SQFlex water supply system

GB 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. SQFlex components

2.1 Pumps

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

Nameplate, helical rotor pump

The nameplate is engraved into the pump sleeve.

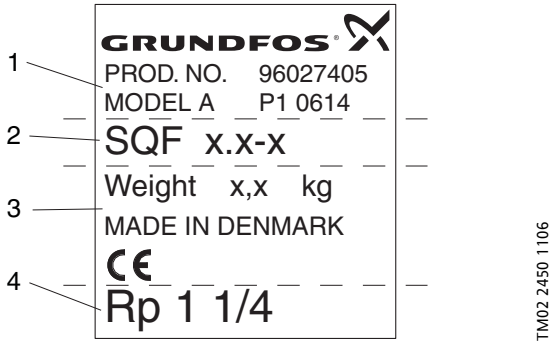

Fig. 1 Nameplate, helical rotor pump

Key to nameplate, helical rotor pump

Pos.	Code	Description
1	PROD. NO. 96027405	Product number
	MODEL A	Pump generation
	P1 0614	Production code, Bjerringbro (P1) + production year and week
2	SQF x.x-x	Type designation. See section *Type key* on page 5.
3	• Weight: x.x kg • MADE IN DENMARK • CE	• Pump net weight • Country of origin • Mark of conformity
4	Rp 1 1/4	Type and size of connecting thread

Nameplate, centrifugal pump

The nameplate is attached to the suction interconnector.

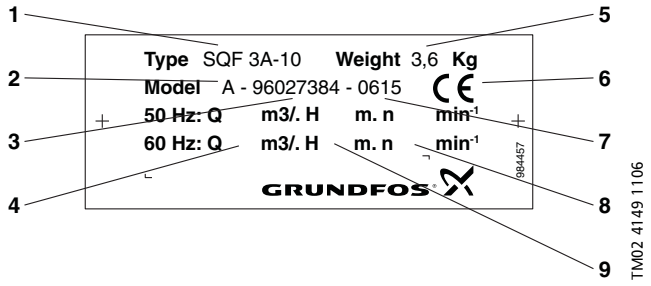

Fig. 2 Nameplate, centrifugal pump

Key to nameplate, centrifugal pump

Pos.	Code	Description
1	Type SQF 3A-10	Type designation. See section *Type key* on page 5.
2	Model A	Pump generation
3	96027384	Product number
4	Q m^3/h	Rated flow rate (not indicated)
5	Weight 3.6 kg	Pump net weight in kg
6	CE	Mark of conformity
7	0615	Production year and week
8	n min^{-1}	Speed (not indicated)
9	H	Head at rated flow rate (not indicated)

Type key

The type key is common for the helical rotor pump and centrifugal pump.

Example	SQF	X -	X -	N

Type range

Rated flow rate in m^3/h
- 0.6 = helical rotor pump
- 1.2 = helical rotor pump
- 2.5 = helical rotor pump
- 3A = centrifugal pump
- 5A = centrifugal pump
- 8A = centrifugal pump
- 11A = centrifugal pump
- 14A = centrifugal pump

Number of stages

Material
W.-Nr. 1.4301
N = W.-Nr. 1.4401

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

SQF 3A and SQF 5A have a splined pump shaft. All other pumps (SQF 3A N, SQF 5A N, SQF 8A (N), SQF 11A (N) and SQF 14A (N)) have a cylindrical shaft.

3. 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 (PM-motor).

Nameplate, motor

The nameplate is engraved into the stator sleeve.

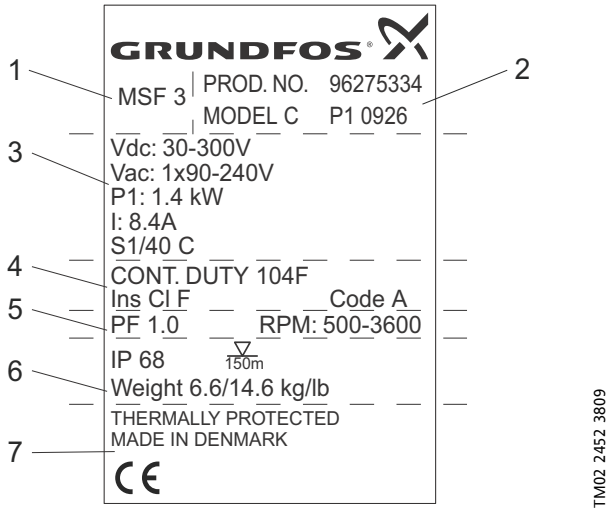

Fig. 3 Nameplate, motor

Key to nameplate, motor

Pos.	Code	Description
1	MSF 3	Type designation
2	PROD. NO. 96275334	Product number
	MODEL C	Motor generation
	P1 0926	Production code, Bjerringbro (P1) + 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 • 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 min^{-1}.
6	IP68 150 m	Enclosure class: IP68. Maximum installation depth: 150 m.
	Weight 6.6 / 14.6 kg/lb	Motor net weight in kg and pounds
7	THERMALLY PROTECTED	Temperature sensor built into the electronic unit
	MADE IN DENMARK	Country of origin
	CE	Mark of approval

4. Control and switch boxes

4.1 CU 200 SQFlex control unit

TM04 5251 2909

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.

Fig. 4 CU 200 SQFlex control unit

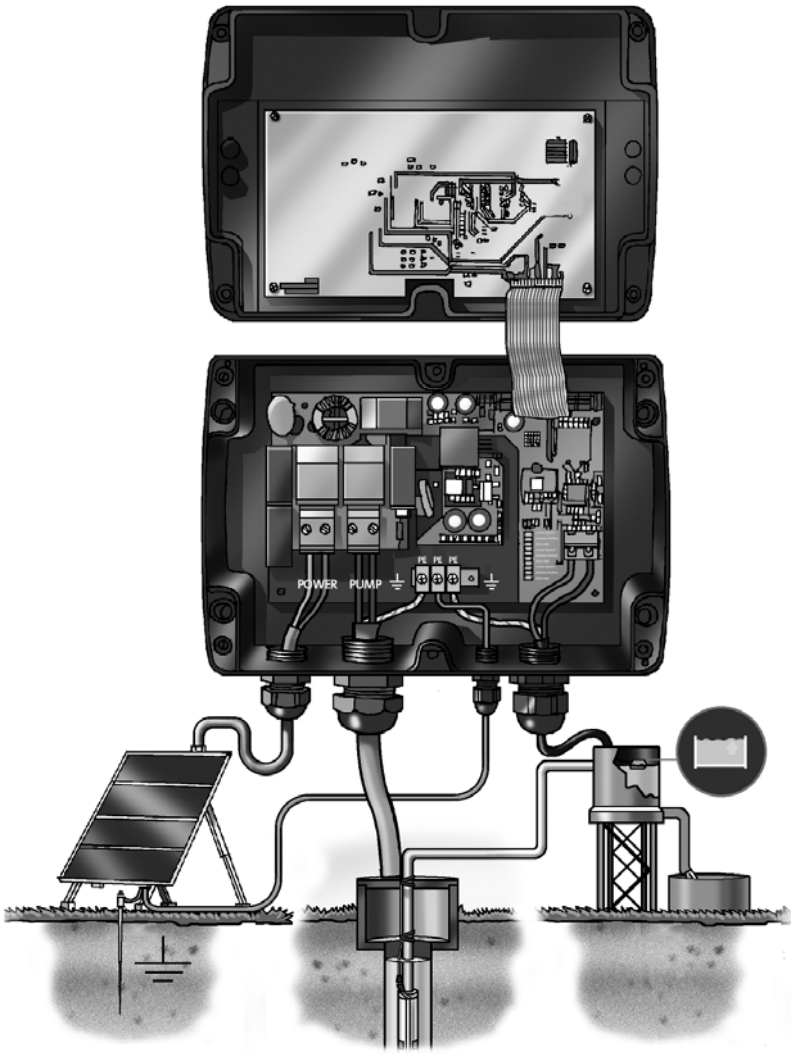

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Fig. 5 Internal (and external) wiring of the CU 200 SQFlex control unit

Technical data

- U_N: 30-300 VDC, 1 x 90-240 V - 10 %/+ 6 %, 50/60 Hz, PE.
- $P_{max.}$: 5 W.
- Enclosure class: IP55 and NEMA 3R.

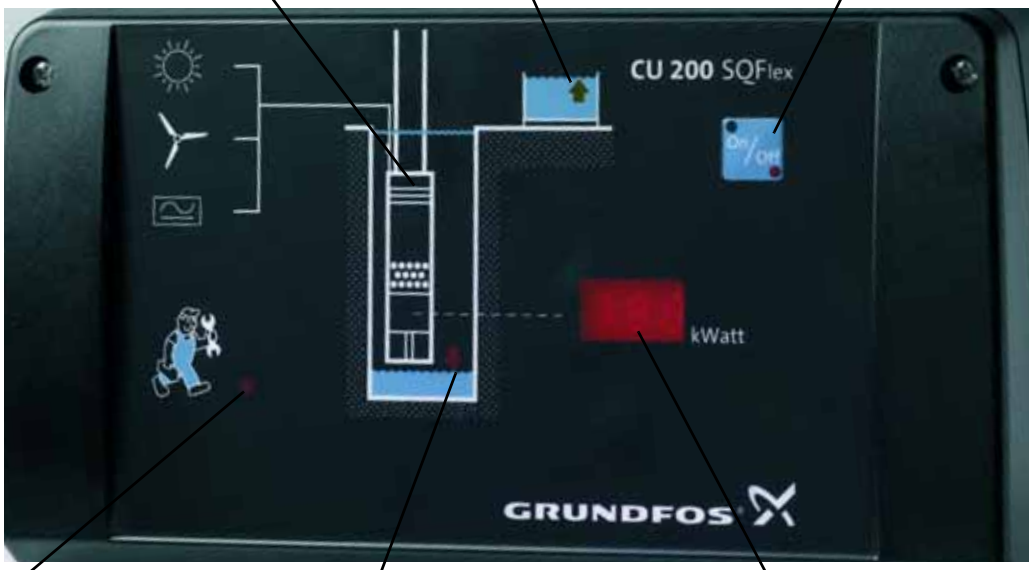
CU 200 SQFlex display and indicator lights

The front cover of the CU 200 features a button and various indicators.

Pump operation
A running green light indicates that the pump is operating at more than 500 min^{-1}.

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 min^{-1}.
Upon start-up, the power consumption of the pump is indicated in steps of 10 W, the maximum indication being 1.4 kW.
When the fault indicator is on, the display indicates fault codes. See section *Fault correction using the CU 200* on page 9.
F1 = overvoltage
F2 = overtemperature
F3 = no contact to pump
F4 = overload.

GrA3237p_w

Fig. 6 CU 200 SQFlex display and indicator lights

Fault correction using the CU 200

Indication/fault	Possible cause	Remedy
1. No light in front cover. The pump does not deliver water.	a) No power supply.	Re-establish the power supply.
	b) Position of ribbon cable connector is wrong, or cable is defective.	Correct the position of the cable, or replace it.
	c) Ribbon cable not fitted.	Fit the ribbon cable.
2. No light in front cover. The pump does not deliver water. The LEDs inside the CU 200 indicating 5 V, 10 V and 24 V internal supply voltage are on, and the 'CONTROL INDICATOR' LED is not flashing.	a) The CU 200 is defective.	Replace the CU 200.
3. The pump does not start. Green indicator light in On/Off button is on. No fault indicated.	a) The CU 200 or pump is defective.	• Check that the 'CONTROL INDICATOR' LED is flashing. If not, replace the CU 200. • Check that there is sufficient voltage on the PUMP terminals. If no voltage can be measured, replace the CU 200. If a supply voltage to the pump can be detected, continue as follows: • Switch off the energy supply, and wait for one minute. • 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. • Repair or replace pump or cable.
4. Red indicator light in On/Off button is on.	a) The pump has been stopped.	Press the On/Off button on the CU 200 to start the pump.
5. The CU 200 indicates 'F3 = no contact to pump'.	a) The CU 200 is defective.	Check • the connection in the CU 200 • the pump cable • the end cover with socket on the pump.
	b) Pump cable or connections defective.	
	c) The pump is defective.	Repair or replace the pump.
6. The CU 200 indicates 'F1 = overvoltage'.	a) Supply voltage is above permissible range.	• Disconnect the solar modules to allow the voltage to drop. • Reconfigure the modules, and reconnect them. If a different supply source is used, check that the voltage is within the recommended voltage range. **Note:** As the voltage is detected at the motor, allow for the voltage drop in the pump cable.
7. The CU 200 indicates 'F2 = overtemperature'.	a) Too high water temperature.	Ensure that the water temperature is below the maximum permissible level.
	b) Incrustations on motor.	Remove incrustations on the motor.
	c) The pump is defective.	Repair or replace the pump.
8. The CU 200 indicates 'F4 = overload'.	a) Too low input voltage.	Increase the supply voltage to 30 VDC or higher.
	b) The pump is defective.	Repair or replace the pump.
	c) **Only helical rotor pumps:** Pumped liquid is contaminated with oil or similar substance.	Clean the liquid, and replace the pump.
	d) Motor liquid low or missing.	Check or refill motor liquid.
9. Green indicator light in On/Off button is flashing.	a) Insufficient power supply.	Increase the number of solar modules, or connect an alternative energy supply, such as wind turbine, batteries or generator.
	b) The pump has seized up.	Clean the pump.
10. Running light on the CU 200, but low power consumption.	a) System not earthed.	Check system for adequate earthing.
	b) The pump is defective.	Repair or replace the pump. If a centrifugal pump is used, check that the riser pipe is not blocked.

Indication/fault	Possible cause	Remedy
11. No light in front cover. The pump delivers water.	a) The CU 200 is defective.	Replace the CU 200.
	b) Ribbon cable not fitted.	Fit the ribbon cable.
12. The pump does not stop when the water reservoir is full. Fault indicator light on the CU 200 is off.	a) Level switch is dirty or defective.	Clean or replace the level switch.
	b) Level switch cable is damaged.	Replace the cable.
13. The pump does not stop when the water reservoir is full. Fault indicator light on the CU 200 is on.	a) The CU 200 is defective.	Replace the CU 200.
14. The pump does not start when the water reservoir is empty. Water reservoir indicator is on.	a) Level switch is defective.	Replace the level switch.
	b) Level switch cable is damaged.	Replace the cable.
	c) The CU 200 is defective.	Replace the CU 200.

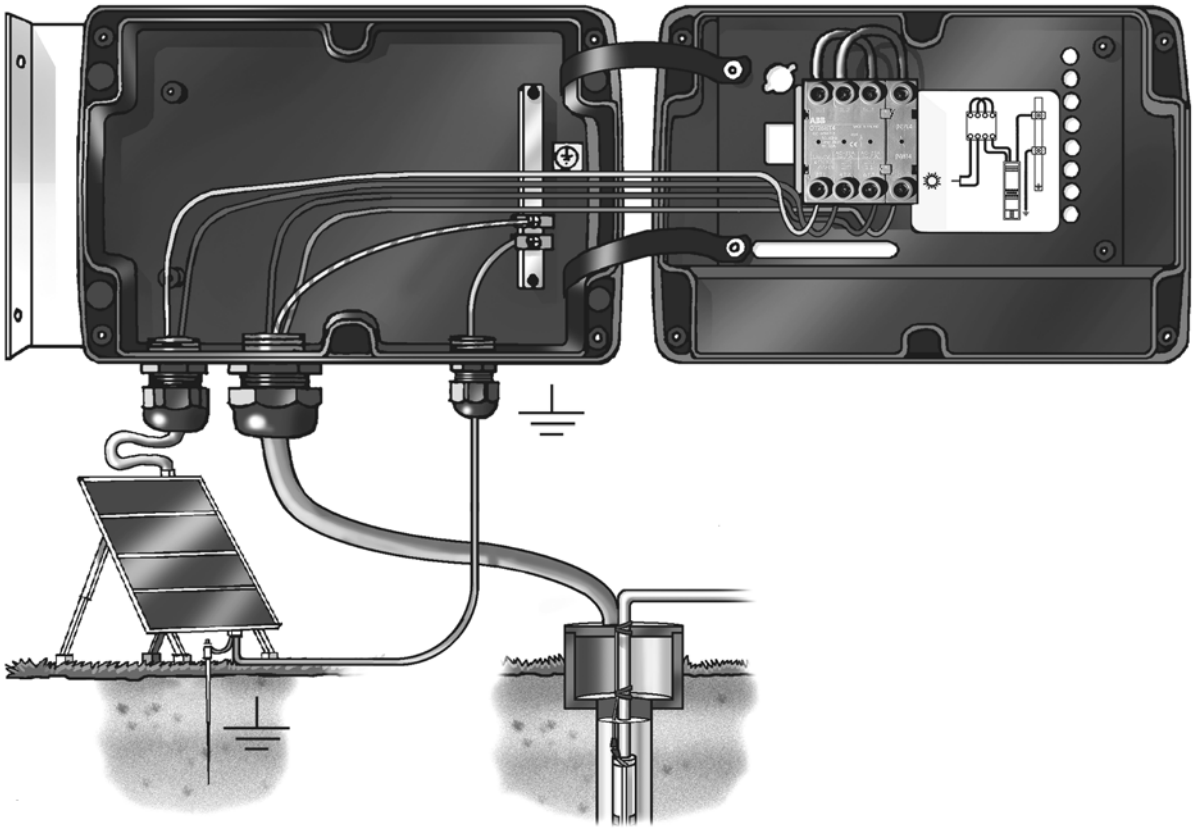
4.2 IO 100 SQFlex switch box

TM04 5080 2609

The IO 100 SQFlex switch box enables manual starting and stopping of the pump in a solar-powered SQFlex system.

In addition, the IO 100 functions as a connection point for all necessary cables.

Fig. 7 IO 100 SQFlex switch box



TM04 5079 2609

Fig. 8 Internal (and external) wiring of the IO 100 SQFlex switch box

Technical data

- $V_{contact}$ max.: 300 VDC, PE.
- $V_{contact}$ max.: 254 VAC, 50/60 Hz, PE.
- $I_{contact}$ max.: 8.4 A.
- I_c < 5 kA.
- Enclosure class: IP55 and NEMA 3R.
- Ambient temperature: -30 °C to +50 °C.

4.3 IO 101 SQFlex switch box

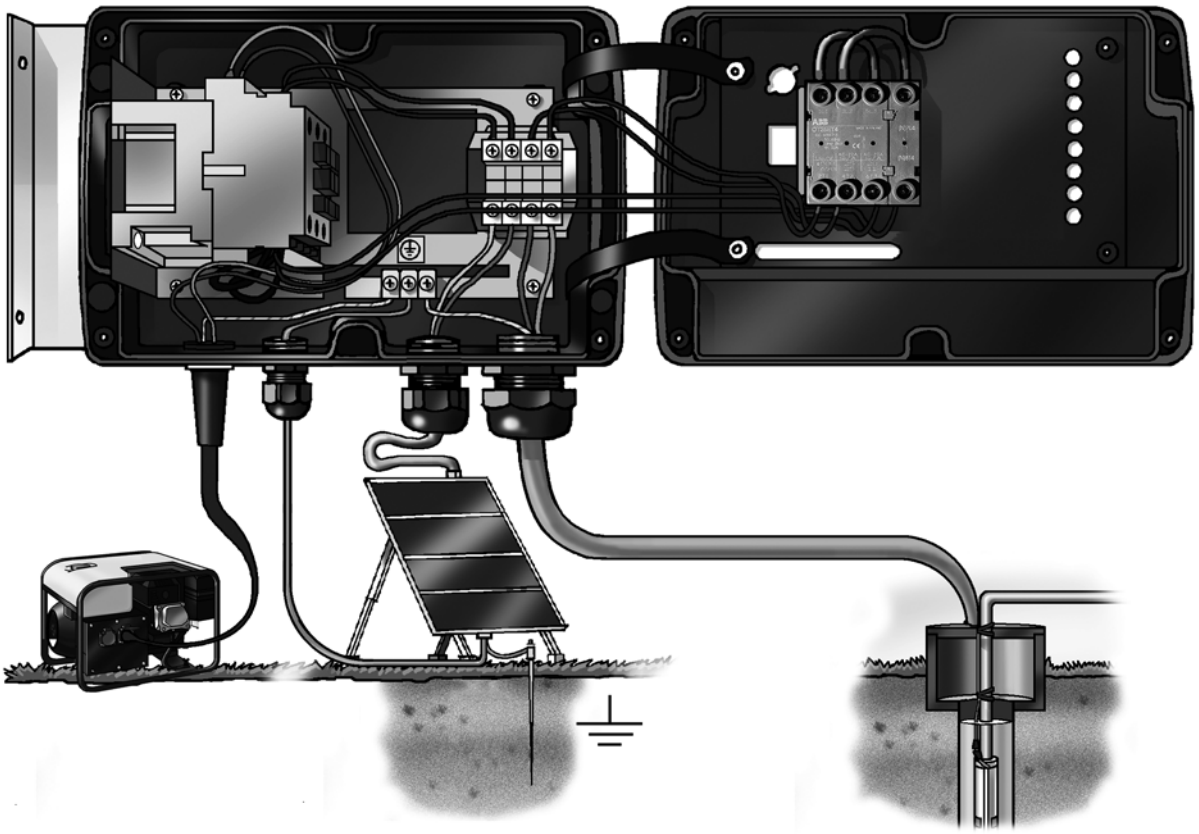
TM04 5694 3809

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. 9 IO 101 SQFlex switch box



TM04 5081 2609

Fig. 10 Internal (and external) wiring of the IO 101 SQFlex switch box

Technical data

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

4.4 IO 102 SQFlex breaker box

TM04 5082 2609

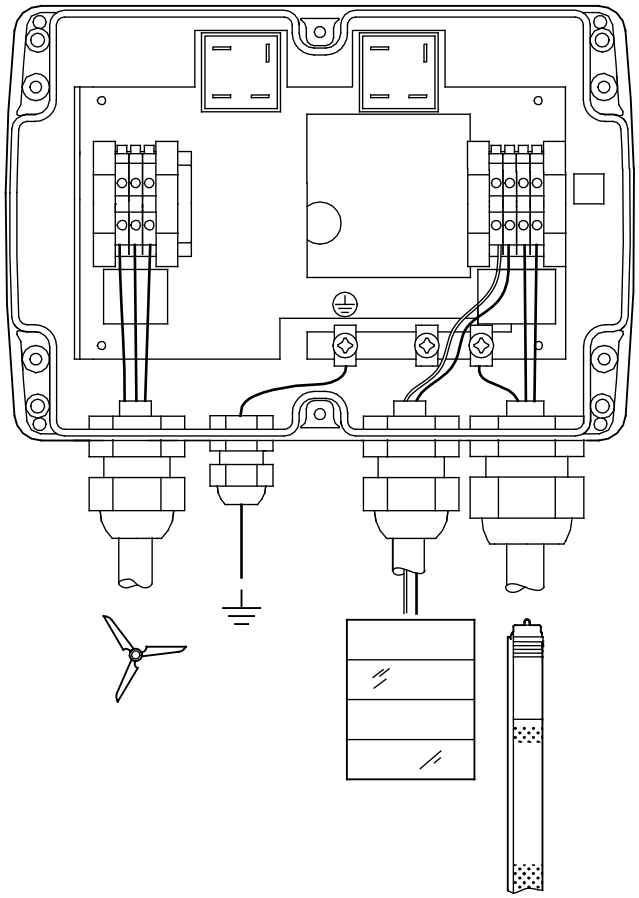
The IO 102 SQFlex breaker box is applicable in SQFlex systems powered exclusively by a wind turbine.

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.

Fig. 11 IO 102 SQFlex breaker box



TM02 4500 1102

Fig. 12 Internal (and external) wiring of the IO 102 SQFlex breaker box

Technical data

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

5. Solar modules

5.1 Positioning

The map in fig. 13 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.

Northern hemisphere

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. See fig. 13.

- 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.

Southern hemisphere

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. See fig. 13.

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.

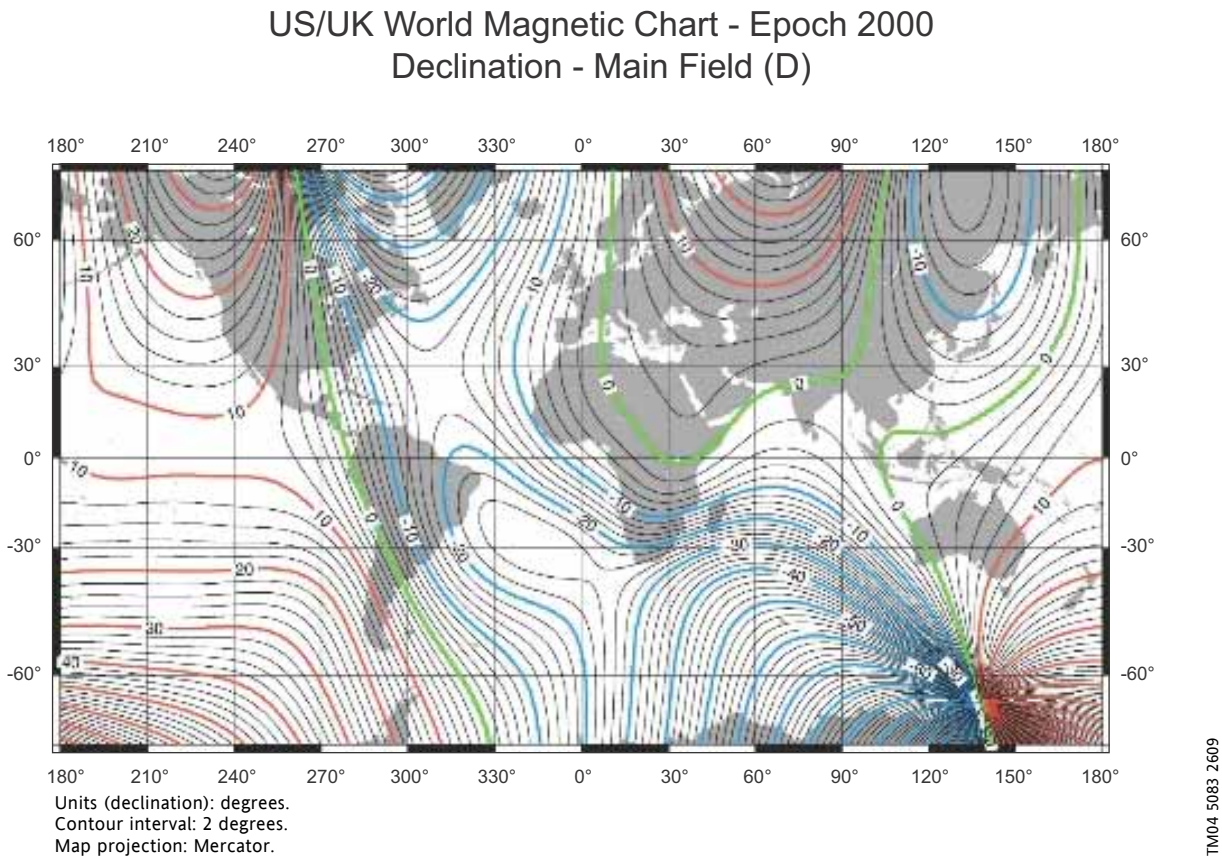


Fig. 13 Map illustrating the differences in magnetic declination in different parts of the world

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 utilisation of the solar radiation, the tilt angle of the support structure can normally be adjusted from 15 ° to 45 °.

5.2 GF 43 and GF 50 solar modules

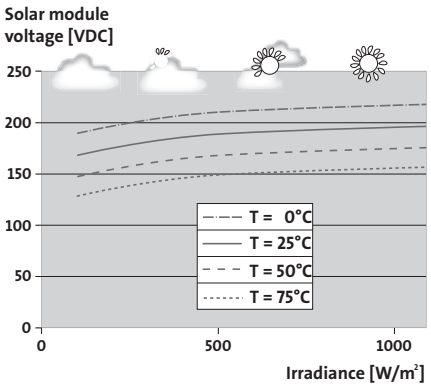
TM04 5084 2609

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 utilisation of the solar energy.

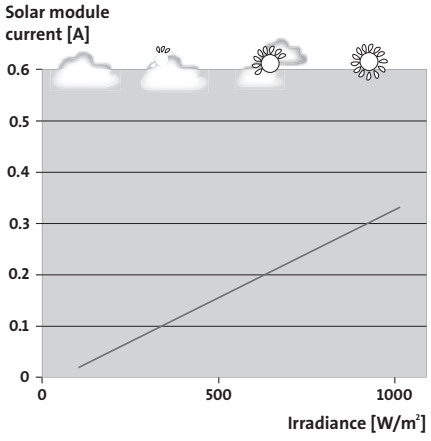
Characteristics		
Solar module	**GF 43**	**GF 50**
Peak power ($P_{max.}$)	43 W	50 W
Warranted minimum $P_{max.}$	38.7 W	45 W
Voltage (V_{mp})	140 V	156 V
Current (I_{mp})	0.31 A	0.32 A
Open-circuit voltage (V_{OC})	194 V	202 V
Short-circuit current (I_{SC})	0.40 A	0.41 A
Minimum bypass diode	6 A	6 A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

Fig. 14 GF 43 and GF 50 solar modules



TM02 6881 1903

Fig. 15 Weather influence on the output



TM02 6882 1903

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

Fig. 16 Weather influence on the output

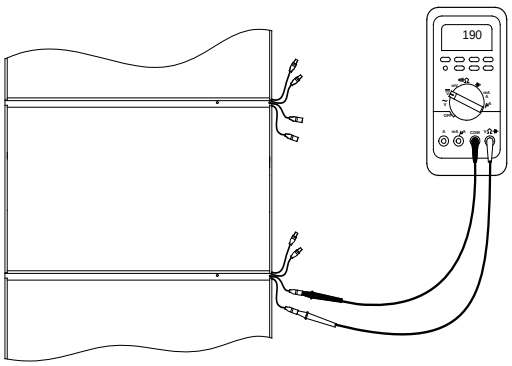
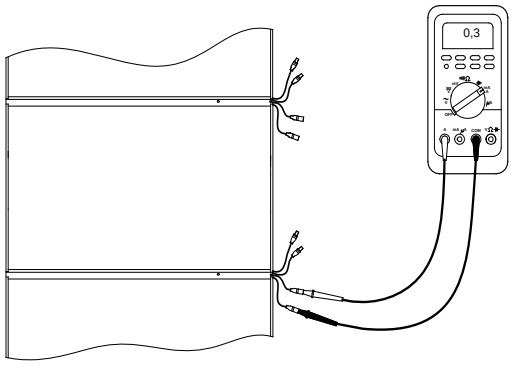


Fig. 17 Measurement of voltage with a multimeter



TM02 4368 0702

Fig. 18 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.

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.*

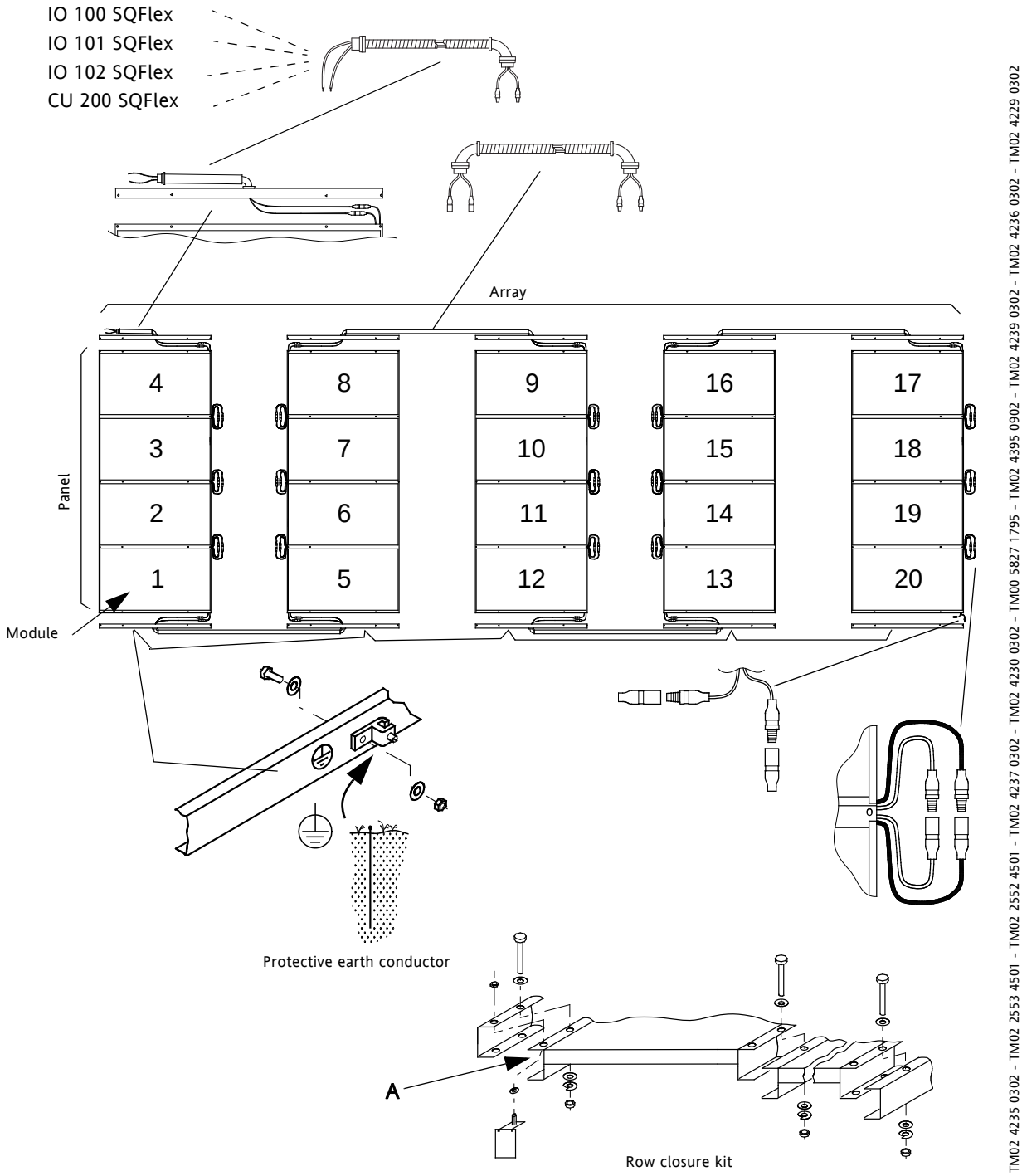


Fig. 19 Accessories needed to connect a PE conductor

The solar panels must be connected to earth via the **P**rotective **E**arth (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 earth clips (pos. A) and earth terminals supplied with the row closure kit.*

5.3 GF 70 and GF 80 solar modules

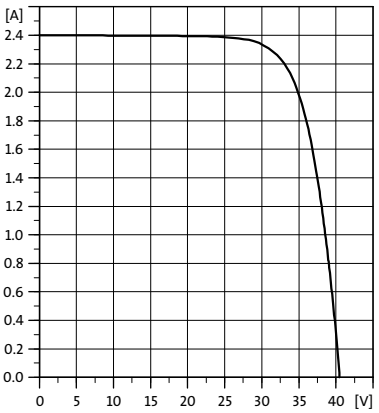
TM04 5085 2609

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 utilisation of the solar energy.

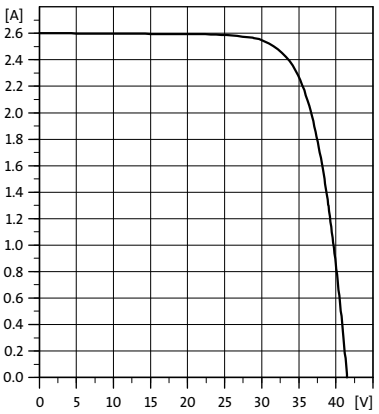
Characteristics		
Solar module	**GF 70**	**GF 80**
Peak power ($P_{max.}$)	70 W	80 W
Voltage (V_{mp})	31.8 V	33.3 V
Current (I_{mp})	2.2 A	2.4 A
Open-circuit voltage (V_{OC})	40.4 V	41.5 V
Short-circuit current (I_{SC})	2.4 A	2.6 A
Reference cell temperature (T_{cref})	77 °F / 25 °C	77 °F / 25 °C
Solar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

Fig. 20 GF 70 and GF 80 solar modules



TM03 3382 0306

Fig. 21 GF 70 performance at 1000 W/m^2, 77 °F / 25 °C



TM03 3383 0306

Fig. 22 GF 80 performance at 1000 W/m^2, 77 °F / 25 °C

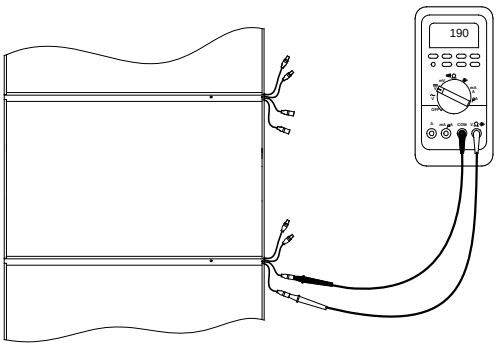
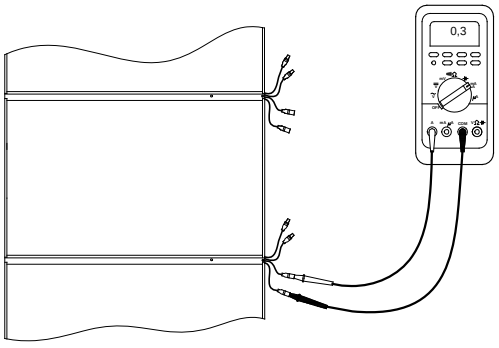


Fig. 23 Measurement of voltage with a multimeter



TM02 4368 0702

Fig. 24 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.

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}.

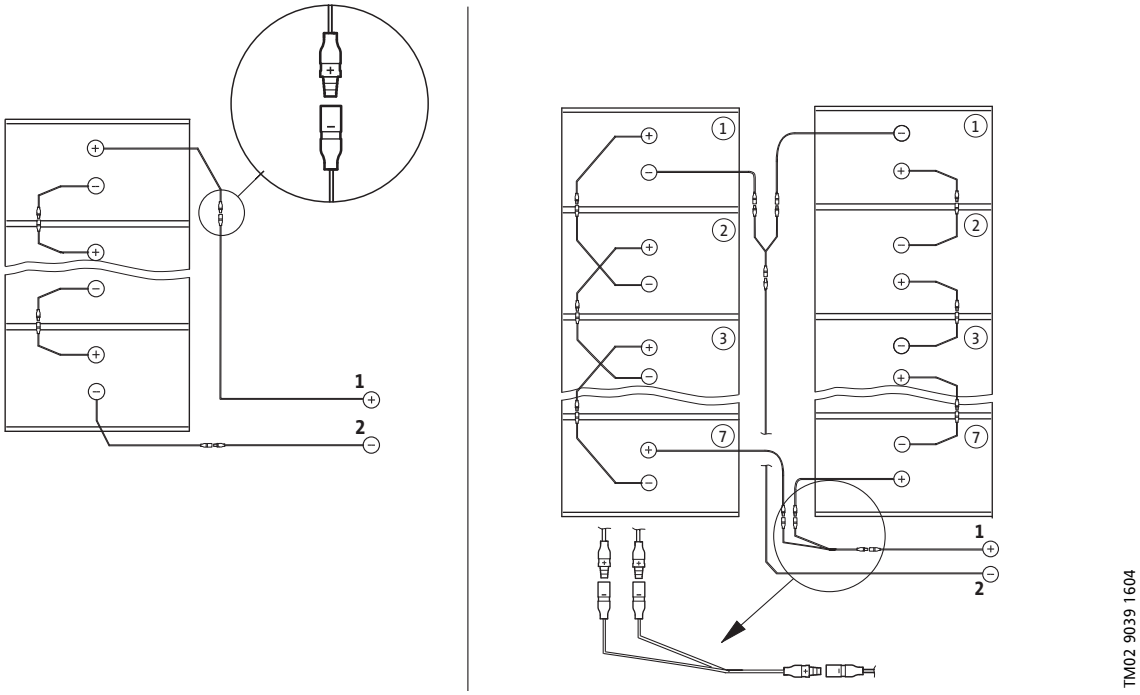


Fig. 25 Electrical connection of GF 70 and GF 80 solar modules

The solar panels must be connected to earth via a **P**rotective **E**arth (PE) conductor.

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

5.4 SX-110 solar modules

Gr4943

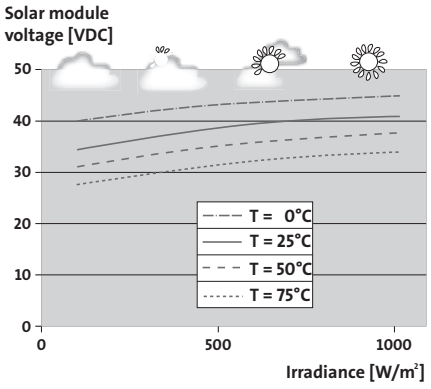
The SX-110 solar modules consist of 72 multicrystalline silicon solar cells in series with bypass diodes installed.

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 utilisation of the solar energy.

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

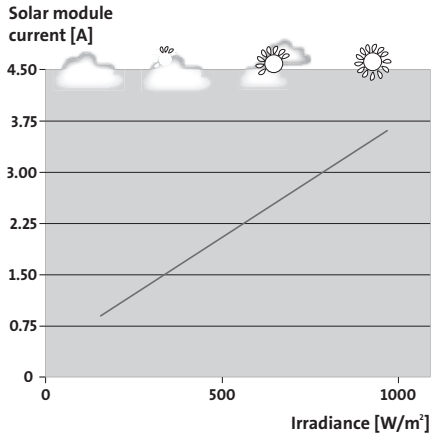
Characteristics	
Solar module	**SX-110**
Peak power ($P_{max.}$)	110 W
Voltage ($V_{mp)}$	32.9 V
Current (I_{mp})	3.34 A
Open-circuit voltage (V_{OC})	41.2 V
Short-circuit current (I_{SC})	3.69 A
Reference cell temperature (T_{cref})	25 °C
Solar irradiation at reference cell temperature (I_{tref})	1000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

Fig. 26 SX-110 solar modules



TM02 6961 2203

Fig. 27 Weather influence on the output



TM02 6960 2203

Fig. 28 Weather influence on the output

Visual inspection of solar modules

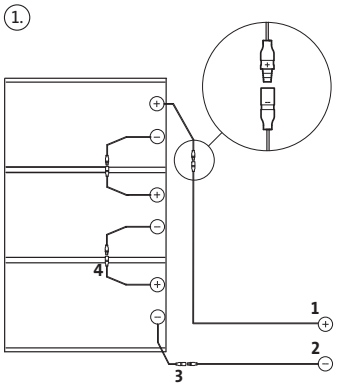
- Check that the solar modules are intact.
- Make sure that trees, grass, bushes, buildings, etc. do not cast a shadow on the solar modules.

Electrical connection of 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.***

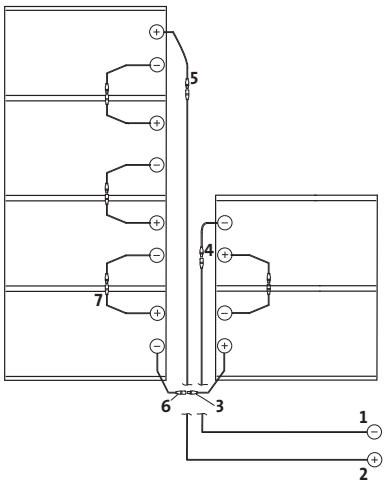
- The cover **must** be removed before the measurement is made.
- Measurements must be made when the solar modules are not connected.
- The current to be measured is the short-circuit current I_{SC}.

1.



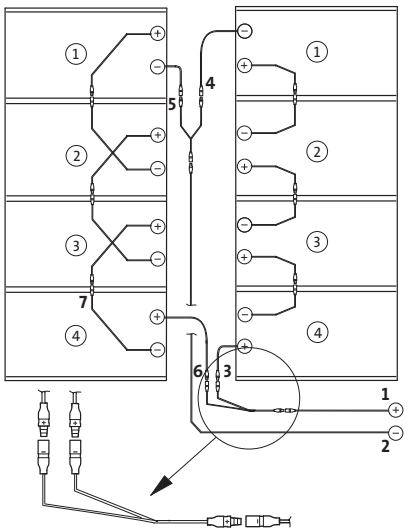
Plug	Modules	Voltage [v]	Current [A]
1 - 2	4 3 2 1	164 123 82 41	3,7 3,7 3,7 3,7
3 - 4	1	41	3,7

2.



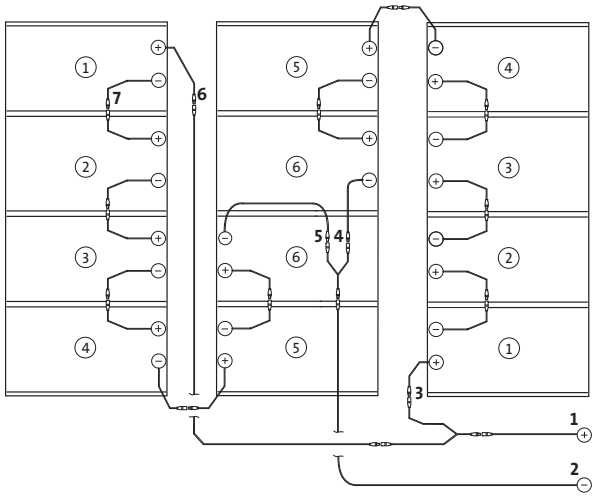
Plug	Modules	Voltage [v]	Current [A]
1 - 2	7 6 5	288 247 206	3,7 3,7 3,7
3 - 4	2 1	82 41	3,7
5 - 6	4	165	3,7
6 - 7	1	41	3,7

3.



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

4.



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

TM02 6875 1903

Fig. 29 Electrical connection of SX-110 solar modules

The solar panels must be connected to earth via a **P**rotective **E**arth (PE) conductor.

5.5 FS-50-D solar modules

TM04 5085 2609

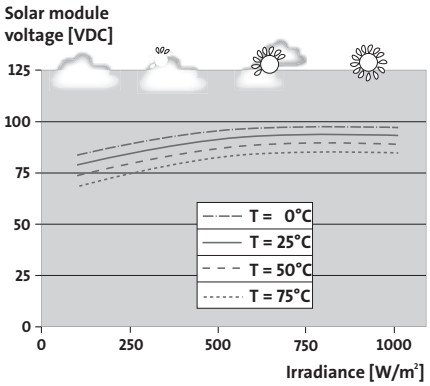
The FS-50-D solar modules consist of thin-film of semiconductor material on glass.

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 utilisation of the solar energy.

This module is UL- and IEC 61646-approved.

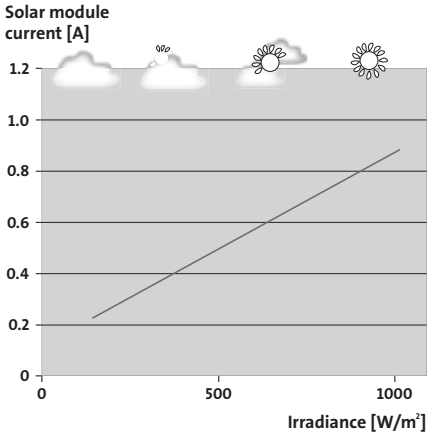
Characteristics	
Solar module	**FS-50-D**
Peak power ($P_{max.}$)	50 W
Voltage ($V_{mp)}$	65 V
Current (I_{mp})	0.77 A
Open-circuit voltage (V_{OC})	90 V
Short-circuit current (I_{SC})	1 A
Maximum series fuse rating	2 A
Reference cell temperature (T_{cref})	25 °C
Solar irradiation at reference cell temperature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

Fig. 30 FS-50-D solar modules



TM02 6963 2003

Fig. 31 Weather influence on the output



TM02 6962 2003

Fig. 32 Weather influence on the output

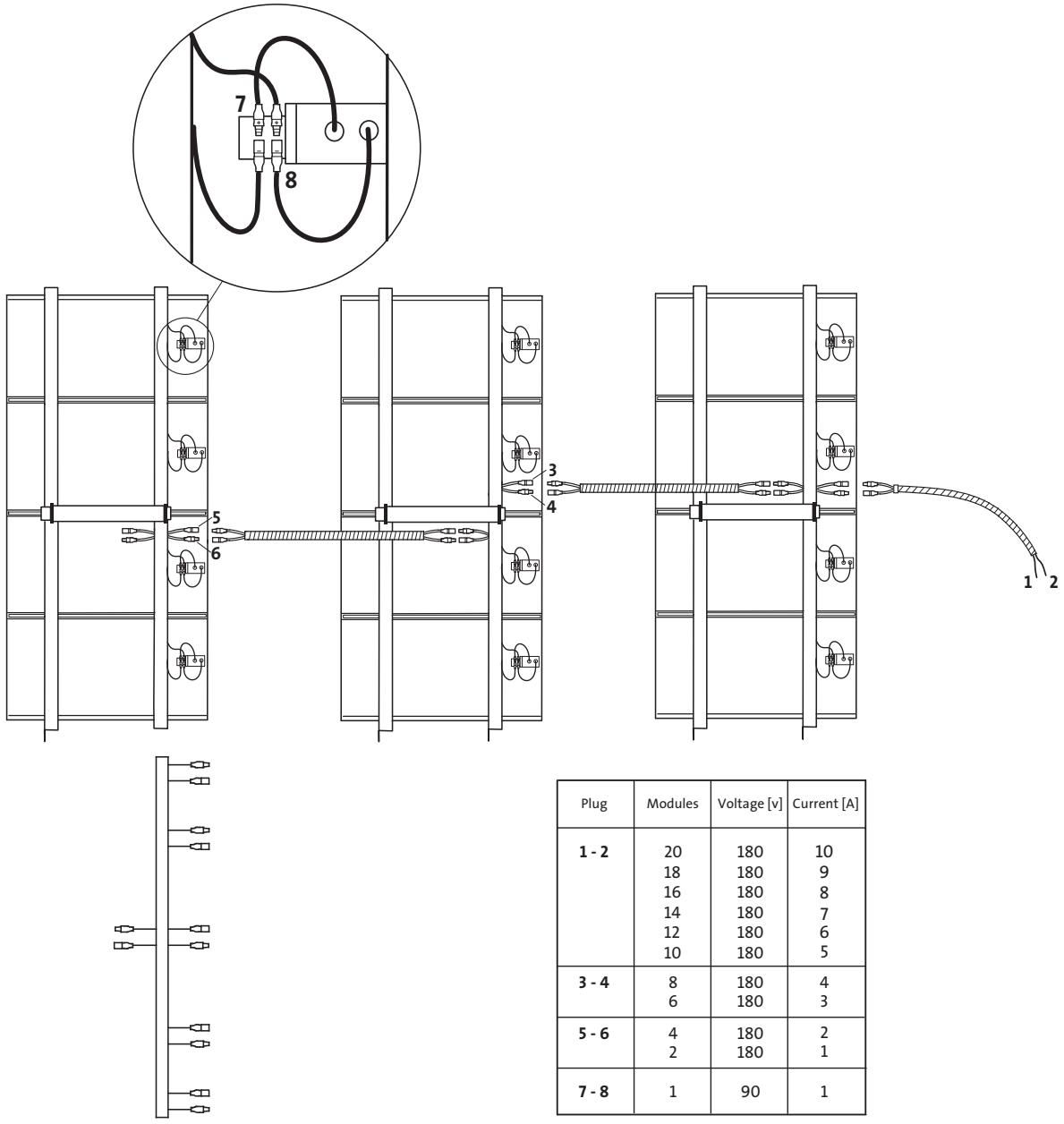
Visual inspection of solar modules

- 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 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}.



Plug	Modules	Voltage [v]	Current [A]
1 - 2	20 18 16 14 12 10	180 180 180 180 180 180	10 9 8 7 6 5
3 - 4	8 6	180 180	4 3
5 - 6	4 2	180 180	2 1
7 - 8	1	90	1

TM02 6874 1903

Fig. 33 Electrical connection of FS-50-D solar modules

The solar panels must be connected to earth via a **P**rotective **E**arth (PE) conductor.

5.6 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 utilisation 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^2	1000 W/m^2

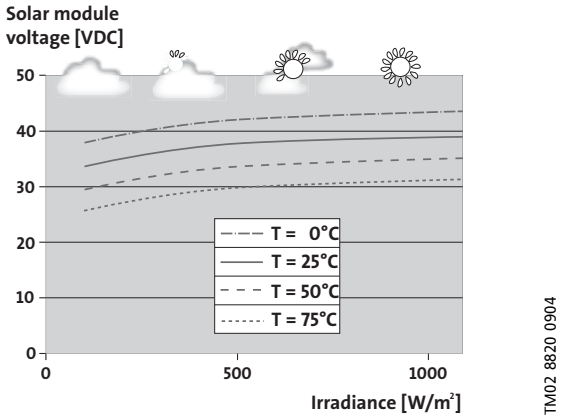


Fig. 34 Weather influence on the output (GF 55C)

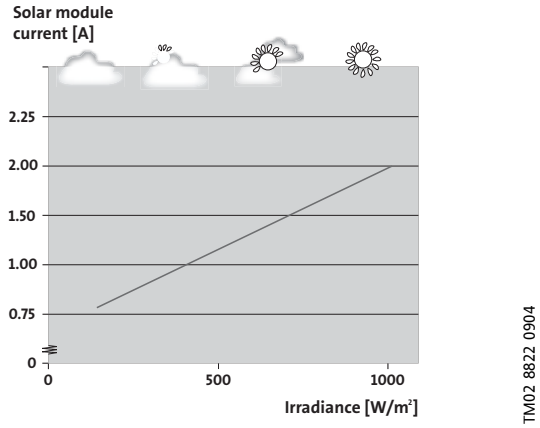


Fig. 35 Weather influence on the output (GF 55C)

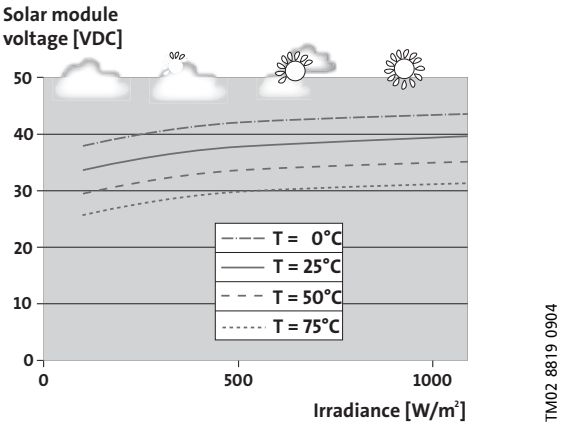


Fig. 36 Weather influence on the output (GF 65C)

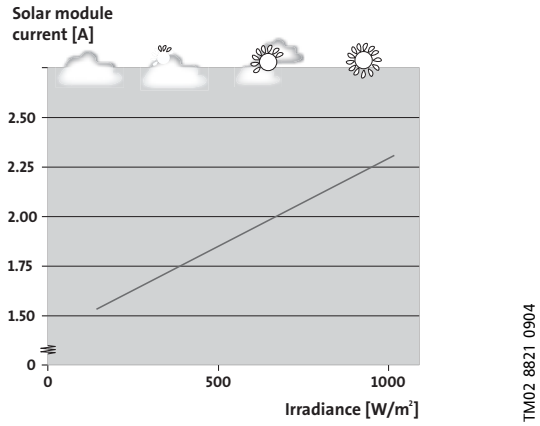


Fig. 37 Weather influence on the output (GF 65C)

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 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}.

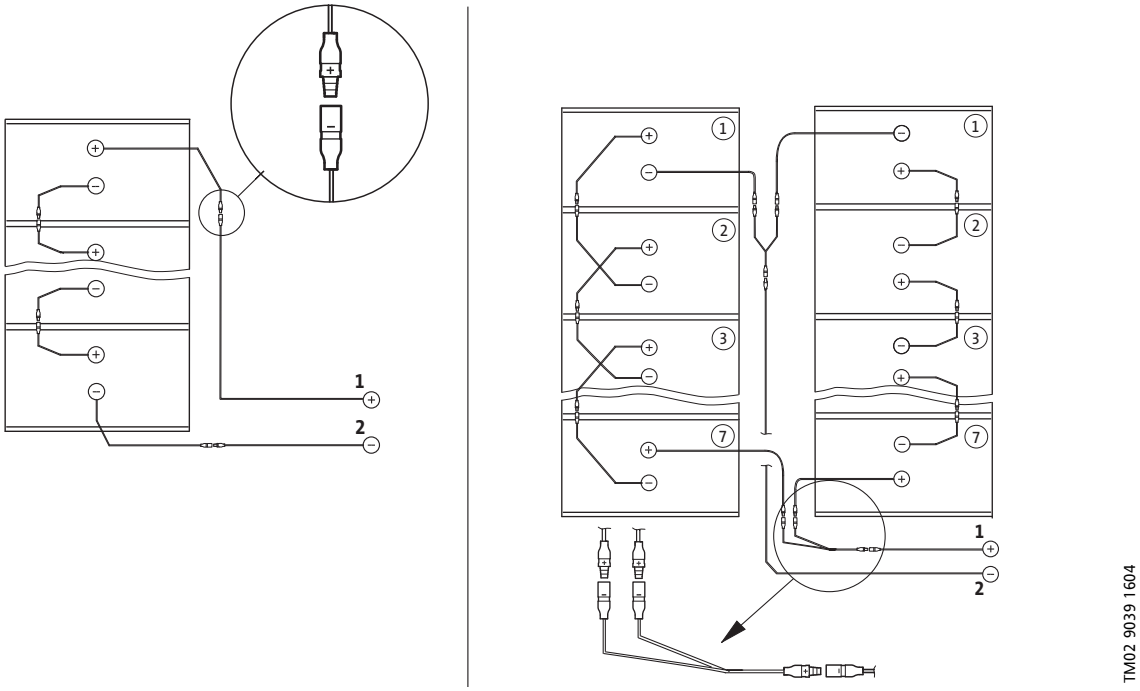


Fig. 38 Electrical connection of GF 55C and GF 65C solar modules

The solar panels must be connected to earth via a **P**rotective **E**arth (PE) conductor.

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

5.7 GTF 55 solar modules

TM02 8296 4903

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.

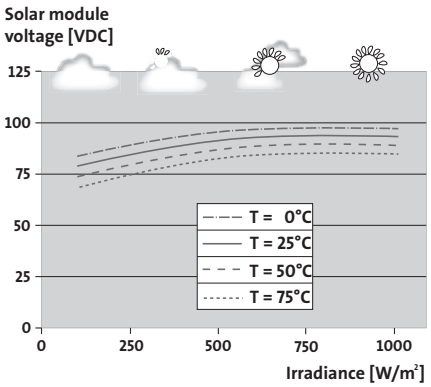
Weatherproof connectors and cord plate eliminate the need for a junction box and module-to-module field wiring.

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 utilisation of the solar energy.

This module is UL- and IEC 61646-approved.

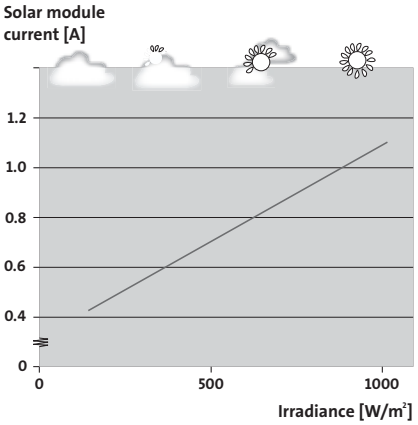
Characteristics	
Solar module	**GTF 55**
Peak power ($P_{max.}$)	55 W
Voltage (V_{mp})	63 V
Current (I_{mp})	0.87 A
Open-circuit voltage (V_{OC})	89 V
Short-circuit current (I_{SC})	1.1 A
Reference cell temperature (T_{cref})	25 °C
Solar irradiation at reference cell temperature (I_{tref})	1000 W/m^2

Fig. 39 GTF 55 solar modules



TM02 6963 2003

Fig. 40 Weather influence on the output



TM02 8823 0904

Fig. 41 Weather influence on the output

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}.

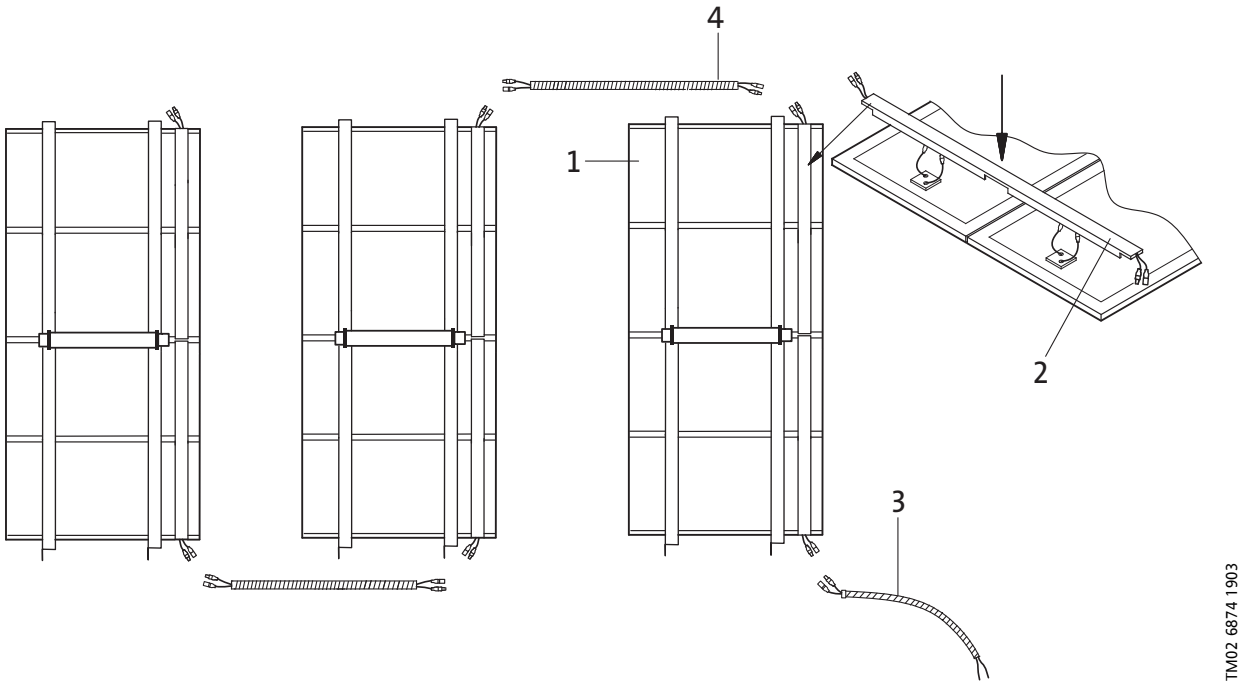


Fig. 42 Electrical connection of GTF 55 solar modules

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 **P**rotective **E**arth (PE) conductor.

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

Modules	Series	Parallel	GTF 55	
			V_{OC} [V]	I_{SC} [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

5.8 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				Option 1	Option 2		
GF 70 (96616395)	GF 80 (96616391)	Array-to-controller wire kit	Array-to-array wire kit	Conduit for array-to-controller wire	Cable guard	Array-to-array wire kit with conduit	Connection
		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

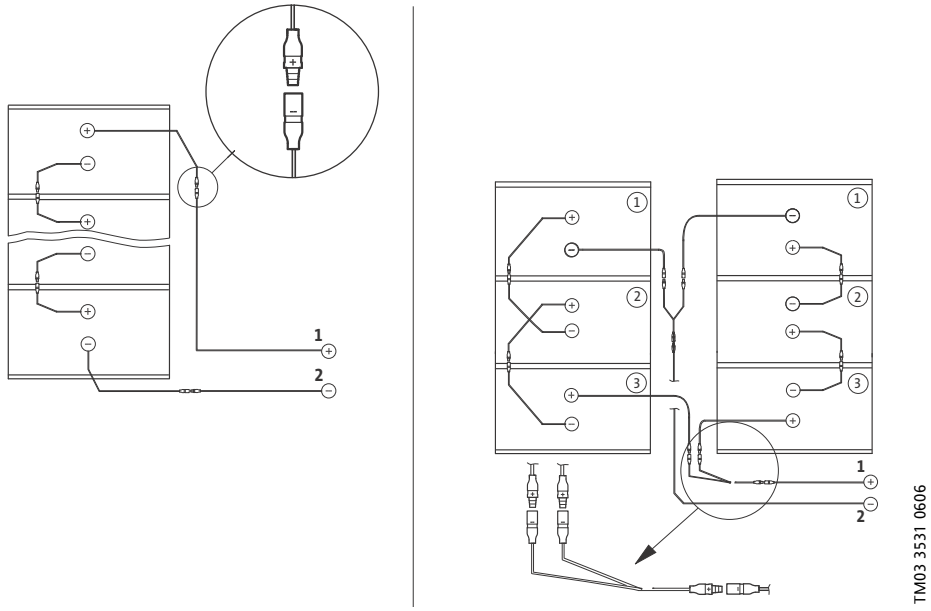


Fig. 43 Two or three GF solar modules connected in series

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

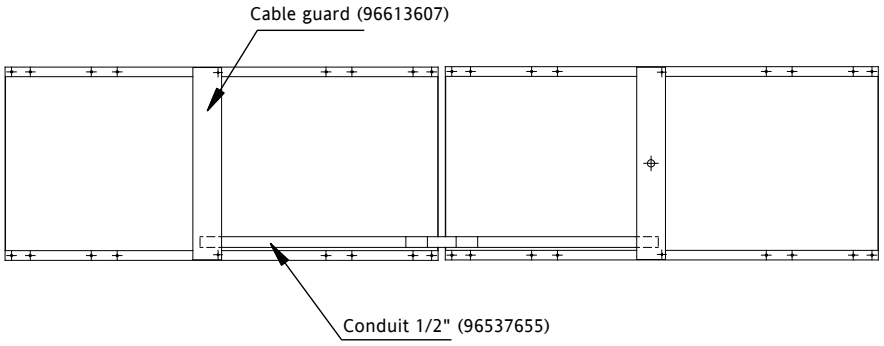
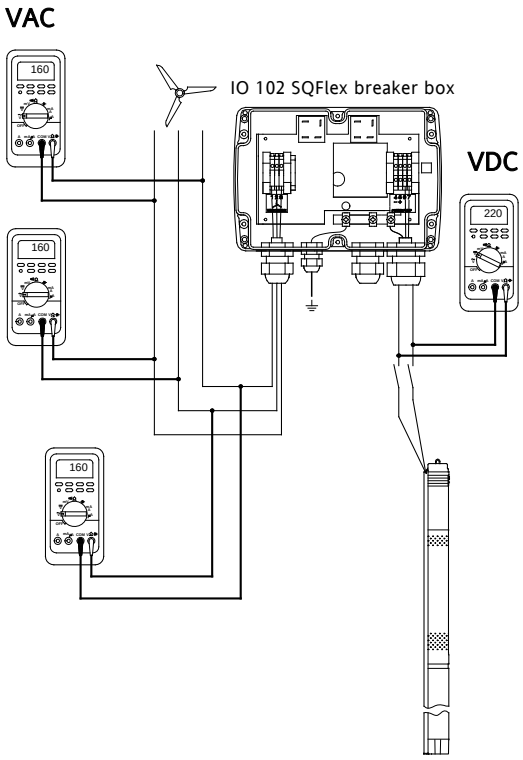


Fig. 44 Example of option 2

6. Wind turbine

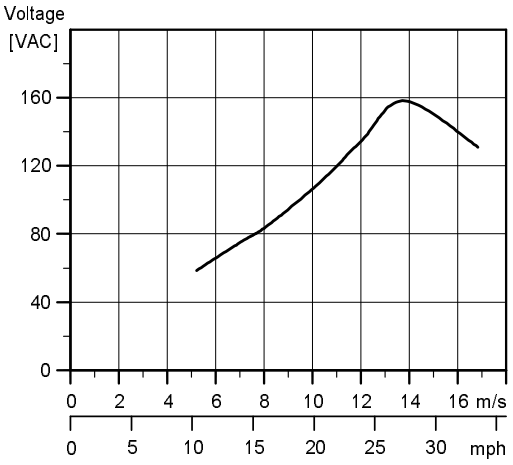
TM05 5087 2609

Fig. 45 Wind turbine



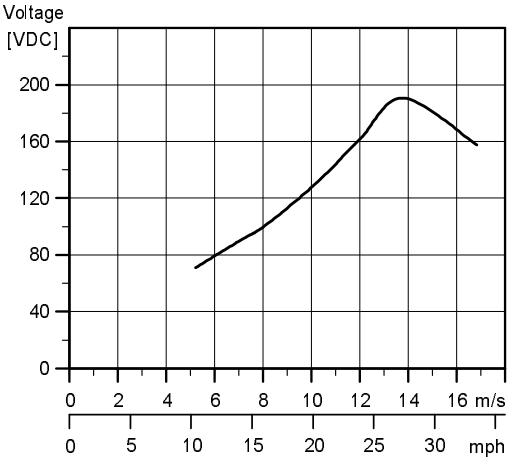
TM02 4367 0702

Fig. 46 Measurement of VAC and VDC



TM04 5525 3309

Fig. 47 Measurement of VAC



TM04 5526 3309

Fig. 48 Measurement of VDC

The values measured between the three phases must be identical.

6.1 Fault correction

1. Find out if the problem is mechanical or electrical.
   – Propeller cannot turn = Mechanical problem. See section *6.2 Mechanical problems* on page 32.
   – Propeller turns slowly = Electrical problem. See section *6.3 Electrical problems* on page 33.
   Electrical problems may be in the wind turbine or the IO 102 breaker box.
   Determine which as follows:
2. 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 section *Overview of possible system combinations* on page 40.
3. If the propeller still does not start, the problem is in the tower wiring or the wind turbine.
4. The propeller is turning, but may have an electrical problem. Using a voltmeter, read the voltage across the wires, 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 the 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 the 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.
5. Should these steps not solve the problem, proceed directly to section *6.3 Electrical problems* on page 33.

6.2 Mechanical problems

Fault	Cause	Remedy
1. The 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 the propeller gently by hand, and blow or use a piece of paper to dislodge debris.
	c) Loose magnet.	Contact distributor.
	d) Worn-out bearing.	Contact distributor.
2. The 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. The 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. The propeller seems out of balance.	a) One or more blades fitted wrongly.	Fit blade(s) correctly.
9. The 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.	Contact distributor.
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.

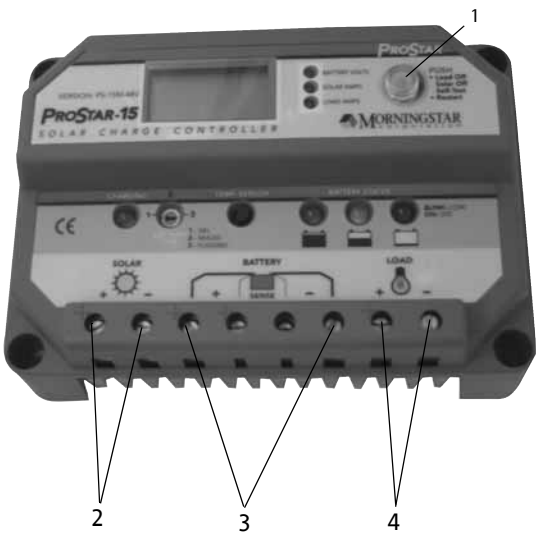
6.3 Electrical problems

Warning

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

Fault	Possible cause	Remedy
1. The pump does not operate, and the propeller does 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 the IO 102 on/off switch to off. Disconnect the pump from the IO 102. Set the on/off switch to on. If the propeller starts to turn, either the pump or the pump cable is defective. Set the IO 102 on/off switch to off. Replace the defective part, and reconnect to the IO 102. Set the on/off switch to on.
	d) The IO 102 is defective.	Set the IO 102 on/off switch to on. Disconnect the three wires from the wind turbine, one at a time, at the IO 102. If the propeller starts to turn, the IO 102 is defective. Replace the IO 102.
2. The pump does not operate, and the propeller turns fast.	a) Wires between the IO 102 and pump may be disconnected.	Set the IO 102 on/off switch to off. Reconnect the wires. Set the IO 102 on/off switch to on.
	b) The pump is defective.	Set the IO 102 on/off switch to off. Replace the pump. Set the 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 the wind turbine and the IO 102 may be disconnected.	Set the IO 102 on/off switch to off. Reconnect the wires. Set the IO 102 on/off switch to on.
	b) The wind turbine is defective.	Set the IO 102 on/off switch to off. Replace the wind turbine. Set the IO 102 on/off switch to on.
	c) The IO 102 is 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.

7. Charge controller



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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)

Fig. 49 Charge controller

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

E0I 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)
EI0 Internal temperature sensor out of range high
EII Internal temperature sensor out of range low
EI2 Remote temperature probe out of range
EI3 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.

8. Start-up

The starting sequence has three steps:

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

Consequently, 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, the current consumption will be uneven, but when the motor has started, the 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.

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.

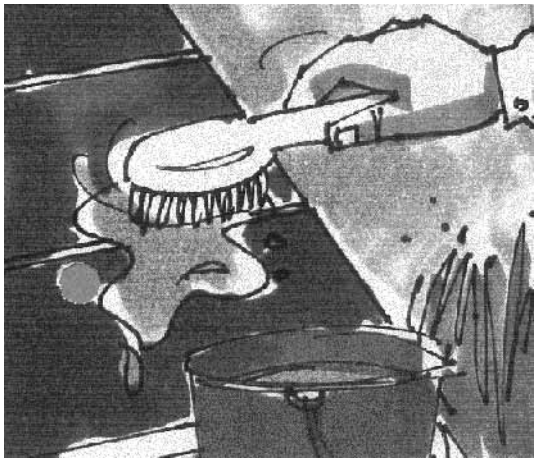
9. Maintenance

This section describes how to maintain solar modules and wind turbines.

Under normal operating conditions, the pumps and the controllers are maintenance-free.

9.1 Solar modules

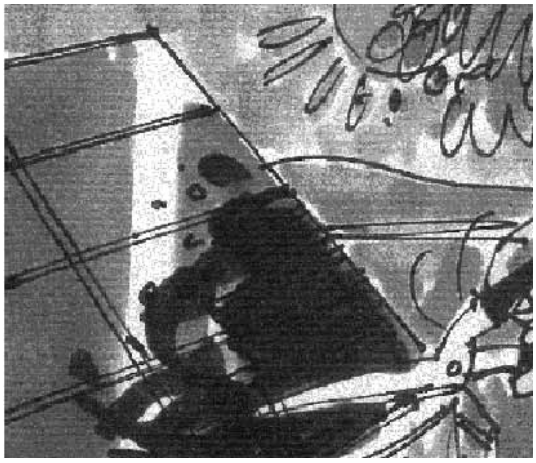
Routine maintenance



TM04 5090 2609

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 that there is no sand or other abrasive particles in the water.
- There is no need to clean the modules underneath.



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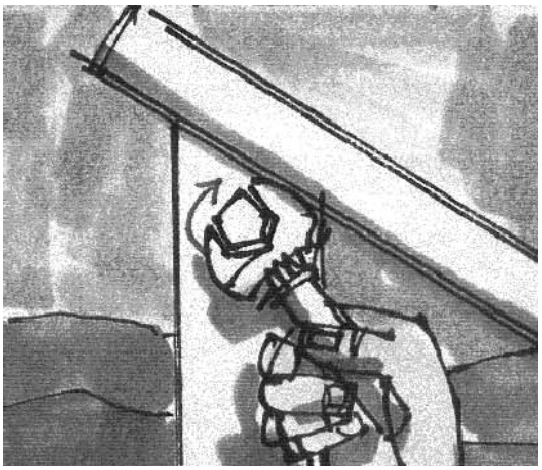
Clearing

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



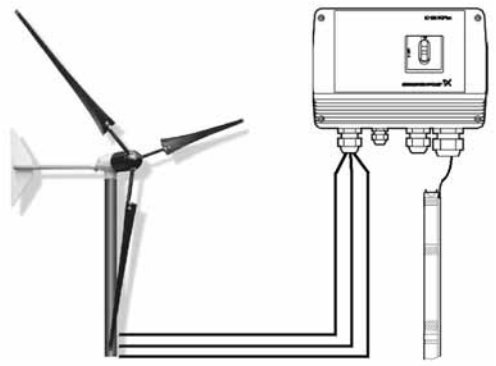
TM04 5092 2609

Tightening

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

9.2 Wind turbine

Monthly maintenance



TM04 5093 2609

Braking test

(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.

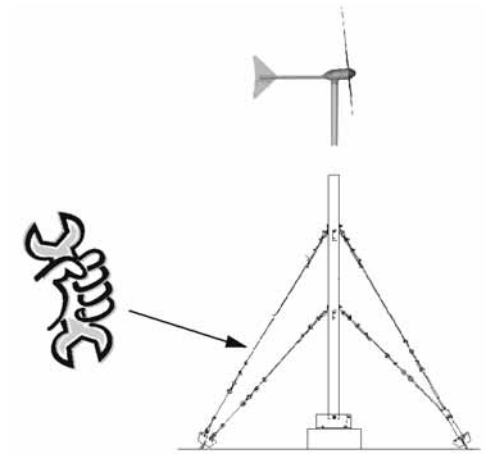
TM04 5094 2609

Checking the 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 *6.3 Electrical problems* on page 33, if required.



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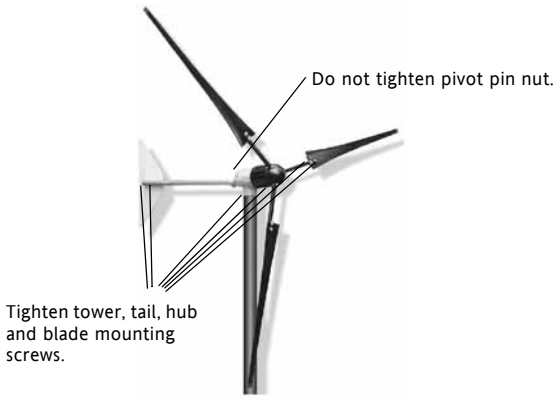
Inspecting the tower

Follow all inspection and maintenance requirements of the tower manufacturer. Tighten all nuts and screws, especially wire clips. Check for cracks and bends or broken parts at the anchors and base structure. Check for broken wire strands, and tighten guys.

Annual maintenance



TM04 5096 2609

Complete mechanical check

- Lower the tower.
- Repair or replace any worn or loose parts.
- Check tightness of all tower mounting nuts and screws and propeller mounting screws.
- Check all bearings. Just perceptible play is acceptable.
- Clean the propeller with mild detergent to remove all dirt and debris. Replace blades if they are cracked or damaged.

10. Fault correction

Visual or general inspection of main components

Before starting specific fault correction, go through these simple visual inspections.

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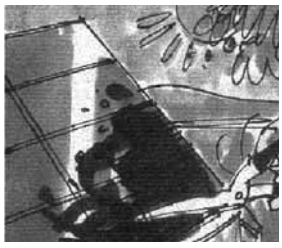

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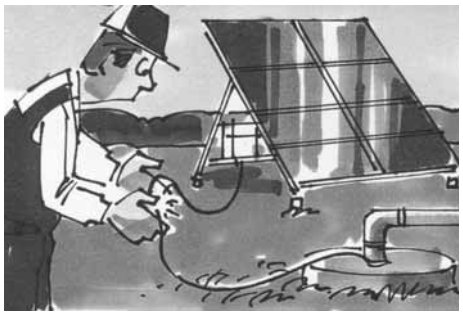
Visual inspection of solar modules

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

Visual inspection of the wind turbine

See section *Checking the mechanical condition* on page 38.



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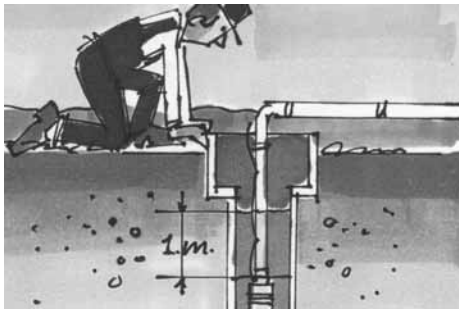
Visual inspection of cables

- Check that the cables are intact.



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Visual inspection of the water level

The water level must be at least 1 m above the pump.

The dry-running sensor must be covered with water.

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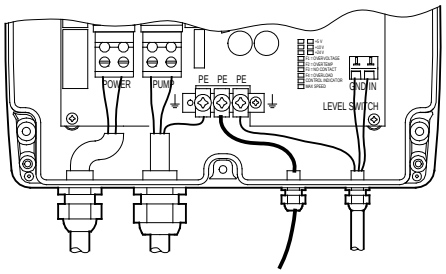
Visual inspection of pipes and hoses

- Check that hoses or pipes are intact.



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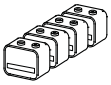
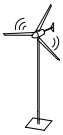
Test using a service CU 200

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 *4.1 CU 200 SQFlex control unit* on page 7.

Overview of possible system combinations

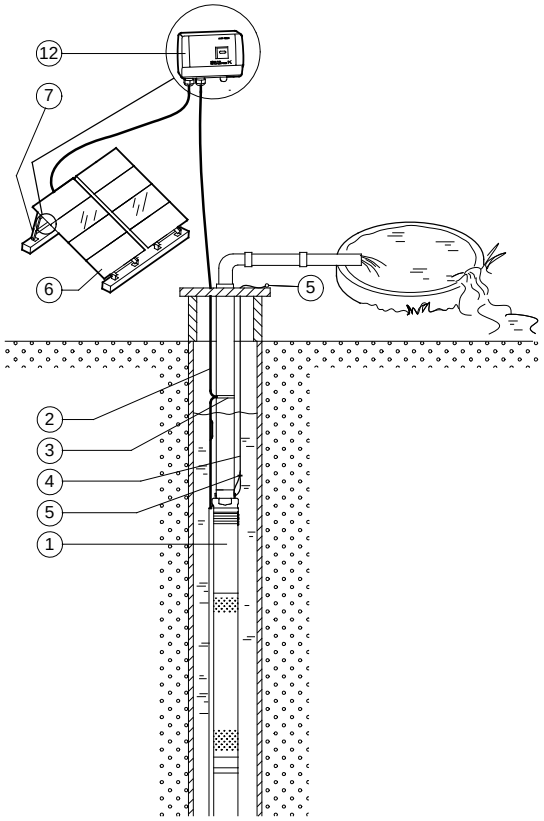
1. In the table below, find the system corresponding to your system.
2. Follow the fault correction instructions for your system.
   In systems with solar modules, fault correction must be carried out in the middle of an unclouded day.
   In systems with wind turbine, fault correction must be carried out at a wind speed of minimum 3.5 m/s (8 mph).
3. Find the faulty component, and repair/replace it, or contact the Grundfos Service Centre 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
10.1 SQFlex Solar on page 41.						 IO 100		
10.2 SQFlex Solar with CU 200 control unit and level switch on page 43.							 CU 200	 (**)
10.3 SQFlex Solar with back-up generator on page 45.						 IO 101		
10.4 SQFlex Solar with CU 200 control unit, level switch and back-up generator on page 47.						 IO 101	 CU 200	 (**)
10.5 SQFlex Solar with back-up batteries on page 49.						 IO 100 or IO 101 (**)	 CU 200	Pressure tank  Pressure switch 
10.6 SQFlex Wind on page 51.						 IO 102		
10.7 SQFlex Wind with CU 200 control unit and level switch on page 53.						 IO 102	 CU 200	 (**)
10.8 SQFlex Combi on page 55.						 IO 102		
10.9 SQFlex Combi with CU 200 control unit and level switch on page 57.						 IO 102	CU 200	(**)
10.10 Options with generator as back-up source on page 59.		(*)	(*)			IO 101	(*)	(*)

(*) May be a component in the system.

(**) Optional.

10.1 SQFlex Solar



Pos.	Component
1	SQF pump
2	Submersible drop cable
3	Cable clips
4	Straining wire
5	Wire clamps
6	Solar panels
7	Support structure
12	IO 100 SQFlex switch box

Fig. 50 SQFlex Solar

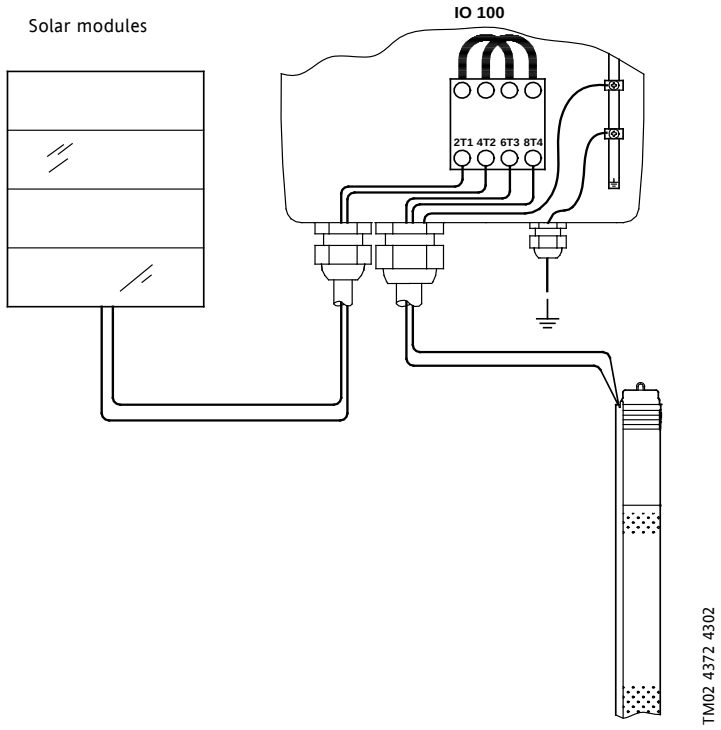


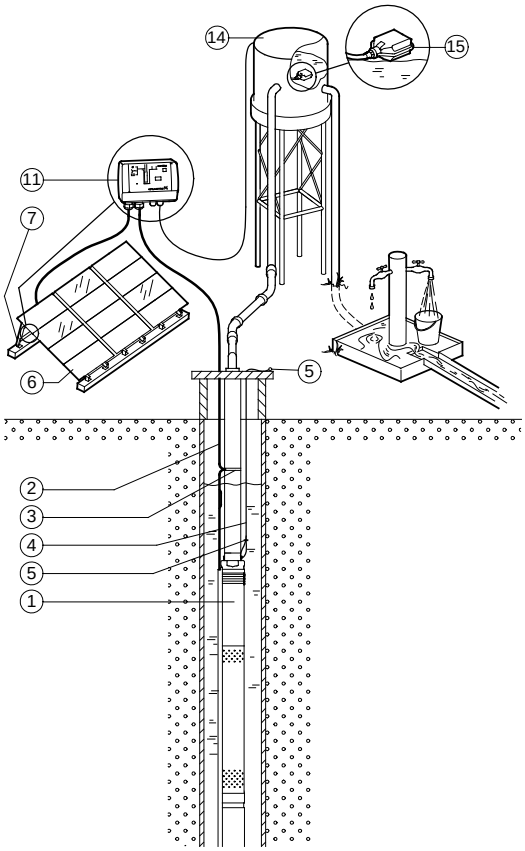
Fig. 51 Internal (and external) wiring of the IO 100 switch box

If the system does not work properly, follow the instructions in section *10.1.1 Fault correction of SQFlex Solar* on page 42.

10.1.1 Fault correction of SQFlex Solar

1. **Disconnect the pump.**
   – Set the IO 100 switch to off.
   – Disconnect the pump cable from the terminals (6T3, N, 8T4).
2. **Check the solar modules.**
   – Measure the voltage and short-circuit current across the terminals (2T1, 4T2).
   See electrical connection:
   5.2 GF 43 and GF 50 solar modules on page 15.
   5.4 SX-110 solar modules on page 19.
   5.5 FS-50-D solar modules on page 21.
   5.6 GF 55C and GF 65C solar modules on page 23.
   5.7 GTF 55 solar modules on page 25.
   5.8 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 27.
   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).
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 pump.**
   – Set the IO 100 switch to off.
   – Reconnect the pump cable to the terminals (6T3, N, 8T4).
   – Switch on the pump by setting the IO 100 switch to 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.

10.2 SQFlex Solar with CU 200 control unit and level switch



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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
14	Water reservoir
15	Level switch (optional)

Fig. 52 SQFlex Solar with CU 200 control unit and level switch

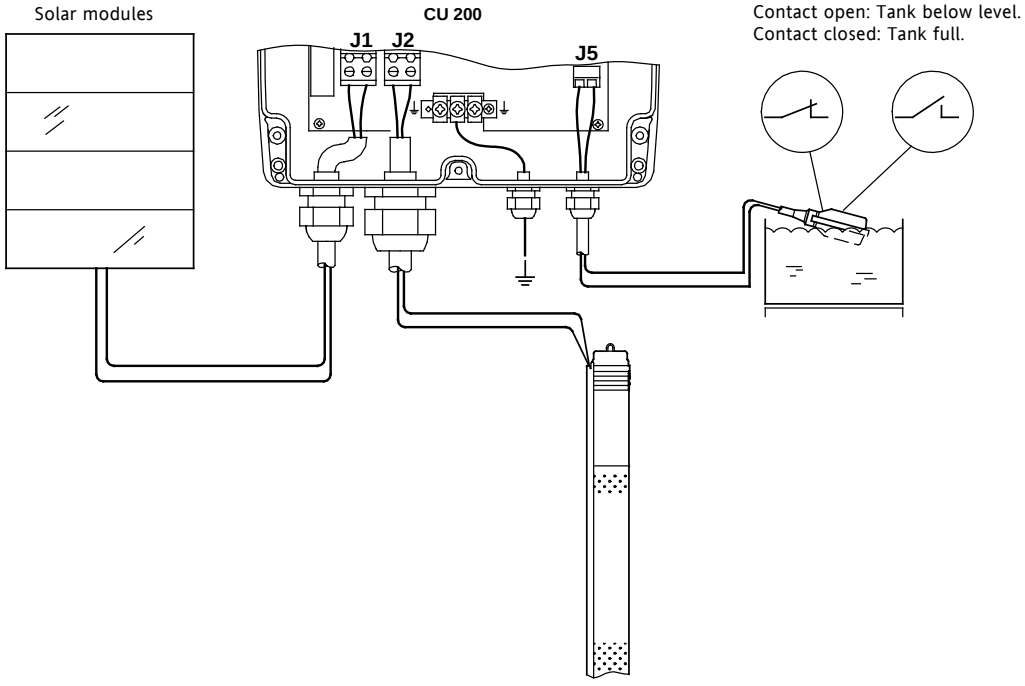

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Fig. 53 Internal (and external) wiring of the CU 200 control unit

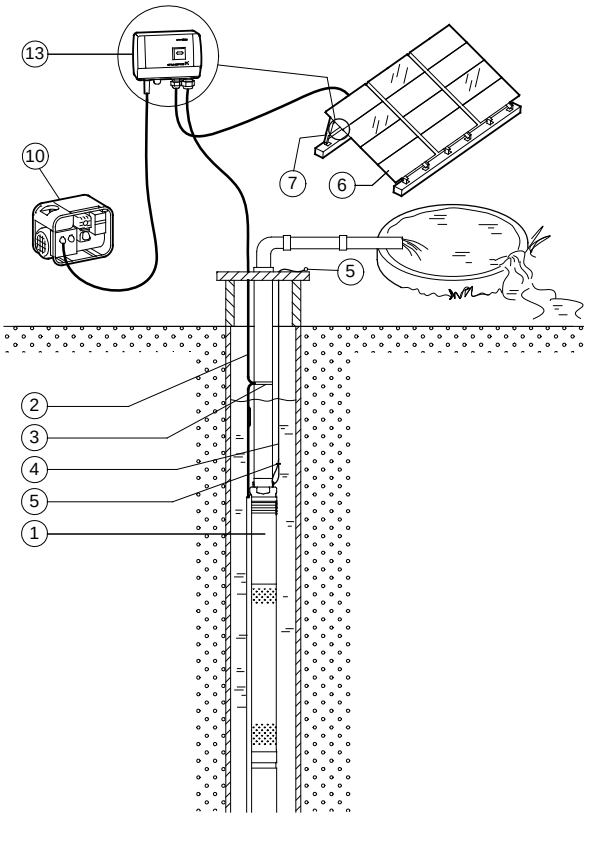
If the system does not work properly, follow the instructions in section *10.2.1 Fault correction of SQFlex Solar with CU 200 control unit and level switch* on page 44.

10.2.1 Fault correction of SQFlex Solar 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 using the CU 200.**
   If the CU 200 indicates a fault, proceed according to section *Fault correction using the CU 200* on page 9.
2. **Disconnect the pump.**
   – Switch off the pump by pressing the On/Off button on the CU 200. The red indicator light must be on.
   – Disconnect the pump cable from terminal J2.
3. **Check the solar modules.**
   – Measure the DC voltage and short-circuit DC current across the terminals (J1).
   See electrical connection:
   5.2 GF 43 and GF 50 solar modules on page 15.
   5.4 SX-110 solar modules on page 19.
   5.5 FS-50-D solar modules on page 21.
   5.6 GF 55C and GF 65C solar modules on page 23.
   5.7 GTF 55 solar modules on page 25.
   5.8 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 27.
   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 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 Ω.
   – Turn the level switch downwards => the contact in the level switch is open. The measured value must be ∞ Ω.
   If one of the two values is incorrect, the level switch is defective.
   Replace the level switch.
5. **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.
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.
   – 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.

10.3 SQFlex Solar with back-up generator



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 petrol-driven generator
13	IO 101 SQFlex switch box

Fig. 54 SQFlex Solar with back-up generator

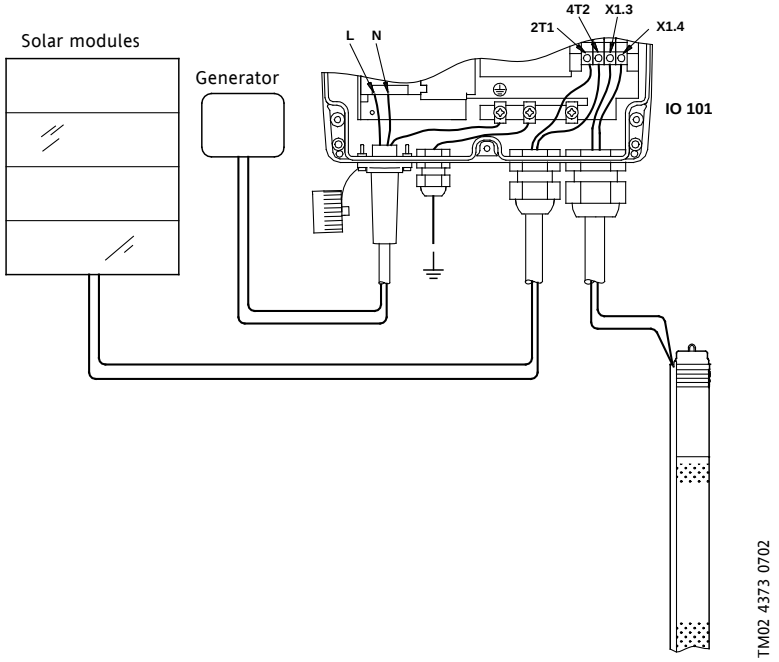


Fig. 55 Internal (and external) wiring of the IO 101 switch box

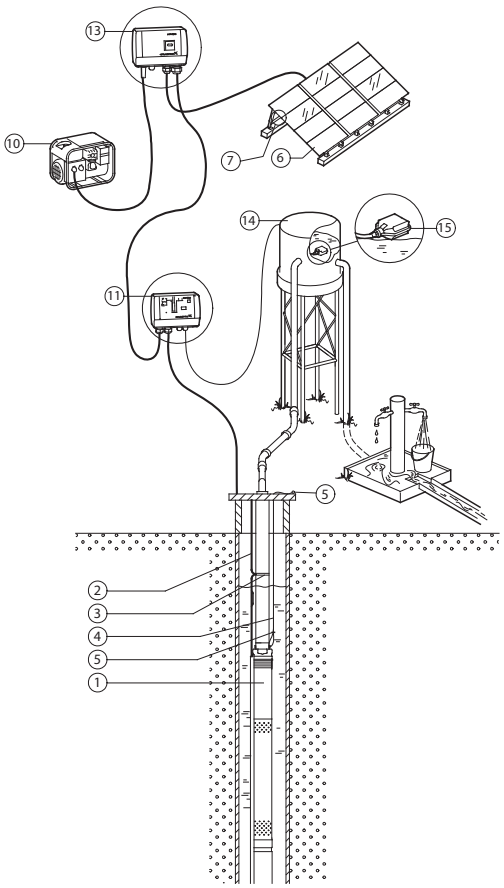
If the system does not work properly, follow the instructions in section *10.3.1 Fault correction of SQFlex Solar with back-up generator* on page 46.

10.3.1 Fault correction of SQFlex Solar with back-up generator

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:
   5.2 GF 43 and GF 50 solar modules on page 15.
   5.4 SX-110 solar modules on page 19.
   5.5 FS-50-D solar modules on page 21.
   5.6 GF 55C and GF 65C solar modules on page 23.
   5.7 GTF 55 solar modules on page 25.
   5.8 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 27.
   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 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.
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 incorrect, the generator is faulty.
   Repair or replace the generator.
5. **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.
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: 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.

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



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 petrol-driven generator
11	CU 200 SQFlex control unit
13	IO 101 SQFlex switch box
14	Water reservoir
15	Level switch (optional)

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Fig. 56 SQFlex Solar with CU 200 control unit, level switch and back-up generator

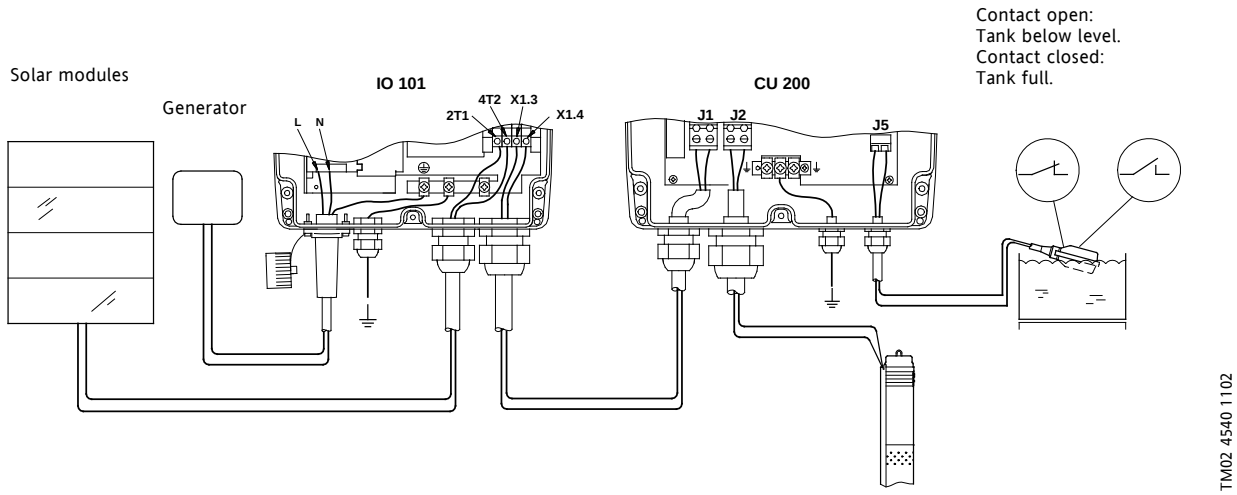

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Fig. 57 Internal (and external) wiring of the CU 200 control unit and IO 101 switch box

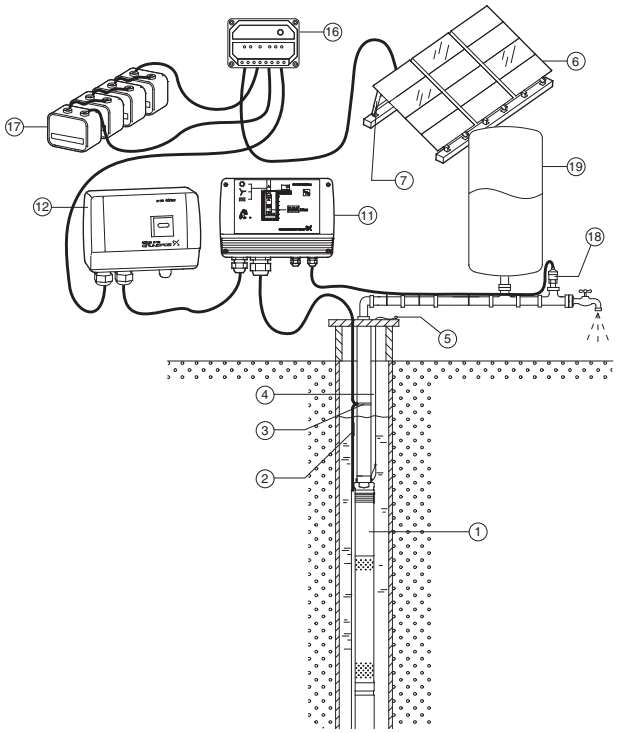
If the system does not work properly, follow the instructions in section *10.4.1 Fault correction of SQFlex Solar with CU 200 control unit, level switch and back-up generator* on page 46.

10.4.1 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 *Fault correction using the 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:
   5.2 GF 43 and GF 50 solar modules on page 15.
   5.4 SX-110 solar modules on page 19.
   5.5 FS-50-D solar modules on page 21.
   5.6 GF 55C and GF 65C solar modules on page 23.
   5.7 GTF 55 solar modules on page 25.
   5.8 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 27.
   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 Ω.
   – Turn the level switch downwards => the contact in the level switch is open. The measured value must be ∞ Ω.
   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.

10.5 SQFlex Solar with back-up batteries



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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

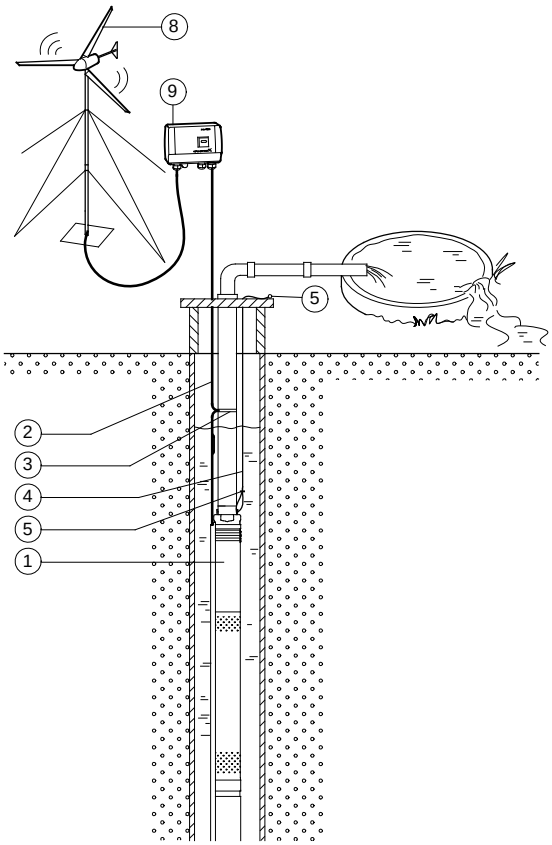
Fig. 58 SQFlex Solar with back-up batteries

If the system does not work properly, follow the instructions in section *10.5.1 Fault correction of SQFlex Solar with back-up batteries* on page 50.

10.5.1 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 *Fault correction using the CU 200* on page 9.
2. **Disconnect the pump.**
   – Switch off the pump by pressing the On/Off button on the CU 200. The red indicator light must be on.
   – 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:
   5.2 GF 43 and GF 50 solar modules on page 15.
   5.4 SX-110 solar modules on page 19.
   5.5 FS-50-D solar modules on page 21.
   5.6 GF 55C and GF 65C solar modules on page 23.
   5.7 GTF 55 solar modules on page 25.
   5.8 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 27.
   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.

10.6 SQFlex Wind



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Pos.	Component
1	SQF pump
2	Submersible drop cable
3	Cable clips
4	Straining wire
5	Wire clamps
8	Wind turbine
9	IO 102 SQFlex breaker box

Fig. 59 SQFlex Wind

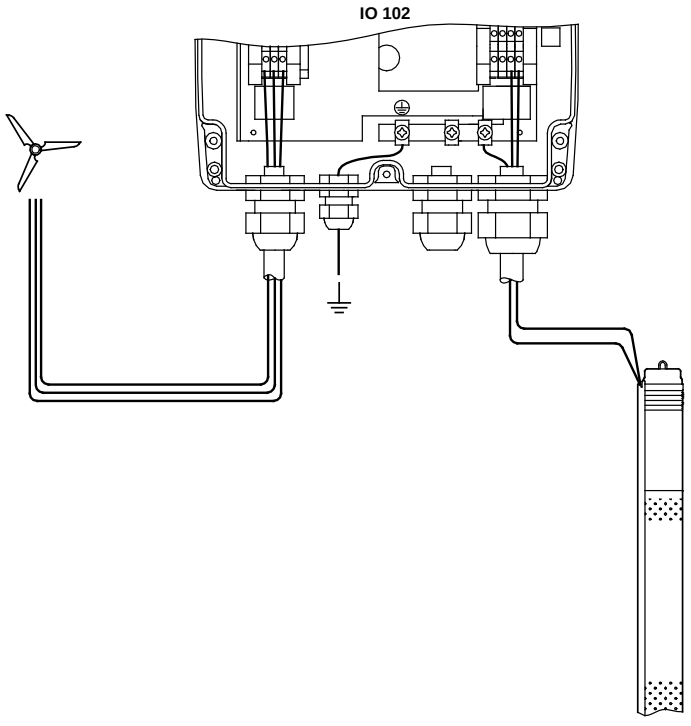

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Fig. 60 Internal (and external) wiring of the IO 102 breaker box

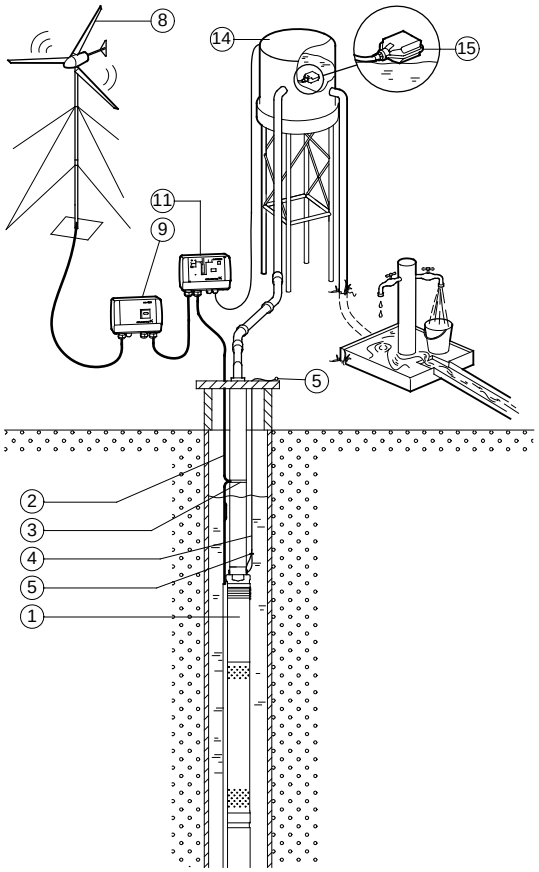
If the system does not work properly, follow the instructions in section *10.6.1 Fault correction of SQFlex Wind* on page 52.

10.6.1 Fault correction of SQFlex Wind

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

1. **Disconnect the pump.**
   - Stop the wind turbine and switch 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 section *6. Wind turbine* on page 30.
     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.
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 section *6. Wind turbine* on page 30.
     If no DC voltage is measured and the propeller is turning, the IO 102 is faulty.
     Replace the IO 102.
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: 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.

10.7 SQFlex Wind with CU 200 control unit and level switch



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Pos.	Component
1	SQF pump
2	Submersible drop cable
3	Cable clips
4	Straining wire
5	Wire clamps
8	Wind turbine
9	IO 102 SQFlex breaker box
11	CU 200 SQFlex control unit
14	Water reservoir
15	Level switch

Fig. 61 SQFlex Wind with CU 200 control unit and level switch

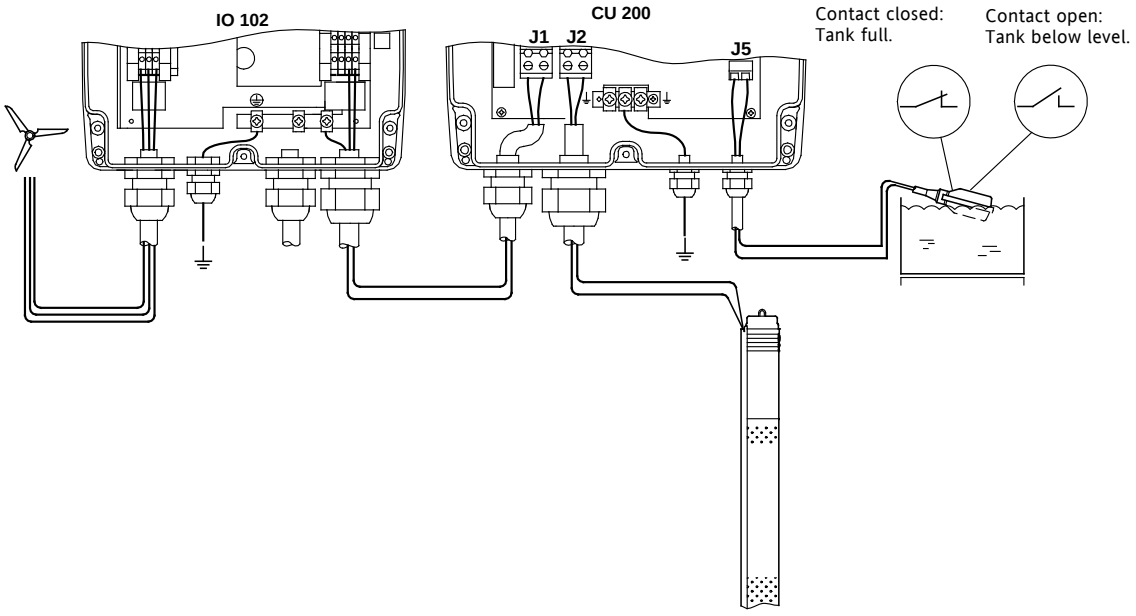

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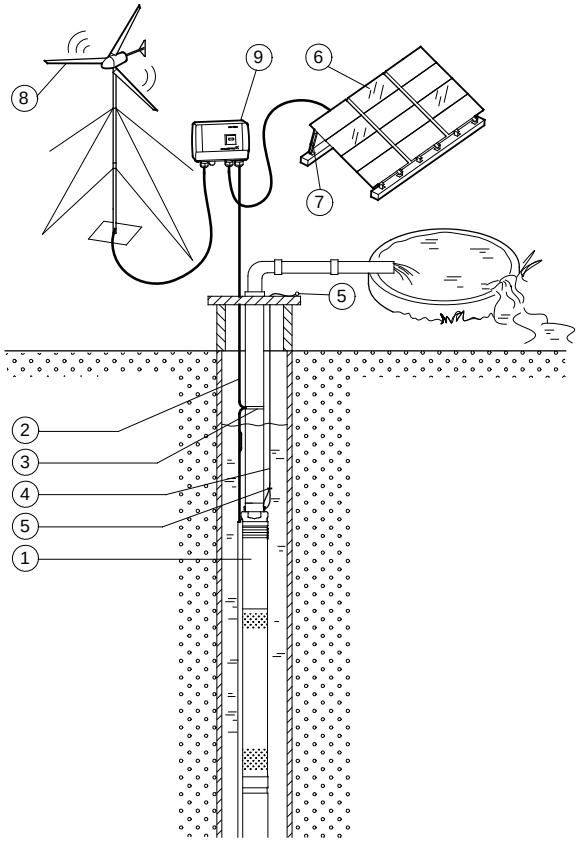
Fig. 62 Internal (and external) wiring of the CU 200 control unit and IO 102 breaker box

If the system does not work properly, follow the instructions in section *10.7.1 Fault correction of SQFlex Wind with CU 200 control unit and level switch* on page 54.

10.7.1 Fault correction of SQFlex Wind with CU 200 control unit and level switch

1. **Check the system using the CU 200.**
   If the CU 200 indicates a fault, proceed according to section *Fault correction using the CU 200* on page 9.
2. **Disconnect the pump.**
   – Switch off the pump by pressing the On/Off button on the CU 200. The red indicator light must be on.
   – Disconnect the pump cable from 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.
   The voltage (U) = 0-250 VAC. The voltage depends on the wind speed. See section *6. Wind turbine* on page 30.
   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 IO 102.
   The voltage (U) = 0-300 VDC. The voltage depends on the wind speed. See section *6. Wind turbine* on page 30.
   If no DC voltage is measured and the propeller is turning, the IO 102 is faulty.
   Replace the IO 102.
5. **Check the level switch in the water reservoir.**
   – Disconnect the level switch cable from terminal J5 in the 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 Ω.
   – Turn the level switch downwards => the contact in the level switch is open. The measured value must be ∞ Ω.
   If one of the two values is incorrect, 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 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.
7. **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.

10.8 SQFlex Combi



Pos.	Component
1	SQF pump
2	Submersible drop cable
3	Cable clips
4	Straining wire
5	Wire clamps
6	Solar panels
7	Support structure
8	Wind turbine
9	IO 102 SQFlex breaker box

Fig. 63 SQFlex Combi

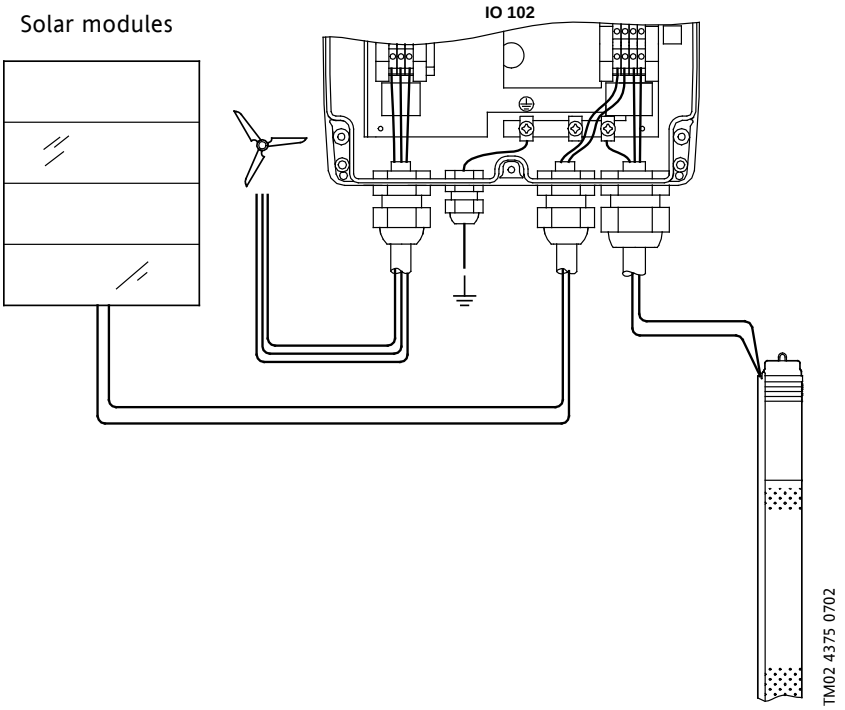


Fig. 64 Internal (and external) wiring of the IO 102 breaker box

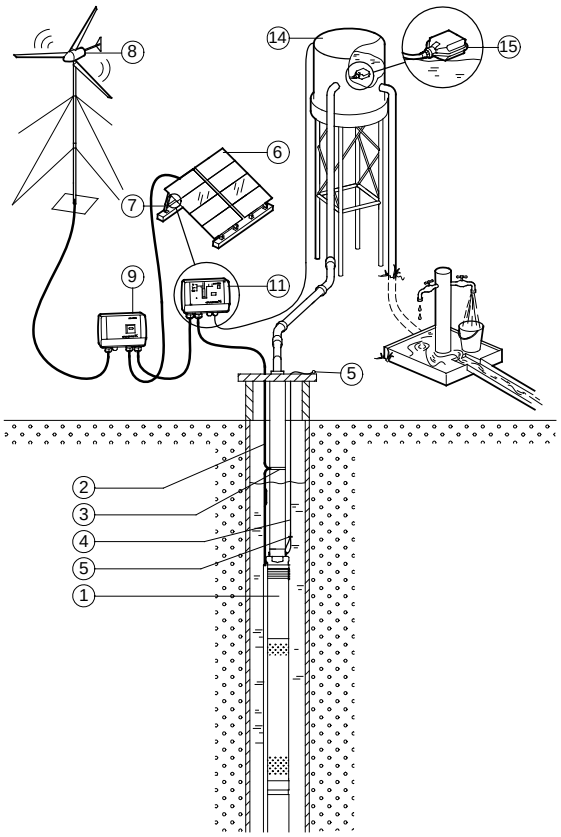
If the system does not work properly, follow the instructions in section *10.8.1 Fault correction of SQFlex Combi* on page 56.

10.8.1 Fault correction of SQFlex Combi

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.
     The voltage (U) = 0-250 VAC. The voltage depends on the wind speed. See section *6. Wind turbine* on page 30.
     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 IO 102.
     The voltage (U) = 0-300 VDC. The voltage depends on the wind speed. See section *6. Wind turbine* on page 30.
     If no DC voltage is measured and the wind turbine is turning, the IO 102 is faulty.
     Replace the IO 102.
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 modules which was disconnected under step 1.
   - Measure the DC voltage and short-circuit DC current across the terminals (2T1, 4T2).
     See electrical connection:
     5.2 GF 43 and GF 50 solar modules on page 15.
     5.4 SX-110 solar modules on page 19.
     5.5 FS-50-D solar modules on page 21.
     5.6 GF 55C and GF 65C solar modules on page 23.
     5.7 GTF 55 solar modules on page 25.
     5.8 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules on page 27.
     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).
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.
     If the values differ from the values measured under step 4, the IO 102 is defective.
     Replace the IO 102.
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: 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.

10.9 SQFlex Combi with CU 200 control unit and level switch



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Pos.	Component
1	SQF pump
2	Submersible drop cable
3	Cable clips
4	Straining wire
5	Wire clamps
6	Solar panels
7	Support structure
8	Wind turbine
9	IO 102 SQFlex breaker box
11	CU 200 SQFlex control unit
14	Water reservoir
15	Level switch

Fig. 65 SQFlex Combi with CU 200 control unit and level switch

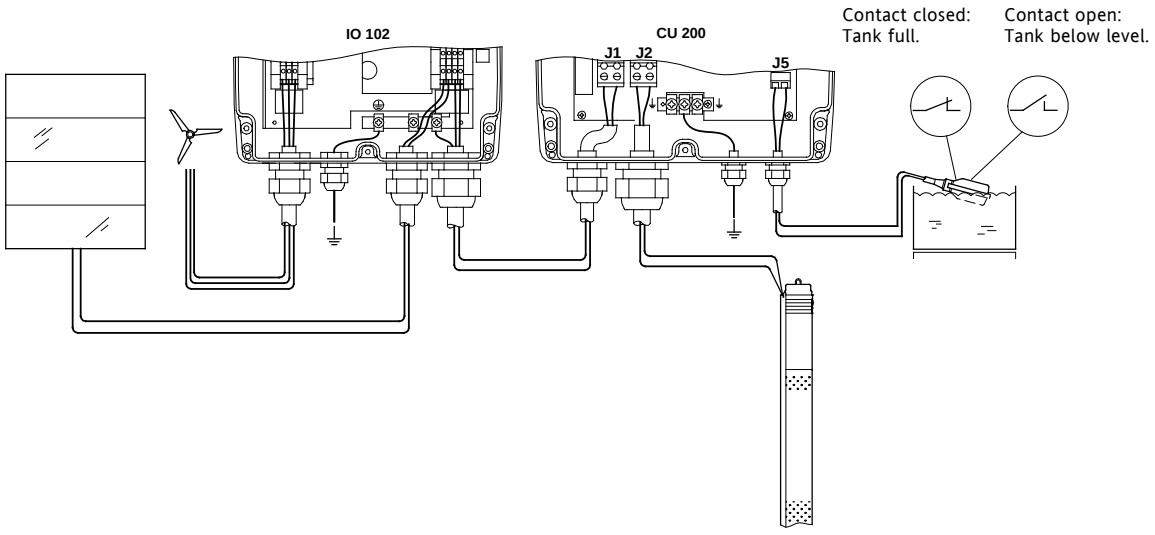

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Fig. 66 Internal (and external) wiring of the CU 200 control unit and IO 102 breaker box

If the system does not work properly, follow the instructions in section *10.9.1 Fault correction of SQFlex Combi with CU 200 control unit and level switch* on page 58.

10.9.1 Fault correction of SQFlex Combi with CU 200 control unit and level switch

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

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 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.
     The voltage (U) = 0-250 VAC. The voltage depends on the wind speed. See section *6. Wind turbine* on page 30.
     The three values measured must be identical. If they differ, or if no AC 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 IO 102.
     The voltage (U) = 0-300 VDC. The voltage depends on the wind speed. See section *6. Wind turbine* on page 30.
     If no DC voltage is measured and the wind turbine is turning, the IO 102 is faulty.
     Replace the IO 102.
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 modules which was disconnected under step 1.
   - Measure the DC voltage and short-circuit DC current across the terminals (2T1, 4T2).
     See electrical connection:
     5.2 GF 43 and GF 50 solar modules on page 15.
     5.4 SX-110 solar modules on page 19.
     5.5 FS-50-D solar modules on page 21.
     5.6 GF 55C and GF 65C solar modules on page 23.
     5.7 GTF 55 solar modules on page 25 and *5.8 GF 70, GF 80, GF 90, GF 101, GF 110, GF 120, GF 130 solar modules* on page 27.
     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).
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.
     If the values differ from the values measured under step 4, the IO 102 is defective.
     Replace the IO 102.
6. **Check the level switch in the water reservoir.**
   - Release the wind turbine by setting the IO 102 switch to on.
   - 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 Ω.
   - Turn the level switch downwards => the contact in the level switch is open. The measured value must be ∞ Ω.
     If one of the two values is incorrect, 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 points 3 and 5 were made.
     If the value differs, the CU 200 is defective.
     Replace the CU 200.
8. **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.

10.10 Options with generator as back-up source

The wiring diagrams below illustrate options with generator as a power supply back-up source.

For application overview, see section *Overview of possible system combinations* on page 40.

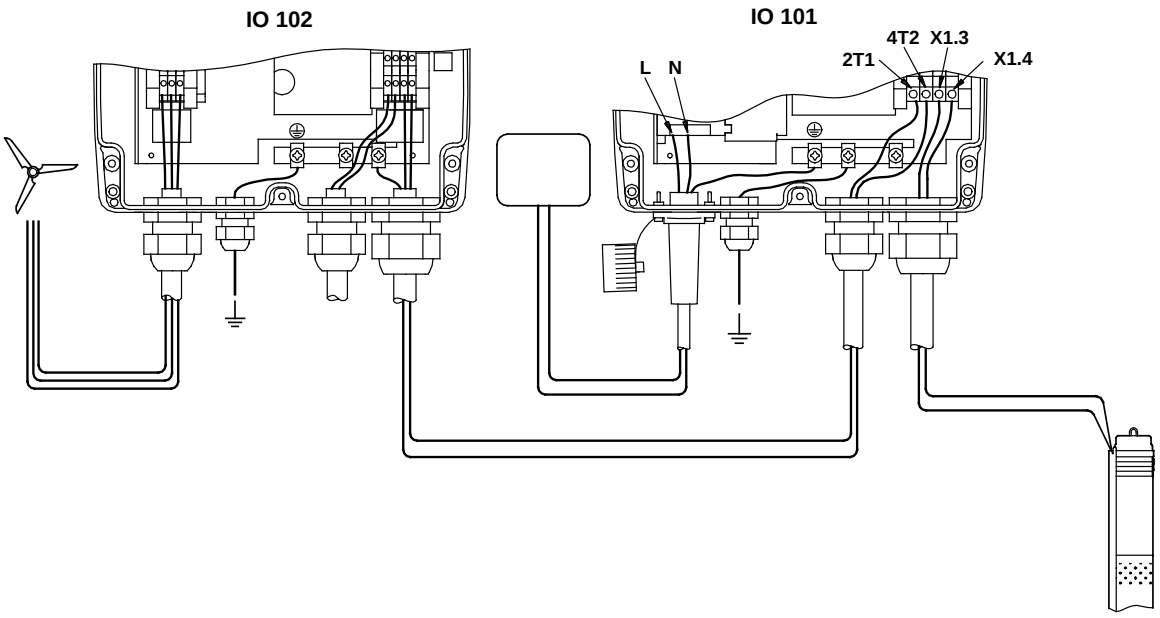

Fig. 67 SQFlex Wind

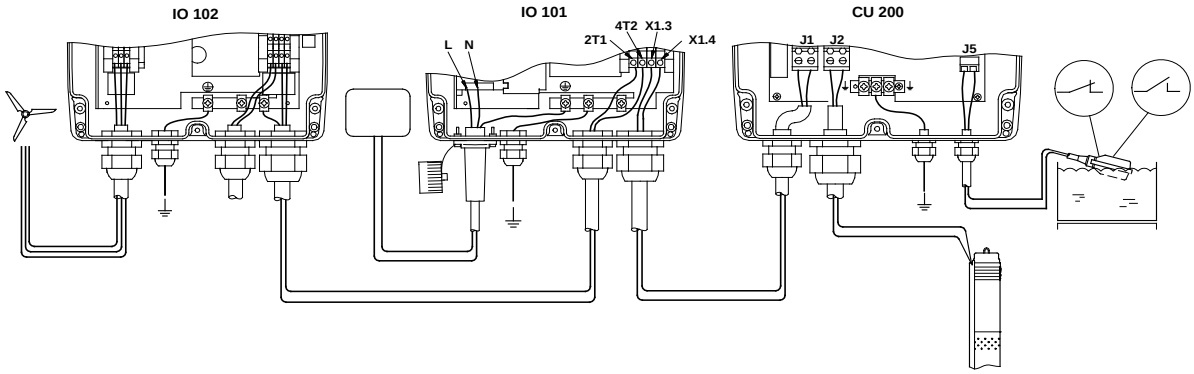

Fig. 68 SQFlex Wind with CU 200 control unit and level switch

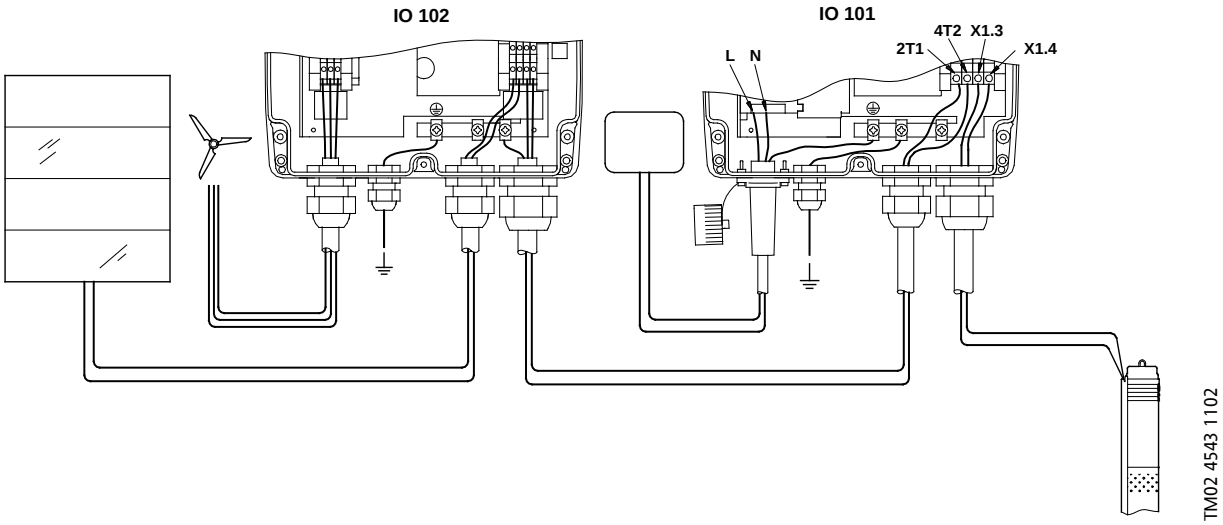

Fig. 69 SQFlex Combi

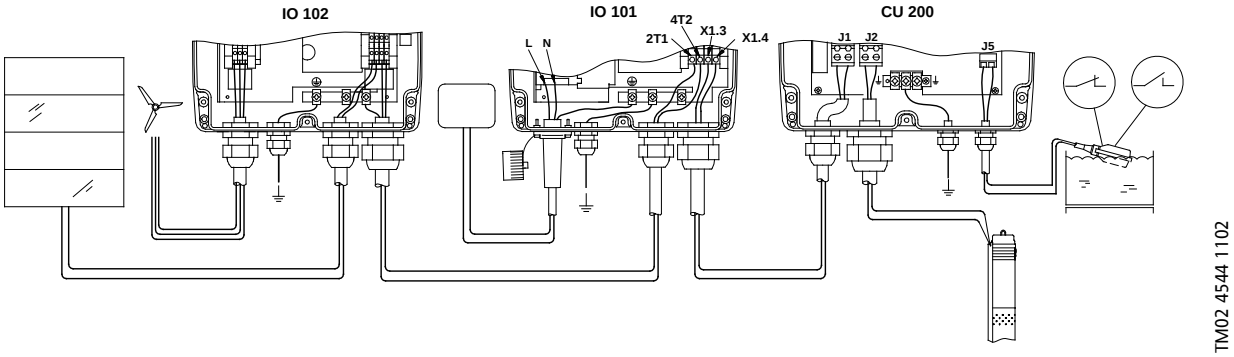

Fig. 70 SQFlex Combi with CU 200 control unit and level switch

11. Service of pump and motor

11.1 General information

Position numbers refer to exploded views, sectional drawings and parts lists. Tool letters refer to section *11.2 Service tools* on page 62.

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 *11.4 Helical rotor pump* on page 65.

When fixing the motor in a vice, tighten only on the 30 mm wide area starting 37 mm from the upper edge of the motor sleeve. See fig. 71.

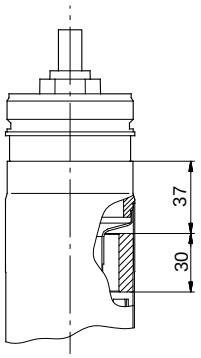

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Fig. 71 Fixing the motor in a vice

11.1.1 Before dismantling

- Disconnect the power supply to the motor.

11.1.2 Before assembly

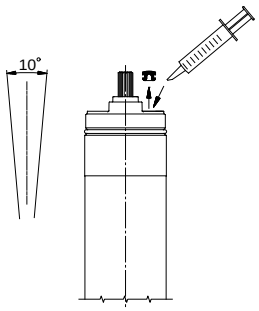
- Clean all parts, and check them for fractures and wear.
- Order the necessary service kits and/or parts.
- Replace defective parts by new parts.
- Moisten rubber parts with soapy water before fitting them.

11.1.3 During assembly

- Lubricate and/or tighten screws and rubber parts according to section *11.3 Torques and lubricants* on page 64.
- Before connecting the pump to the motor, fill the motor with Grundfos motor liquid SML 3.

Filling of motor liquid

1. Place the motor in vertical position with an inclination of approx. 10 °. See fig. 72.
2. Remove the filling plug using a screwdriver or a similar tool.
3. Inject motor liquid SML 3 into the motor with a filling syringe or similar.
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 *11.5.2 Fitting pump to motor* on page 67 (centrifugal pump) or section *11.4.2 Assembly* on page 65 (helical rotor pumps).



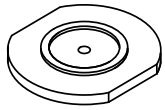
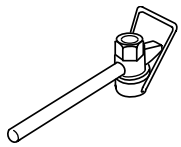
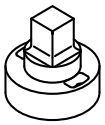
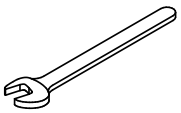
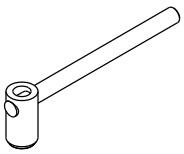
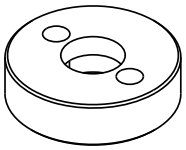
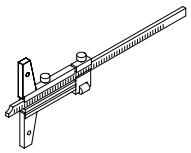
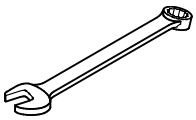
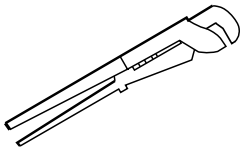
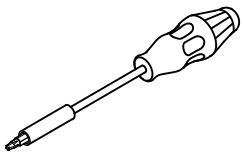
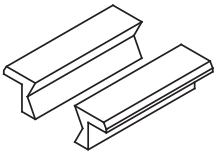
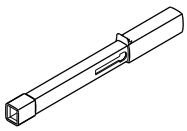
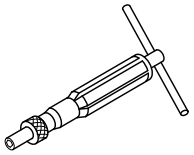
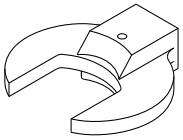
TM01 1434 4597

Fig. 72 Filling the motor

11.1.4 After assembly

Test the head and flow according to the test specifications. See section *11.11 Testing the pump using a CU 200 control unit* on page 79.

11.2 Service tools

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

Special tools

Pos.	Designation	To be used for pos.	Supplementary information	Helical rotor pump	SQF 3A SQF 5A	SQF 8A	SQF 11A SQF 14A
A	Mounting plate					SV0049	
B	Spline pin with screw				SV0226		
C	Spacing pipe		∅13 / ∅8.5 x 39.5		SV0006[a)]		
			∅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	

[a)] Only for SQF 3A N and SQF 5A N.

Standard tools

Pos.	Designation	To be used for pos.	Supplementary information	Helical rotor pump	SQF 3A SQF 5A	SQF 8A	SQF 11A SQF 14A
L	Hexagon key	D	6 mm			SV1204	
M	Ring/open-end spanner	16, 24	10 mm (two pcs needed for pos. 16)			SV0083	
		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	SQF 3A SQF 5A	SQF 8A	SQF 11A SQF 14A
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	
V	Open-end spanner	R, 16, 202c	10 mm	9 x 12	SV0610			
		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	

11.3 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	Corn oil
11	Split cone nut	SQF 3A N and 5A N	7.5 - 10	
		SQF 8A (N)	22	
		SQF 11A (N) and 14A (N)	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	**Model A only:** Nut	Motor	1.5	
250	**Model B/C only:** Screw	Motor	3.5	
	Model A only: End cover with cable	All		Klübersynth

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

- Klübersynth UH1 64-2403, product No 96962871 (45 g).
- 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.

11.4 Helical rotor pump

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

See also fig. 75 on page 73.

The tool letters in brackets refer to the tool specification on page 63.

11.4.1 Dismantling

1. Fix the motor in a vice.
   Note: Tighten only on the area shown in fig. 71.
2. Slacken screws (pos. 18b) with screwdriver (torx) (O), and remove them together with the cable guard (pos. 18).
3. If the motor is intact, the cable need not be removed. If the motor is defective, remove the screws for end cover with socket at the bottom of the motor with screwdriver (torx) (O), and pull the end cover with cable and socket out of the motor.
4. Remove discharge chamber (pos. 1a) with valve casing complete with key for discharge chamber (F) and ring/open-end spanner (M). Hold the pump with pipe wrench (N) on the weld just above the upper strainer.
5. Loosen outer sleeve (pos. 55) with pump stator (pos. 9) from the motor with pipe wrench (N) on the weld just above the upper strainer. Hold the motor with open-end spanner (G).
6. Pull outer sleeve (pos. 55) with pump stator (pos. 9) free of the pump rotor (pos. 13) and torsion shaft (pos. 16) with a jerk.
7. Remove 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 sand slinger (pos. 159c) from the motor shaft.
9. Remove torsion shaft (pos. 16) from the motor shaft with two ring/open-end spanners (M).
10. Remove pump rotor (pos. 13) from the torsion shaft (pos. 16) with ring/open-end spanner (M). Hold the torsion shaft with ring/open-end spanner (M).
11. If the parts of the valve casing complete are defective, replace these parts. Prise 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.

11.4.2 Assembly

1. Fill the motor with liquid. See section *Filling of motor liquid* on page 61.
2. Fit pump rotor (pos. 13) to the torsion shaft (pos. 16) and tighten to the correct torque with torque wrench (R) and open-end spanner (V). See section *11.3 Torques and lubricants*. Hold the pump rotor with ring/open-end spanner (M).
3. Fit torsion shaft (pos. 16) to the motor shaft and tighten to the correct torque with torque wrench (R), open-end spanner (V) and ring/open-end spanner (M). See section *11.3 Torques and lubricants*.
4. Push sand slinger (pos. 159c) on the motor shaft with a distance of 3 mm to the top of the motor.
5. Fit pump stator (pos. 9) with the conical stator inlet against the strainer into the outer sleeve (pos. 55).
6. Fit 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.
   SQF 2.5-2: Turn flange (pos. 6) with the even surface against the pump stator (pos. 9).
7. Assemble the valve and discharge chamber if they have been dismantled.
   – Place the valve casing complete on a plane surface.
   – Grease O-ring (pos. 1d), and fit it in the outside recess of the valve casing.
   – Press discharge chamber (pos. 1a) over the valve casing. Turn the discharge chamber, and fit 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.
8. Fit discharge chamber (pos. 1a) with valve casing complete and tighten to the correct torque with key for discharge chamber (F), torque wrench (R) and open-end spanner (V). See section *11.3 Torques and lubricants*. Hold the pump with pipe wrench (N), or fix it in a vice. The jaws must be placed on the weld just above the upper strainer.
9. Moisten pump rotor (pos. 13) with clean water, and fit the pump on the motor. Tighten to the correct torque with key for discharge chamber (F), open-end spanner (V) and torque wrench (R). See section *11.3 Torques and lubricants*.

10. Push the end cover with socket and cable into the motor if it has been removed.
    Model A: Fit and tighten nuts (pos. 250) with socket for hexagon head screws (P), adaptor for torque screwdriver (T) and torque screwdriver (S).
    Model B/C: Fit and tighten screws (pos. 250) with set of torx® bits (X), adaptor for torque screwdriver (T) and torque screwdriver (S).
11. **Model A:** Fit cable guard (pos. 18). Press the two upper flaps under the outer sleeve, and fit screws (pos. 18a and 18b). Tighten screws (pos. 18a) with screwdriver (torx) (O).
    Model B/C: Insert the cable guard between the flaps at the bottom and at the top, and push the cable guard into place. Tighten screws (pos. 18a) with screwdriver (torx) (O).
12. Test the pump performance using a CU 200 control unit, if available.
    See section *11.11 Testing the pump using a CU 200 control unit* on page 79.
13. Install the pump. See section *8. Start-up* on page 36.

11.5 Centrifugal pump and motor

See also fig. 76 to 79 on pages 74 to 77.

The tool letters in brackets refer to the tool specification on page 63.

11.5.1 Detaching pump from motor

1. Fix the motor in a vice.
   Note: Tighten only on the area shown in fig. 71.
2. Slacken screws (pos. 18b), if any, with screwdriver (torx) (O), and remove them together with the cable guard (pos. 18).
3. Remove cable guard (pos. 18c).
4. If the motor is intact, the cable need not be removed. If the motor is defective, remove screws or nuts (pos. 250) for the end cover with socket with screwdriver (torx) (O) or with socket for hexagon head screws (P), adaptor for torque screwdriver (T) and torque screwdriver (S). Pull the end cover with cable and socket out of the motor.
5. Remove nuts (pos. 19a), and lift the pump off the motor.
6. Remove spline protector (pos. 24b) and supporting ring (pos. 24a) from the pump shaft.
7. Remove shaft end (pos. 24) from the motor shaft with clamping tool for shaft end (I) and ring/open-end spanner (M).
8. Remove connecting piece (pos. 14a) from the motor with pipe wrench (N). Hold the motor with open-end spanner (G).
9. Remove sand slinger (pos. 159c), if fitted.

11.5.2 Fitting pump to motor

1. Fill the motor with liquid. See section *Filling of motor liquid* on page 61.
2. Fit sand slinger (pos. 159c) with a distance of 3 mm to the top of the motor.
3. Screw shaft end (pos. 24) on to the motor shaft, and push it home. Adjust the height to 88.15 mm ± 0.2 mm with measuring template (H). See fig. 73.
4. Tighten the nut to the correct torque with torque wrench (R) and open-end spanner (V). See section *11.3 Torques and lubricants*. Counter-hold with the clamping tool for shaft end (I). Check that the height is still 88.15 mm ± 0.2 mm.
5. Fit supporting ring (pos. 24a) and spline protector (pos. 24b).
6. Fit connecting piece (pos. 14a) and tighten with pipe wrench (N).

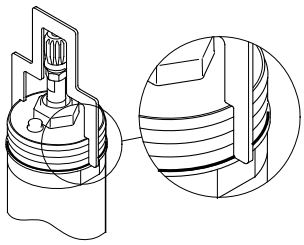


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Fig. 73 Adjusting the height

7. 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 with torque wrench (R) and ring insert tool (U). See section *11.3 Torques and lubricants*.
8. Push the end cover with socket and cable into the motor if it has been removed.
   Model A: Fit and tighten nuts (pos. 250) with socket for hexagon head screws (P), adaptor for torque screwdriver (T) and torque screwdriver (S).
   Model B/C: Fit and tighten screws (pos. 250) with set of torx® bits (X), adaptor for torque screwdriver (T) and torque screwdriver (S).
9. Fit cable guard (pos. 18c), and secure it with screws (pos. 18a), if any.
10. Fit cable guard (pos. 18), and secure it with screws (pos. 18b), if any.
11. Test the pump performance using a CU 200 control unit, if available.
    See section *11.11 Testing the pump using a CU 200 control unit* on page 79.
12. Install the pump. See section *8. Start-up* on page 36.

11.6 Centrifugal pump with splined shaft

See also fig. 76 on page 74.

The tool letters in brackets refer to the tool specification on page 63.

11.6.1 Dismantling

1. Fit and tighten 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. Slacken screws (pos. 19), and remove them together with washers (pos. 71). Remove 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 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 suction interconnector (pos. 14) and bottom chamber (pos. 10) free of the mounting plate (A).
7. Replace worn wear parts, if any. See section *11.8 Checking and replacing wear parts of centrifugal pumps* on page 71.

11.6.2 Assembly

1. Fit suction interconnector (pos. 14) to the mounting plate (A).
2. Press bottom chamber (pos. 10) into the suction interconnector (pos. 14).
3. Slide 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 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 chamber (pos. 9) and impeller (pos. 13) until the last impeller has been fitted.
7. Fit washer (pos. 76) (with the three grooves upwards) and nut (pos. 19b).
8. Make sure that the top impeller engages with the splined shaft, and tighten nut (pos. 19b) to the correct torque with torque wrench (R) and ring insert tool (U). See section *11.3 Torques and lubricants*.
   Note: Check that the impellers can be raised and lowered, as it is important that the nut is tightened against the impellers.
9. Fit valve casing complete (pos. 1) and 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 straps (pos. 17), washers (pos. 71) and screws (pos. 19). Tighten diagonally to the correct torque with torque wrench (R) and ring insert tool (U). See section *11.3 Torques and lubricants*.
11. Remove the pump from the mounting plate (A), and fit the pump to the motor. See section *11.5.2 Fitting pump to motor* on page 67.

11.7 Centrifugal pump with cylindrical shaft

See also figs 77 and 78 on pages 75 and 76.

The tool letters in brackets refer to the tool specification on page 63.

11.7.1 Dismantling

1. Fit mounting plate (A) to the suction interconnector (pos. 14) using the spacing pipe (C) and 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 mounting plate (A) in a vice.
2. Slacken and remove nuts (pos. 19). Remove strap (pos. 17).
3. Remove valve casing complete (pos. 1) and top chamber (pos. 4) (SQF 3A N and SFQ 5A N chamber (pos. 9)). Remove stop ring (pos. 85) of SQF 3A N and SQF 5A N.
4. Loosen split cone nut (pos. 11) with key for split cone nut (E). Knock split cone (pos. 12) down through and out of the impeller (pos. 13) with key for split cone nut (E).
5. Remove 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 stop ring (pos. 85) of SQF 11A and SQF 14A.
7. Loosen guide (pos. 25) from the recess of the suction interconnector (pos. 14) (only SQF 11A and SQF 14A). Lift the suction interconnector off the mounting plate (A).
8. Remove hexagon socket head screw with washer (D), spacing pipe (C) and pump shaft (pos. 16).
9. Check and replace wear parts. See section *11.8 Checking and replacing wear parts of centrifugal pumps* on page 71.

11.7.2 Assembly

1. Fit shaft (pos. 16) to the mounting plate (A) using 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 mounting plate (A) in a vice.
2. Slide suction interconnector (pos. 14) over the shaft so that the projection of the suction interconnector engages with the recess of the mounting plate. Press bottom chamber (pos. 10) / guide (pos. 25) home in the suction interconnector.
3. Fit 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) with key for split cone nut (E) and tighten to the correct torque with torque wrench (R) and open-end spanner (V). See section *11.3 Torques and lubricants*.
4. Fit 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 stop ring (pos. 85) after the middle impeller of SQF 3A/5A N and SQF 11A/14A (N).
   In SQF 11A/14A (N) the small recess of the stop ring must be downwards.
   Note: The top chamber of SQF 8A (N) and SQF 11A/14A (N) is (pos. 4).
6. Fit valve casing (pos. 1) so that the holes for the straining wire 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 strap (pos. 17) and nuts (pos. 19). Tighten diagonally to the correct torque with torque wrench (R) and ring insert tool (U). See section *11.3 Torques and lubricants*.
8. Remove the pump from the mounting plate (A), and fit it on the motor. See section *11.5.2 Fitting pump to motor* on page 67.
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 fig. 74.

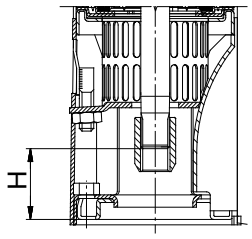

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Fig. 74 Position of shaft

Position	Distance [mm]		
	SQF 3A SQF 5A	SQF 3A N SQF 5A N SQF 11A (N) SQF 14A (N)	SQF 8A (N)
Bottom position H_{max}	37.5	37.15	37.15
Top position H_{min}	38.4	39.15	40.15

11.8 Checking and replacing wear parts of centrifugal pumps

Bearing (pos. 8) (not in SQF 3A/5A N)

Check	Replace
• Check whether the bearings are defective due to sand or dry running.	• Remove bearing (pos. 8) by pressing it out of the chamber (pos. 9). • Press a new bearing into the chamber from the bottom side with the largest bearing diameter against the bottom side of the chamber.

Top bearing (pos. 6)

Check	Replace
• Check whether the bearing is defective.	• Press bearing (pos. 6) out of the valve casing (cylindrical shaft). **SQF 3A/5A (splined shaft):** Press the bearing out using a screwdriver, if necessary. • Press the new bearing into the valve casing from the bottom side.

Valve seat (pos. 3) (only in SQF 3A/5A)

Check	Replace
• Check whether the rubber is hard or compressed so that the valve cup (pos. 2) touches the metal.	• Free valve guide (pos. 70) where it is positioned under the recess of the valve casing. Pull guide and valve cup (pos. 2) out of the valve casing. • Push valve seat (pos. 3) out of the valve casing by inserting a screwdriver between the valve seat and the valve casing. • Press the valve seat home in the valve casing with the flat side downwards.

Neck ring (pos. 7)

Check	Replace
• Check whether the rubber is hard or worn as this may reduce the head or flow rate.	• Prise 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. • 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: SQF 3A/5A smooth surface SQF 3A/5A N rubber side SQF 8A (N) "This side up" SQF 11A/14A (N) lip

11.9 Motor

See also fig. 79 on page 77.

The tool letters in brackets refer to the tool specification on page 63.

11.9.1 Dismantling

1. Remove sand slinger (pos. 159c) if it has not already been removed.
2. Remove motor top cover (pos. 225) with ring/open-end spanner (M).
3. Empty the motor of motor liquid.
4. Slacken thrust-bearing housing (pos. 243) with open-end spanner (G), and screw it out of the stator housing (pos. 201).
5. Lift the thrust-bearing housing and rotor (pos. 202) out of the stator housing.
6. Place the rotor in a vice with soft jaws (Q).
7. Remove shaft end (pos. 202c) and the rotating part of the thrust bearing (pos. 206) from the stator with puller for thrust bearing (J).
8. Lift the stationary part of the thrust bearing (pos. 203) out of the thrust-bearing housing.
9. Lift the thrust-bearing housing off the rotor shaft.
10. Remove the bearing plate with radial bearing (pos. 205) from the rotor shaft.
11. Remove stop ring (pos. 202a) from the rotor shaft.

11.9.2 Assembly

1. Replace O-rings (pos. 224) on the thrust-bearing housing (pos. 243) and top cover (pos. 225).
2. Fit stop ring (pos. 202a) to the rotor shaft (pos. 202).
3. Fit bearing plate with radial bearing (pos. 205) to the rotor shaft.
4. Fit thrust-bearing housing (pos. 243) to the rotor shaft.
5. Fit the stationary part of the thrust bearing (pos. 203) in the thrust-bearing housing. Make sure that the projections of the thrust bearing engage with the holes in the thrust-bearing housing.
6. Fit the rotating part of the thrust bearing (pos. 206) to the rotor shaft.
7. Fit shaft end (pos. 202c) to the end of the rotor shaft. Tighten the shaft end to the correct torque with torque wrench (R) and open-end spanner (V). See section *11.3 Torques and lubricants*.
8. Fit thrust-bearing housing (pos. 243) and the rotor in the stator housing (pos. 201).
9. Tighten the thrust-bearing housing to the correct torque with torque wrench (R) and open-end spanner (W). See section *11.3 Torques and lubricants*.
10. Fit top cover (pos. 225), and tighten it to the correct torque with torque wrench (R) and ring insert tool (U). See section *11.3 Torques and lubricants*.
11. Fill the motor with motor liquid. See section *Filling of motor liquid* on page 61.

11.10 Exploded views

This section shows exploded views of pumps, motor and wind turbine. They refer to sections *11.4* to *11.9*.

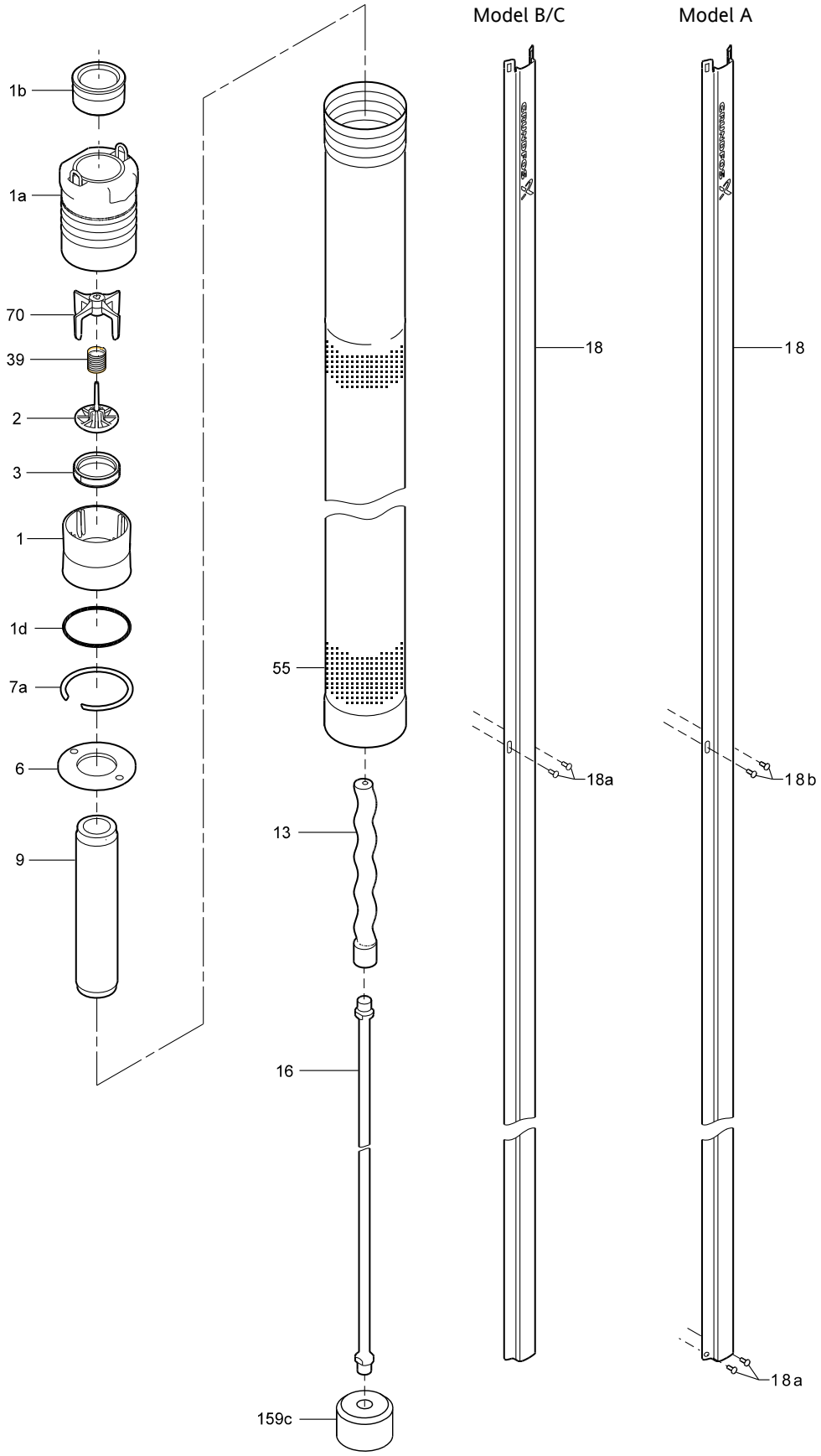


Fig. 75 Helical rotor pumps, SQF 0.6-2, SQF 0.6-3, SQF 1.2-2, SQF 2.5-2

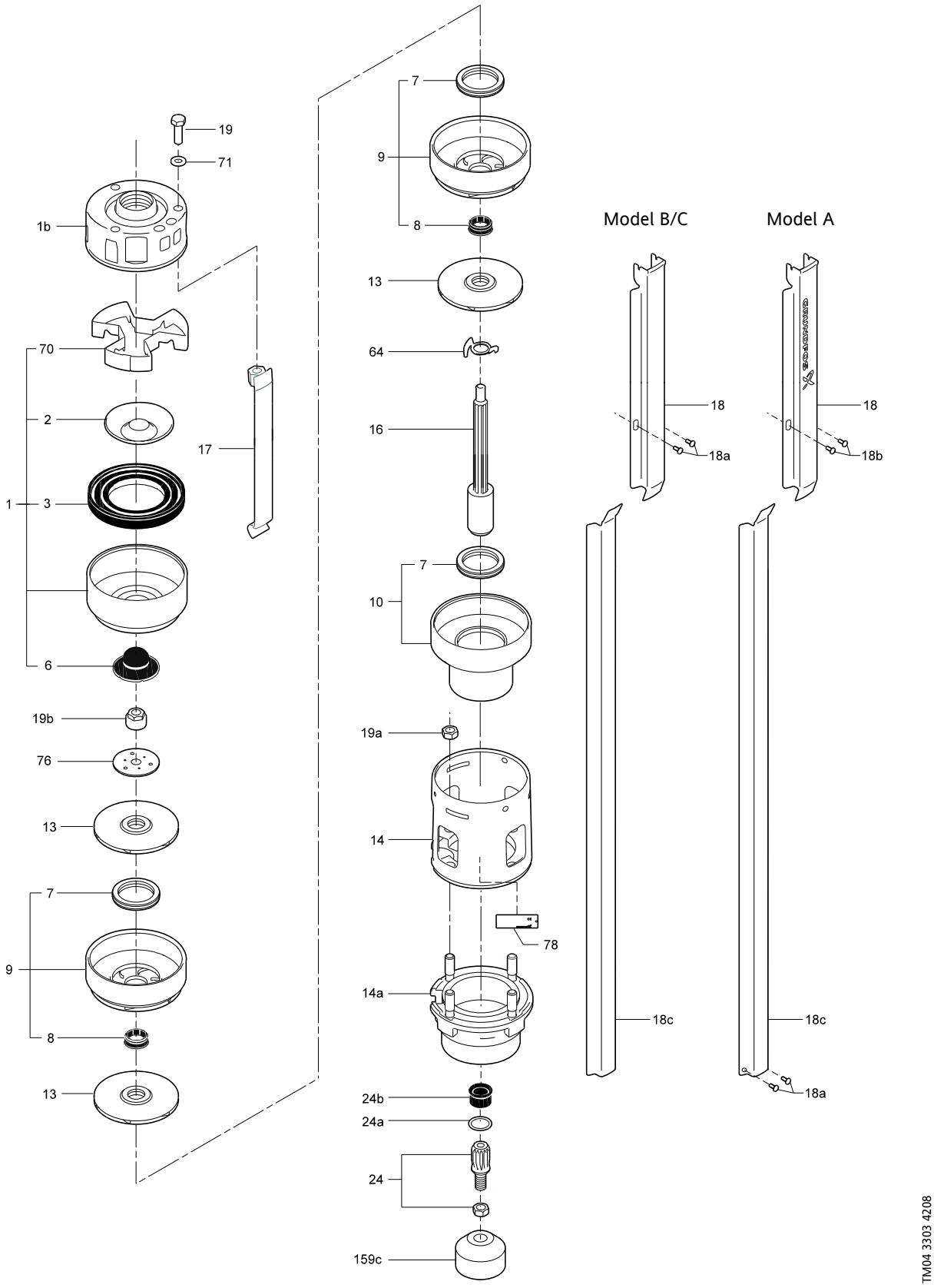


Fig. 76 Centrifugal pump with splined shaft, SQF 3A-10, SQF 5A-3, SQF 5A-6, SQF 5A-7

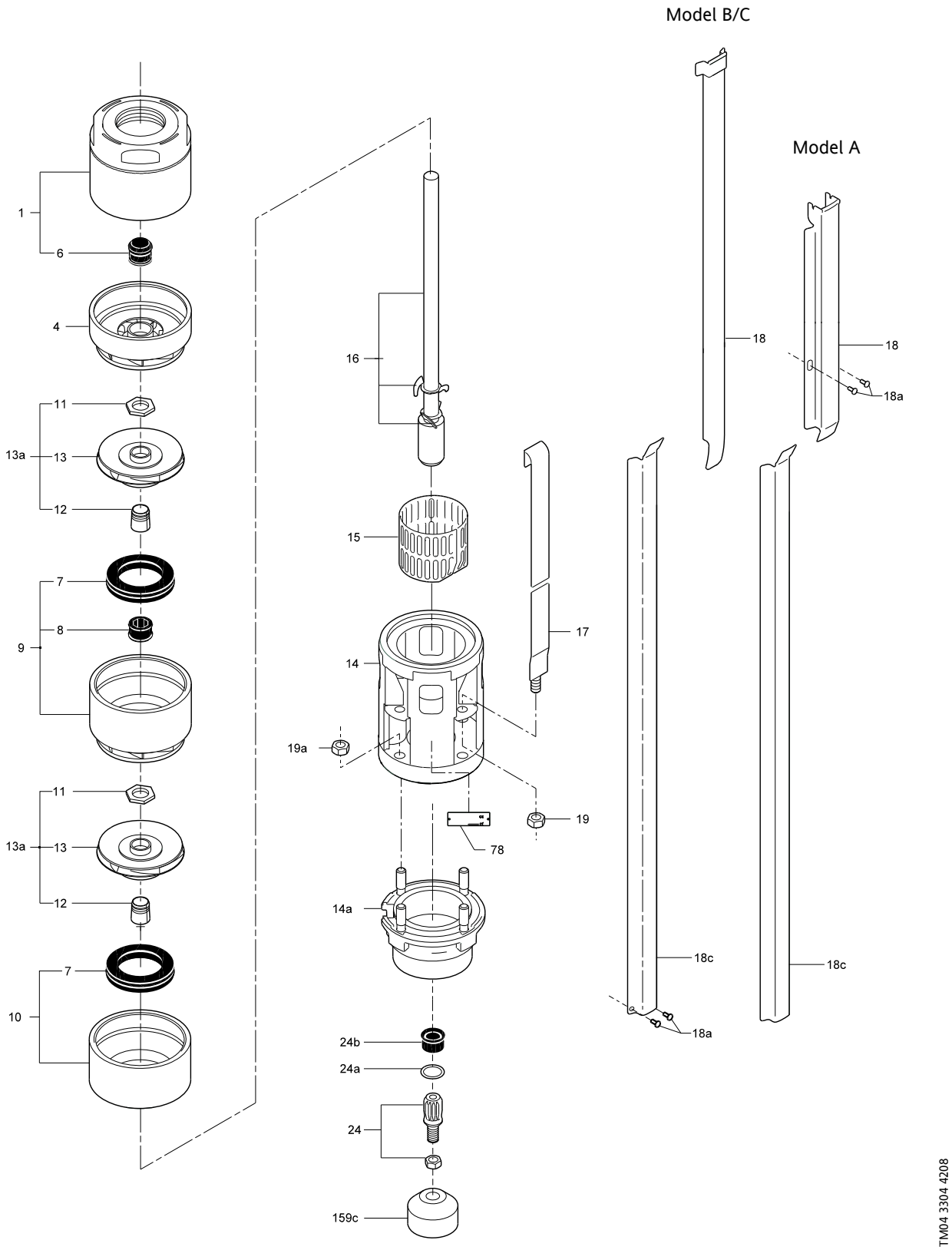


Fig. 77 Centrifugal pump with cylindrical shaft, SQF 8A-3, SQF 8A-5

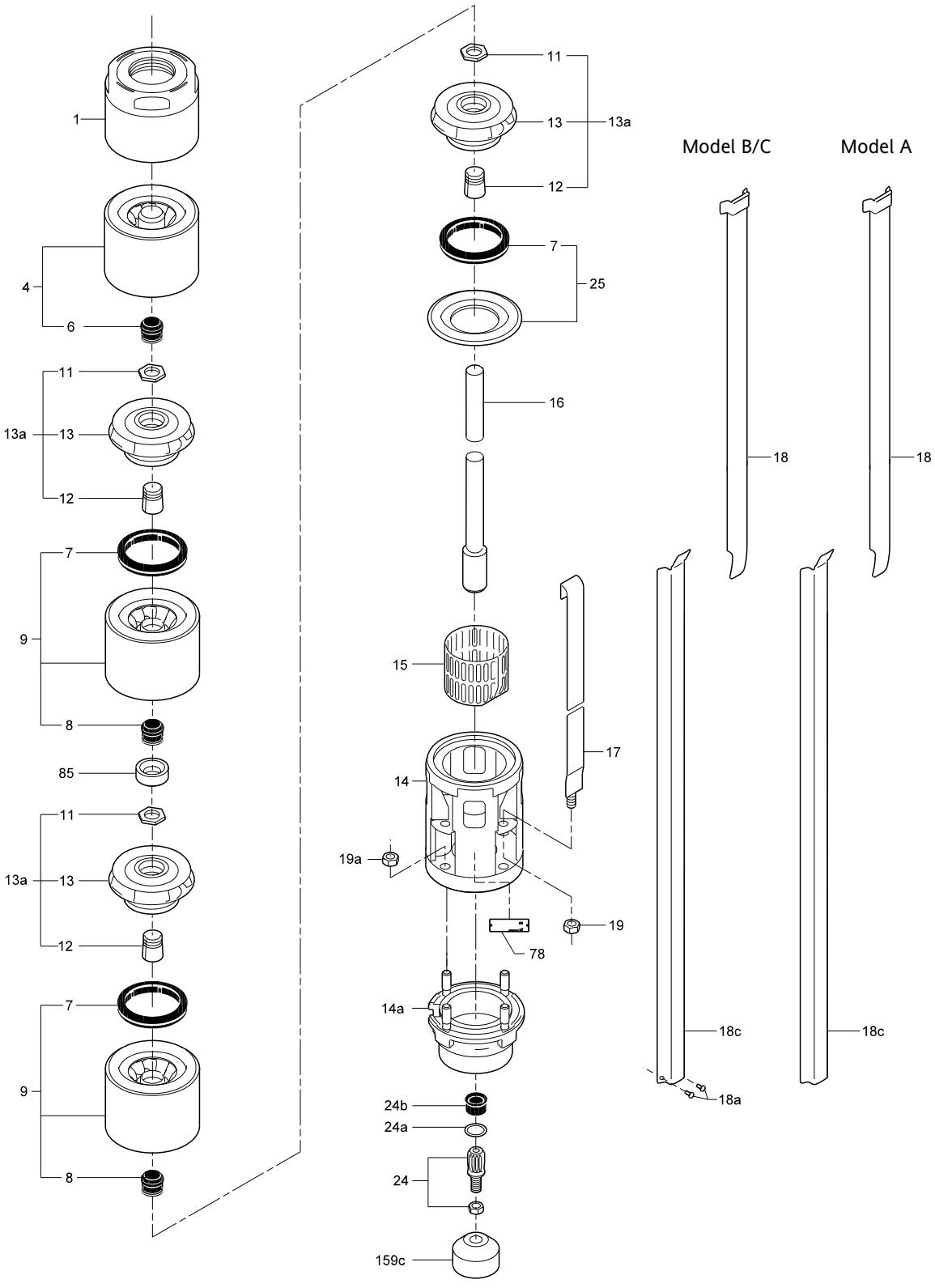


Fig. 78 Centrifugal pump with cylindrical shaft, SQF 11A-3, SQF 14A-3

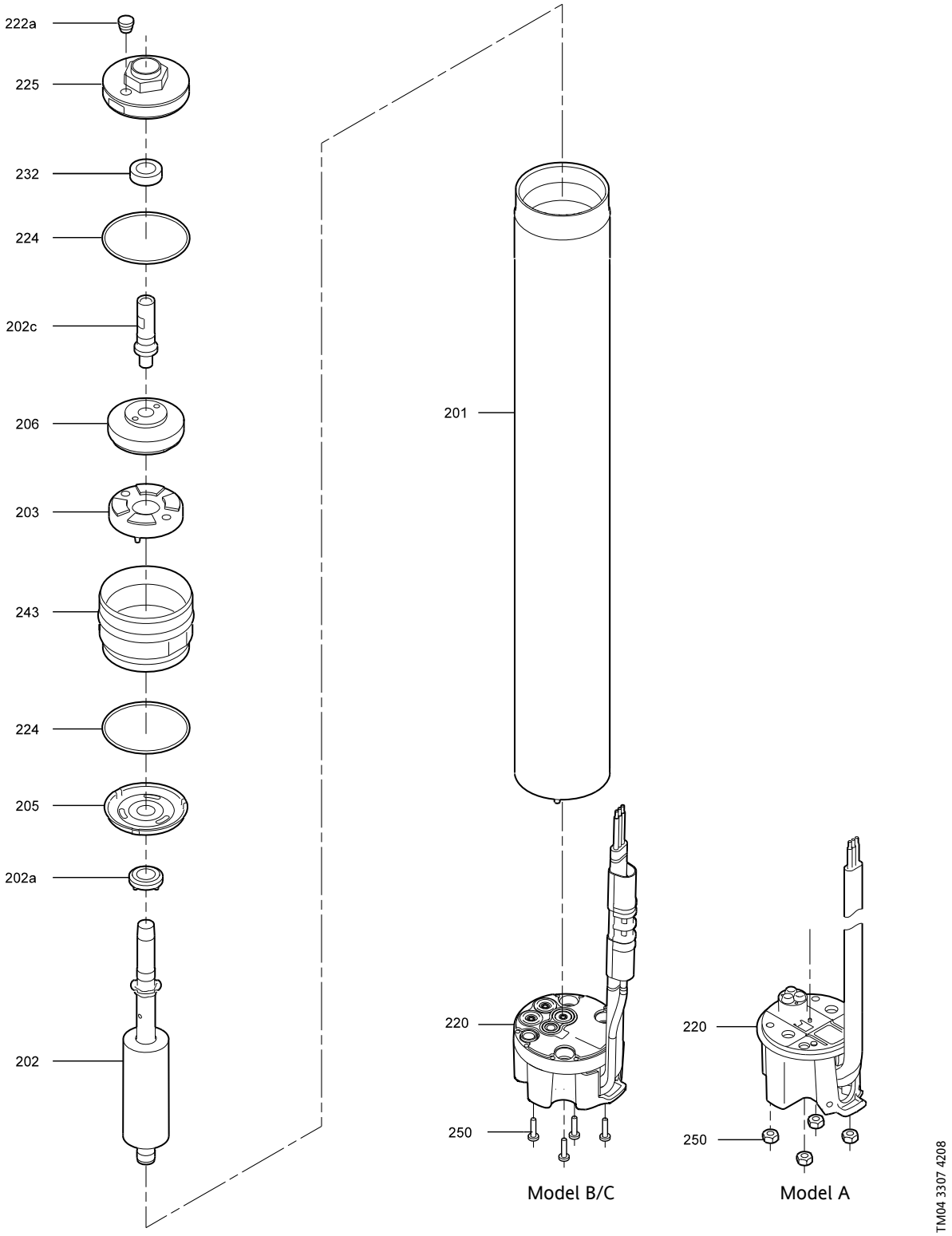

222a
225
232
224
202c
206
203
243
224
205
202a
202
201
220
250
Model B/C
220
250
Model A
TM04 3307 4208

Fig. 79 Motor

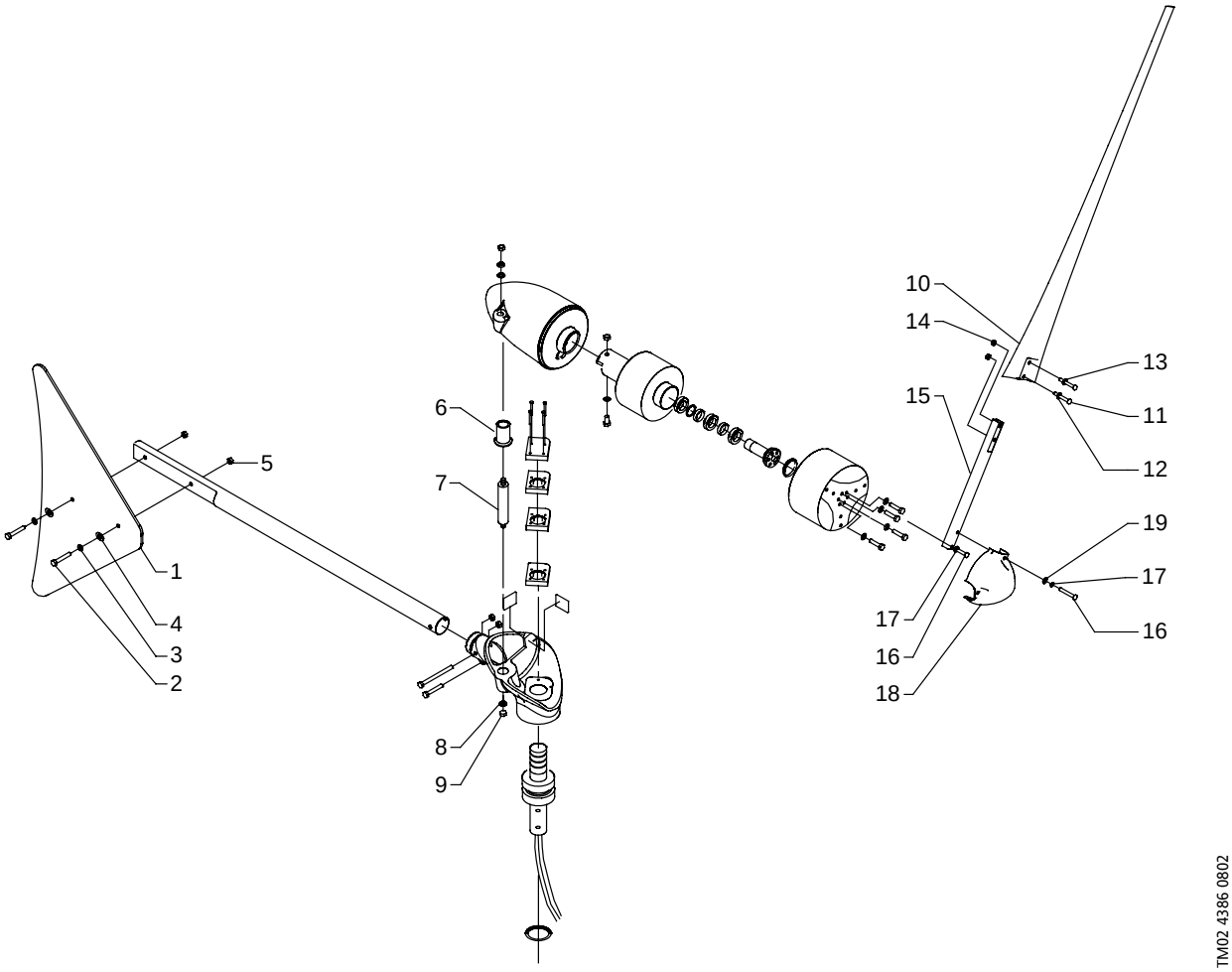


Fig. 80 Wind turbine

11.11 Testing the pump using a CU 200 control unit

The pump must deliver a flow rate (m^3/h) at a given power consumption and head. The test value curves in section *11.11.1 Test value curves* on pages 80 and 81 apply to the head stated for each pump. The curve values are minimum values.

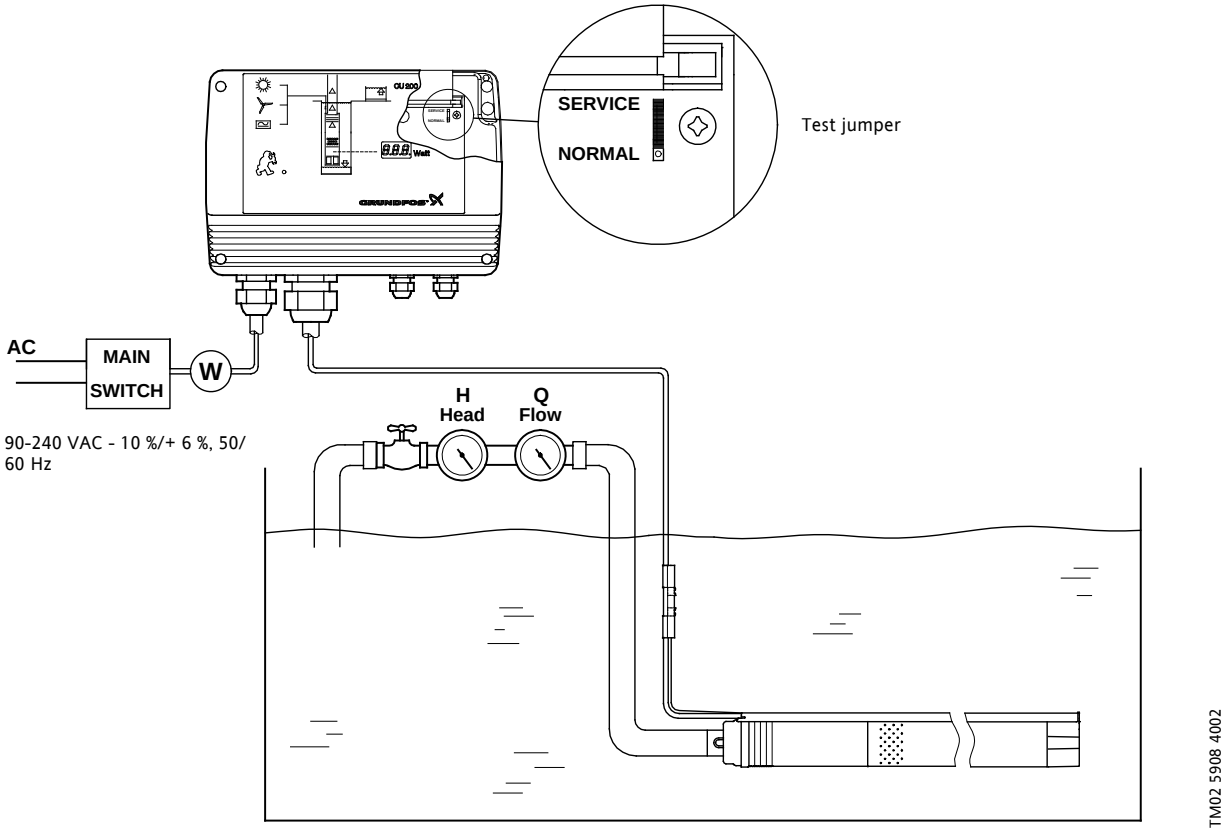


Fig. 81 Testing the pump using a CU 200 control unit

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 fig. 81.
   Refit the front cover.
4. Connect the power supply.
5. Make sure that the system is off. The red indicator light on 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 top 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 *11.11.1 Test value curves* on pages 80 and 81.
9. Read the flow rate Q [m^3/h] using a flowmeter or a similar device and the power consumption P1 [W] using a wattmeter.
10. In the relevant curve chart, find the intersection point of the values read for flow (Q) and power consumption P1 [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.

11.11.1 Test value curves

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

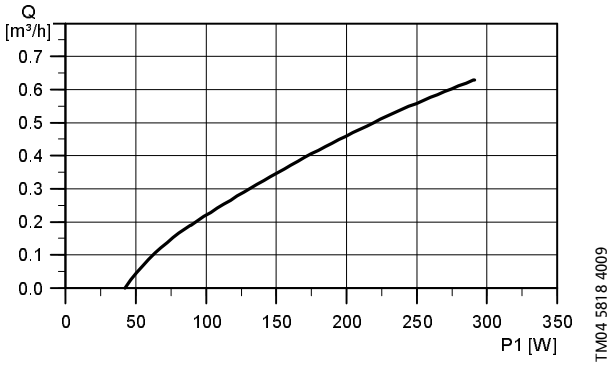


Fig. 82 Service test, SQF 0.6 - 2
H = 60 m

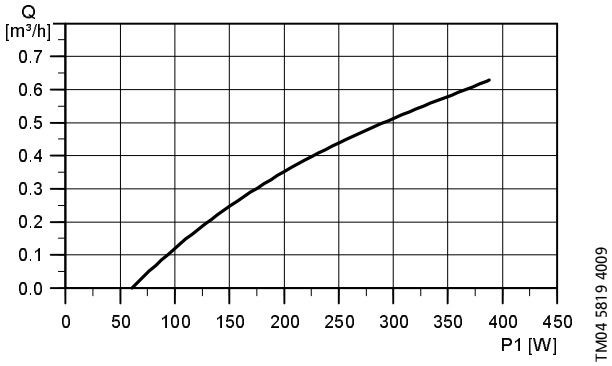


Fig. 83 Service test, SQF 0.6 - 3
H = 100 m

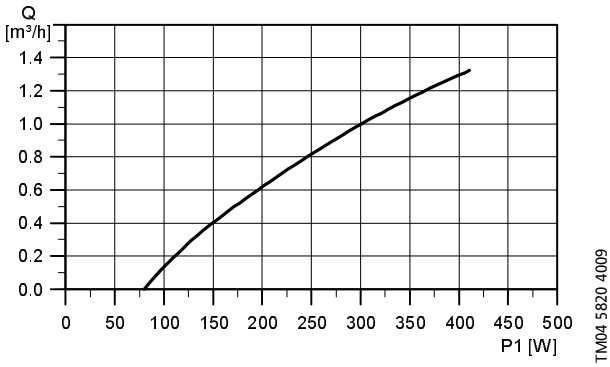


Fig. 84 Service test, SQF 1.2 - 2
H = 60 m

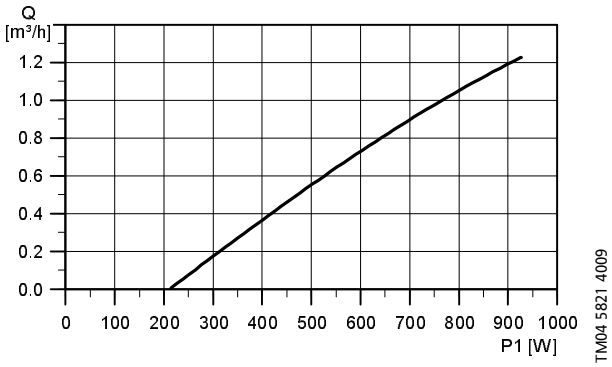


Fig. 85 Service test, SQF 1.2 - 3
H = 170 m

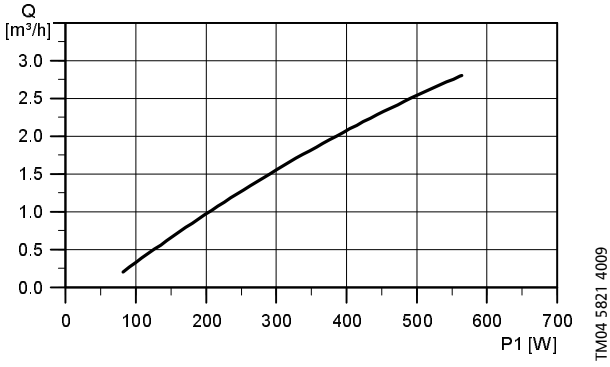


Fig. 86 Service test, SQF 2.5 - 2
H = 40 m

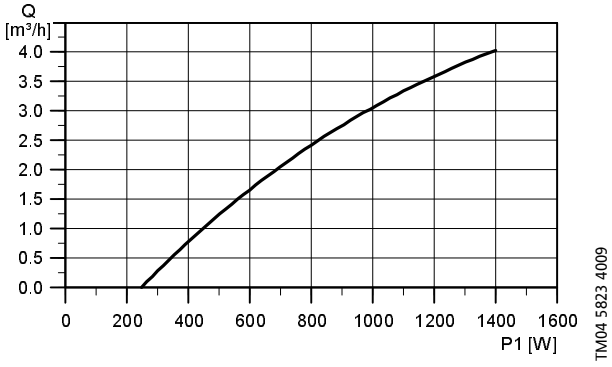


Fig. 87 Service test, SQF 3A-10
H = 50 m

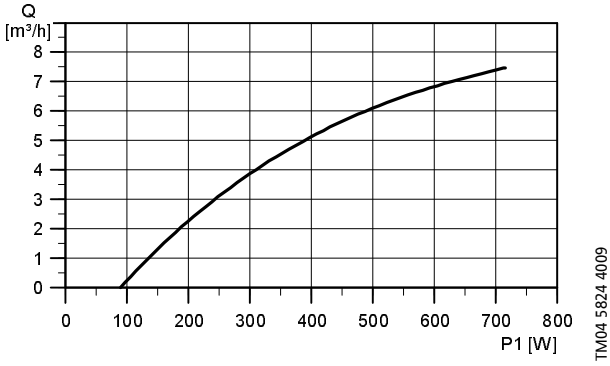


Fig. 88 Service test, SQF 5A-3
H = 10 m

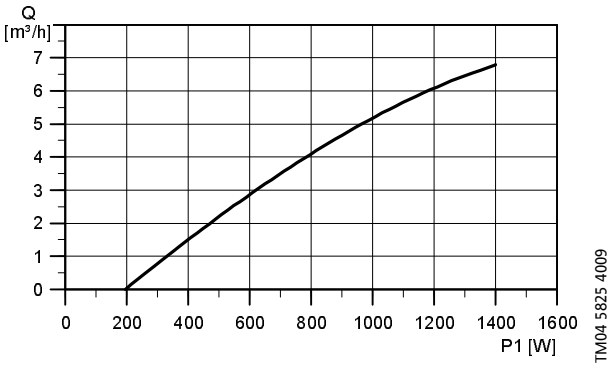


Fig. 89 Service test, SQF 5A-6
H = 30 m

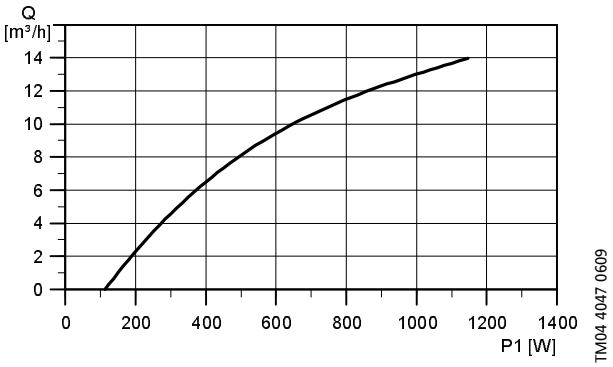


Fig. 90 Service test, SQF 5A-7
H = 30 m

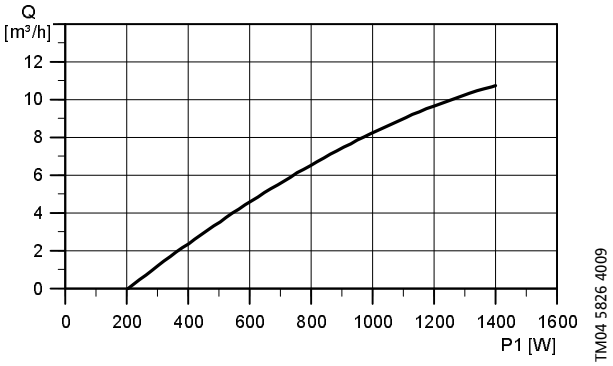


Fig. 91 Service test, SQF 8A-3
H = 10 m

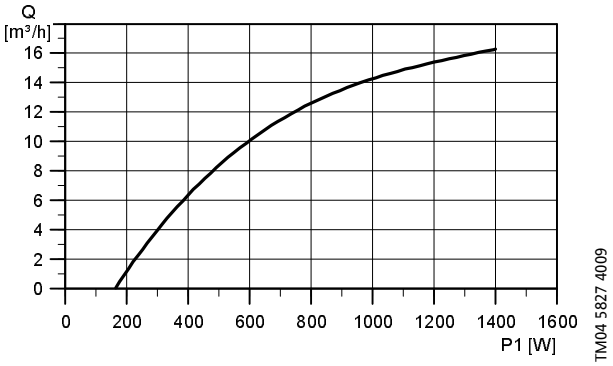


Fig. 92 Service test, SQF 8A-5
H = 20 m

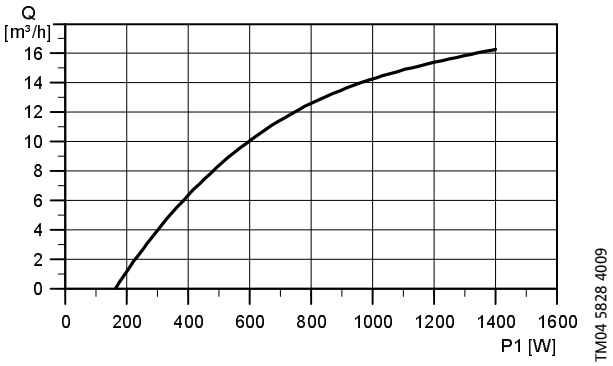


Fig. 93 Service test, SQF 11A-3
H = 10 m

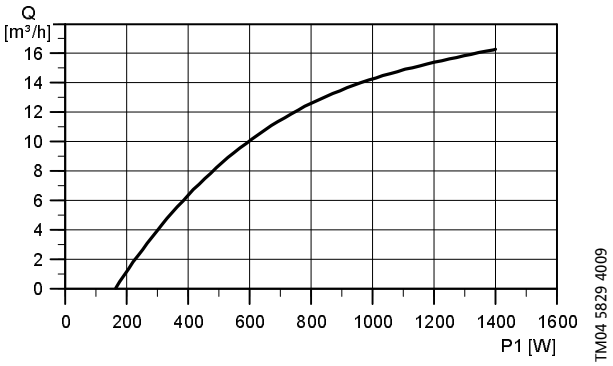


Fig. 94 Service test, SQF 14A-3
H = 15 m

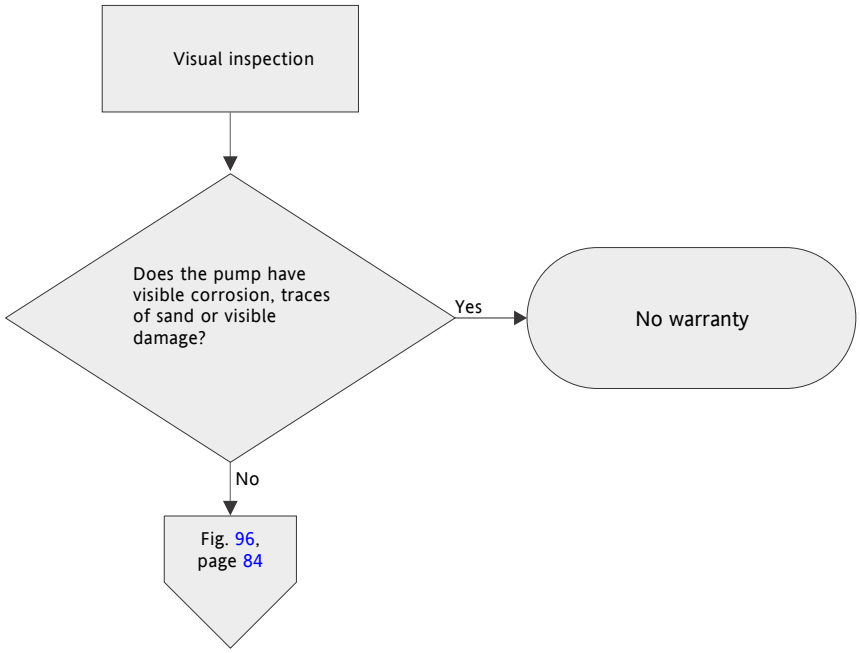
12. Fault analysis

The fault analysis requires a known-good SQFlex pump and a known-good CU 200.

The fault analysis is subdivided into these analyses:

- *12.1 Fault analysis, pump (using a known-good CU 200)*
- *12.2 Fault analysis, CU 200 (using a known-good SQFlex pump)*.

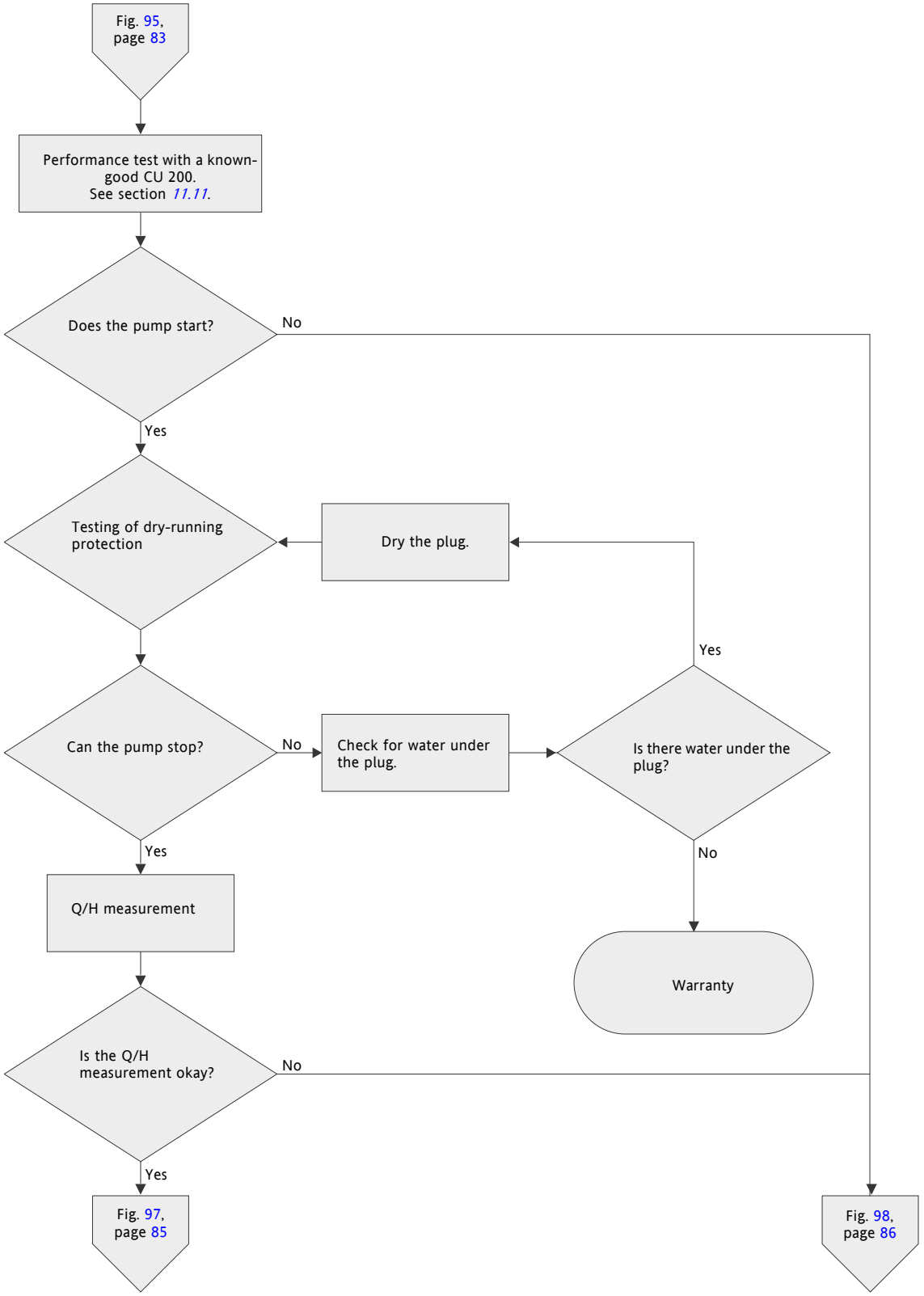
12.1 Fault analysis, pump (using a known-good CU 200)



TM04 4072 0609

Fig. 95 Fault analysis, pump - step 1

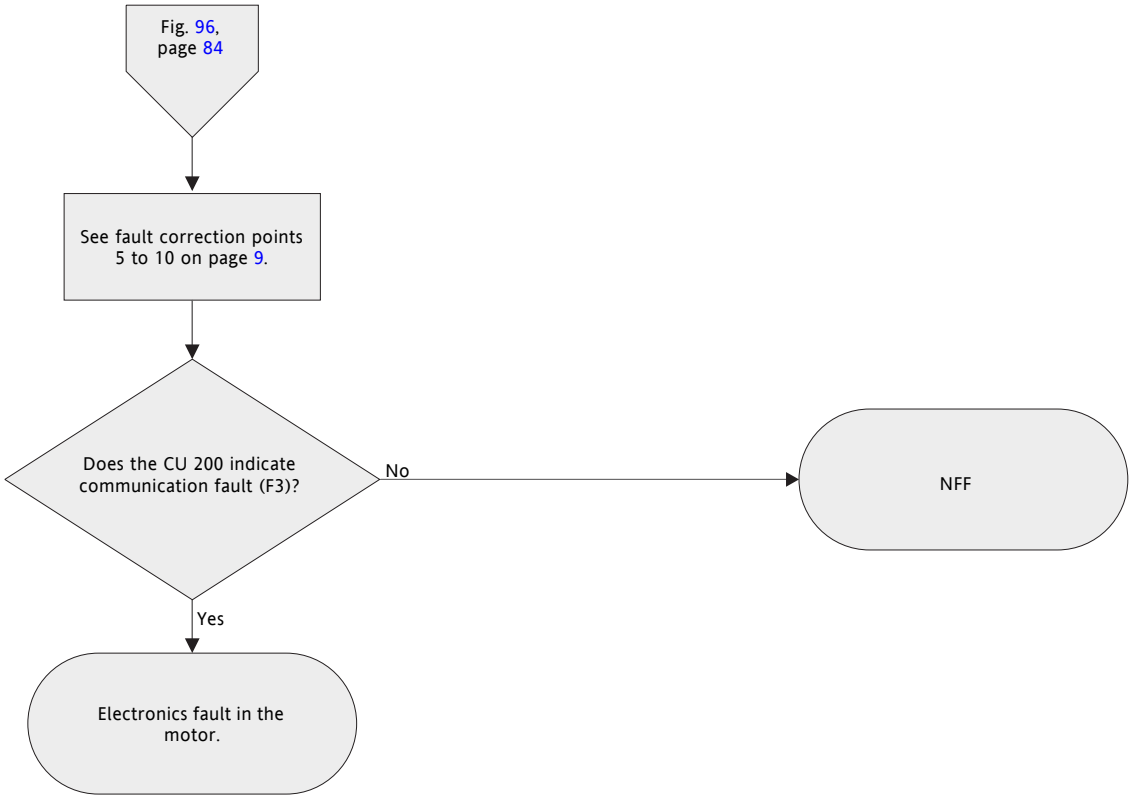
12.1.1 Fault analysis, pump (using a known-good CU 200) (continued from previous page)



TM04 4073 0609

Fig. 96 Fault analysis, pump - step 2

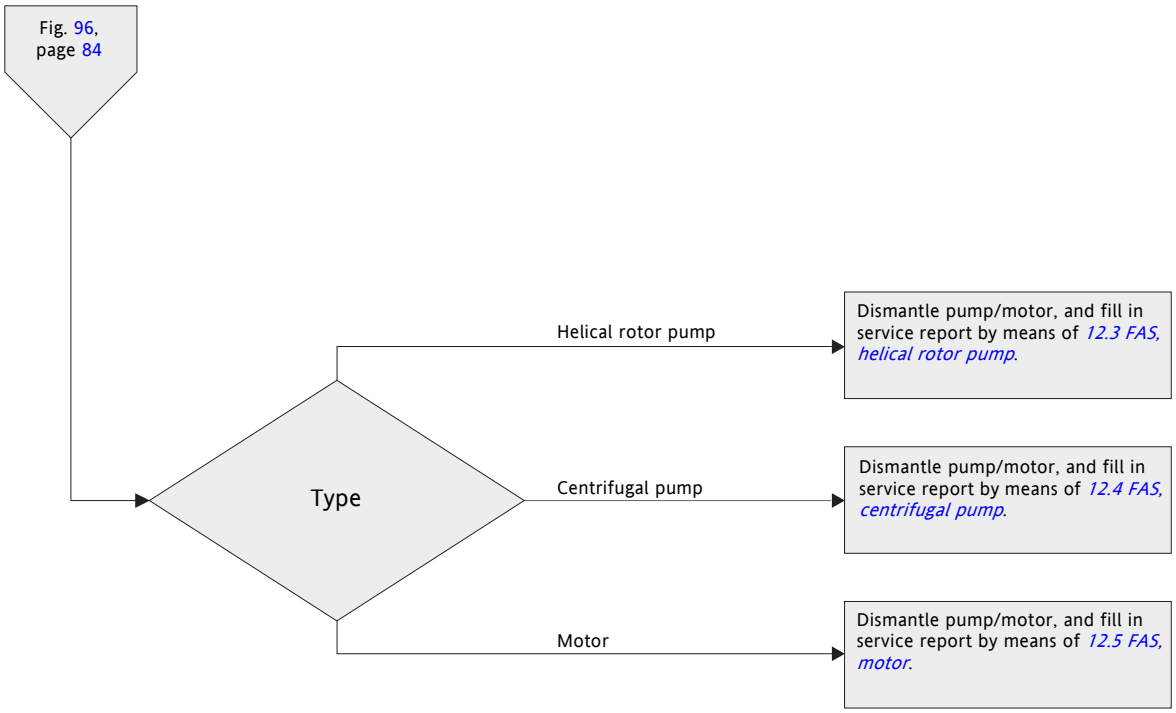
12.1.2 Fault analysis, pump (using a known-good CU 200) (continued from previous page)



TM04 4074 0609

Fig. 97 Fault analysis, pump - step 3

12.1.3 Fault analysis, pump (using a known-good CU 200) (continued from previous page)



TM04 4075 0609

Fig. 98 Fault analysis, pump - step 4

12.2 Fault analysis, CU 200 (using a known-good SQFlex pump)

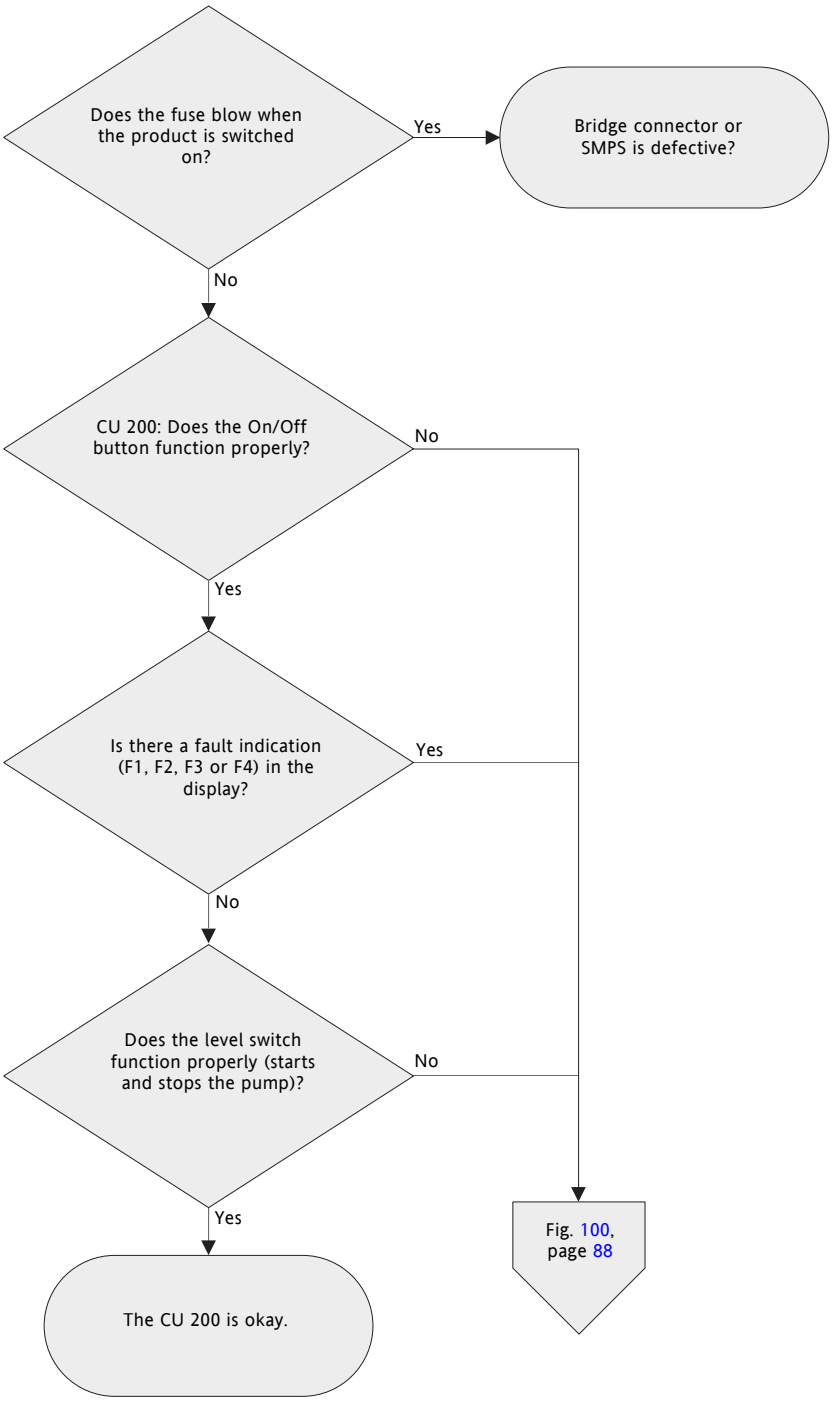


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Fig. 99 Fault analysis, CU 200 - step 1

12.2.1 Fault analysis, CU 200 (using a known-good SQFlex pump) (continued from previous page)

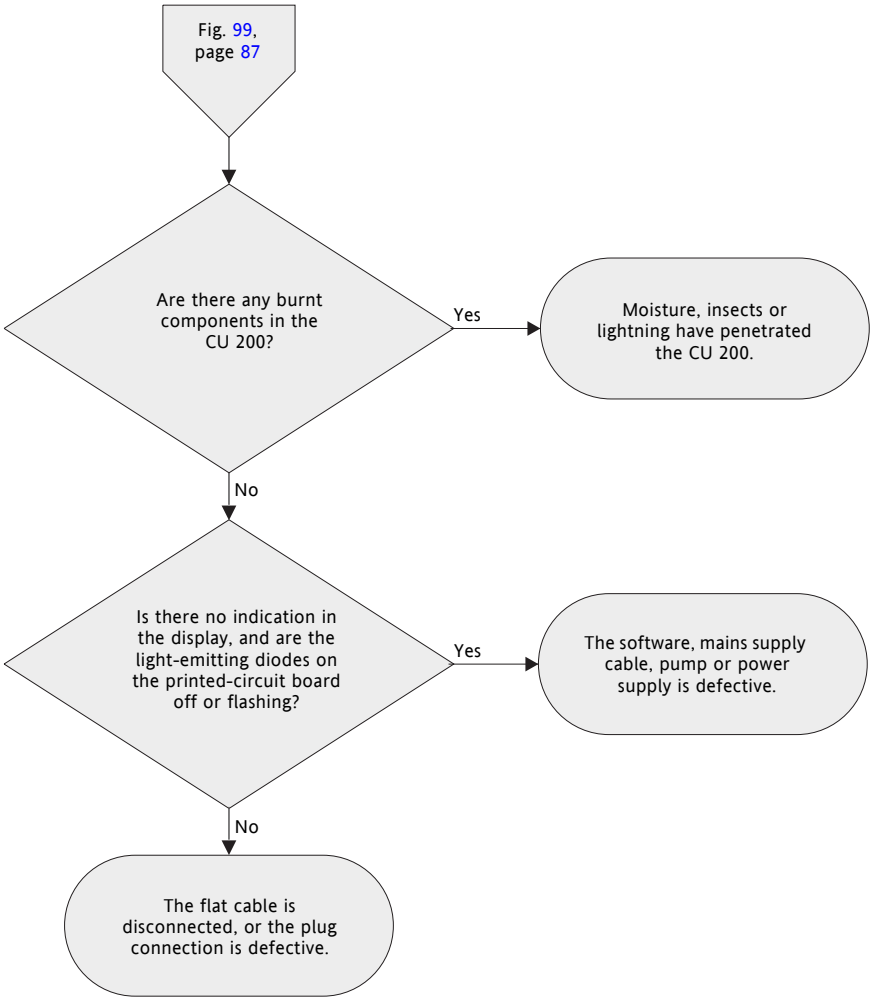

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Fig. 100 Fault analysis, CU 200 - step 2

12.3 FAS, helical rotor pump

Where		What		Why	
FAS		FAS		FAS	
5	Cable guard	3	Missing	8	Production failure
22	Non-return valve	3	Missing	8	Production failure
		6	Leaking	5 or 52	Blocked by impurities Construction failure
		28	Damaged	5 or 52	Blocked by impurities Construction failure
10	Discharge chamber	26	Welding defect	8	Production failure
		12	Loose	10	Other cause
		15	Blocked/clogged	5	Blocked by impurities
162	Pump stator SQFlex	2	Excessive wear	1	Sand
		7	Low capacity/head	56	Water temp. low
		8	Swollen	13	Excessive liquid temp.
		16	Melted	4	Dry running
163	Pump rotor SQFlex	2	Excessive wear	1	Sand
		7	Low capacity/head	2	Solids in liquid
185	Torsion shaft	4	Breakage	52	Construction failure
		9	Deformed/bent	52	Construction failure
		12	Loose	8	Production failure
30	Pump sleeve	4	Breakage	1 or 52	Sand Construction failure
		9	Deformed/bent	7	Installation failure
186	Sand slinger	12	Loose	52	Construction failure

12.4 FAS, centrifugal pump

Where		What		Why	
FAS		FAS		FAS	
38	Straps	4	Breakage	8	Production failure
		26	Welding defect	8	Production failure
31	Shaft	4	Breakage	52	Construction failure
8	Coupling	2	Excessive wear	2	Solids in liquid
		12	Loose	8	Production failure
17	Impeller	2	Excessive wear	2	Solids in liquid
		15	Blocked/clogged	1	Sand
		26	Welding defect	8	Production failure
6	Chamber	26	Welding defect	8	Production failure
		28	Damaged	2	Solids in liquid
21	Neck ring	8	Swollen	19	Application failure
		15	Blocked/clogged	5	Blocked by impurities
		28	Damaged	2	Solids in liquid
188	Connecting piece	4	Breakage	52	Construction failure
187	Shaft end	2	Excessive wear	2	Solids in liquid
		4	Breakage	32	Vibration
		12	Loose	8	Production failure
186	Sand slinger	12	Loose	52	Construction failure
10	Discharge chamber	15	Blocked/clogged	5	Blocked by impurities
22	Non-return valve	6	Leaking	5 or 52	Blocked by impurities Construction failure
5	Cable guard	3	Missing	8	Production failure
39	Suction interconnector	4	Breakage	19	Application failure

12.5 FAS, motor

Where		What		Why	
FAS		FAS		FAS	
187	Shaft end	2	Excessive wear	32	Vibration
		4	Breakage	32	Vibration
71	Thrust bearing	2	Excessive wear	12	Cooling insufficient
		28	Damaged	2	Solids in liquid
31	Shaft	4	Breakage	32 or 52	Vibration Construction failure
74	All bearings	2	Excessive wear	2	Solids in liquid
72	Thrust ring	9	Deformed/bent	13	Excessive liquid temp.
64	Motor liquid	24	Motor liquid low/missing	8 or 13	Production failure Excessive liquid temp.
33	Shaft seal	12	Loose	13	Excessive liquid temp.
63	Motor cable	20	Short-circuit	25	Moisture/water
		28	Damaged	21 or 25	Lightning Moisture/water
		18	Will not start	4	Dry running
67	Stator housing	28	Damaged	9 or 25	Corrosion Moisture/water
57	Drop cable	28	Damaged	25	Moisture/water
52	Cable plug	20	Short-circuit	25	Moisture/water
		28	Damaged	21 or 25	Lightning Moisture/water
		18	Will not start	4	Dry running

12.6 FAS, electronic devices

Where		What		Why	
FAS		FAS		FAS	
49	Complete products	17	Other functional failures	8	Production failures

Subject to alterations.

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