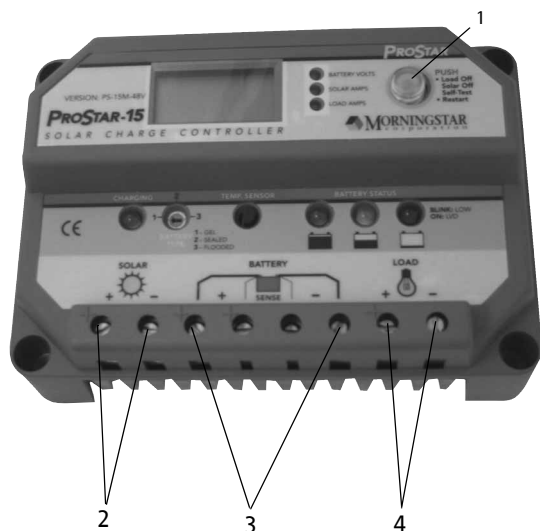


Fig. 56 Charge controller

The charge controller is used for battery charging. The charge controller is a fully automatic battery charger, and the only setting required is the selection of battery type.

There are three battery types to choose from:

- gel battery
- sealed battery
- flooded battery.

The charge controller enables manual disconnection of the pump, the solar modules or both at the same time via the push-button.

Pos.	Description
1	Push-button (Load Off/Solar Off/Self-Test/Restart)
2	Cable entry for power supply (solar input)
3	Cable entry for back-up batteries
4	Cable entry for pump (load)

### Display disconnect and protections

The following protection functions and disconnect conditions will be displayed in the digital meter when they occur:

LUD	LVD, low-voltage load disconnect (load only)
Hud	High-voltage disconnect (both solar and load)
Hot	High-temperature disconnect (both solar and load)
OCP	Overcurrent and short-circuit protection (load, solar current)
0.0	Short-circuit protection (solar only).

### Self-diagnostics (self-test)

If the push-button is pressed for four seconds, the charge controller will go into automatic self-diagnostics.

**Note** *The button must be released to start the self-test.*

END --- END display continues if no error was detected.

END END display continues if an error was detected.

To terminate the self-test, push the button.

The self-test can be repeated to confirm the result.

### Error list

E01	Rotary-switch battery selection failure
E03	Voltage reference test failed (circuit, malfunctions)
E04	Solar array current fault (circuit, FETs)
E07	Load FETs off test (load connection, FETs shorted)
E08	Load current fault (circuit, FETs)
E09	Load FETs on test (load circuit, FETs open)
E10	Internal temperature sensor out of range high
E11	Internal temperature sensor out of range low
E12	Remote temperature probe out of range
E13	Battery sense fault (battery V drop over 5 V, no sense negative connection).

If the self-diagnostic test indicates that no failures were found, it is very likely that the problem is with the solar system or battery.

**Battery is not charging**

- Check the green CHARGING LED above the solar input. With sunlight on the solar array, this LED should be on.
- Check that the proper BATTERY TYPE has been selected.
- Check that all wire connections in the system are correct and tight. Check the polarity (+/-) of the connections.
- Measure the solar array open-circuit voltage (disconnected from the controller), and confirm it is normal. If the array voltage is low or zero, correct the fault in the array.
- Confirm that the load is not drawing more energy than the solar array can provide.
- If the BATTERY SENSE terminals are not used, there may be excessive voltage drops between the charge controller and the battery. This is a common cause of undercharging batteries.
- Check the condition of the battery. Determine if the battery voltage falls at night with no load. If the battery is unable to maintain its voltage, it may be failing.
- Measure the solar input voltage (during daytime) and battery voltage at the charge controller terminals. If the voltages at the terminals are the same (within about 0.5 V), the solar array is charging the battery. If the solar voltage is close to open-circuit voltage (about 20 V), and the battery voltage is low, the controller is not charging the battery and may be defective. Make sure that the charge controller is not in regulation (PWM) for this test.

**Note**

***If the battery is not being fully recharged, measure the voltage at the battery terminals on the charge controller and then at the terminals on the battery. This should be done at midday with full charging from the solar array (and not in PWM regulation). If the charge controller terminals are 1 V higher than the battery terminals, for example, this voltage drop will cause the battery to regulate 1 V below its desired regulation (PWM) voltage, and it will take longer to recharge. In this case, the SENSE terminals should be connected to the battery for accurate charging.***

**Load is not operating properly**

- Check that the load is connected and turned on. Confirm that no fuses or circuit breakers in the system are tripped (there are no fuses or circuit breakers inside the charge controller).
- Check all connections to the load and battery connections. Make sure that voltage drops in the system are not too high (a voltage drop to the load will reduce the voltage at the load).
- Check the LED indications on the charge controller. If the red status LED is on, the load has been disconnected due to low battery voltage (LVD). This is a normal protection function of the charge controller, and the load will be automatically reconnected when the battery is charged by the solar array.
- If the LEDs are flashing, the load may have been disconnected for protection from one of the following faults:
  - short-circuit or overload (R/G-Y sequencing)

**Note**

***After three automatic retries, the fault must be cleared, and the load must be switched off or disconnected for 10 seconds or longer to restore power to the load terminals.***

- high temperature (R-Y sequencing)
- high voltage (R-G sequencing).
- Measure the voltage at the BATTERY terminals. If above LVD and no faults are present, the load should have power. Then measure the voltage at the LOAD terminals. If there is no voltage present, the controller may be defective.

## 5. Start-up

The starting sequence has three steps:

1. Charging the capacitor
2. positioning of the rotor
3. start.

During start-up the motor will make small rotations in order to bring the rotor into the correct starting position. These rotations also ensure that there is water in the pump and that the pump parts are lubricated.

During start-up current consumption will be uneven but when the motor has started, current consumption will be constant.

Helical rotor pumps:

- If sufficient energy is available the pump will normally be running within one minute.
- If sufficient energy is available and the motor does not start within 15 minutes, the pump rotor may be stuck due to dryness. This situation can arise if the pump has been stocked for some time. Dismantle the pump and loosen the rotor, or add water to the pump rotor/stator assembly.
- If sufficient energy is not available the starting sequence will be repeated.

Please note that after the pump has started running, it will take a while to fill the riser pipe. How long depends on the energy available, the installation depth and the dimensions of the riser pipe. At moderate energy supply and high head, it may take up to one hour.

## 6. Maintenance

This section describes how to maintain solar modules and wind turbines. Under normal operating conditions the pumps and the controls are maintenance-free.

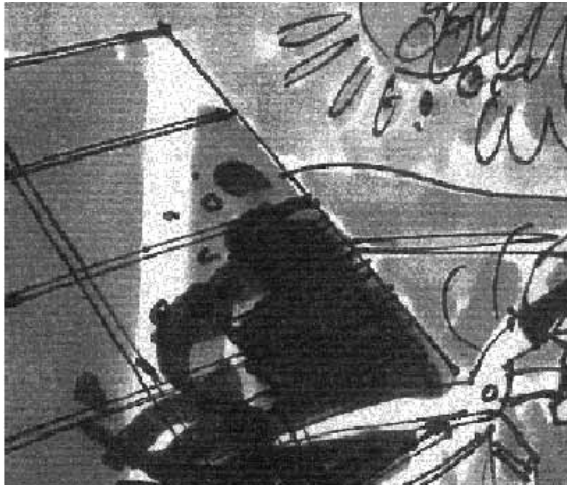
### 6.1 Solar modules

#### 6.1.1 Routine maintenance



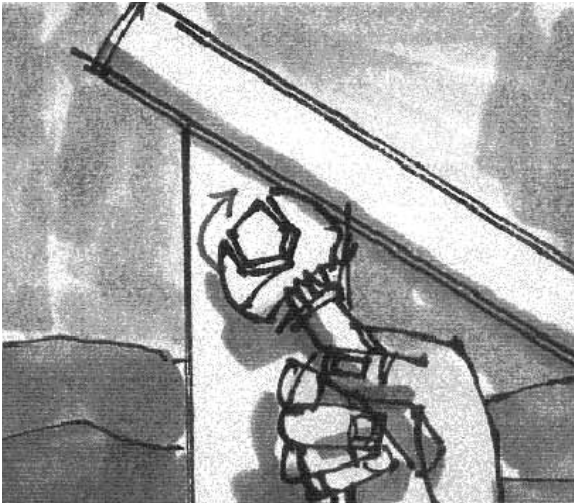
##### Cleaning

- The solar modules must be cleaned when they are dirty. Use only clean water without soap and a soft brush or cloth. Make sure there is no sand or other abrasive particles in the water.
- There is no need to clean the modules underneath.



##### Cleaning

- Make sure that the sun can shine directly on the modules.
- Cut down grass or trees that cast a shadow on the solar modules.



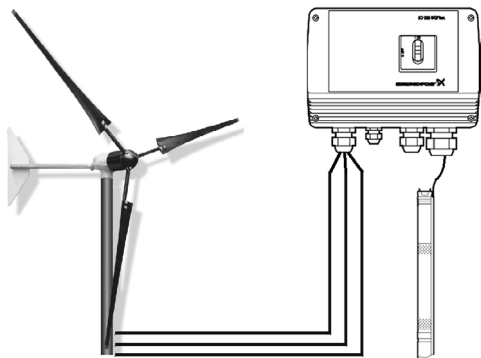
##### Tighten

- Tighten screws and nuts on the support structure if they have loosened.



## 6.2 Wind turbine

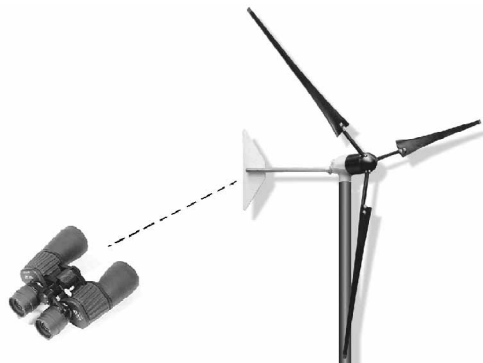
### 6.2.1 Monthly maintenance



#### Test brake

(This checks electrical wiring.)

Stop the wind turbine in a moderate wind (charging but not furling). No unusual difficulty or noise should be experienced in stopping the propeller. A noise during braking can indicate a disconnected wire.

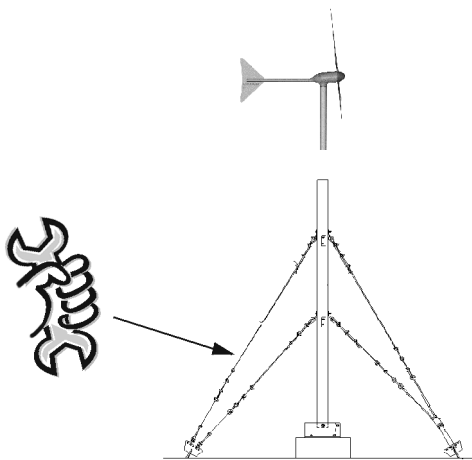


#### Check mechanical condition

Watch and listen from the tower base.

Use binoculars. The propeller and tail must not wobble. There should be no mechanical noise, rattle or vibration.

Lower or climb the tower for inspection, if required. There should be no buzzing either heard or felt with your hand on the tower mast. Go to Section 3.15.3 *Electrical troubleshooting table* on page 36, if required.



#### Inspect the tower

Follow all inspection and maintenance requirements of the tower manufacturer.

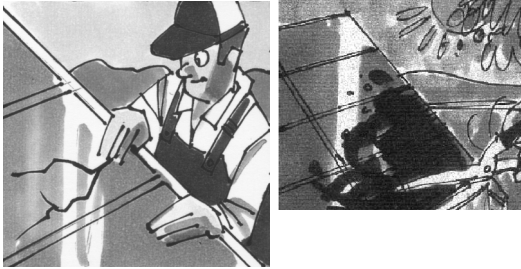
Tighten all nuts and screws, especially wire clips. Check for cracks and bent or broken parts at the anchors and base structure. Check for broken wire strands and tighten guys.

### 6.2.2 Annual maintenance

## 7. Troubleshooting

### 7.1 Visual/general inspection of main components

Before starting specific Troubleshooting, go through these simple visual inspections first.

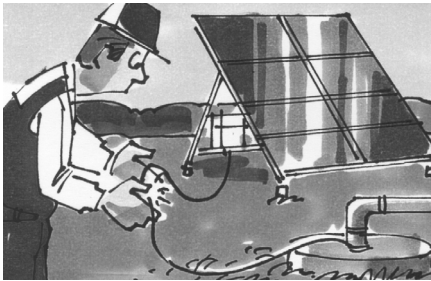


#### Visual inspection of solar modules

- Check that the solar modules are intact.
- Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.

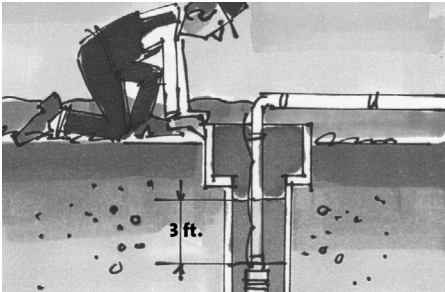
#### Visual inspection of the wind turbine

- See *Check mechanical condition* on page 41.



#### Visual inspection of cables

- Check that the cables are intact.



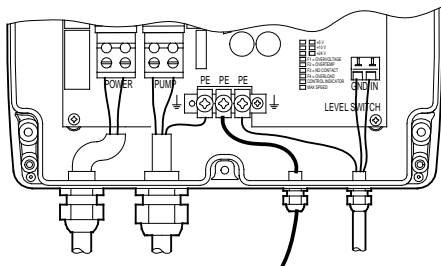
#### Visual inspection of the water level

- The water level must be at least 3 ft. (0.9 m) above the pump.
- The dry running sensor must be under water.



#### Visual inspection of pipes and hoses

- Check that hoses or pipes are intact.










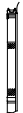





















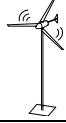













#### Test by means of a service CU200




If available, a CU 200 can be used for testing systems without a CU 200. Connect the CU 200 and proceed according to the instructions in Section 8.13 *Testing the pump by means of CU 200 SQFlex3 control unit* on page 73.

**Overview of possible system combinations**

1. In the table below, find the system corresponding to your system.
2. Follow the fault correction instructions for your system.  
In systems with solar modules, fault correction must be carried out in the middle of an unclouded day.

3. Find the faulty component, and repair/replace it, or contact the Grundfos Service Center stating the data from the component's nameplate.

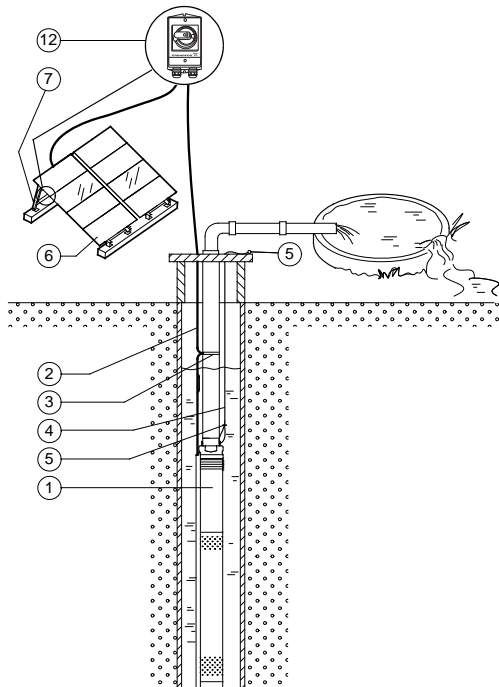
System	System components							
	Pump	Solar panel	Wind turbine	Generator/battery	Charge controller	Switch box or breaker box	Control unit	Additional extras
7.1.1 Solar-powered system on page 45.								
7.1.3 Solar-powered system with CU 200 control unit and level switch on page 47.								 (**)
7.1.5 Solar-powered system with generator back-up on page 49.								
7.2 SQFlex Solar with CU 200 control unit, level switch and back-up generator on page 51.								 (**)
7.3 SQFlex Solar with back-up batteries on page 53.								 Pressure tank  Pressure switch
7.2 SQFlex Solar with CU 200 control unit, level switch and back-up generator on page 51.								
7.3.4 Wind-powered system with CU 200 control unit and level switch on page 57.								 (**)
7.3.6 Combined system on page 59.								
7.3.8 Combined system with CU 200 control unit and level switch on page 61.								 (**)

		System components							
System		Pump	Solar panel	Wind turbine	Generator/battery	Charge controller	Switch box or breaker box	Control unit	Additional extras
7.3.10 Options with generator as back-up source on page 63.			(*)	(*)			 IO 101	(*)	(*)

(\*) May be a component in the system.

(\*\*) Optional.

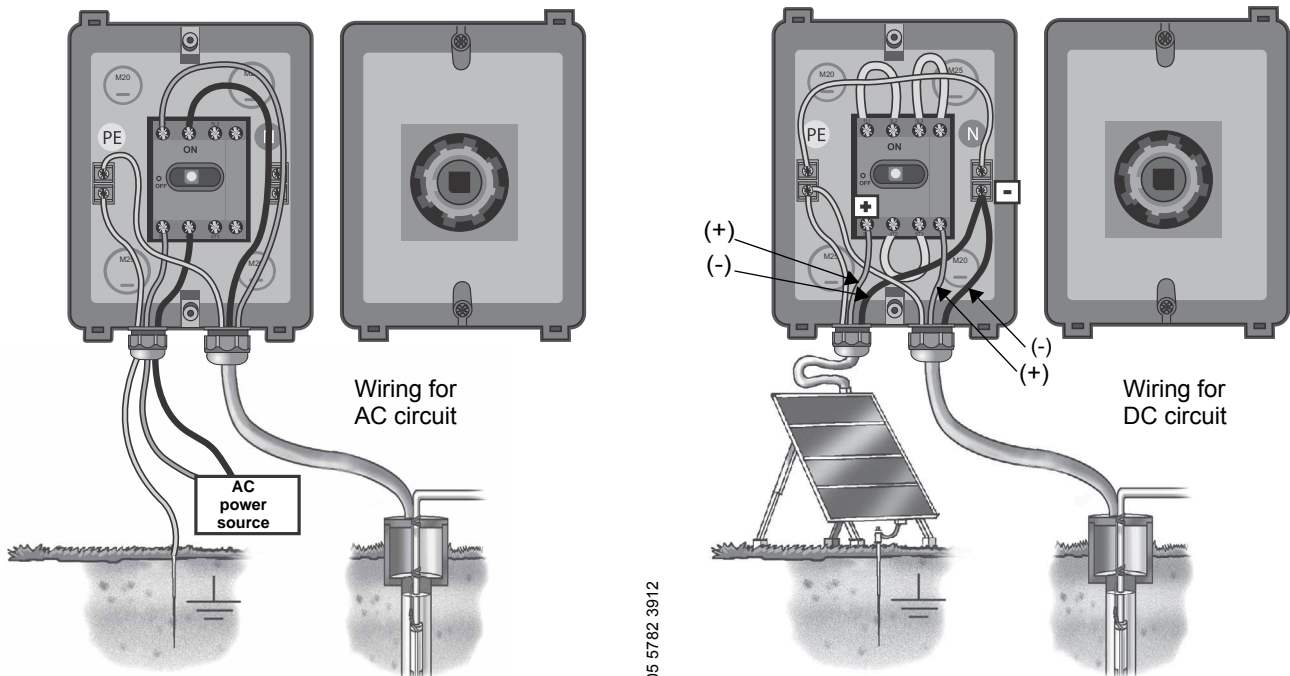
7.1.1 Solar-powered system



Pos	Component
1.	SQF pump
2.	Submersible drop cable
3.	Cable clips
4.	Safety cable
5.	Wire clamps
6.	Solar modules
7.	Support structure
12.	IO 50 SQFlex switch box

TM02 2304 4101

Fig. 57 Solar-powered system and its main components



TM05 5782 3912

TM05 5783 3912

Fig. 58 Internal (and external) wiring of IO50 SQFlex switch box.

If the system does not work properly, follow the instructions in Section 7.1.2 *Troubleshooting of a solar-powered system* on page 46.

## 7.1.2 Troubleshooting of a solar-powered system

### 1. Disconnect the pump

- Set the IO 50 switch to off.
- Disconnect the pump cable from the terminals (8T4, PE, N).

### 2. Check the solar modules

- Measure the voltage and short-circuit current across the terminals (2T1, N, PE).  
See electrical connection in Section 3.4 *Solar modules* on page 14.
- If the DC voltage or DC current is outside the range, one or more of the solar modules is faulty. Replace the faulty solar module/s.
- See electrical connection:
  - 3.5 *GF 43 and GF 50 solar modules* on page 15.
  - 3.7 *SX-110 solar modules* on page 19.
  - 3.9 *FS-50-D solar modules* on page 21.
  - 3.10 *GF 55C and GF 65C solar modules* on page 23.
  - 3.12 *GTF 55 solar modules* on page 26.
  - 3.13 *GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules* on page 28.
  - 3.14 *GF100TF solar modules* on page 30.
- Check the IO 50 box
- Set the IO 50 switch to on.
- Measure the DC voltage across the terminals using a voltmeter.
- Measure the DC current through the wires using an ammeter.  
If the values differ from the values measured under step 2, the IO 50 is defective.  
Replace the IO 50 box.

### 3. Check the pump

- Set the IO 50 switch to Off.
- Reconnect the pump cable to the terminals.
- Switch on the pump by setting the IO 50 switch to On.  
Note that the dry running sensor is covered with water.  
If the pump starts, it was stopped due to dry running and has now been reset.
- Wait five minutes.  
If the pump does not start, it is defective. Repair or replace the pump.

7.1.3 Solar-powered system with CU 200 control unit and level switch

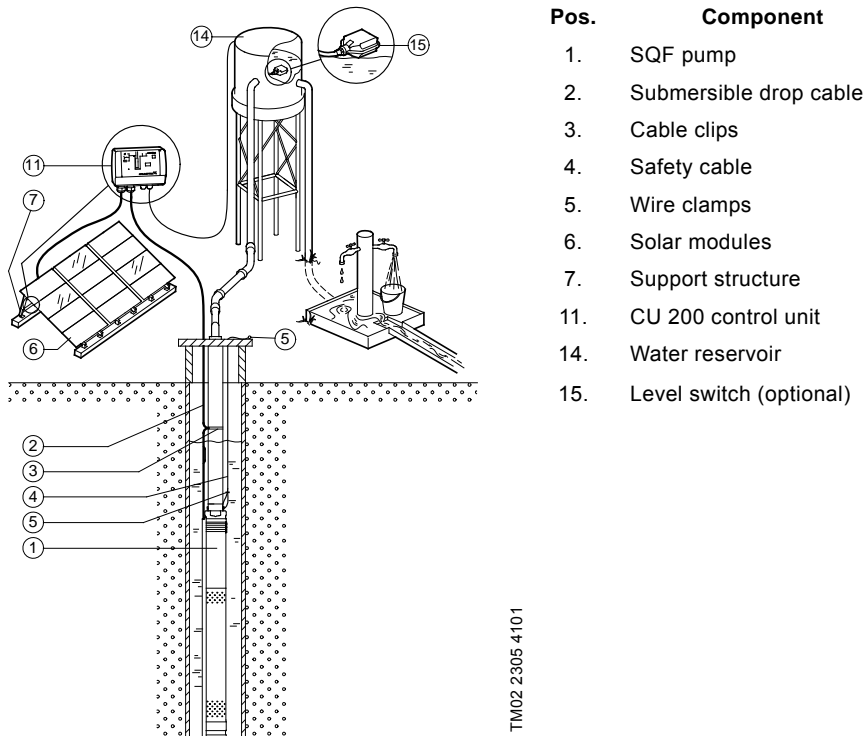


Fig. 59 Solar-powered system with CU 200 and level switch

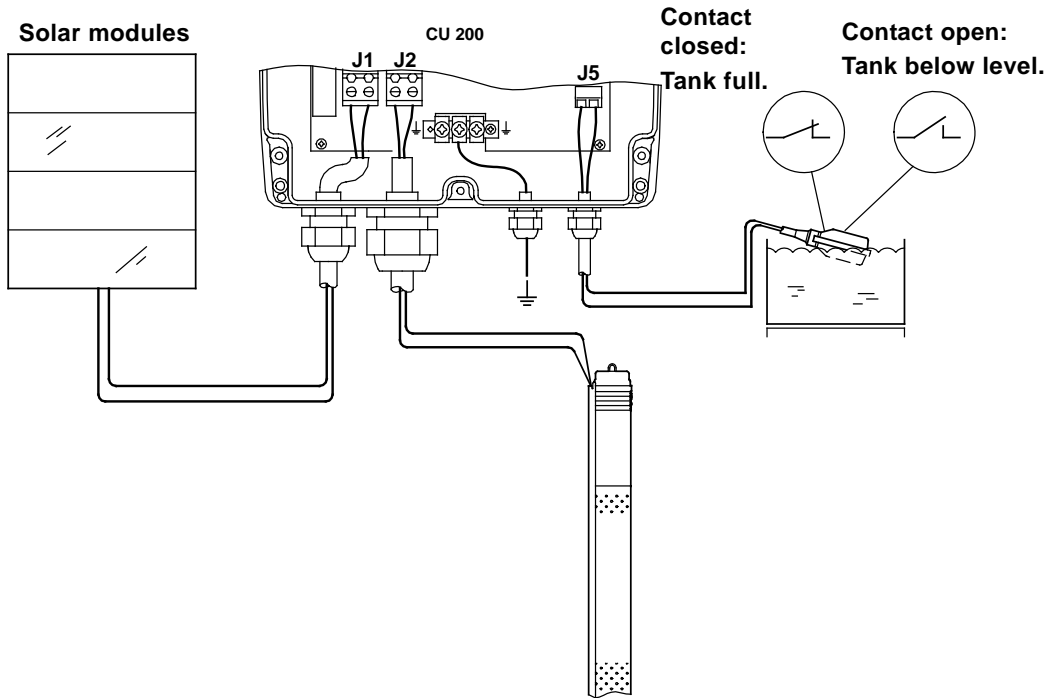


Fig. 60 Internal (and external) wiring of CU 200 SQFlex control unit

If the system does not work properly, follow the instructions in Section 7.1.4 *Troubleshooting of a solar-powered system with CU 200 control unit and level switch* on page 48.

### 7.1.4 Troubleshooting of a solar-powered system with CU 200 control unit and level switch

All measuring points/terminal designations in the following refer to the CU 200 control unit.

#### 1. Check the system by means of the CU 200.

- If the CU 200 indicates fault, proceed according to Section *Troubleshooting by means of CU 200* on page 9.

#### 2. Disconnect the pump.

- Switch off the pump by pressing the ON/OFF button at the CU 200. The OFF light must be on.\*
- Disconnect power to CU200.
- Disconnect the pump cable from the terminal J2.

#### 3. Check the solar modules.

- Measure the voltage and short-circuit current across the terminals (2T1, 4T2).  
See electrical connection:  
3.5 GF 43 and GF 50 solar modules on page 15.  
3.7 SX-110 solar modules on page 19.  
3.9 FS-50-D solar modules on page 21.  
3.10 GF 55C and GF 65C solar modules on page 23.  
3.12 GTF 55 solar modules on page 26.  
3.13 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 28.  
3.14 GF100TF solar modules on page 30.
- If the DC voltage or DC current is outside the range, one or more of the solar modules is faulty. Replace the faulty solar module(s).

#### 4. Check the level switch in the water reservoir.

- Disconnect the level switch cable from the terminal J5.
- Measure the disconnected level switch cable with an ohmmeter.
- Turn the level switch upwards => the contact in the level switch is closed. The measured value must be approx. 0 W.
- Turn the level switch downwards => the contact in the level switch is open. The measured value must be ∞ W.  
If one of the two values is not correct, the level switch is defective. Replace the level switch.

#### 5. Check the CU 200 control unit.

- Let the level switch remain disconnected.
- Measure the voltage and current across the terminals for the pump (J2).  
If the values measured differ from the values measured under step 3, the CU 200 is defective. Replace the CU 200.

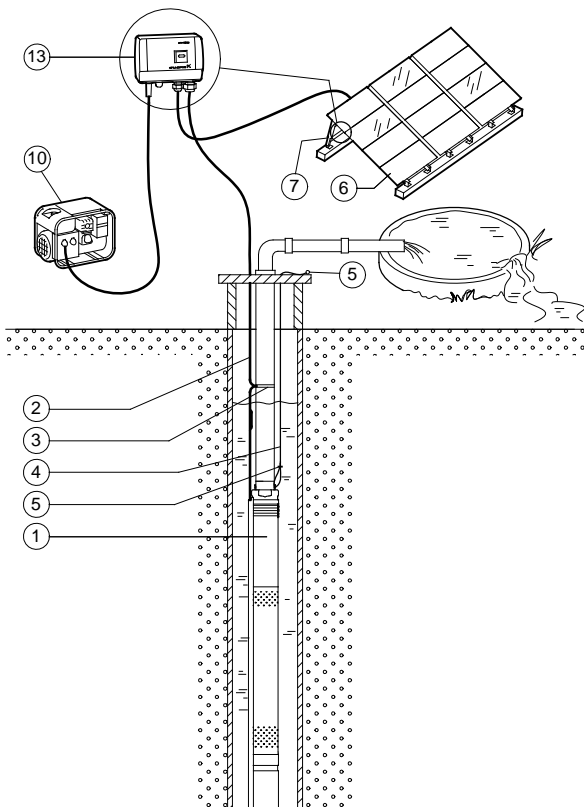
#### 6. Check the pump.

- Make sure that CU 200 is set to off by pressing ON/OFF button. The OFF light must be on.\*
- Disconnect power to CU200.
- Reconnect the pump cable to the terminal J2.
- Reconnect level switch to J5.  
The level switch must point downwards to send a starting signal to the CU 200.
- Switch on the pump by pressing the ON/OFF button. The on light must be on.  
Note that the dry running sensor is covered with water.  
If the pump starts, it was stopped due to dry running and has now been reset.
- Wait five minutes.  
If the pump does not start, it is defective. Repair or replace the pump.

**\* Note: Switching off the pump using the ON/OFF button at the CU200 DOES NOT disconnect power. Use extreme caution when disconnecting or connecting wires.**

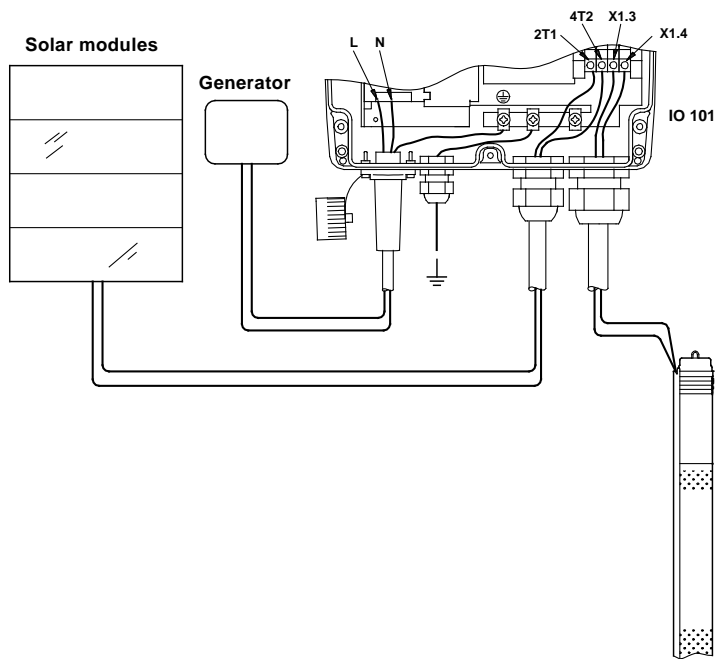


7.1.5 Solar-powered system with generator back-up



Pos.	Component
1	SQF pump
2	Submersible drop cable
3	Cable clips
4	Safety cable
5	Wire clamps
6	Solar modules
7	Support structure
10	Diesel or gasoline powered generator
13	IO 101 switch box

TM02 2309 4101



TM02 4373 0702

Fig. 62 Internal (and external) wiring of IO 101 SQFlex switch box

If the system does not work properly, follow the instructions in Section 7.1.6 *Troubleshooting of a solar-powered system with generator back-up* on page 50.

### 7.1.6 Troubleshooting of a solar-powered system with generator back-up

All measuring points/terminal designations in the following refer to the IO 101 switch box.

#### 1. Disconnect the pump.

- Make sure that the generator has been turned off.
- Set the IO 101 switch to Off.
- Disconnect the pump cable from the terminals (X1.3, X1.4)

#### 2. Check the solar modules.

Measure the DC voltage and short-circuit DC current across the terminals (2T1, 4T2).

See electrical connection:

3.5 GF 43 and GF 50 solar modules on page 15.

3.7 SX-110 solar modules on page 19.

3.9 FS-50-D solar modules on page 21.

3.10 GF 55C and GF 65C solar modules on page 23.

3.12 GTF 55 solar modules on page 26.

3.13 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 28.

3.14 GF100TF solar modules on page 30.

- If the DC voltage or DC current is outside the range, one of the solar modules is faulty. Replace the solar module.

#### 3. Check the IO 101 box.

- Set the IO 101 switch to on.
- Measure the DC voltage and DC current across the terminals (X1.3, X1.4).  
If the values differ from the values measured under step 2, the IO 101 is defective. Replace the IO 101.

#### 4. Check the generator

- Set the IO 101 switch to off.
- Turn on the generator.
- Measure the AC voltage across the terminals (L, N).  
The voltage (U) = rated generator voltage (see generator nameplate).  
If the value is not correct, the generator is faulty. Repair or replace the generator.

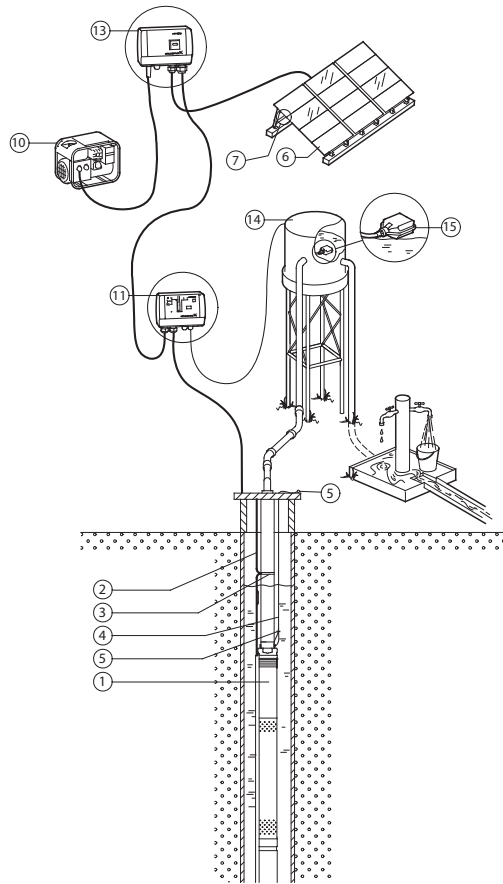
#### 5. Check the IO 101 box during generator operation.

- The generator must be running. Set the IO 101 switch to on.
- Measure the AC voltage across the terminals (X1.3, X1.4).  
The voltage (U) = rated generator voltage (see generator nameplate).  
If the value is not correct, the IO 101 is faulty. Replace the IO 101.

#### 6. Check the pump.

- Set the IO 101 switch to off.
- Reconnect the pump cable to the terminals (X1.3, X1.4).
- Set the IO 101 switch to on.  
Note that the dry running sensor is covered with water.  
If the pump starts, it was stopped due to dry running and has now been reset.
- Wait five minutes.  
If the pump does not start, it is defective. Repair or replace the pump.

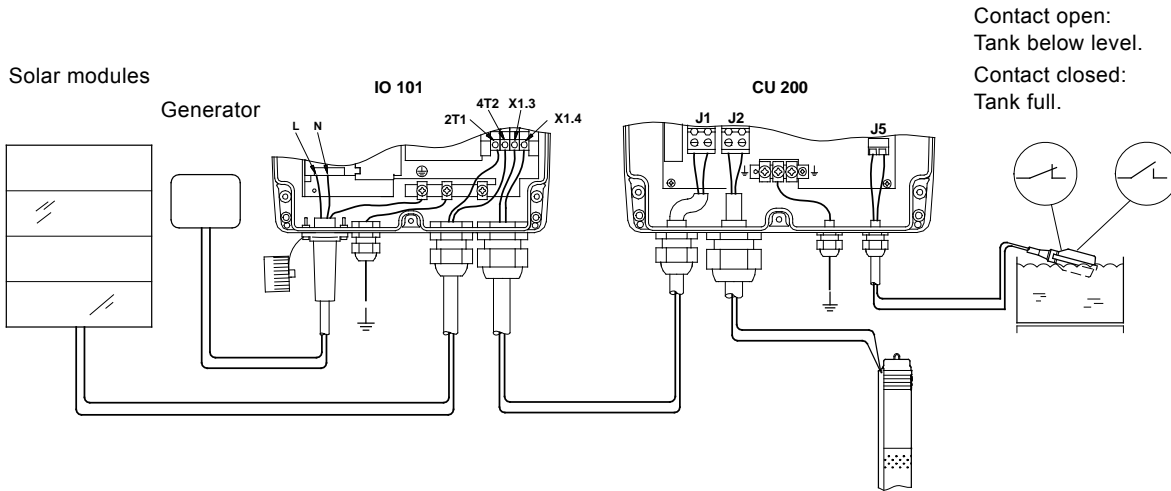
**7.2 SQFlex Solar with CU 200 control unit, level switch and back-up generator**



TM03 5497 3706

Pos.	Component
1	SQF pump
2	Submersible drop cable
3	Cable clips
4	Straining wire
5	Wire clamps
6	Solar panels
7	Support structure
10	Diesel- or gasoline-driven generator
11	CU 200 SQFlex control unit
13	IO 101 SQFlex switch box
14	Water reservoir
15	Level switch (optional)

**Fig. 63** SQFlex Solar with CU 200 control unit, level switch and back-up generator



TM02 4540 1102

**Fig. 64** Internal (and external) wiring of the CU 200 control unit and IO 101 switch box

If the system does not work properly, follow the instructions in section 7.2.1 *Fault correction of SQFlex Solar with CU 200 control unit, level switch and back-up generator* on page 52.

### 7.2.1 Fault correction of SQFlex Solar with CU 200 control unit, level switch and back-up generator

All measuring points/terminal designations in the following refer to the CU 200 control unit or the IO 101 switch box.

#### 1. Check the system using the CU 200.

If the CU 200 indicates a fault, proceed according to section *Troubleshooting by means of CU 200* on page 9.

#### 2. Disconnect the pump.

- Make sure that the generator has been turned off.
- Set the IO 101 switch to off.
- Disconnect the pump cable from terminal J2.

#### 3. Check the solar modules.

- Measure the DC voltage and short-circuit DC current across the terminals (2T1, 4T2).  
See electrical connection:  
See electrical connection:  
3.5 GF 43 and GF 50 solar modules on page 15.  
3.7 SX-110 solar modules on page 19.  
3.9 FS-50-D solar modules on page 21.  
3.10 GF 55C and GF 65C solar modules on page 23.  
3.12 GTF 55 solar modules on page 26.  
3.13 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 28.  
3.14 GF100TF solar modules on page 30.
- If the DC voltage or DC current is outside the range, one or more of the solar modules are faulty.  
Replace the faulty solar module(s).

#### 4. Check the IO 101 switch box.

- Set the IO 101 switch to on.
- Measure the DC voltage and DC current across the terminals (X1.3, X1.4).  
If the values differ from the values measured under step 2, the IO 101 is defective.  
Replace the IO 101.

#### 5. Check the generator.

- Set the IO 101 switch to off.
- Turn on the generator.
- Measure the AC voltage across the terminals (L, N).  
The voltage (U) = rated generator voltage (see generator nameplate).  
If the value is incorrect, the generator is faulty.  
Repair or replace the generator.

#### 6. Check the IO 101 switch box during generator operation.

- The generator must be running. Set the IO 101 switch to on.
- Measure the AC voltage across the terminals (X1.3, X1.4).  
The voltage (U) = rated generator voltage (see generator nameplate).  
If the value is incorrect, the IO 101 is faulty.  
Replace the IO 101.

#### 7. Check the level switch in the water reservoir.

- Disconnect the level switch cable from terminal J5.
- Measure the disconnected level switch cable with an ohmmeter.
- Turn the level switch upwards => the contact in the level switch is closed. The measured value must be approx. 0  $\Omega$ .
- Turn the level switch downwards => the contact in the level switch is open. The measured value must be  $\infty \Omega$ .  
If one of the two values is incorrect, the level switch is defective.  
Replace the level switch.

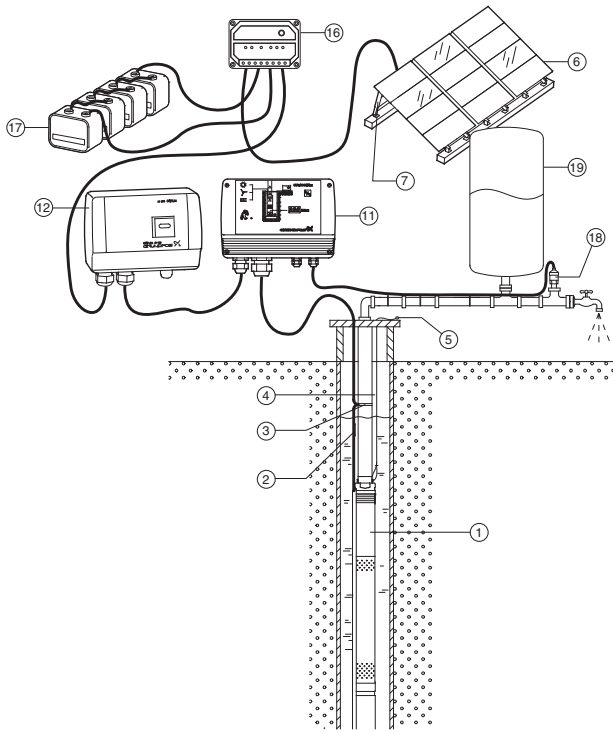
#### 8. Check the CU 200 control unit.

- Let the level switch remain disconnected.
- Measure the DC voltage and DC current across the terminals for the pump (J2).  
If the values differ from the values measured under step 3, the CU 200 is defective.  
Replace the CU 200.

#### 9. Check the pump.

- Make sure that the CU 200 is set to off by pressing the On/Off button. The red indicator light must be on.
- Reconnect the pump cable to terminal J2.
- Reconnect the level switch cable to terminal J5.  
The level switch must point downwards to send a starting signal to the CU 200.
- Switch on the pump by pressing the On/Off button. The green indicator light must be on.  
**Note:** The dry-running sensor must be covered with water.  
If the pump starts, it was stopped due to dry running and has now been reset.
- Wait five minutes.  
If the pump does not start, it is defective.  
Repair or replace the pump.

### 7.3 SQFlex Solar with back-up batteries



TM03 4232 1906

Pos.	Component
1	SQF pump
2	Submersible drop cable
3	Cable clips
4	Straining wire
5	Wire clamps
6	Solar panels
7	Support structure
11	CU 200 SQFlex control unit
12	IO 101 SQFlex switch box (optional)
16	Charge controller
17	Batteries
18	Pressure switch
19	Pressure tank

**Fig. 65** SQFlex Solar with back-up batteries

If the system does not work properly, follow the instructions in section 7.3.1 *Fault correction of SQFlex Solar with back-up batteries* on page 54.

### 7.3.1 Fault correction of SQFlex Solar with back-up batteries

#### 1. Check the system using the CU 200.

If the CU 200 indicates a fault, proceed according to section *Troubleshooting by means of CU 200* on page 9.

#### 2. Disconnect the pump.

- Switch off the pump by pressing the ON/OFF button at the CU 200. The OFF light must be on.\*
- Disconnect power to CU200.
- Disconnect the pump cable from the terminal J2.

#### 3. Check the solar modules.

- Measure the DC voltage and short-circuit DC current across the terminals (2T1, 4T2).

See electrical connection:

3.5 GF 43 and GF 50 solar modules on page 15.

3.7 SX-110 solar modules on page 19.

3.9 FS-50-D solar modules on page 21.

3.10 GF 55C and GF 65C solar modules on page 23.

3.12 GTF 55 solar modules on page 26.

3.13 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 28.

3.14 GF100TF solar modules on page 30.

If the DC voltage or DC current is outside the range, one of the solar modules is faulty.

Replace the solar module.

#### 1. Check the batteries.

- Measure the voltage. It must be 48 V.

#### 2. Check the charge controller.

- Set the IO 100 or IO 101 switch to off.
- Check that current runs in the conductors to the batteries by means of a snap-on amperemeter or an ordinary amperemeter.

#### 3. Check the IO 100 switch box.

- Set the IO 100 switch to on.
- Measure the DC voltage across the terminals (6T3, N, 8T4) using a voltmeter.
- Measure the DC current across the terminals (6T3, N, 8T4) using an ammeter.  
If the values differ from the values measured under step 2, the IO 100 is defective.  
Replace the IO 100.

#### 4. Check the IO 101 switch box.

- Set the IO 101 switch to on.
- Measure the DC voltage and DC current across the terminals (X1.3, X1.4).  
If the values differ from the values measured under step 2, the IO 101 is defective.  
Replace the IO 101.

#### 5. Check the CU 200 control unit.

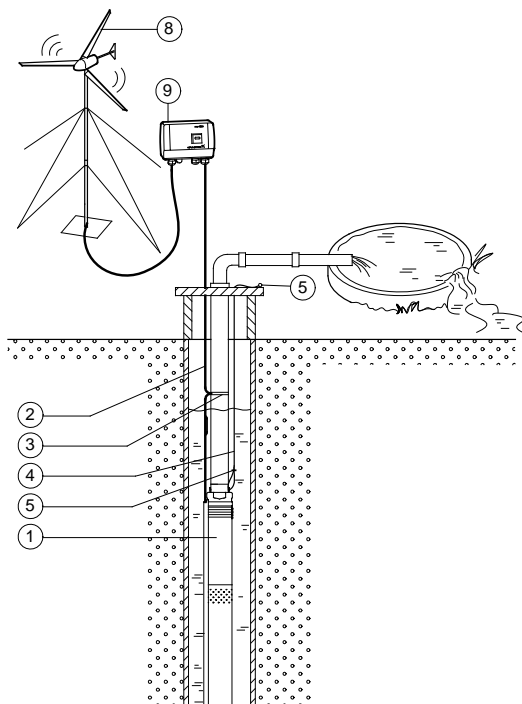
- Let the level switch remain disconnected.
- Measure the DC voltage across the terminal for the pump (J2) in the CU 200.  
The value must correspond to the value measured under step 4.  
If the value differs, the CU 200 is defective.  
Replace the CU 200.

#### 6. Check the pump.

- Make sure that the CU 200 is set to off by pressing the On/Off button. The red indicator light must be on.
- Reconnect the pump cable to terminal J2.
- Connect the level switch cable to terminal J5.  
The level switch must point downwards to send a starting signal to the CU 200.
- Switch on the pump by pressing the On/Off button. The green indicator light must be on.  
**Note:** The dry-running sensor must be covered with water.  
If the pump starts, it was stopped due to dry running and has now been reset.
- Wait five minutes.  
If the pump does not start, it is defective.  
Repair or replace the pump.

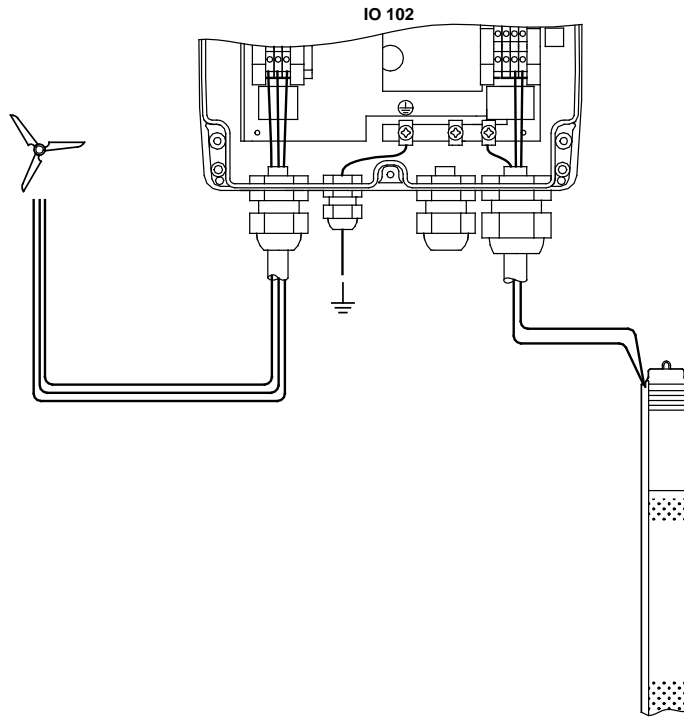
\* **Note: Switching off the pump using the ON/OFF button at the CU200 DOES NOT disconnect power. Use extreme caution when disconnecting or connecting wires.**

7.3.2 Wind-powered system



TM02 2306 4101

Fig. 66 The wind-powered system main components.



TM02 4374 0702

Fig. 67. Internal (and external) wiring of IO 102 SQFlex breaker box

If the system does not work properly, follow the instructions in Section 7.3.3 *Troubleshooting of a wind-powered system* on page 56.

### 7.3.3 Troubleshooting of a wind-powered system

All measuring points/terminal designations in the following refer to the IO 102 breaker box.

#### 1. Disconnect the pump.

- Stop the wind turbine and turn off the pump, by turning the ON/OFF switch to off.
- Disconnect the pump cable from the terminals in the IO 102 breaker box.
- Release the wind turbine by turning the ON/OFF switch to on.

#### 2. Check the wind turbine.

- Measure the AC voltage across the terminals for the wind turbine, i.e. one measurement between each of the three phases.

The voltage (U) = 0-250 VAC. The voltage depends on the wind speed, see 3.15 *Wind turbine* on page 33.

The three values measured must be identical. If they differ, or if no voltage is measured and the propeller is turning, the wind turbine is faulty. Repair or replace the wind turbine.

#### 3. Check the IO 102 breaker box.

- Measure the DC voltage across the terminals for the pump. The voltage (U) = 0-300 VDC. The voltage depends on the wind speed, see 3.15 *Wind turbine* on page 33. If no voltage is measured and the propeller is turning, the breaker box is faulty. Replace the breaker box.

#### 4. Check the pump.

- Stop the wind turbine by turning the ON/OFF switch to off.
- Reconnect the pump cable to the terminals.
- Release the wind turbine and turn on the pump, by turning the ON/OFF switch to on.

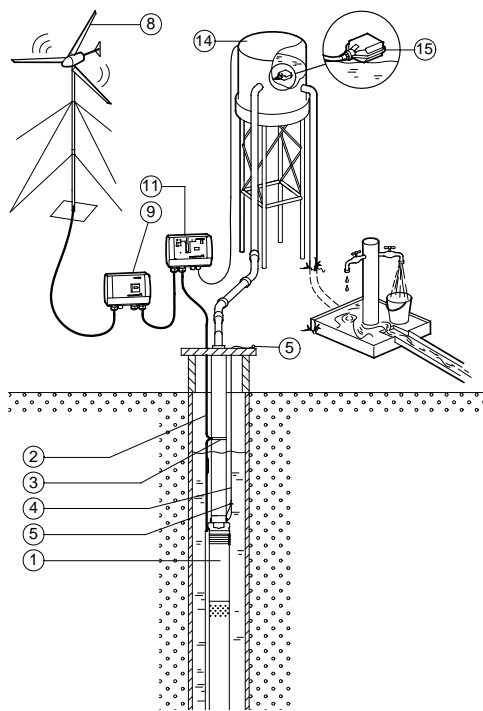
Note that the dry running sensor is covered with water.

If the pump starts, it was stopped due to dry running and has now been reset.

- Wait five minutes. If the pump does not start, it is defective. Repair or replace the pump.

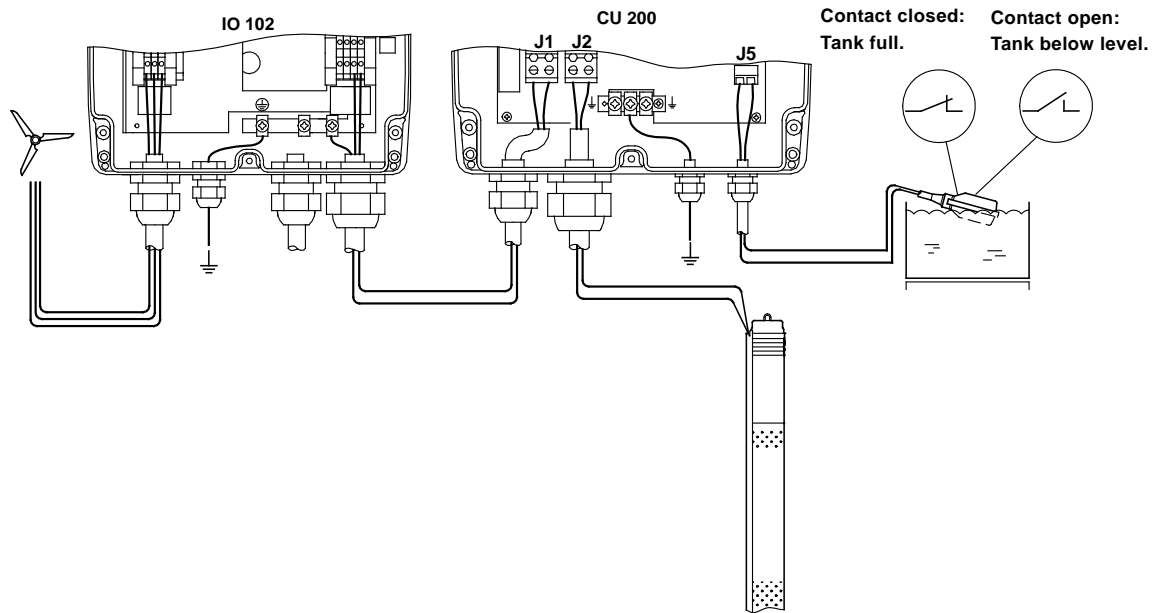


7.3.4 Wind-powered system with CU 200 control unit and level switch



TM02 2308 4101

Fig. 68 Wind-powered system with CU 200 and level switch



TM02 4377 0702

Fig. 69 Internal (and external) wiring of IO 102 breaker box and CU 200 SQFlex control unit

If the system does not work properly, follow the instructions in Section 7.3.5 *Troubleshooting of a wind-powered system with CU 200 control unit and level switch* on page 58.

### 7.3.5 Troubleshooting of a wind-powered system with CU 200 control unit and level switch

#### 1. Check the system by means of the CU 200.

- If the CU 200 indicates fault, proceed according to Section *Troubleshooting by means of CU 200* on page 9.

#### 2. Disconnect the pump.

- Switch off the pump by pressing the ON/OFF button at the CU 200. The OFF light must be on.\*
- Disconnect power to the CU200.
- Disconnect the pump cable from the terminal J2.

#### 3. Check the wind turbine.

- Measure the AC voltage across the terminals for the wind turbine, i.e. one measurement between each of the three phases.  
U = 0-250 VAC. The voltage depends on the wind speed, see 3.15 *Wind turbine* on page 33.  
The three values measured must be identical. If they differ, or if no AC voltage is measured and the Propeller is turning, the wind turbine is faulty. Repair or replace the wind turbine.

#### 4. Check the IO 102 breaker box.

- Measure the DC voltage across the terminals for the CU 200 in the breaker box.  
U = 0-300 VDC. The voltage depends on the wind speed, see 3.15 *Wind turbine* on page 33.  
If no DC voltage is measured and the Propeller is turning, the breaker box is faulty. Replace the breaker box.

#### 5. Check the level switch in the water reservoir.

- Disconnect the level switch cable from the terminal J5 in CU 200.
- Measure the disconnected level switch cable with an ohmmeter.
- Turn the level switch upwards => the contact in the level switch is closed. The measured value must be approx. 0 W.
- Turn the level switch downwards => the contact in the level switch is open. The measured value must be ∞ W.  
If one of the two values is not correct, the level switch is defective. Replace the level switch.

#### 6. Check the CU 200 control unit.

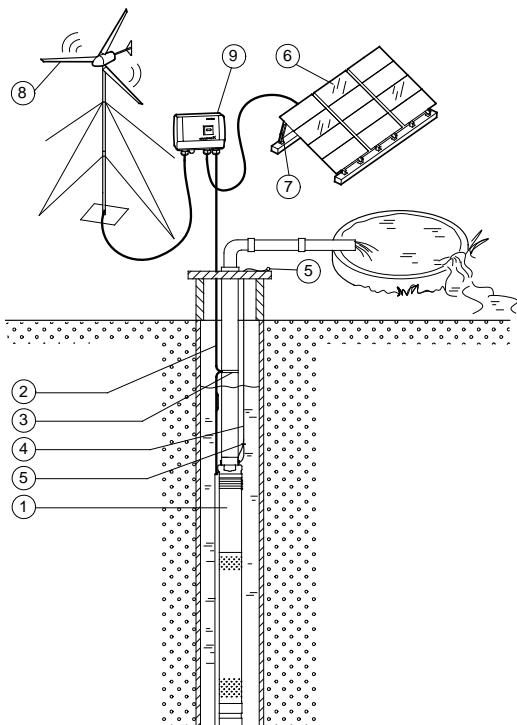
- Let the level switch remain disconnected.
- Measure the DC voltage across the terminal for the pump (J2) in CU 200.  
The value must correspond to the value measured under step 4.  
If the value differs, the CU 200 is defective. Replace the CU 200.

#### 7. Check the pump.

- Make sure that CU 200 is set to off by pressing ON/OFF button. The OFF light must be on.\*
- Disconnect power to the CU200.
- Reconnect the pump cable to the terminal J2.
- Connect the level switch cable to the terminal J5.  
The level switch must point downwards to send a starting signal to the CU 200.
- Switch on the pump by pressing the ON/OFF button. The on light must be on.  
Note that the dry running sensor is covered with water.  
If the pump starts, it was stopped due to dry running and has now been reset.
- Wait five minutes. If the pump does not start, it is defective. Repair or replace the pump.

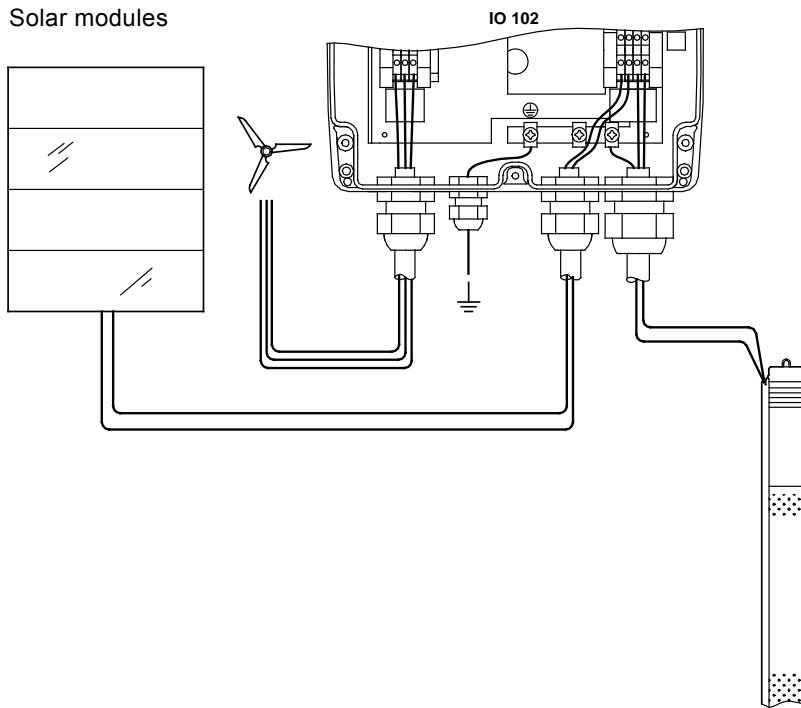
\* **Note: Switching off the pump using the ON/OFF button at the CU200 DOES NOT disconnect power. Use extreme caution when disconnecting or connecting wires.**

7.3.6 Combined system



TM02 2307 4101

Fig. 70 Combined system main components



TM02 4375 0702

Fig. 71 Internal (and external) wiring of IO 102 SQFlex breaker box

If the SQFlex system does not work properly, follow the instructions in Section 7.3.5 *Troubleshooting of a wind-powered system with CU 200 control unit and level switch* on page 58.

### 7.3.7 Troubleshooting of a combined system

All measuring points/terminal designations in the following refer to the IO 102 breaker box.

#### 1. Disconnect the pump.

- Set the IO 102 switch to off.
- Disconnect the pump cable from the terminals.
- Disconnect plus or minus from the solar modules.  
**WARNING:** Do not touch the wire due to high voltage.  
Release the wind turbine by setting the IO 102 switch to on.

#### 2. Check the wind turbine.

- Measure the AC voltage across the terminals for the wind turbine, i.e. one measurement between each of the three phases.  
U = 0-250 VAC. The voltage depends on the wind speed, see 6.2 *Wind turbine* on page 41.  
The three values measured must be identical. If they differ (more than 10 V), or if no voltage is measured and the wind turbine is turning, the wind turbine is faulty. Repair or replace the wind turbine.

#### 3. Check the IO 102 breaker box with wind turbine connected.

- Measure the DC voltage across the terminals for the CU 200 in the breaker box.  
U = 0-300 VDC. The voltage depends on the wind speed, see 6.2 *Wind turbine* on page 41.  
If no DC voltage is measured and the wind turbine is turning, the breaker box is faulty. Replace the breaker box.

#### 4. Check the solar modules.

- Disconnect the three wires from the wind turbine one by one and short-circuit all three wires to each other in order to stop the turbine.  
**WARNING:** Do not touch the wire due to high voltage.
- Reconnect the wire from the solar panel which was disconnected under step 1.
- Measure the DC voltage and short-circuit DC current across the terminals (2T1, 4T2).  
See electrical connection in Section 3.4 *Solar modules* on page 14.  
If the DC voltage or DC current is outside the range, one or more of the solar modules is faulty. Replace the faulty solar module/s.

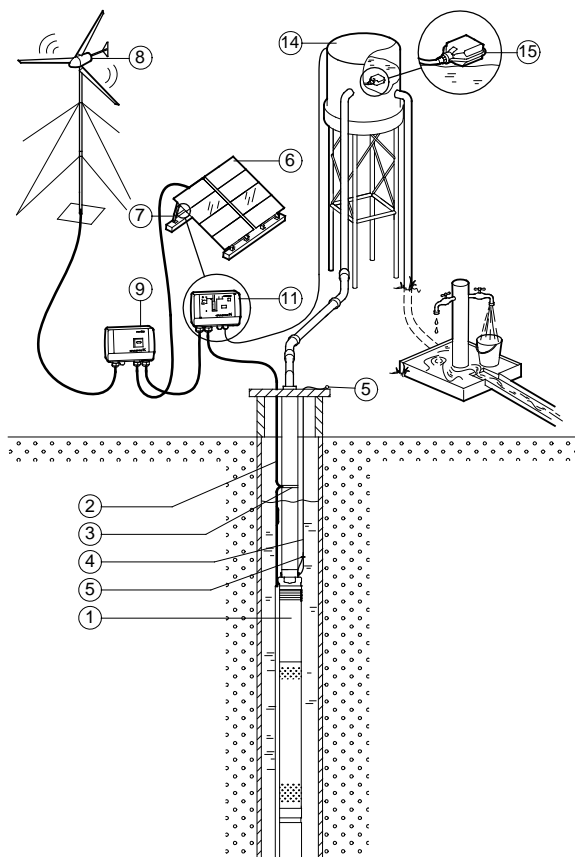
#### 5. Check the IO 102 breaker box with solar modules connected

- Connect the solar modules by setting the IO 102 switch to on.
- Measure the DC voltage and short circuit DC current, across the terminals for the pump.  
The values must correspond to the values measured under step 4.  
If the values differ, the breaker box is defective. Replace the breaker box.

#### 6. Reset of dry-running alarm

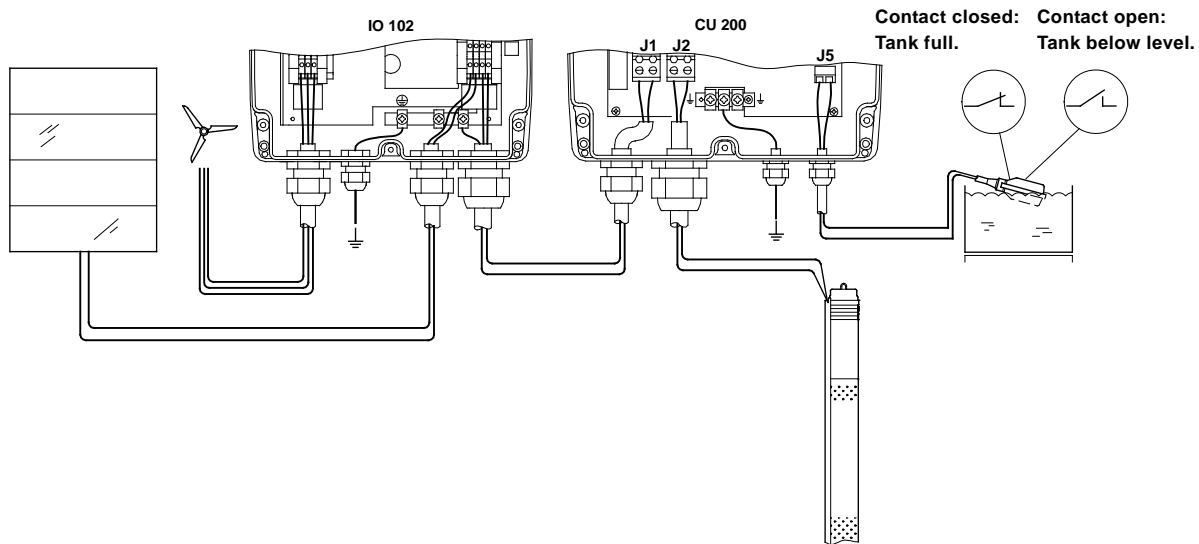
- Set the IO 102 switch to off.
- Reconnect the pump cable to the terminals.
- Set the IO 102 switch to on.  
Note that the dry running sensor is covered with water.  
If the pump starts, it was stopped due to dry running and has now been reset.
- Wait five minutes.  
If the pump does not start, it is defective. Repair or replace the pump.

7.3.8 Combined system with CU 200 control unit and level switch



TM02 2310 4101

Fig. 72 Combined system with CU 200 and level switch



TM02 4376 0702

Fig. 73 Internal (and external) wiring for IO 102 SQFlex breaker box and CU 200 SQFlex control unit

If the system does not work properly, follow the instructions in Section 7.3.9 *Troubleshooting of a combined system with CU 200 control unit and level switch* on page 62.

### 7.3.9 Troubleshooting of a combined system with CU 200 control unit and level switch

Measuring points/terminal designations in the following refer to the IO 102 breaker box or the CU 200.

#### 1. Disconnect the pump.

- Set the IO 102 switch to off.
- Disconnect plus or minus from the solar modules.  
**WARNING:** Do not touch the wire due to high voltage.
- Disconnect the pump cable from the terminal J2.
- Release the wind turbine by setting the IO 102 switch to on.

#### 2. Check the wind turbine.

- Measure the AC voltage across the terminals for the wind turbine, i.e. one measurement between each of the three phases.  
U = 0-250 VAC. The voltage depends on the wind speed, see 6.2 *Wind turbine* on page 41.  
The three values measured must be identical. If they differ, or if no voltage is measured and the wind turbine is turning, the wind turbine is faulty. Repair or replace the wind turbine.

#### 3. Check the IO 102 breaker box with wind turbine connected.

- Measure the DC voltage across the terminals for the CU 200 in the breaker box.  
U = 0-300 VDC. The voltage depends on the wind speed, see 6.2 *Wind turbine* on page 41.  
If no voltage is measured and the wind turbine is turning, the breaker box is faulty. Replace the breaker box.

#### 4. Check the solar modules.

- Disconnect the three wires from the wind turbine one by one and short-circuit all three wires to each other in order to stop the turbine.  
**WARNING:** Do not touch the wire due to high voltage.
  - Reconnect the wire from the solar panel which was disconnected under step 1.
  - Measure the DC voltage and short-circuit DC current across the terminals (2T1, 4T2).  
See electrical connection in 3.4 *Solar modules* on page 40.  
If the DC voltage or DC current is outside the range, one or more of the solar modules is faulty. Replace the faulty solar module/s.
5. Check the IO 102 breaker box with solar modules
- Connect the solar modules by setting the IO 102 switch to on.
  - Measure the DC voltage and short circuit DC current, across the terminals for the pump.  
The values must correspond to the values measured under step 4.  
If the values differ, the breaker box is defective. Replace the breaker box.

#### 6. Check level switch in the water reservoir.

- Release the wind turbine by setting the IO 102 switch to on.
- Disconnect the level switch cable from the terminal J5.
- Measure the disconnected level switch cable with an ohmmeter.
- Turn the level switch upwards => the contact in the level switch is closed. The measured value must be approx. 0 W.
- Turn the level switch downwards => the contact in the level switch is open. The measured value must be ∞ W.  
If one of the two values is not correct, the level switch is defective. Replace the level switch.

#### 7. Check the CU 200 control unit.

- Let the level switch remain disconnected.
- Measure the DC voltage across the terminals for the pump (J2).  
The value must correspond to the value measured under step 3 or 5.  
**Note:** The sun and wind conditions may have changed since the measurements in point 3 or 5 were made  
If the value differs, the CU 200 is defective. Replace the CU 200.

#### 8. Check the pump.

- Make sure that CU 200 is set to off by pressing ON/OFF button. The OFF light must be on.\*
- Disconnect power to the CU 200.
- Reconnect the pump cable to the terminal J2.
- Connect the level switch cable to the terminal J5.  
The level switch must point downwards to send a starting signal to the CU 200.
- Press the ON/OFF button the on light must be on.  
Note that the dry running sensor is covered with water.  
If the pump starts, it was stopped due to dry running and has now been reset.
- Wait five minutes.  
If the pump does not start, it is defective. Repair or replace the pump

\* **Note: Switching off the pump using the ON/OFF button at the CU200 DOES NOT disconnect power. Use extreme caution when disconnecting or connecting wires.**

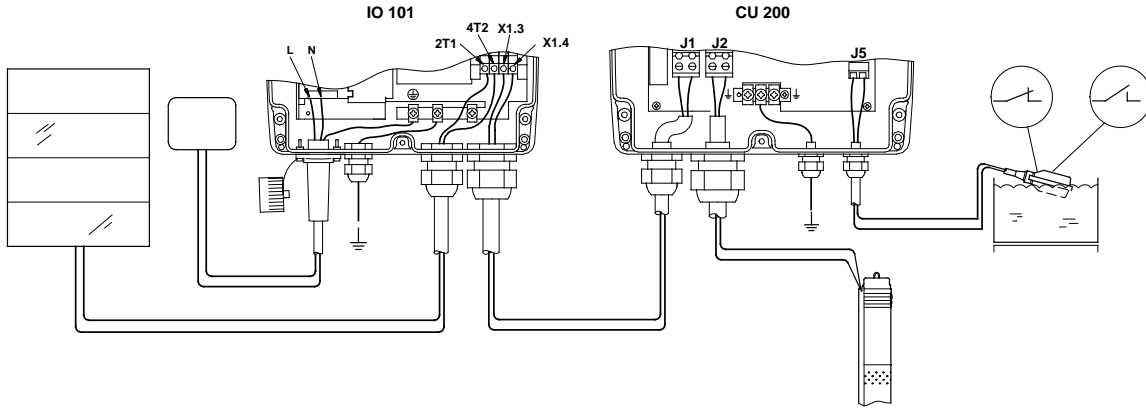
### 7.3.10 Options with generator as back-up source

Below are wiring diagrams for options with generator as a power supply back-up source.

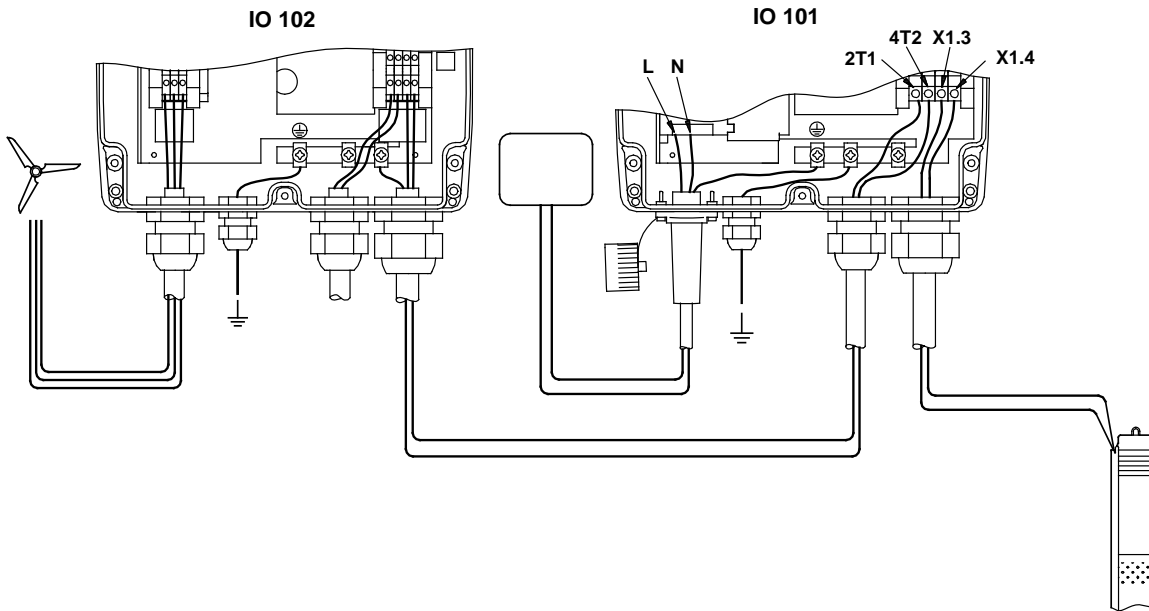
For Troubleshooting of the individual components see Sections 3.1 *Pumps* on page 4 to 6.2 *Wind turbine* on page 41.

For application overview see section *Overview of possible system combinations* on page 43.

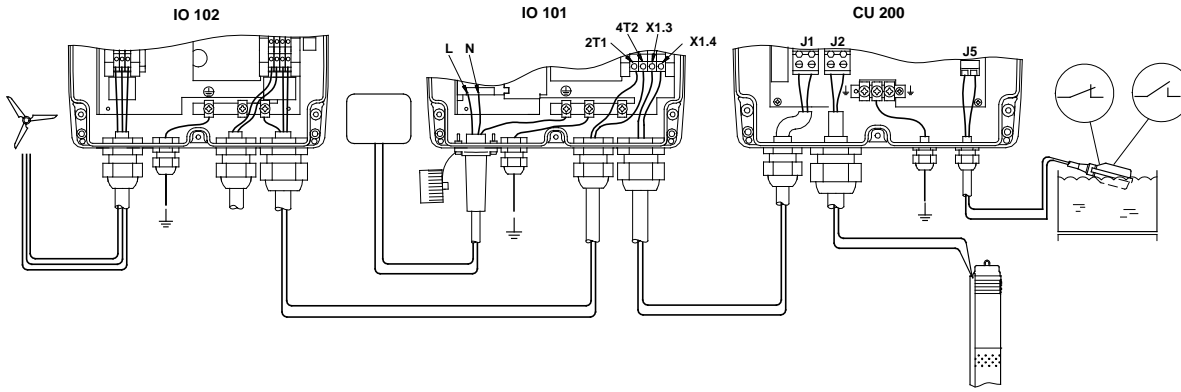
#### Solar-powered system with CU 200 control unit and level switch



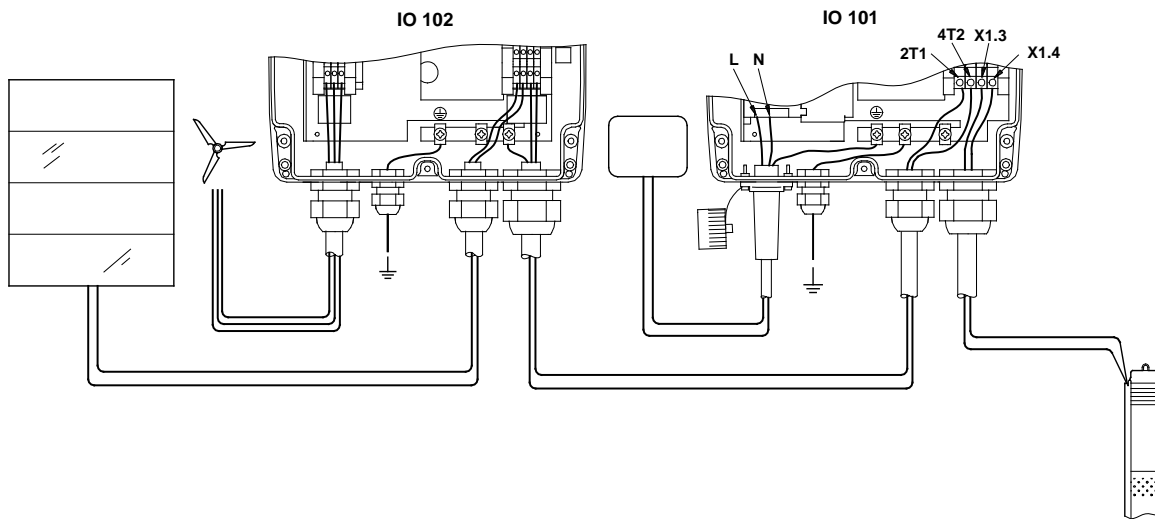
#### Wind-powered system



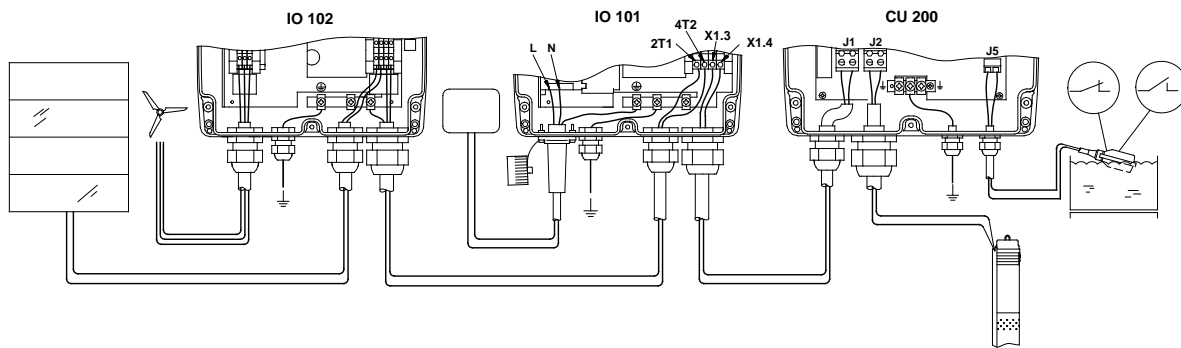
Wind-powered system with CU 200 control unit and level switch



Combined system



Combined system with CU 200 control unit and level switch

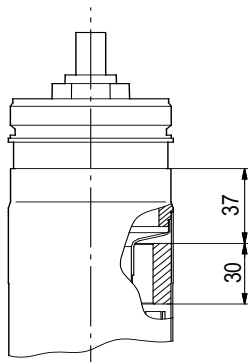




## 8. Service of pump and motor

### 8.1 General information

Helical rotor pumps cannot be separated from the motor as a unit. If the motor or the pump has to be replaced, the pump must be dismantled, see section 8.8 *Helical type pumps* on page 69.



TM02 5769 3902

**Fig. 74** When fixing the motor in a vise, tighten only on the 30 mm wide area starting 37 mm from the upper edge of the motor sleeve.

Position numbers refer to exploded views, Sectional drawings and parts lists; tool letters refer to section 8.6 *Service tools* on page 66.

### 8.2 Before dismantling

- Disconnect the electricity supply to the motor.

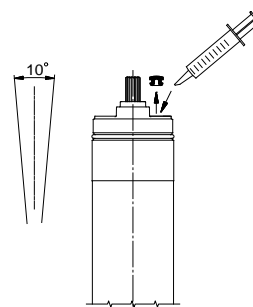
### 8.3 Before assembly

- Clean all parts and check them for fractures and wear.
- Order the necessary service kits and/or parts.
- Replace defective parts by new parts.
- Moisten rubber parts with soapy water before fitting them.

### 8.4 During assembly

- Lubricate and/or tighten screws and rubber parts according to Section 8.7 *Torques and lubricants* on page 68.
- Before connecting the pump to the motor, fill the motor with GRUNDFOS motor liquid SML 2.

## 8.5 Filling of motor liquid



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**Fig. 75** Filling of motor

1. Place the motor in vertical position with an inclination of approx. 10°.
2. Remove the filling plug using a screwdriver or a similar tool.
3. Inject motor liquid SML 2, into the motor with a filling syringe or the like.
4. To allow possible air to escape, move the motor from side to side.
5. Refit the filling plug and make sure that it is tight.

Fit the pump to the motor, see Section 8.9 *Centrifugal pump and motor* (centrifugal pump) on page 69 or Section 8.8.2 *Assembly* (helical pumps) on page 69.

### 8.5.1 After assembly

Test the head and flow according to the test specifications, see Section 8.13 *Testing the pump by means of CU 200 SQFlex3 control unit* on page 73.

8.6 Service tools

A		TM01 6221 1899	B		TM02 5767 3902	C		TM00 0686 3892	D		TM02 4331 0602
E		TM01 3812 4698	F		TM02 5766 3902	G		TM00 1391 5092	H		TM02 5754 3902
I		TM04 3308 4208	J		TM04 3309 4208	K		TM02 5765 3902	L		TM00 1470 5292
M		TM00 1392 5092	N		TM02 5753 3902	O		TM01 4252 5098	P		TM02 4330 0602
Q		TM01 4246 5098	R		TM00 1396 5092	S		TM02 4335 0602	T		TM02 4336 0602
U		TM00 9124 4496	V		TM00 9123 4496	W		TM04 3310 4208	X		TM00 6729 4895

## Special tools

Pos.	Designation	To be used for pos.	Supplementary information	Helical rotor pump	16 SQF 25 SQF	40 SQF	60 SQF
A	Mounting plate					SV0049	
B	Spline pin with screw				SV0226		
C	Spacing pipe		∅ 13 / ∅ 8.5 x 39.5		SV0006 <sup>a)</sup>		
			∅ 13 / ∅ 8.5 x 39.0				SV0008
D	Hexagon socket head screw with washer		M8 x 65				SV0074
E	Key for split cone nut	11, 12	22 mm		SV0182	SV0187	
			27 mm				SV0217
F	Key for discharge chamber	1a		SV0064			
G	Open-end spanner	243	62 mm			SV2080	
H	Measuring template	24				96079961	
I	Clamping tool for shaft end	24				96797664	
J	Puller for thrust bearing	206				96797666	
K	Depth gauge	14, 16				SV0305	

<sup>a)</sup> Only for SQF 3A N and SQF 5A N.

## Standard tools

Pos.	Designation	To be used for pos.	Supplementary information	Helical rotor pump	16 SQF 25 SQF	40 SQF	60 SQF
L	Hexagon key	D	6 mm			SV1204	
		16, 24	10 mm (two pcs needed for pos. 16)			SV0083	
M	Ring/open-end spanner	19, 19a	13 mm			SV0055	
		13	17 mm	SV0056			
		F, 1a	24 mm	SV0122			
		225	27 mm			SV0084	
N	Pipe wrench	13	1"	Standard			
		14a	4"			Standard	
O	Screwdriver (torx)	18a	T10			SV0066	
P	Socket for hexagon head screws	250, T (Model A)	7 mm			SV0457	
Q	Soft jaws	202				SV0412	

## Torque tools

Pos.	Designation	To be used for pos.	Supplementary information	Helical rotor pump	16 SQF 25 SQF	40 SQF	60 SQF
R	Torque wrench	U, V	4-20 Nm	9 x 12			SV0292
		F, W	40-200 Nm	14 x 18	SV0400		
S	Torque screwdriver	T, X	1-6 Nm	1/4"			SV0438
T	Adaptor for torque screwdriver	S, P		1/4"			SV0437
U	Ring insert tool	R, 19, 19a	13 mm	9 x 12			SV0294
		225	27 mm				SV0527
		R, 16, 202c	10 mm	9 x 12	SV0610		
V	Open-end spanner	24	12 mm	9 x 12			96944218
		R, E, 11, 12	22 mm	9 x 12			SV0622
		R, F, 1a	24 mm	14 x 18			SV0624
W	Open-end spanner	243	62 mm				96893773
X	Set of torx® bits	250 (Model B/C)	T20				96884936

## 8.7 Torques and lubricants

This section shows the screws and nuts that must be tightened to a certain torque and the lubricants to be used.

Pos.	Description	Pump type	Torque [Nm]	Lubricant
	Pump/motor	Helical rotor	55	
1a	Discharge chamber*	Helical rotor	100	Rocol
11	Split cone nut	16 SQF and 25 SQF	7.5 - 10	
		40 SQF	22	
		60 SQF	30	
13/16	Pump rotor/torsion shaft	Helical rotor	18	
14a	Connecting piece	Centrifugal		
16	Torsion shaft/motor shaft	Helical rotor	18	
19	Screw	Centrifugal, splined shaft	18	Gardolube
	Nut	Centrifugal, cylindrical shaft		
19a	Nut	Centrifugal	18	Gardolube
19b	Nut	Centrifugal, splined shaft	11	Gardolube
24	Shaft end (nut)	Centrifugal	18	
202c	Shaft end	Motor	18	Klübersynth
225	Top cover	Motor	15	Klübersynth
243	Thrust-bearing housing	Motor	70	Klübersynth
250	<b>Model A only:</b> Nut	Motor	1.5	
250	<b>Model B/C only:</b> Screw	Motor	3.5	
	<b>Model A only:</b> End cover with cable	All		Klübersynth

\* The thread of the discharge chamber **must** be lubricated.

Notes:

Rocol Sapphire Aqua-Sil, part no. RM2924 (0.5 l).

Gardolube L 6034, product No SV9995 (1 l).

Motor liquid SML 3, product No 795896 (1 l).

It is not necessary to lubricate screws and nuts treated with "Delta Seal", as this coating is anti-corrosive and lubricating.

## 8.8 Helical type pumps

Helical pumps cannot be separated from the motor as a unit. If the motor or the pump must be replaced, the pump must be dismantled.

### 8.8.1 Dismantling

1. Fix the motor in a vise. **Note:** Tighten only on the area shown in fig. 74.
2. Refer to Section 9. *Exploded views* on page 76. Unscrew the screws pos. 18a and 18b and remove them together with the cable guard pos. 18.
3. If the motor is intact, the cable need not to be removed. If the motor is defective, remove the nuts for end cover with socket at the bottom of the motor and pull the end cover with cable and socket out of the motor.
4. Remove the discharge chamber pos. 1a with valve casing complete using the Key for discharge chamber (F). Hold the pump by means of the Pipe wrench (M), on the weld just above the upper strainer.
5. Loosen the outer sleeve pos. 55 with pump stator pos. 9 from the motor using the Pipe wrench (M), on the weld just above the upper strainer. Hold the motor with the Open-end spanner (G).
6. Pull the outer sleeve pos. 55 with pump stator pos. 9 free of the pump rotor pos. 13 and torsion shaft pos. 16 with a bump.
7. Remove the pump stator pos. 9 and flange pos. 6 by knocking the discharge end of the outer sleeve hard against a solid wooden surface such as a workbench or table.
8. Remove the torsion shaft pos. 16 from the motor shaft using two ring/open-end spanners (K).
9. Remove the pump rotor pos. 13 from the torsion shaft pos. 16 using the Pipe wrench (M). Hold the torsion shaft with the Ring/open-end spanner (K).
10. If the parts of the valve casing complete are defective, replace these parts. Prise the retaining ring pos. 7a out of the recess of the discharge chamber pos. 1a and press the parts down and out of the discharge chamber.

### 8.8.2 Assembly

1. Fill the motor with liquid, see 8.5 *Filling of motor liquid* on page 65.
2. Fit the pump rotor pos. 13 to the torsion shaft pos. 16 and tighten to correct torque, see 8.7 *Torques and lubricants* on page 68. Hold the pump rotor using the Pipe wrench (M) on the cylindrical part below the pump rotor.
3. Fit the torsion shaft to the motor shaft and tighten to the correct torque, see 8.7 *Torques and lubricants* on page 68.
4. Fit the pump stator pos. 9 with the conical stator inlet against the strainer into the outer sleeve pos. 55.
5. Fit the flange pos. 6 into the outer sleeve and press it on the upper part of the stator, fixing the stator in the centre of the outer sleeve.
 

**11SQF-2:** Turn the flange pos. 6 with the even surface against the stator pos. 9.
6. Assemble the valve and discharge chamber if it has been dismantled.
  - Place the valve casing complete on a plane surface with the bearing pos. 6 downwards.
  - Lubricate the O-ring pos. 1d with grease and fit it in the outside recess of the valve casing.
  - Press the discharge chamber pos. 1a over the valve casing. Turn the discharge chamber and fit the retaining ring pos. 7a in the recess of the discharge chamber.
  - Grease the thread of the discharge chamber with valve casing complete and screw it into the top of the sleeve.

7. Fit the discharge chamber pos. 1a with valve casing complete and tighten to the correct torque by means of the Key for discharge chamber (F). Hold the pump using the Pipe wrench (M) or fix it in a vise. The jaws must be placed on the weld just above the upper strainer.
8. Moisten the pump rotor pos. 13 with clean water and fit the pump on the motor. Tighten to the correct torque, see 8.7 *Torques and lubricants* on page 68, by means of the Key for discharge chamber (F).
9. Push the end cover with socket and cable into the motor if it has been removed. Fit and tighten the nuts using the Socket for hexagon head screws (O), the Adapter for torque screwdriver (R), and the Torque screwdriver (Q).
10. Fit the cable guard pos. 18. Press the two upper flaps under the outer sleeve and fit the screws pos. 18a and 18b. If the accessible holes in the outer sleeve at the lower strainer are not threaded, they must be tapped using the tapping screw included in the cable guard service kit and the assembly kit or by means of an M3 set screw.
11. Test the pump performance using a CU 200 control unit, if available. See Section 8.13 *Testing the pump by means of CU 200 SQFlex3 control unit* on page 73.
12. Install the pump. See Section 5. *Start-up* on page 39.

## 8.9 Centrifugal pump and motor

### 8.9.1 Detaching pump from motor

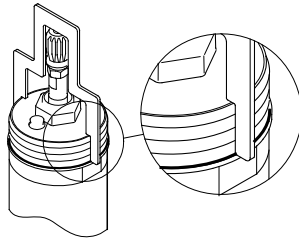
13. Fix the motor in a vice.
 

**Note:** Tighten only on the area shown in fig. 74 on page 65.
14. Unscrew the screws pos. 18a and remove them together with the cable guard pos. 18c.
15. Unscrew the screws pos. 18b and remove them (if any) together with the cable guard pos. 18.
16. If the motor is intact, the cable need not be removed. If the motor is defective, remove the nuts for the end cover with socket and pull the end cover with cable and socket out of the motor.
17. Remove the nuts pos. 19a and lift the pump off the motor
18. Remove the spline protector pos. 24b and supporting ring pos. 24a from the pump shaft.
19. Remove the shaft end pos. 24 from the motor shaft.
20. Remove the connecting piece pos. 14a from the motor by means of the Pipe wrench (M). Hold the motor using the Open-end spanner (G).

### 8.9.2 Fitting pump to motor

1. Fill the motor with liquid, see 8.5 *Filling of motor liquid* on page 65.
2. Screw the shaft end pos. 24 on to the motor shaft and push it home. Adjust the height to 88.15 mm  $\pm$ 0.2 mm by means of the Measuring template (H), see fig. 76.
3. Tighten the nut to the correct torque, see 8.7 *Torques and lubricants* on page 68. Check that the height is still 88.15 mm  $\pm$ 0.2 mm.
4. Fit the supporting ring pos. 24a and the spline protector pos. 24b.
 

Fit the connecting piece pos. 14a and tighten using the Pipe wrench (M).



**Fig. 76** Measuring template

5. Fit the pump to the motor. The cable recesses in the suction interconnector pos. 14 and the connecting piece pos. 14a must be next to each other. Fit the four nuts pos. 19a and tighten diagonally to the correct torque, see *8.7 Torques and lubricants* on page 68.
6. Push the end cover with cable into the motor if it has been removed. Fit and tighten the nuts, see *8.7 Torques and lubricants* on page 68, using the Socket for hexagon head screws (O), the Adapter for torque screwdriver (R), and the Torque screwdriver (Q).
7. Fit the cable guard pos. 18c and secure it with screws pos. 18a.
8. Fit the cable guard pos. 18 and secure with screws pos. 18b (25 SQF).
9. Test the pump performance using a CU 200 control unit, if available. See Section *8.13 Testing the pump by means of CU 200 SQFlex3 control unit* on page 73.
10. Install the pump, see section 5. *Start-up* on page 39.

## 8.10 Centrifugal pump type with splined shaft

### 8.10.1 Dismantling

1. Fit the and tighten the Spline pin with screw (B) on the Mounting plate (A).  
**Note:** Make sure that the Mounting plate is positioned correctly so that the recess of the Mounting plate and the suction interconnector pos. 14 fit into each other.
2. Place the pump on the Mounting plate (A).
3. Unscrew and remove the screws pos. 19 together with the washers pos. 71. Remove the strap pos. 17.
4. Dismantle the pump in the following order until the last chamber has been removed:
  - discharge piece pos. 1b
  - valve casing complete pos. 1
  - nut pos. 19b
  - washer pos. 76
  - impeller pos. 13
  - chamber pos. 9.
5. Pull the pump shaft pos. 16 with priming disc pos. 64 up and out of the suction interconnector pos. 14 and the bottom chamber pos. 10.
6. Lift the suction interconnector pos. 14 and the bottom chamber pos. 10 free of the Mounting plate (A).
7. Replace worn wear parts, if any, see Section *8.12 Checking and replacing wear parts of centrifugal pumps* on page 72.

### 8.10.2 Assembly

1. Fit the suction interconnector pos. 14 to the Mounting plate (A).
2. Press the bottom chamber pos. 10 into the suction interconnector pos. 14.
3. Slide the priming disc pos. 64 over the pump shaft pos. 16 and push until it touches the coupling.  
**Note:** The dogs of the priming disc must point upwards.
4. Fit the pump shaft to the Spline pin with screw (B).
5. Fit the first impeller pos. 13 and press it until it engages with the neck ring pos. 7 in the bottom chamber pos. 10.
6. Fit the chamber pos. 9 and the impeller pos. 13 until the last impeller has been fitted.
7. Fit the washer pos. 76 (with the three grooves upwards) and the nut pos. 19b.
8. Make sure that the top impeller engages with the splined shaft and tighten the nut pos. 19b to the correct torque, see *8.7 Torques and lubricants* on page 68.  
**Note:** Check that the impellers can be raised and lowered, as it is important that the nut is tightened against the impellers.
9. Fit the valve casing complete pos. 1 and the discharge piece pos. 1b.  
**Note:** Turn the discharge piece so that the slots for the cable guard are located above the screw holes for the screws pos. 18b in the suction interconnector pos. 14.
10. Lubricate the threads of the screws pos. 19, and fit the straps pos. 17, washers pos. 71 and screws pos. 19. Tighten diagonally to the correct torque, see *8.7 Torques and lubricants* on page 68.
11. Remove the pump from the Mounting plate (A) and fit the pump to the motor, see Section *8.9.2 Fitting pump to motor* on page 69.

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## 8.11 Centrifugal pump type with cylindrical shaft

### 8.11.1 Dismantling

1. Fit the Mounting plate (A) to the suction interconnector pos. 14 by means of the Spacing pipe (C) and the Hexagon socket head screw with washer (D).

**Note:** Make sure that the mounting plate is positioned correctly so that the recess of the mounting plate and the projection of the suction interconnector pos. 14 fit into each other.

Fix the Mounting plate (A) in a vise.

2. Slacken and remove the nuts pos. 19. Remove the strap pos. 17.
3. Remove the valve housing complete pos. 1 and the top chamber pos. 4 (25 SQF chamber pos. 9.)  
Remove the stop ring pos. 85 of 25 SQF.
4. Loosen the split cone nut pos. 11 using the Key for split cone nut (E). Knock the split cone pos. 12 down through and out of the impeller pos. 13 using the Key for split cone nut (E).
5. Remove the impeller pos. 13, split cone pos. 12, split cone nut pos. 11 and chamber pos. 9.
6. Repeat steps 4. and 5. until all impellers and chambers have been removed.  
Remove the stop ring pos. 85 of 60 SQF.
7. Loosen the guide pos. 25 from the recess of the suction interconnector pos. 14 (only 60 SQF). Lift the suction interconnector off the Mounting plate (A).
8. Remove the Hexagon socket head screw with washer (D), Spacing pipe (C), and pump shaft pos. 16.
9. Check and replace wear parts, see Section 8.12 *Checking and replacing wear parts of centrifugal pumps* on page 72.

### 8.11.2 Assembly

1. Fit the shaft pos. 16 to the Mounting plate (A) by means of the Spacing pipe (C) and Hexagon socket head screw with washer (D).

**Note:** Make sure that the Mounting plate (A) is positioned correctly so that the recess of the mounting plate and the projection of the suction interconnector pos. 14 fit into each other.

Fix the Mounting plate (A) in a vise.

2. Slide the suction interconnector pos. 14 over the shaft so that the projection of the suction interconnector engages with the recess of the mounting plate. Press the bottom chamber pos. 10 / guide pos. 25 home in the suction interconnector.
3. Fit the split cone pos. 12, impeller pos. 13 (the impeller collar must point downwards) and split cone nut pos. 11. Give the split cone nut a few turns. Press the impeller home against the chamber pos. 10 / guide pos. 25 using the Key for split cone nut (E) and tighten to the correct torque, see 8.7 *Torques and lubricants* on page 68.
4. Fit the chamber pos. 9.
5. Repeat steps 3. and 4. until all impellers and chambers have been fitted.  
**Note:** For each section, make sure that the chamber and the impeller are fitted correctly before the split cone nut is tightened.  
**Note:** Fit the stop ring pos. 85 after the middle impeller of 25 SQF and 60 SQF. In 60 SQF the small recess of the stop ring must be downwards.  
**Note:** The top chamber of 40 SQF and 60 SQF is pos. 4.
6. Fit the valve housing pos. 1 so that the holes for the safety cable are opposite the motor cable (cable opening in the suction interconnector) and that the slots for the straps are aligned to the points where the straps are attached to the suction interconnector.
7. Fit the strap pos. 17 and nuts pos. 19. Tighten diagonally to the correct torque, see 8.7 *Torques and lubricants* on page 68.
8. Remove the pump from the Mounting plate (A) and fit it on the motor, see Section 8.9.2 *Fitting pump to motor* on page 69.
9. Check the axial clearance of the pump shaft by measuring the distance between the contact surface of the suction interconnector and the shaft end using a slide gauge or depth gauge. Measure with the shaft in its top and bottom position, see table and fig. 77.

	16 SQF 25 SQF	60 SQF	40 SQF
Bottom position $H_{\max}$	37.5	37.15	37.15
Top position $H_{\min}$	38.4	39.15	40.15

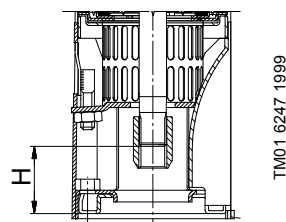


Fig. 77

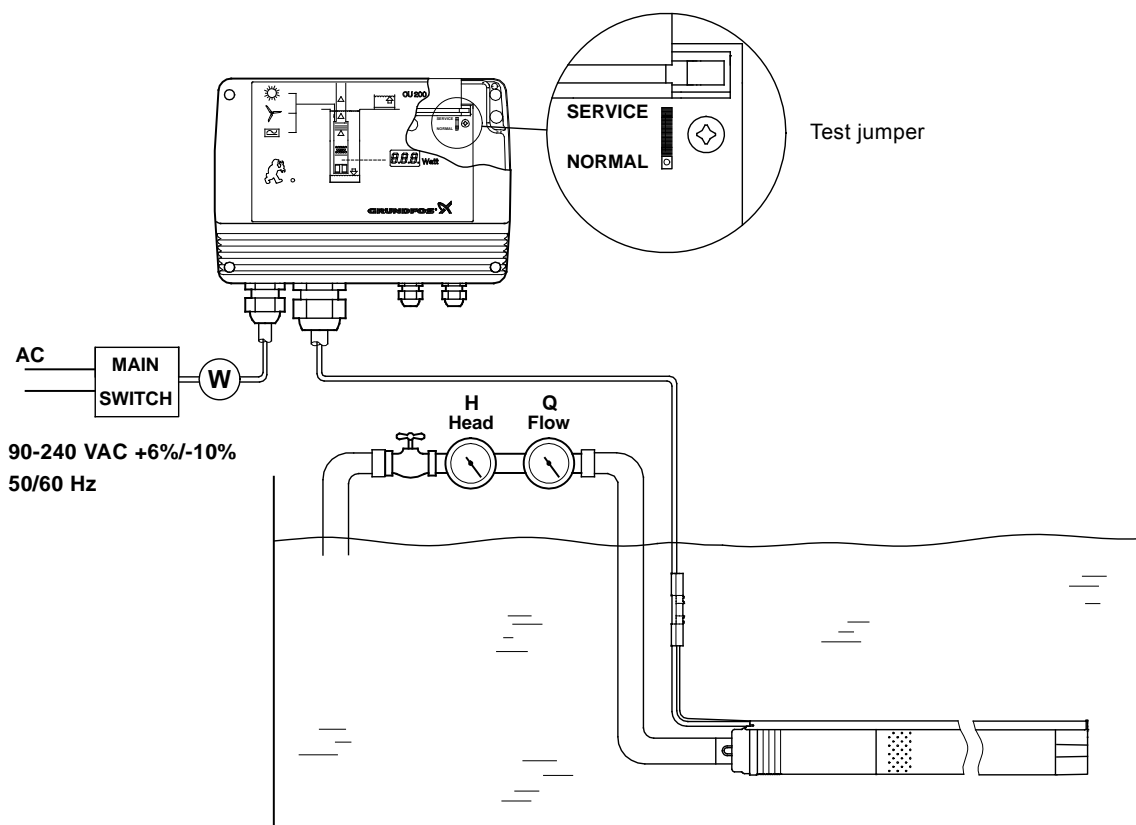
## 8.12 Checking and replacing wear parts of centrifugal pumps

<b>Bearing pos. 8</b>	
<b>Check</b>	<b>Replace</b>
<ul style="list-style-type: none"> <li>Check whether the bearings are defective due to sand or dry running.</li> </ul>	<ul style="list-style-type: none"> <li>Remove the bearing pos. 8 by pressing it out of the chamber pos. 9.</li> <li>Press a new bearing into the chamber from the bottom side with the largest bearing diameter against the bottom side of the chamber.</li> </ul>
<b>Top bearing pos. 6</b>	
<b>Check</b>	<b>Replace</b>
<ul style="list-style-type: none"> <li>Check whether the bearing is defective.</li> </ul>	<ul style="list-style-type: none"> <li>Press the bearing pos. 6 out of the valve housing (cylindrical shaft). 25 SQF (splined shaft): Press the bearing out using a screwdriver, if necessary.</li> <li>Press the new bearing into the valve housing from the bottom side.</li> </ul>
<b>Valve seat pos. 3 (only in 25 SQF)</b>	
<b>Check</b>	<b>Replace</b>
<ul style="list-style-type: none"> <li>Check whether the rubber is hard or compressed so that the valve cup pos. 2 touches the metal.</li> </ul>	<ul style="list-style-type: none"> <li>Free the valve guide pos. 70 where it is positioned under the recess of the valve casing. Pull the guide and the valve cup pos. 2 out of the valve housing.</li> <li>Push the valve seat pos. 3 out of the valve housing by inserting a screwdriver between the valve seat and the valve housing.</li> <li>Press the valve seat home in the valve housing with the flat side downwards.</li> </ul>
<b>Neck ring pos. 7</b>	
<b>Check</b>	<b>Replace</b>
<ul style="list-style-type: none"> <li>Check whether the rubber is hard or worn as this may reduce the head or flow rate.</li> </ul>	<ul style="list-style-type: none"> <li>Prize the neck ring pos. 7 free of the chamber pos. 9/10 or guide pos. 25 by inserting a screwdriver between the neck ring and the chamber/guide.</li> <li>Press the neck ring home in the chamber pos. 9/10 or guide pos. 25. The following side of the neck ring must be up:               <ul style="list-style-type: none"> <li>25 SQF      smooth surface</li> <li>40 SQF      "This side up"</li> <li>75 SQF      lip</li> </ul> </li> </ul>



### 8.13 Testing the pump by means of CU 200 SQFlex3 control unit

The pump must deliver a flow rate (gpm) at a given power consumption and head. The 8.13.1 Test value curves on page 74 apply to the head stated for each pump. The curve values are minimum values.



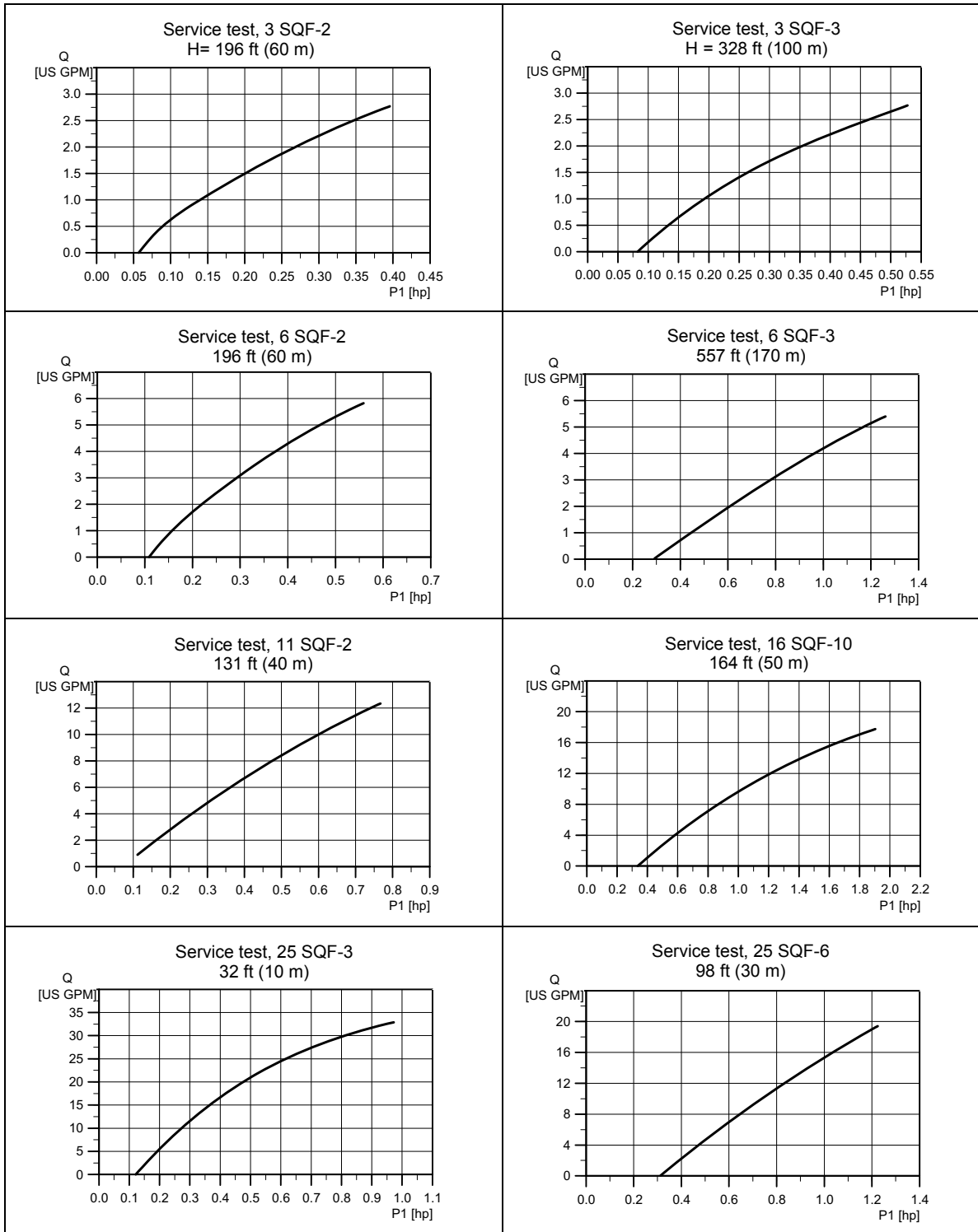
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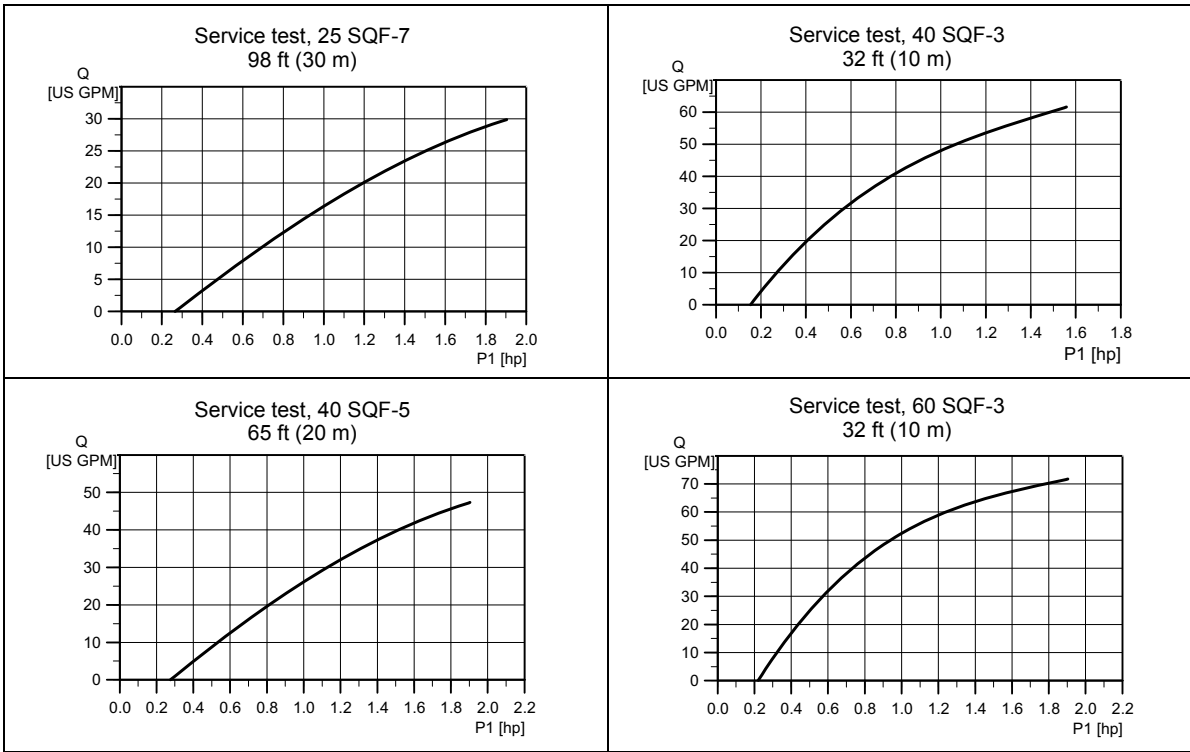
**Fig. 78** Using the CU200 control unit to test the pump

1. Open the discharge valve completely to reduce the counter-pressure to a minimum.
2. Disconnect the power supply to the pump.
3. Remove the front cover of the CU 200, and set the test jumper to service position, see illustration. Refit the front cover.
4. Connect the power supply.
5. Make sure that the system is off. The red indicator light of the ON/OFF button must be on. If the system is not off, press the ON/OFF button once.
6. Press the ON/OFF button for at least four seconds. Release the button. The CU 200 is now in test mode. (The bottom flow indicator is permanently on, and the pump is running slowly.)
7. Press the ON/OFF button twice (the upper flow indicator is permanently on). The pump now adjusts its speed.
8. Adjust the counter-pressure to the value stated for each pump in the curves in Section 8.13.1 Test value curves on page 74.
9. Read the flow rate  $Q$  [ $m^3/h$ ] using a flowmeter or a similar device and the power consumption  $P_1$  [ $W$ ] using a wattmeter.
10. In the relevant curve chart, find the intersection point of the values read for flow ( $Q$ ) and power consumption  $P_1$  [ $W$ ].
  - If the intersection is above the minimum curve, the flow rate is sufficient.
  - If the intersection is below the minimum curve, the flow rate is insufficient, and the pump should be checked and defective parts replaced.
11. Press the ON/OFF button once. The CU 200 is no longer in test mode.
12. Disconnect the power supply, and disconnect the pump and the CU 200.
13. Move the test jumper from service to normal position.

8.13.1 Test value curves

The curve shown in the curve charts below is the minimum performance curve for the pump.





9. Exploded views

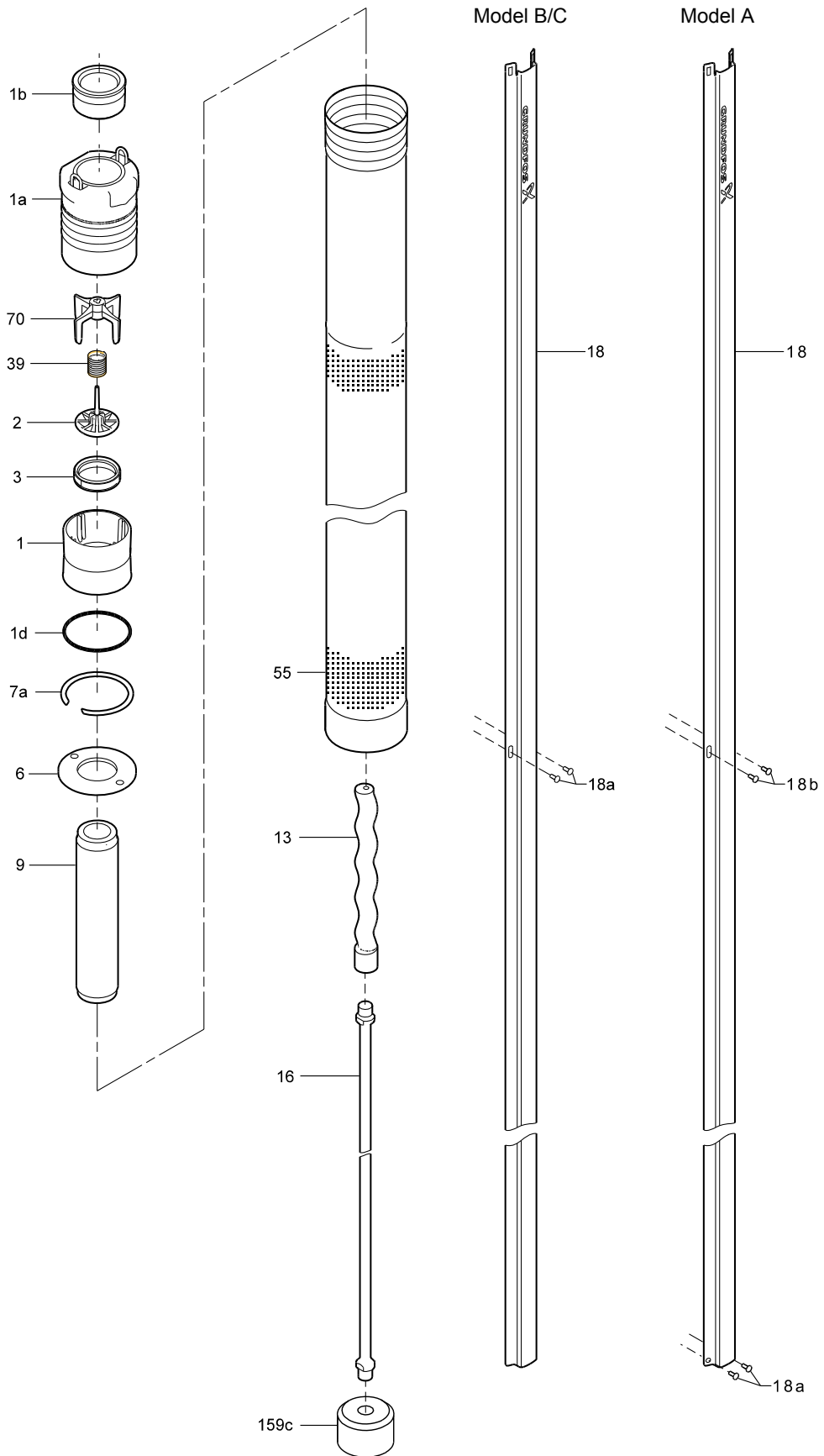


Fig. 79 Helical rotor pumps, 3 SQF, 6 SQF, 11 SQF

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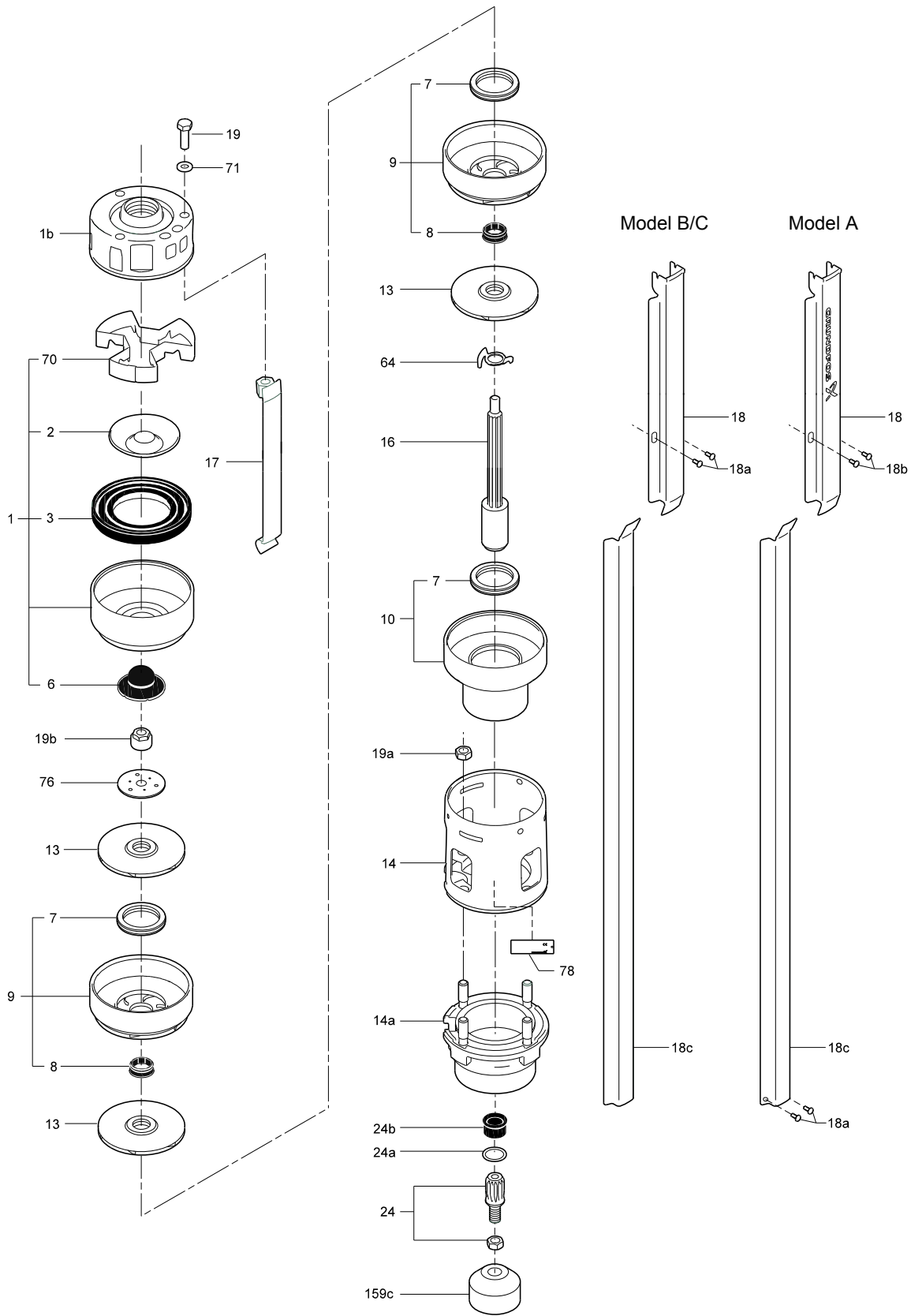


Fig. 80 Centrifugal pump with splined shaft, 16 SQF, 25 SQF

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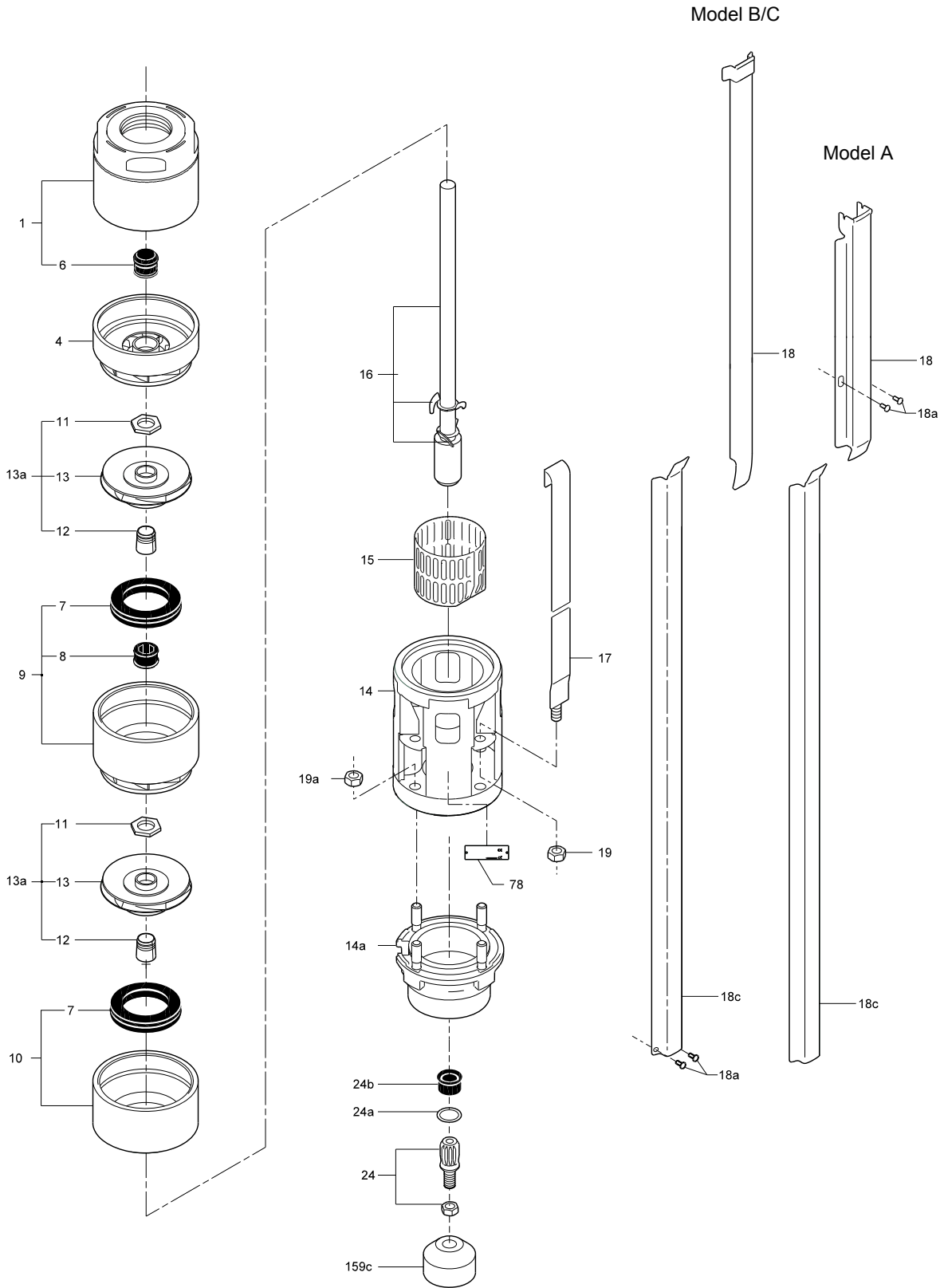


Fig. 81 Centrifugal pump with cylindrical shaft, 40 SQF

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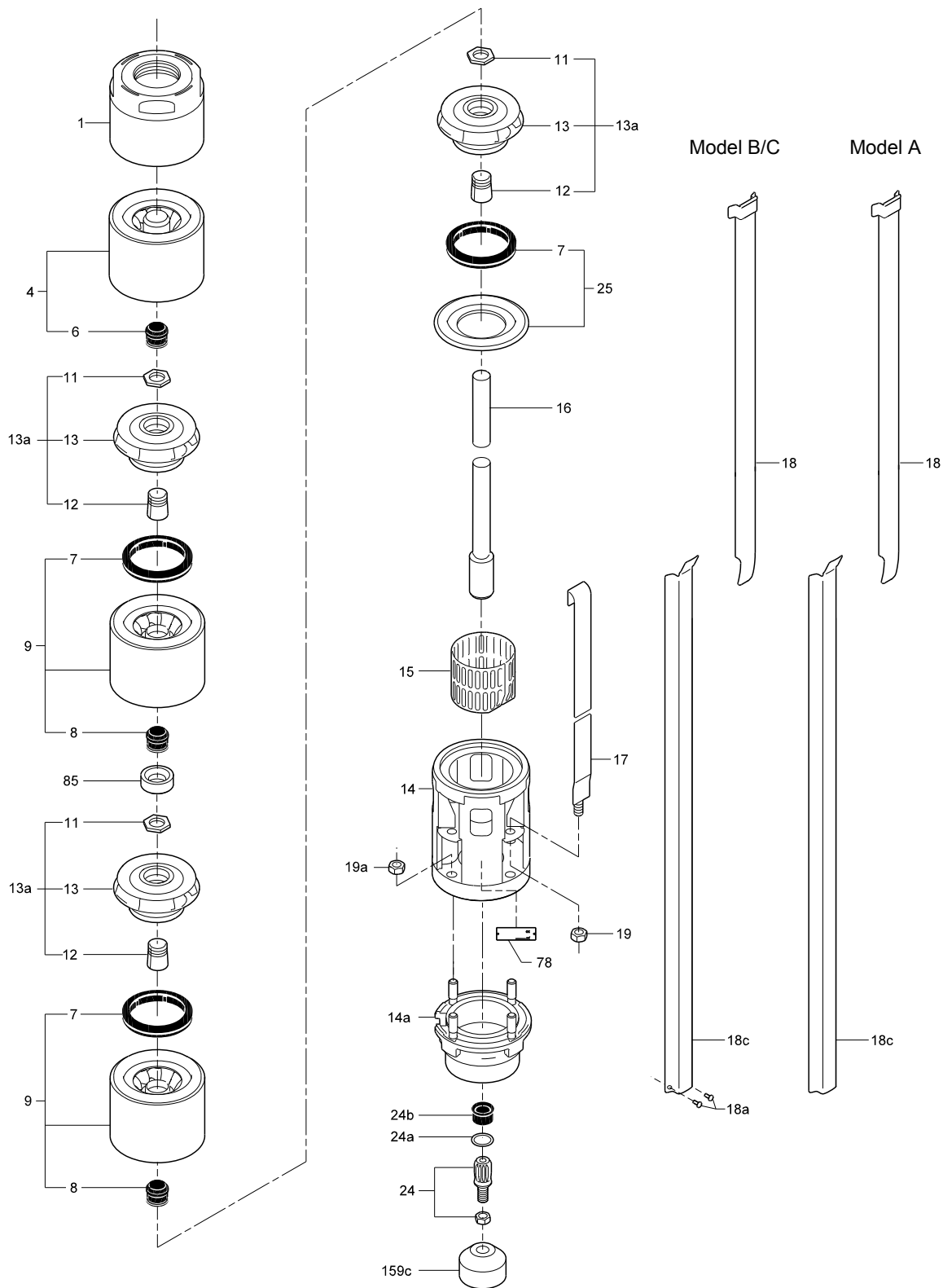


Fig. 82 Centrifugal pump with cylindrical shaft, 60 SQF

TM04 3305 4208

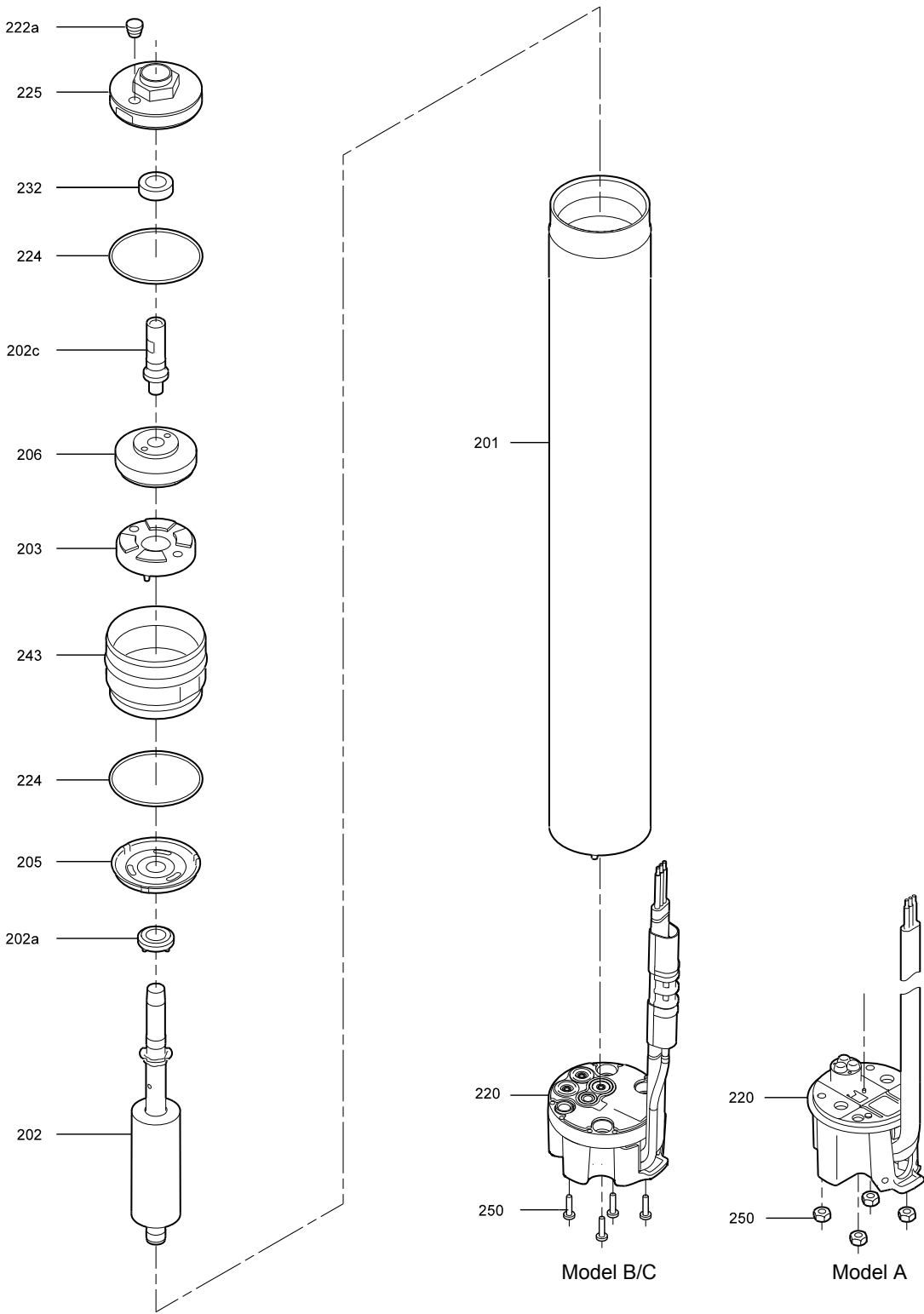


Fig. 83 Motor

TM04 3307 4208



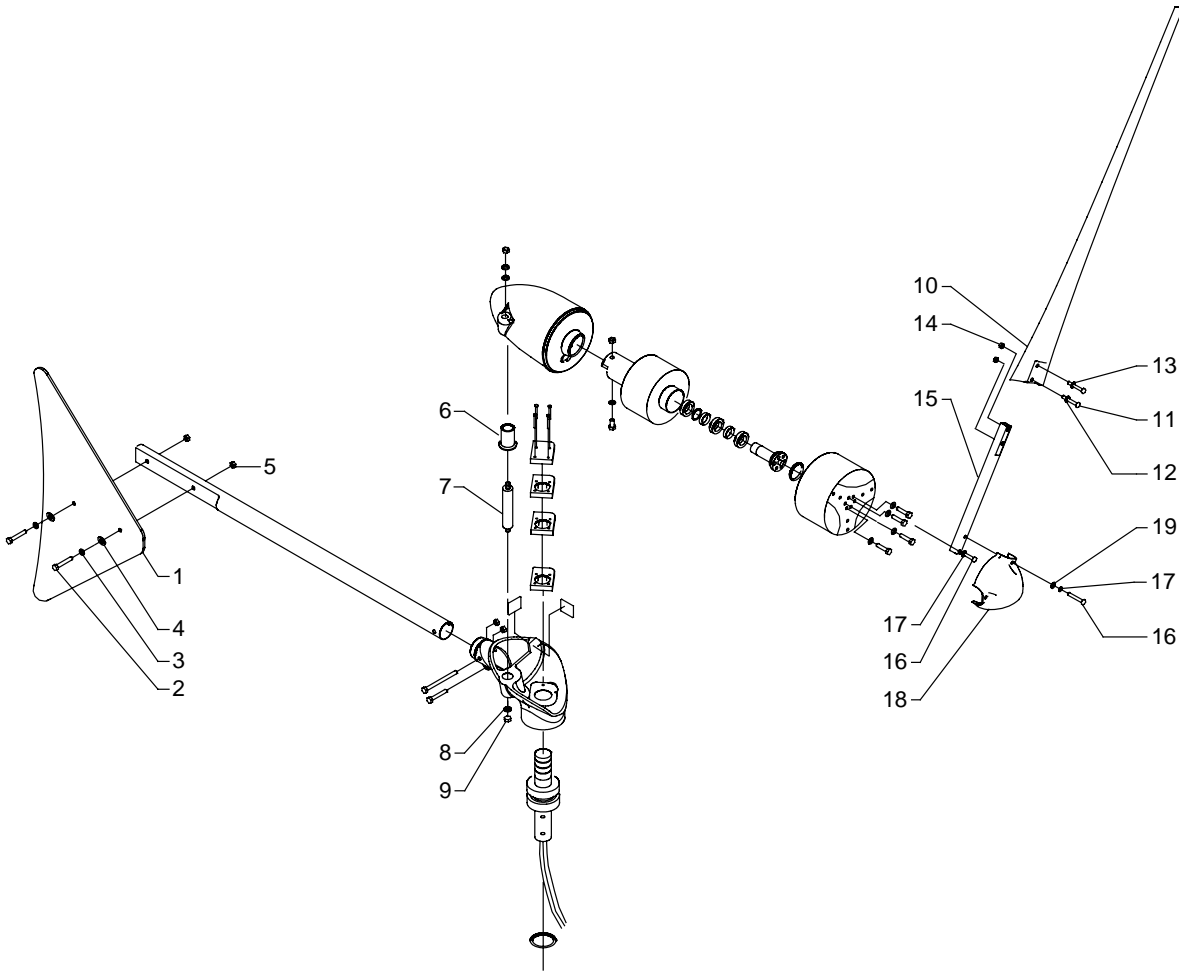


Fig. 84 Wind turbine

TM02 4386 0802



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