KÄRCHER

Service Manual

HDS Middle Range

1.071-..., 1.077-...
HDS 7/12, HDS 8/17, HDS 9/18, HDS 10/20

HDS Premium Range

1.071-...
HDS 12/18, HDS 13/20

Service Manual 04.2008 **5.906-433.0**

Foreword

Good service work requires comprehensive and practical training as well as clear documents.

We therefore provide regular basic training and further training courses for service technicians covering our whole range of products.

In addition, we produce service manuals for the most important units, which can initially be used as instructions and later for reference purposes.

Furthermore, we regularly provide service information about new product developments.

Should you have any additions, corrections or questions regarding this document, please send them to the following quoting the given subject:

international-service@de.kaercher.com

Subject:	Fall 105756

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1.1 Technical Features

General:

Mobile hot water high-pressure cleaner with various power ratings for commercial use.

– High-performance burner with vertical heating coil and continuous ignition.

– Integrated scale inhibitor.

– Steam operation (water temperatures up to 155 °C) with separate steam nozzle.

– Burner fan and fuel pump directly on the electric motor.

Unit connected load:

– 3.4 kW (HDS 7/12-4 M/MX).

– 5.5 kW (HDS 8/17-4 M/MX).

– 6.4 kW (HDS 9/18-4 M/MX).

– 7.8 kW (HDS 10/20-4 M/MX).

– 8.4 kW (HDS 12/18-4 S/SX).

– 9.3 kW (HDS 13/20-4 S/SX).

Pump:

– 3 piston axial pump with stainless steel pistons, with ceramic coating in several models.

– Cylinder head made of brass.

– High-pressure and suction valves made of stainless steel.

– Working pressure: 3-20 MPa (30-200 bar).

– Water volume: 350-1300 l/h.

– With pressure gauge.

– Overflow valve with pressure and flow control valve.

– Float tank.

– Safety valve.

– Fine water filter.

Electronics:

– Program switch.

– Flame sensor (optional).

– Water temperature control with temperature sensor.

– Exhaust temperature limiter.

– Low-water protection.

– Dry running protection for pump.

– Level sensor for fuel, scale inhibitor and cleaning agent tanks (partly optional).

– Operating hours counter.

– Fault memory.

– Component check.

– Fault monitoring.

– Rotary direction monitoring.

Cleaning agent:

– 2 cleaning agent tanks.

– Cleaning agent suction with fine filter.

– Metering valve on unit with automatic rinsing in neutral position.

– Cleaning agent operation with low pressure and high pressure.

Accessories:

– Rotary control for pressure and flow control valve

– Softgrip easy-press handgun

– Stainless steel spray lance, rotatable

– Power nozzle (25°), (stainless steel)

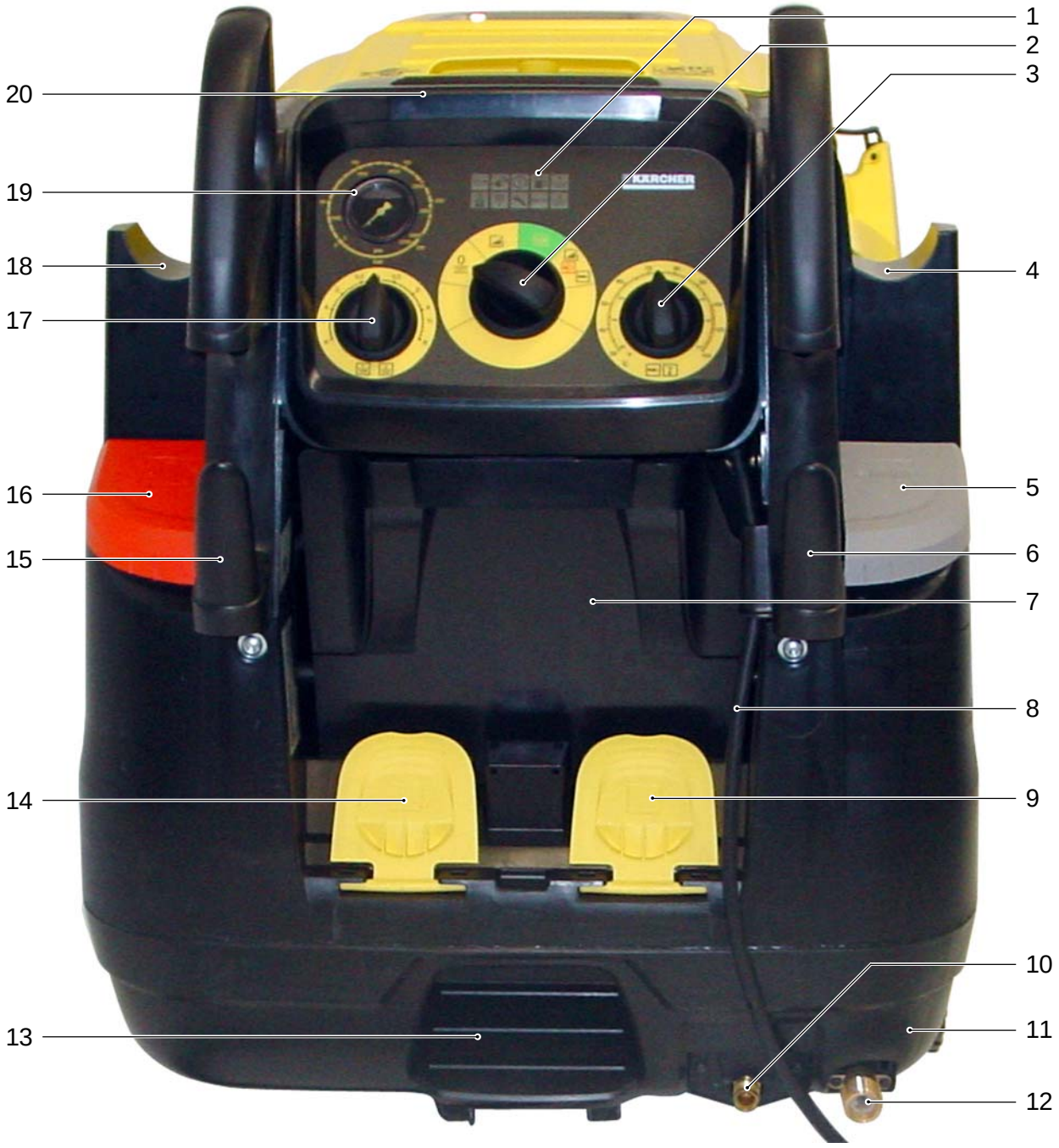
– Steam nozzle (brass)

1.2 View from the front

1 Push handle (2x)
2 Cover, top storage compartment
3 Safety latch, softgrip easy-press handgun
4 Rotary control
5 Trigger lever
6 Softgrip easy-press handgun
7 Cap, fuel tank
8 High-pressure hose
9 Rotatable spray lance
10 High-pressure nozzle
11 Transport wheel (2x)
12 Transport handle
13 Swivel castor
14 Swivel castor with parking brake*
15 Chassis
16 Unit cover
17 Exhaust gas flue, continuous-flow heater
18 Latch, unit cover

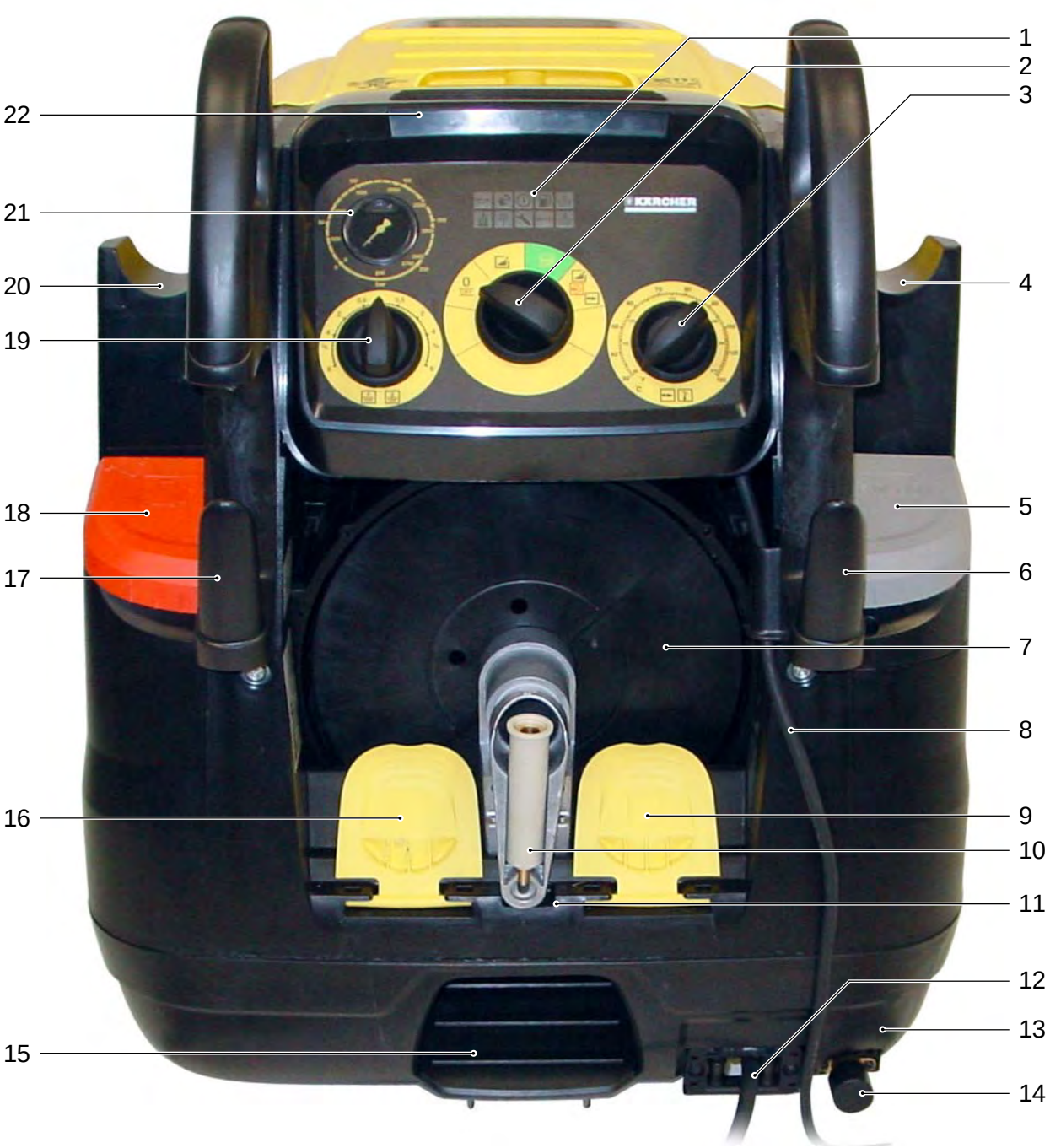
*) HDS 7/12 and HDS 8/17 have one swivel castor only.

1.3 View from the rear (unit without hose reel)



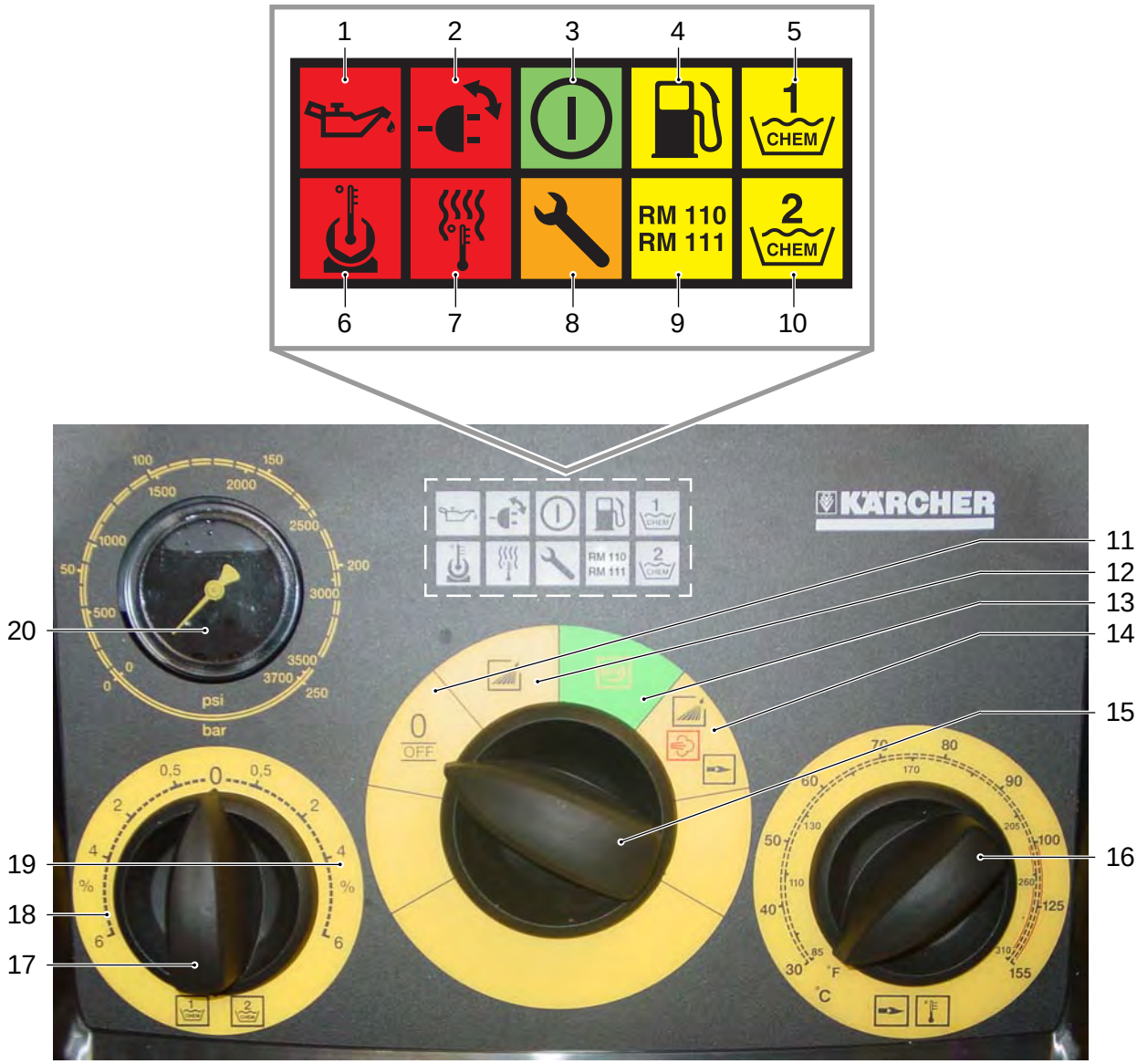
1 Indicator lights
2 Program switch (Q1)
3 Adjustment, water temperature
4 Spray lance holder, RH
5 Cap, scale inhibitor tank
6 Storage, mains cable
7 Storage compartment, bottom
8 Mains cable
9 Cap, cleaning agent tank 2
10 High-pressure outlet
11 Chassis
12 Water connection with fine water filter
13 Tread
14 Cap, cleaning agent tank 1
15 Storage, high-pressure hose
16 Cap, fuel tank
17 Adjustment, cleaning agent metering
18 Spray lance holder, LH
19 Pressure gauge
20 Cover, top storage compartment

1.4 View from the rear (unit with hose reel)



1 Indicator lights
2 Program switch (Q1)
3 Adjustment, water temperature
4 Spray lance holder, RH
5 Cap, scale inhibitor tank
6 Storage, mains cable
7 Hose reel, high-pressure hose
8 Mains cable
9 Cap, cleaning agent tank 2
10 Crank handle, hose reel
11 Recess, hose reel locking device
12 High-pressure hose
13 Chassis
14 Water connection with fine water filter
15 Tread
16 Cap, cleaning agent tank 1
17 Storage, high-pressure hose
18 Cap, fuel tank
19 Adjustment, cleaning agent metering
20 Spray lance holder, LH
21 Pressure gauge
22 Cover, top storage compartment

2.1 Control panel



1 Indicator LED 0, pump (red)
2 Indicator LED 1, rotational direction (red)
3 Indicator LED 2, operation (green)
4 Indicator LED 3, fuel (yellow)
5 Indicator LED 4, cleaning agent tank 1 (yellow)
6 Indicator LED 5, motor (red)
7 Indicator LED 6, burner (red)
8 Indicator LED 7, service (orange)
9 Indicator LED 8, scale inhibitor (yellow)
10 Indicator LED 9, cleaning agent tank 2 (yellow)
11 Program switch „OFF“ position
12 Program switch „Cold Water Operation“ position
13 Program switch „Eco Mode*“ position
14 Program switch „Hot Water/Steam Operation“ position
15 Program switch
16 Adjustment, water temperature
17 Metering valve, cleaning agent
18 Metering range, cleaning agent 1
19 Metering range, cleaning agent 2
20 Pressure gauge

*** Note**
In „Eco Mode“ the water temperature is kept at 60°C (+/- 9). Adjusted water temperatures < 60°C are effective, settings > 60°C remain ineffective.

2.1 Control panel

Functions of the LED displays in operating mode

LED No.	Symbol	Activity	Meaning / Action
0		1 x flashing	Insufficient oil. Check/top up the oil level of the high-pressure pump.
		2 x flashing	Leakage. Check high-pressure system for leaks.
		3 x flashing	Dry running. Check water inlet/ensure water supply.
		4 x flashing	Reed switch sticks. Check safety block/repair reed switch.
1		1 x flashing	Motor rotates in the wrong direction. Switch off the unit and rotate the phase inverter in the unit plug through 180°.
2		light up	Unit is ready for operation.
		1 x flashing	Unit was either in continuous operation for 30 minutes or was in standby operation for 30 minutes.
3		light up	Fuel tank is empty. Add more fuel.
4		light up	Cleaning agent tank 1 is empty. Add more cleaning agent (HDS 12/18 only).
5		1 x flashing	Fault in the motor contactor (motor current below 1.5 A for 3 seconds although contactor connected). Check/replace contactor.
		2 x flashing	Motor thermal contact is open/defective. Determine/remove cause. Replace the motor
		3 x flashing	Current asymmetry or undervoltage or overvoltage. Check mains connection.
		4 x flashing	Current consumption too high. Check mechanics for resistance. Check mains connection.
6		1 x flashing	Exhaust thermostat is open. Check exhaust temperature/ replace thermostat. Perform burner maintenance.
		2 x flashing	Flame sensor signals burner fault. Clean and check burner, ignition and fuel system.
		3 x flashing	RFID read-write electronics are defective - replace.
		4 x flashing	Temperature sensor fault. Cable break (temperature below -5 °C, although burner is on) or short-circuit (temperature above 220 °C for a lengthy period).
7		light up	Service work is due.

2.1 Control panel

Functions of the LED displays in operating mode

LED No.	Symbol	Activity	Meaning / Action
8		light up	Scale inhibitor level switch detects empty or units on the tag* of the scale inhibitor bottle have been used up.
		1 x flashing	5 hours after-running time have expired, burner is blocked. Insert new scale inhibitor bottle.
9		light up	Cleaning agent tank 2 is empty. Add more cleaning agent (HDS 12/18 only).

*** Note**
The tag is an electronic component on the new rectangular scale inhibitor bottle. The tag is located behind the bottle label. The tag can be electronically read and written. See also Chapter 2.8.2.

2.1 Control panel

Template for numerical value displays

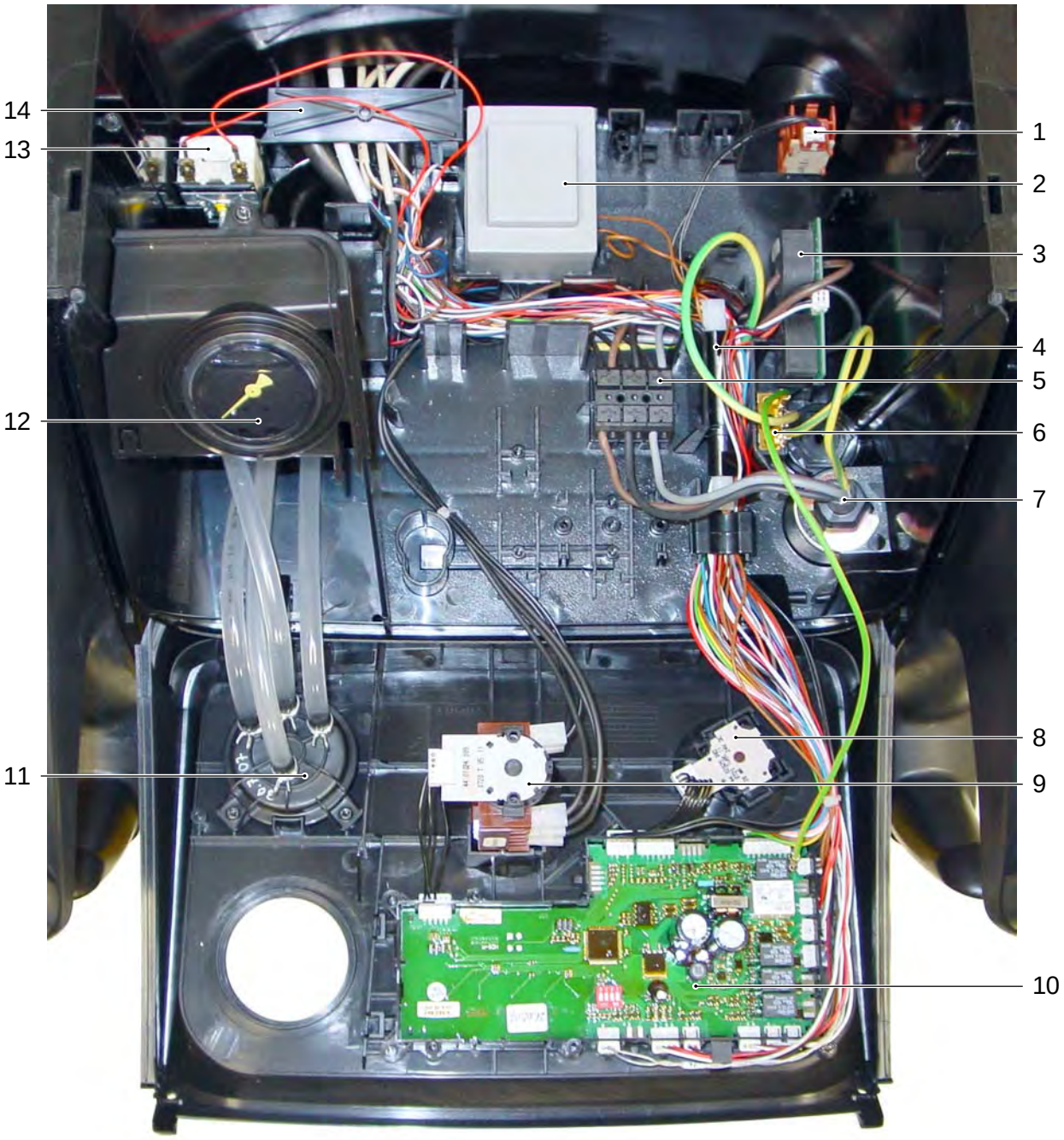
The template below can be placed on the LED displays of the control panel for improved recognition of the numerical value displays in the service functions.

0	1	2	3	4
5	6	7	8	9

Template for placing on the control panel

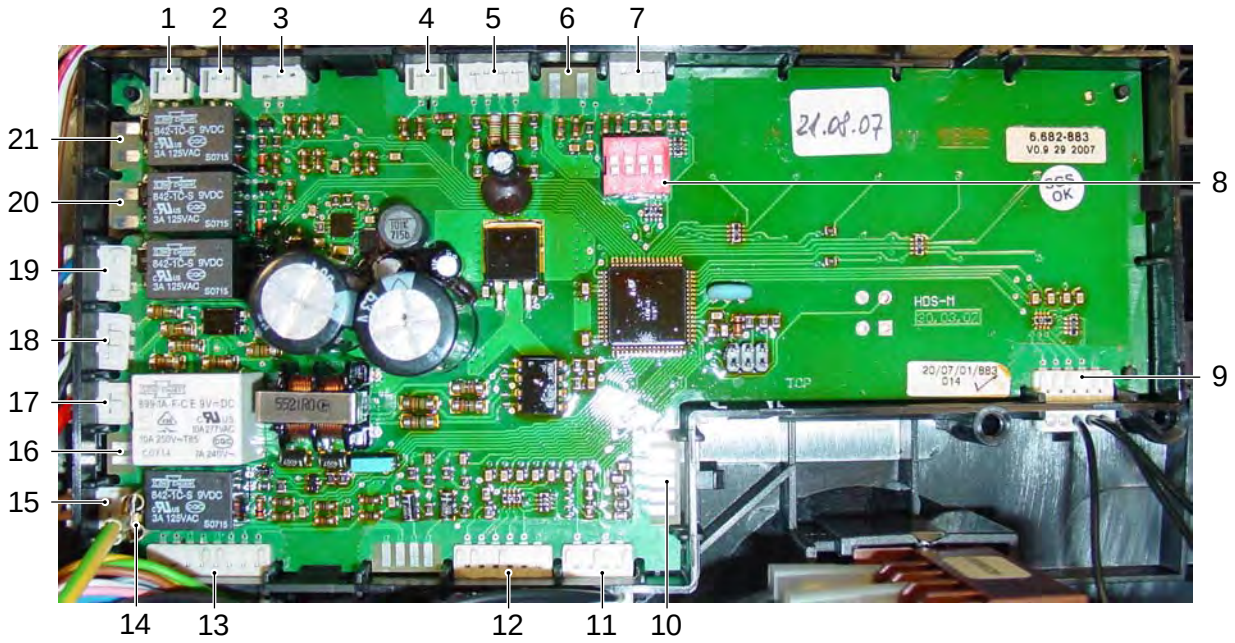
2.1 Control panel

2.1.1 Control panel, view from inside



1 Service switch and adjustment, scale inhibitor metering
2 Control circuit transformer (T1)
3 Current transformer
4 Fuse 2.0 AT (6.644-052) for control circuit transformer T1
5 Terminal strip
6 Earth point
7 Mains cable
8 Adjustment, water temperature
9 Program switch
10 Printed circuit board, control panel
11 Cleaning agent metering valve
12 Pressure gauge
13 Exhaust temperature limiter
14 Cable comb

2.1.2 Printed circuit board, control panel



DIP switches (8)

All DIP switches are set to „OFF“ in the factory. The following functions can be activated by changing these settings:

DIP1 on: Not rotational direction monitoring (in single phase units)

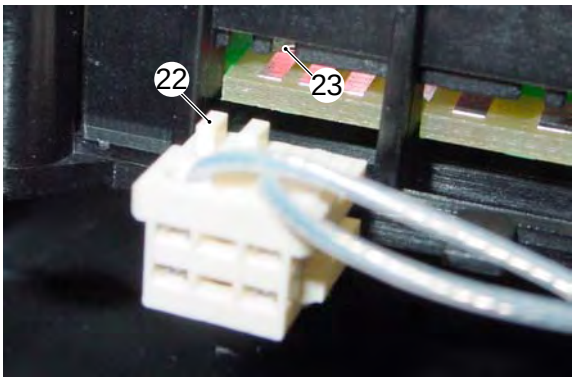
DIP2 on: Flame sensor is evaluated

DIP3 on: Pump after-running for soft start-up operation

DIP4 on: Metering of scale inhibitor liquid for water volume ≥1000 litres

Plug coding

The plugs for the printed circuit board connections have coding pins (22) and matching recesses in the printed circuit board holder (23) so that only the respective appropriate plug can be plugged into a connection.



1 Connection, cleaning agent tank 1 level sensor
2 Connection, cleaning agent tank 2 level sensor
3 Connection, fuel tank level sensor
4 Connection, scale inhibitor level switch
5 Connection, current transformer
6 Connection, flame sensor
7 Connection, temperature sensor
8 DIP switches
9 Connection, program switch
10 Connection, RFID
11 Connection, service switch
12 Connection, water temperature adjustment
13 Connection, motor distributor printed circuit board
14 Earth connection, printed circuit board
15 Connection, control circuit transformer 1
16 Connection, control circuit transformer 2 (optional)
17 Connection, exhaust temperature limiter
18 Connection, low-water protection
19 Connection, scale inhibitor solenoid valve
20 Connection, solenoid valve cleaning agent 1 (optional)
21 Connection, solenoid valve cleaning agent 2 (optional)
22 Coding pin
23 Recess for coding pin

2.2 Control panel with display (HDS 13/20 only)

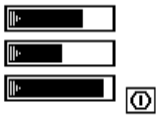
1 Display
2 Program switch „OFF“ position
3 Program switch „Cold Water Operation“ position
4 Program switch „Eco Mode*“ position
5 Program switch „Hot Water/Steam Operation“ position
6 Program switch
7 Adjustment, water temperature
8 Metering valve, cleaning agent
9 Metering range, cleaning agent 1
10 Metering range, cleaning agent 2
11 Pressure gauge
12 Level, cleaning agent tank 2
13 Level, cleaning agent tank 1
14 Level, fuel

*** Note**
In „Eco Mode“ the water temperature is kept at 60°C (+/- 9). Adjusted water temperatures < 60°C are effective, settings > 60°C remain ineffective.

2.2.1 Status displays

Note
Status and maintenance displays are displayed consecutively, like in a slide show. Each image is displayed for 3 seconds.

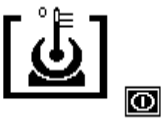
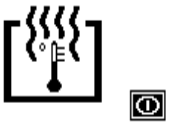
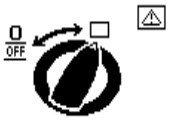
The fault displays remain until the unit is switched off.

Display	Explanation	Note
	Top bar: Fuel level (8 levels) Middle bar: Cleaning agent 1 level (4 levels) Bottom bar: Cleaning agent 2 level (4 levels) In the event of a cable break the respective bar is not displayed at all.	
	Pump maintenance due	Perform maintenance. Reset pump hours.
	Burner maintenance due	Perform maintenance. Reset burner hours.
	Accessories maintenance due	Perform maintenance. Reset handgun switchings.

2.2.2 Maintenance - operating liquids

Display	Explanation	Note
	Scale inhibitor empty.	Insert new bottle.
	Scale inhibitor bottle missing or the 5 hours' after-running time have expired. The burner is blocked.	Insert new bottle.
	High-pressure pump oil refill container is empty.	Add more oil.

2.2.3 Error messages

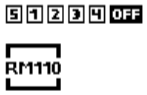
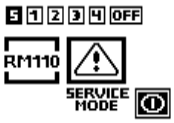
Display	Explanation	Note
	Rotating field incorrect.	Invert phase in the commutating pole plug .
	Motor thermal contact (WSK) in the motor has actuated.	Switch off unit and let the motor cool down.
	Mains voltage too low or too high or phase has failed or motor current too high.	Check mains connection. Check pump for sluggishness.
	Insufficient water	Open water tap. Ensure water supply.
	Exhaust temperature too high	Perform burner maintenance.
	Time monitoring active for 30 min, continuous pause/ continuous operation	Switch off unit and then switch on again.

2.2.4 Error messages with service requirement

Note
One display is used here for several faults. It may be possible to localise the fault by reading out the fault memory.

Display	Explanation	Note
	Low-water protection sticks	Check low-water protection.
	10 short start-ups/leakage	Remove leaks in the high-pressure system.
	Contactor does not switch	Check contactor. Check current transformer installation. This fault is not saved.
	Temperature sensor (NTC) is defective	Check NTC NTC cable chafed bare
	Flame sensor detects impermissible state	Possible causes: - Fuel solenoid valve - Fuel line/filter - External light - Inspection glass is sooty - Scale in combustion chamber - Fuel empty and fuel empty signal is defective
	RFID read-write electronics are defective	Check connection with RFID read-write electronics.

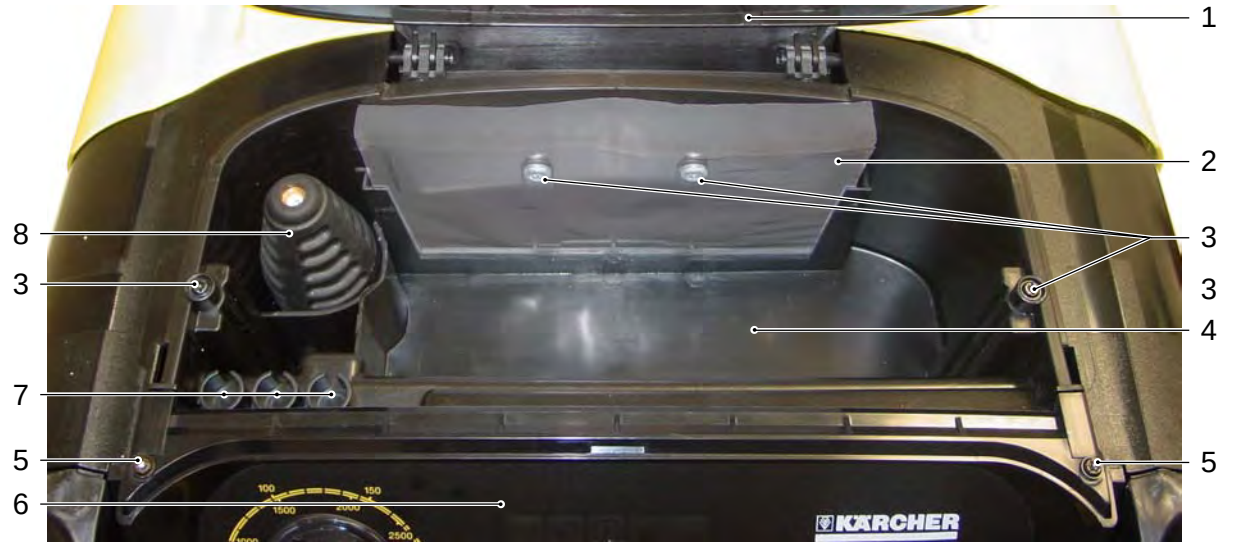
2.2.5 DGT setting

Display	Explanation	Note
	Scale inhibitor metering set according to the water hardness. This display appears for 3s if the scale inhibitor setting is changed.	
	Important! Service mode position. After switching back on the unit will be in Service mode. This display remains until another scale inhibitor setting is selected.	

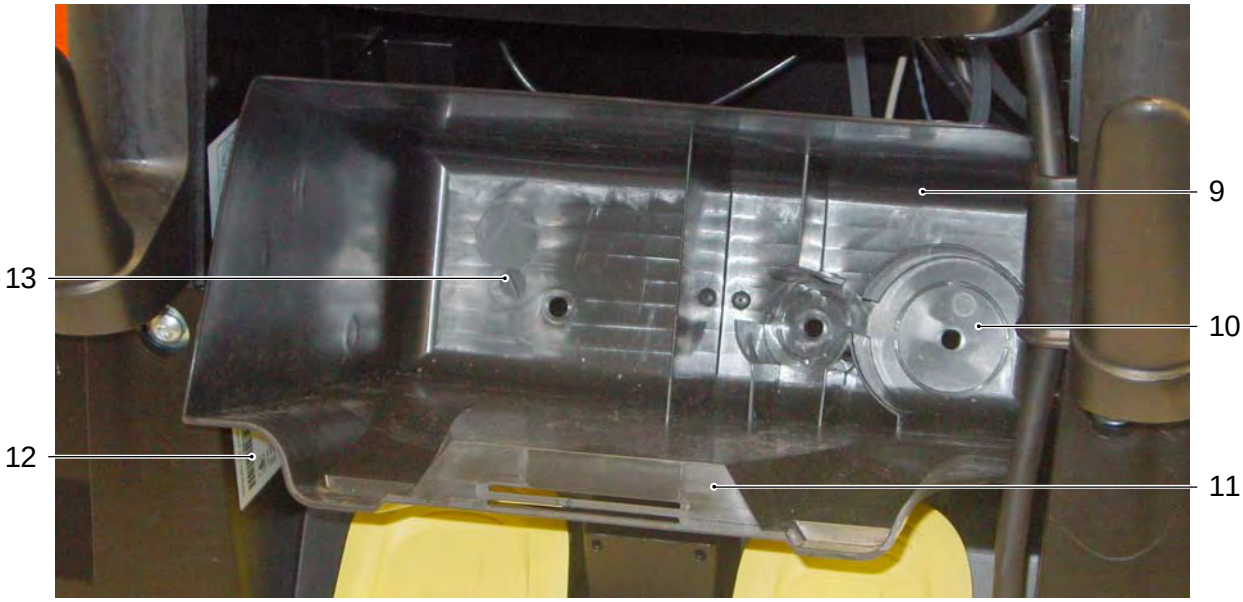
2.2.6 Self-service mode

Display	Explanation	Note
	It is necessary to insert money	For operation with self-service printed circuit board only

2.3 Storage compartments



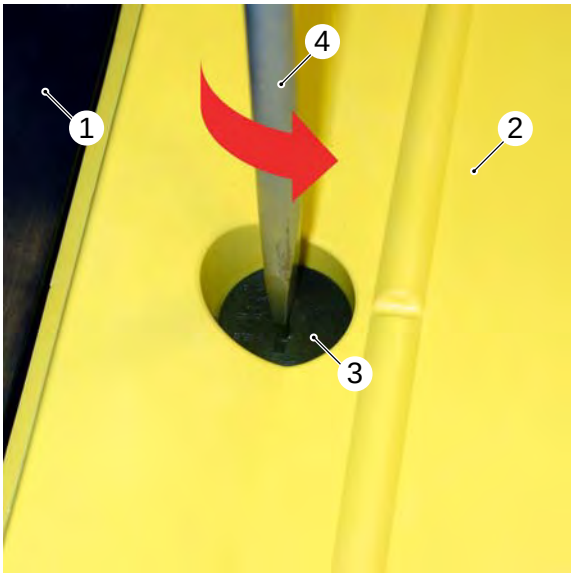
Top storage compartment



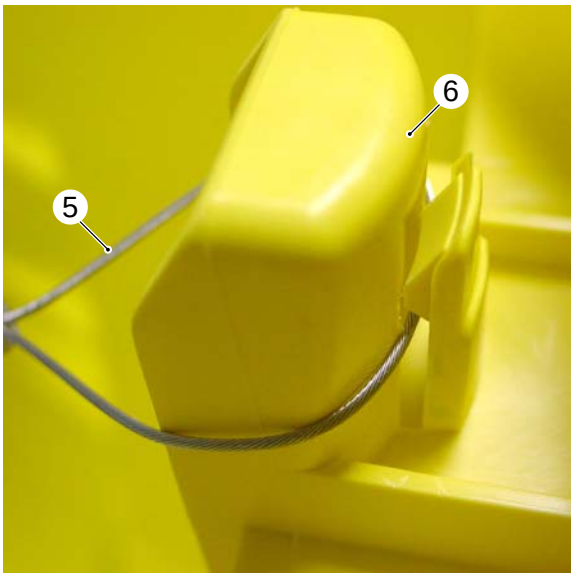
Bottom storage compartment (in unit without hose reel only)

1 Cover, top storage compartment
2 Storage, operating instructions
3 Retaining screw, top storage compartment (4x)
4 Storage compartment, top
5 Retaining screw, control panel
6 Control panel
7 Storage, spare nozzles
8 Storage, dirt blaster
9 Storage compartment, bottom
10 Bottle holder for round scale inhibitor bottle or cleaning agent bottle
11 Handle grip, fold open storage compartment
12 Rating plate, LH above cleaning agent tank 1 or in the storage compartment (4).
13 Bottle holder for two RFID scale inhibitor bottles

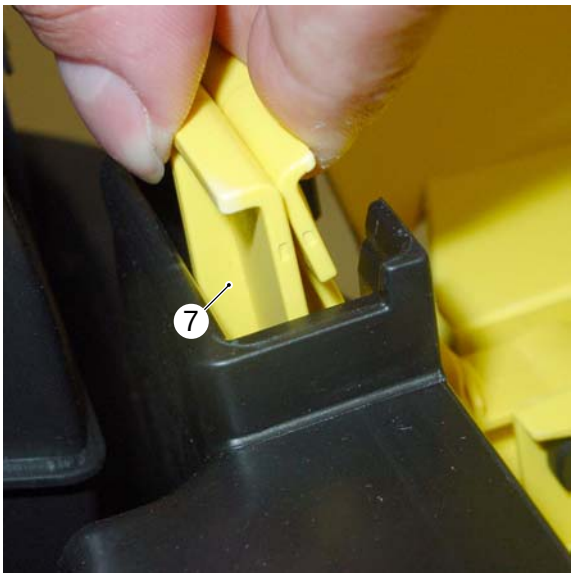
2.4 Unit cover



Latch, unit cover



Lug, restraining cable



Unclip unit cover hinge

Open unit cover and remove if necessary

– To open the unit cover (2), use a screwdriver (4) to push down the locking device (3) and to turn it through 90° to the left.

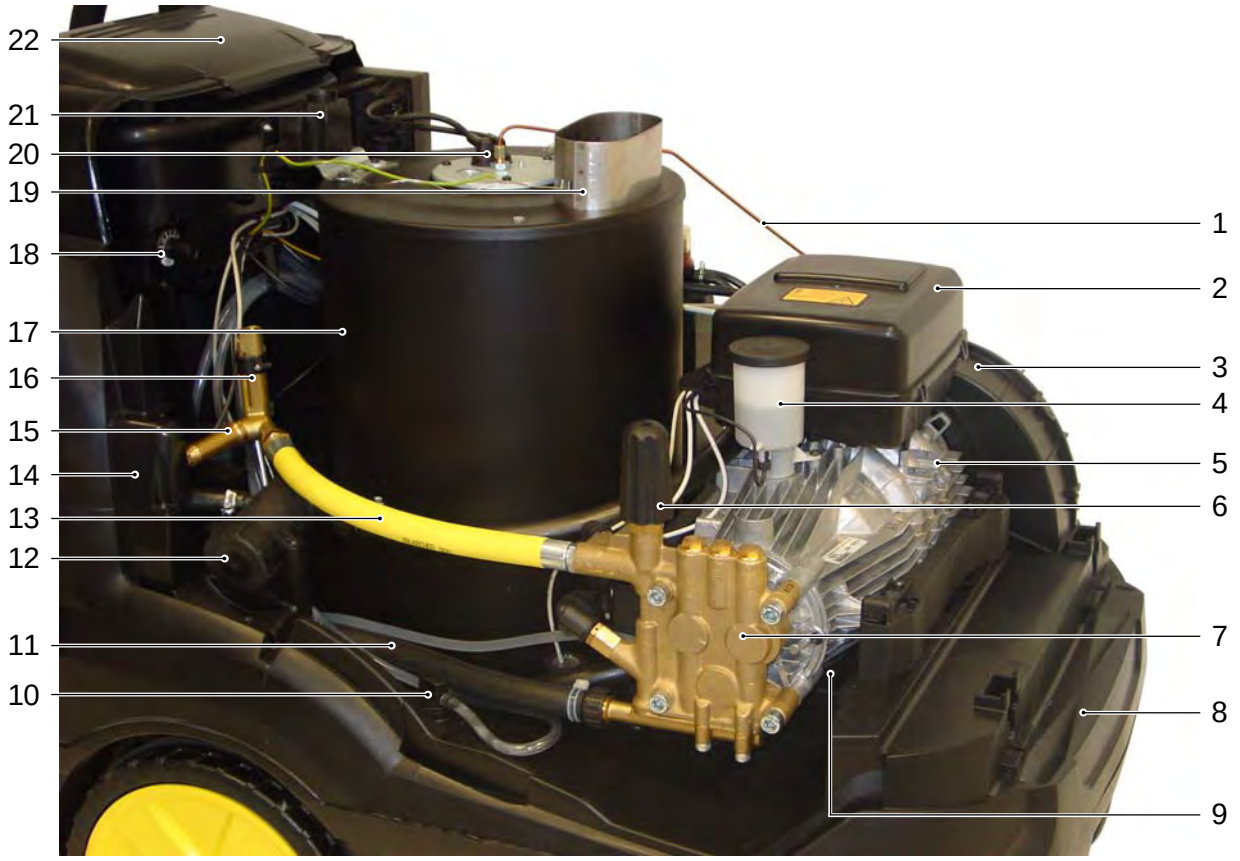
– Open up unit cover.

– Unhook restraining cable (5) from the lug (6).

– Unclip the hinges (7) and remove the unit cover (2).

1 Top storage compartment
2 Unit cover
3 Latch, unit cover
4 Screwdriver
5 Restraining cable, unit cover
6 Lug, restraining cable
7 Hinge, unit cover (2x)

2.5 View from the right, unit cover removed



1 Fuel line to the continuous-flow heater
2 Electrical box, motor
3 Burner fan
4 Oil refill container, pump
5 Motor
6 Handle, pressure and flow control valve
7 Pump head
8 Chassis
9 Oil drain plug
10 Screw plug with suction hose connection, cleaning agent tank 2
11 Water hose, to the pump
12 Housing, fine water filter
13 SDS hose, to the safety block
14 Splashback, safety valve
15 Safety valve
16 Low-water protection
17 Continuous-flow heater
18 Service switch and scale inhibitor adjustment
19 Exhaust gas flue, continuous-flow heater
20 Burner, continuous flow heater
21 Locking device block, unit cover
22 Cover, top storage compartment

2.6 Service switch

Service switch in „OFF“ position

Service switch in „Service“ position

Service switch in „SET“ position

Adjusting the water hardness

The scale inhibitor metering (RM 110/111) is adjusted according to the local water hardness (ask the local water supply company or determine using a hardness tester 6.768-004).

Water hardness	Setting	°dH
very soft	Position OFF	up to 3.0
soft	Position 1	3.1 - 7.0
medium	Position 2	7.1 - 14
hard	Position 3	14 - 21.0
very hard	Position 4	> 21.0

Note
Do not set below position 3 if using RM 111.

Service position

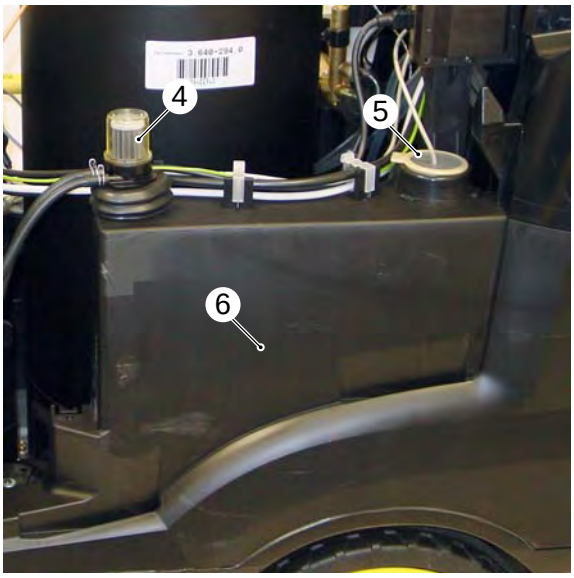
In the „Service“ position the Service switch and the control panel can be used to edit the unit’s settings. From the „Service“ position the Service switch can be turned a little bit further into the „SET“ position. From this position the switched returns to the „Service“ position after it is released. The „SET“ position merely fulfils an inching function.

The possible settings are described in Chapter 3.1 and 3.2 „Service Functions“.

1 Position marking
2 Service switch

2.7 Fuel tank

Fuel tank (diesel, heating oil)

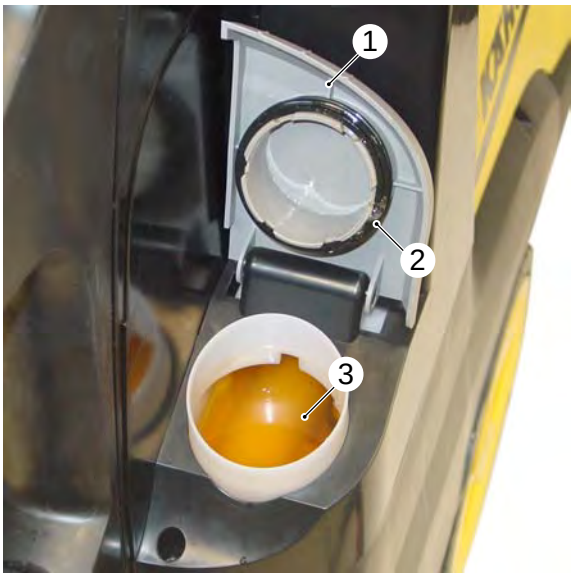


Fuel tank (diesel, heating oil)

Level sensor, fuel tank

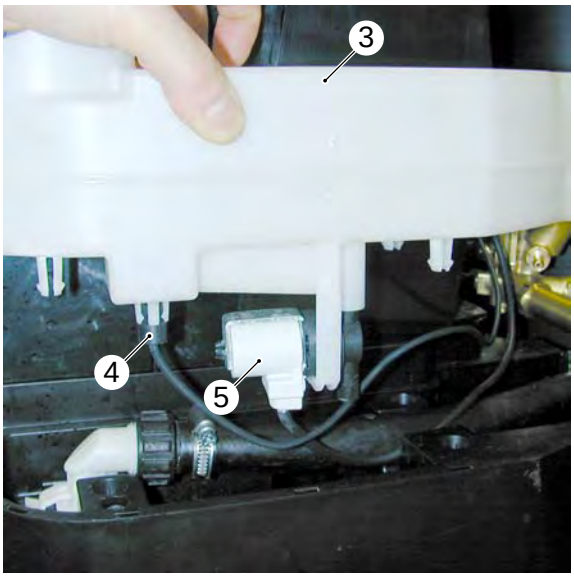
1 Cap, fuel tank
2 Seal, fuel tank cap
3 Tank inlet, fuel tank with prefilter
4 Fuel filter
5 Level sensor, fuel tank
6 Fuel tank (diesel, heating oil)

2.8 Scale inhibitor



Scale inhibitor tank (RM 110/111)

Scale inhibitor tank with level sensor



Scale inhibitor tank, removed

2.8.1 Metering via tank (export version)

The scale inhibitor is metered in accordance with the setting at the Service switch. The setting is described under 2.6 Service switch. Metering takes place in Program switch position „Eco“ and „Hot Water“ only, at a water temperature set to ≥ 50 °C.

The empty signal is sent via the level sensor (4) and is displayed by means of the indicator light or display.

Burner operation is possible even without scale inhibitor. However, if the water is hard (contains calcium carbonate), faults due to scale deposits are to be expected.

Note
The metering may not be switched off if using RM 111 (see Chapter 2.6).

1 Cap, scale inhibitor tank
2 Seal, scale inhibitor tank cap
3 Scale inhibitor tank (RM 110/111)
4 Level sensor, scale inhibitor tank
5 Metering valve, scale inhibitor tank

2.8 Scale inhibitor

Top RFID unit with inserted scale inhibitor bottle

Scale inhibitor bottle holder

Scale inhibitor bottle seal

2.8.2 Metering via RFID (European version)

The scale inhibitor is metered in accordance with the setting at the Service switch. The setting is described under 2.6 Service switch. Metering takes place in Program switch position „Eco“ and „Hot Water“ only, at a water temperature set to ≥ 50 °C.

The empty signal is sent via the level sensor in the scale inhibitor tank or via the read-write electronics in conjunction with the tag on the bottle. A new scale inhibitor bottle must be inserted within 5 operating hours, otherwise the burner switches off to protect against limescale and a corresponding fault message appears.

Burner operation cannot be recommenced until after a new original scale inhibitor bottle has been inserted. An already empty but refilled bottle will not be accepted.

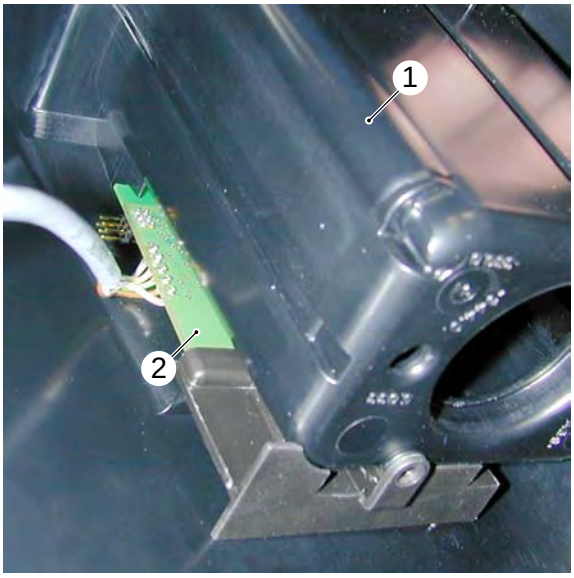
The bottle operates with internal partial vacuum. If the bottle is damaged or drilled open it quickly empties.

Faults due to scale deposits are to be expected if the burner is operated with water containing calcium carbonate without scale inhibitor.

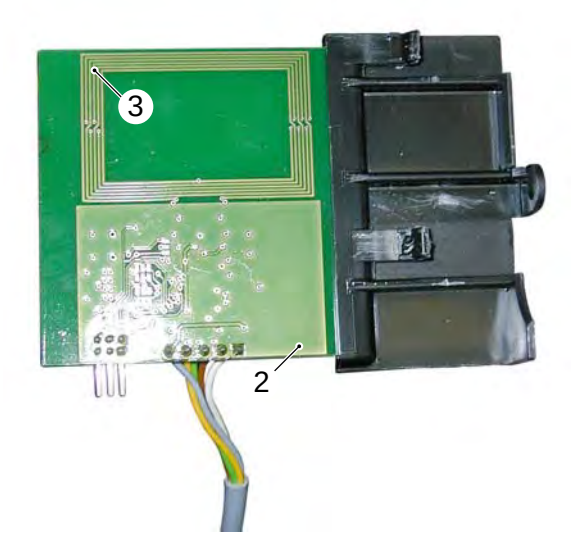
Note
The metering may not be switched off if using RM 111 (see Chapter 2.6).

1 Scale inhibitor bottle with RFID tag
2 Top RFID unit
3 Retaining screws, top RFID unit (2x)
4 Bottle opener insert
5 Seal, scale inhibitor bottle

2.8 Scale inhibitor



Top RFID unit with read-write electronics



RFID read-write electronics

RFID tag, underneath the label

How the RFID works

RFID (Radio Frequency Identification) means identification with the help of high frequency.

Underneath the label (4) on the scale inhibitor bottle there is a transponder (microchip with antenna, also called a tag) (5).

The read-write electronics (2) integrated in the top RFID unit (1) can read out data from the tag and can also write data on the tag. The tag draws its power supply from the high-frequency field of the read-write electronics (2). The data is transferred due to changes in the field intensity.

The read-write electronics (2) queries the type of care product and stores the metered units on the tag (5).

When the bottle is empty (after 3000 units) or the level switch in the scale inhibitor container signals empty, an after-running time of 5 hours is started. This after-running time is counted on the tag.

If the after-running time has expired or if the empty bottle is removed, the burner is switched off.

If a bottle has been detected as being empty it is electronically blocked and can no longer be used. A new original scale inhibitor bottle must therefore always be used.

1 Top RFID unit
2 Read-write electronics
3 Antenna, read-write electronics
4 Label, scale inhibitor bottle
5 RFID tag, underneath the label

2.9 Float tank

Float tank with float valve

1 Water inlet
2 Float tank
3 Float ball
4 Float valve

Float tank

The float tank (2) is integrated in the chassis. It is located on the right-hand side, underneath the scale inhibitor tank.

The float tank uniformly supplies the pump with water. It also serves as a partition between the water inlet (1) and pump and prevents cleaning agent from getting into the water supply line in the event of damage.

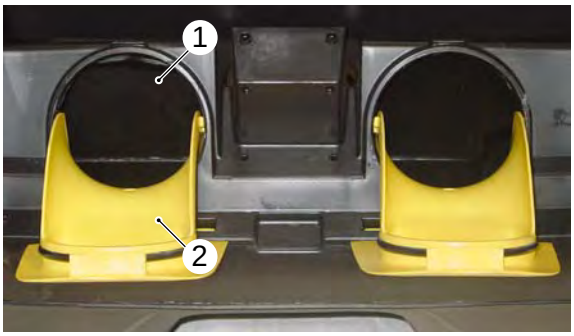
Float valve

Water flows through the open float valve (4) into the float tank (2).

As the water level rises the float ball (3) lifts and closes the float valve (4).

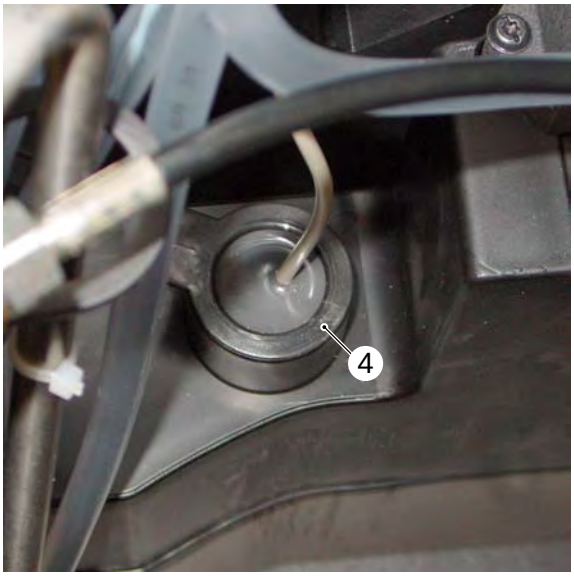
The float valve (4) is permanently set and must not be adjusted.

2.10 Cleaning agent tank 1



Cleaning agent tank 1 (left-hand side)

Suction hose with filter



Level sensor, cleaning agent tank 1

Cleaning agent tank 1

The cleaning agent tank 1 (1) is located in the rear part of the chassis.

Suction hose

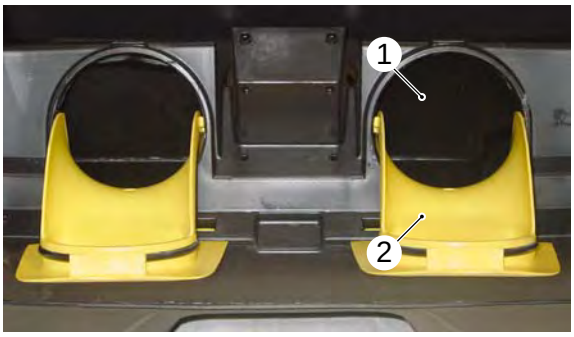
The retaining plug with suction hose (3) connection is located between the continuous flow heater and the bottom storage compartment or the hose reel.

Level sensor (optional)

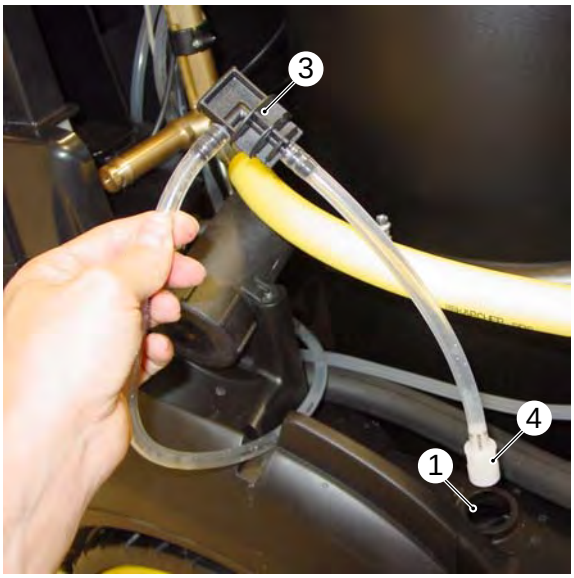
The level sensor (4) contains a reed switch which is actuated by means of a magnet in the float (see Chap. 2.11, Item 6).

1 Cleaning agent tank 1
2 Cap, cleaning agent tank 1
3 Screw plug with suction hose connection, cleaning agent tank 1
4 Level sensor, cleaning agent tank 1 (optional)

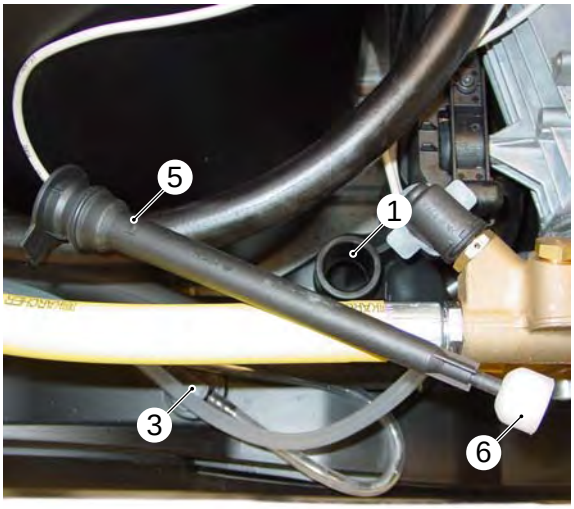
2.11 Cleaning agent tank 2



Cleaning agent tank 2 (right-hand side)



Suction hose with filter (removed)



Level sensor, cleaning agent tank 2 (removed)

Cleaning agent tank 2

The cleaning agent tank 2 (1) is located in the right-hand part of the chassis.

Suction hose

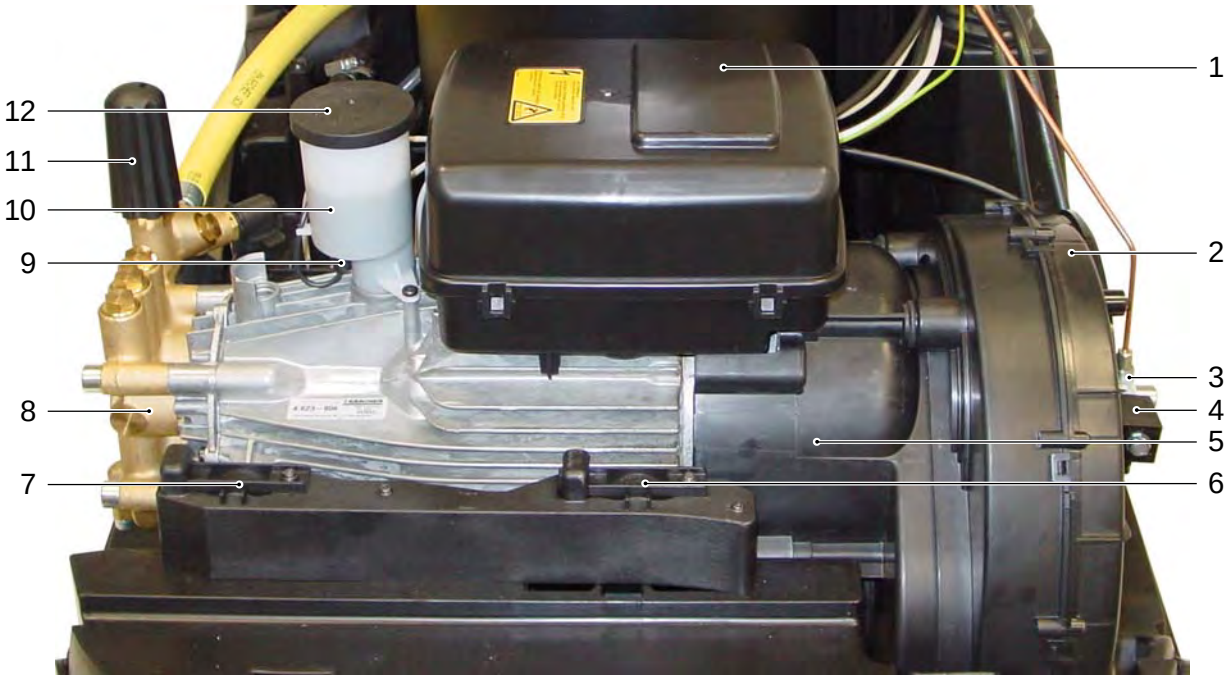
The retaining plug with suction hose (3) connection is located above the right-hand transport wheel. A cleaning agent filter (4) is fitted onto the end of the suction hose.

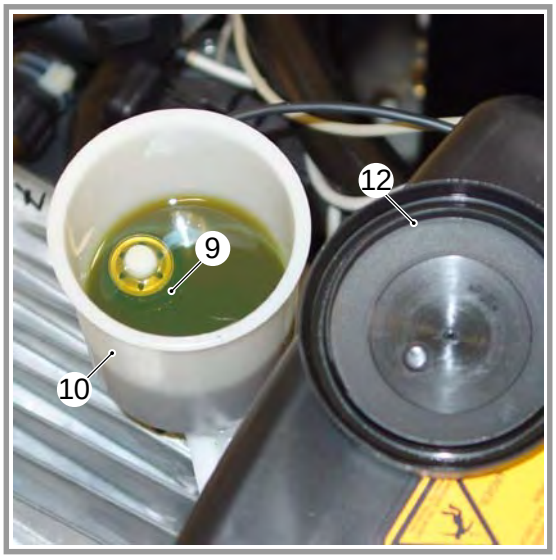
Level sensor (optional)

The level sensor (5) contains a reed switch which is actuated by means of a magnet in the float (6).

1 Cleaning agent tank 2
2 Cap, cleaning agent tank 2
3 Screw plug with suction hose connection, cleaning agent tank 2
4 Cleaning agent filter
5 Level sensor, cleaning agent tank 2 (optional)
6 Float with magnet, level sensor

2.12 Motor (air-cooled)





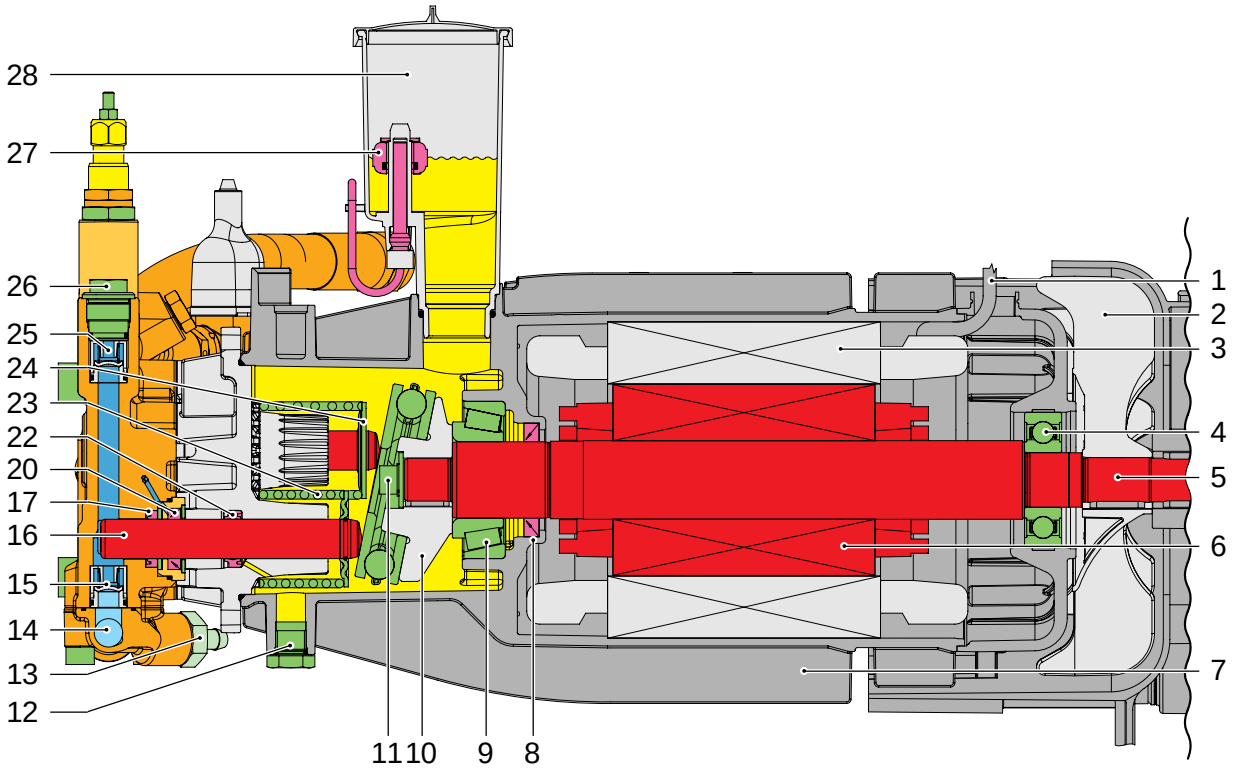
Oil refill container (10) with oil level sensor (9)

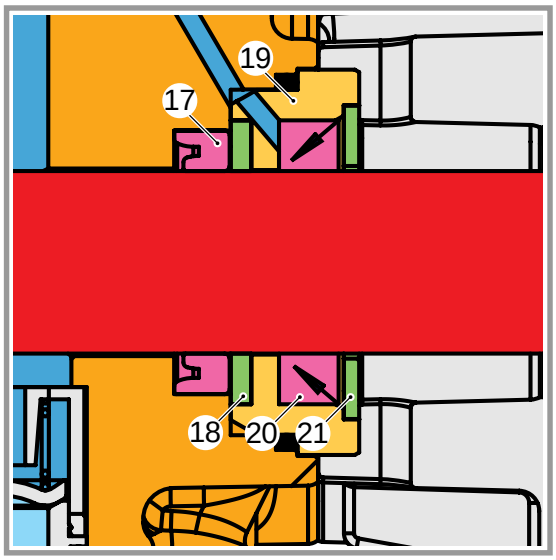
Oil drain plug

The oil drain plug is located on the underside of the pump housing.

1 Electrical box, motor
2 Burner fan
3 Fuel pump
4 Solenoid valve, fuel pump
5 Fan, motor cooling
6 Motor retainer, LH (2x)
7 Motor retainer, RH (2x)
8 Pump head
9 Oil level sensor
10 Oil refill container
11 Handle, pressure and flow control valve
12 Cover, oil refill container

2.12 Motor (air-cooled)

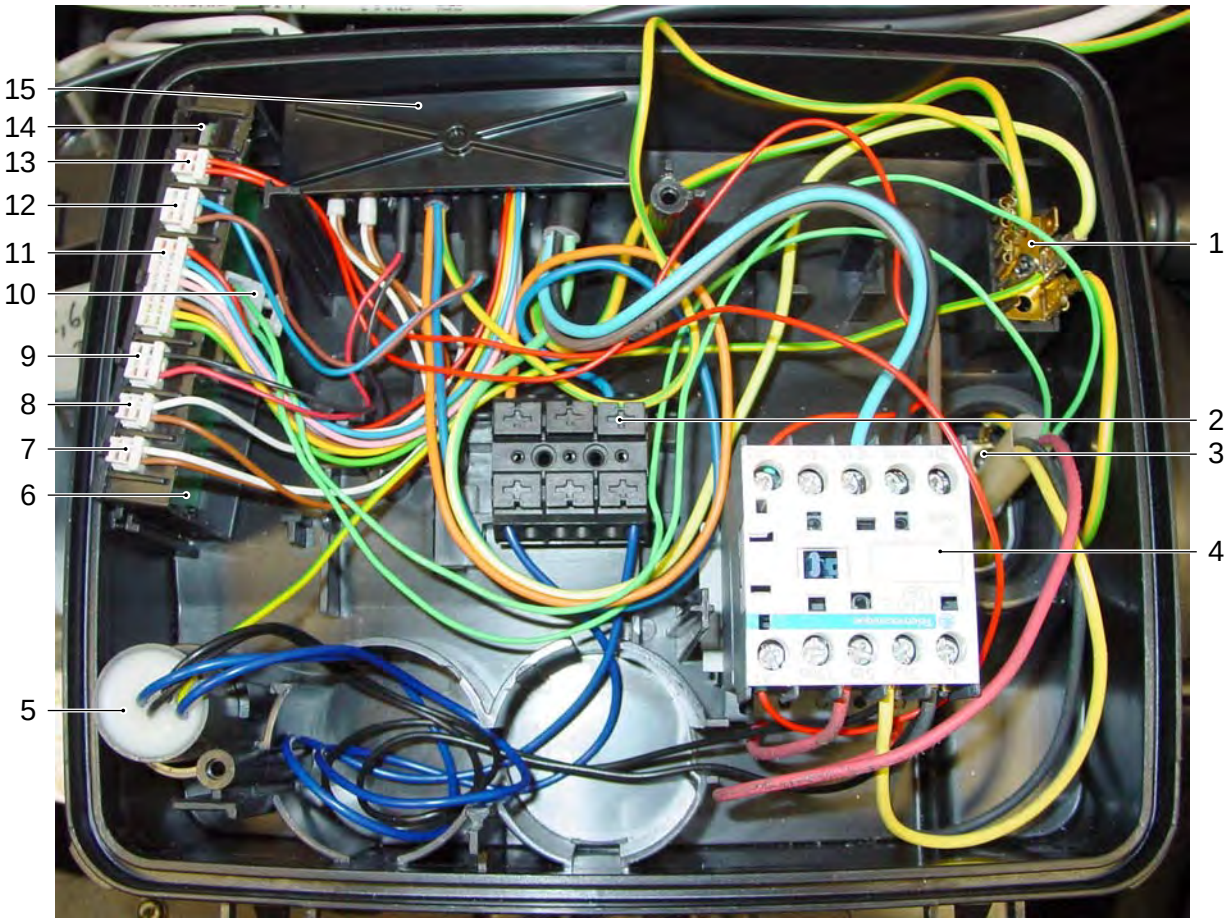




Piston seals

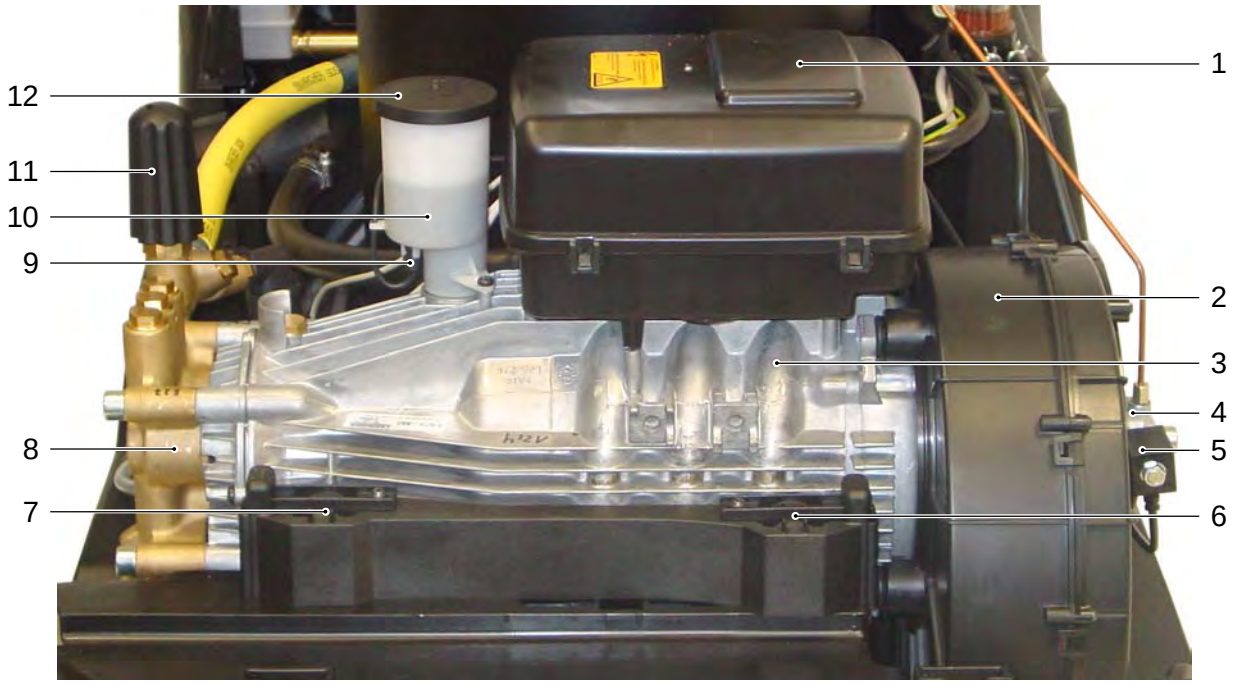
1 Connection cable, motor
2 Fan wheel, motor cooler
3 Stator
4 Motor bearing, rear (B bearing)
5 Motor shaft
6 Rotor
7 Housing, motor
8 Shaft seal, motor shaft
9 Motor bearing, front (A bearing)
10 Swash plate with thrust ball bearing
11 Retaining screw, swash plate
12 Oil drain plug
13 Cleaning agent intake
14 Suction side, pump
15 Suction valve
16 Piston
17 Sealing ring, high-pressure seal
18 Washer
19 Bushing
20 Low-pressure seal
21 Washer
22 Oil seal
23 Piston spring
24 Fixing plate for piston spring
25 Pressure valve
26 Valve screw
27 Oil level sensor
28 Oil refill container

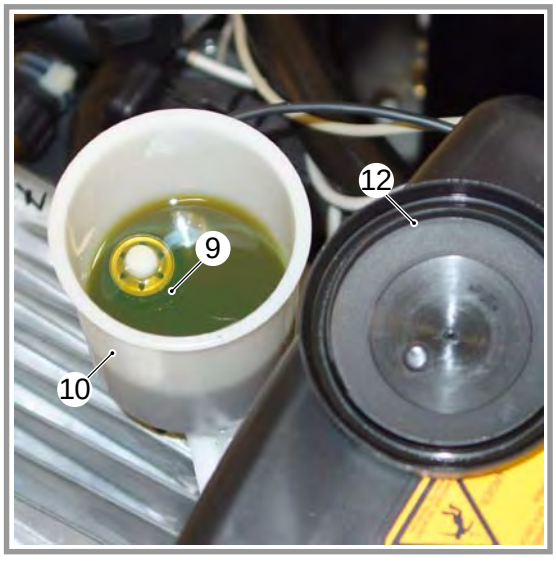
2.13 Electrical box, air-cooled motor



1 Earth point
2 Terminal strip
3 Earth connection, motor housing
4 Motor contactor (K1)
5 Interference suppression filter
6 Printed circuit board, motor distributor
7 Connection, „ON“ pressure switch
8 Connection, „OFF“ pressure switch
9 Connection, oil level sensor
10 Connection, motor thermal contact
11 Connection, control panel printed circuit board
12 Connection, fuel solenoid valve
13 Connection, motor contactor
14 Connection, soft start (optional)
15 Cable comb

2.14 Motor (water-cooled)





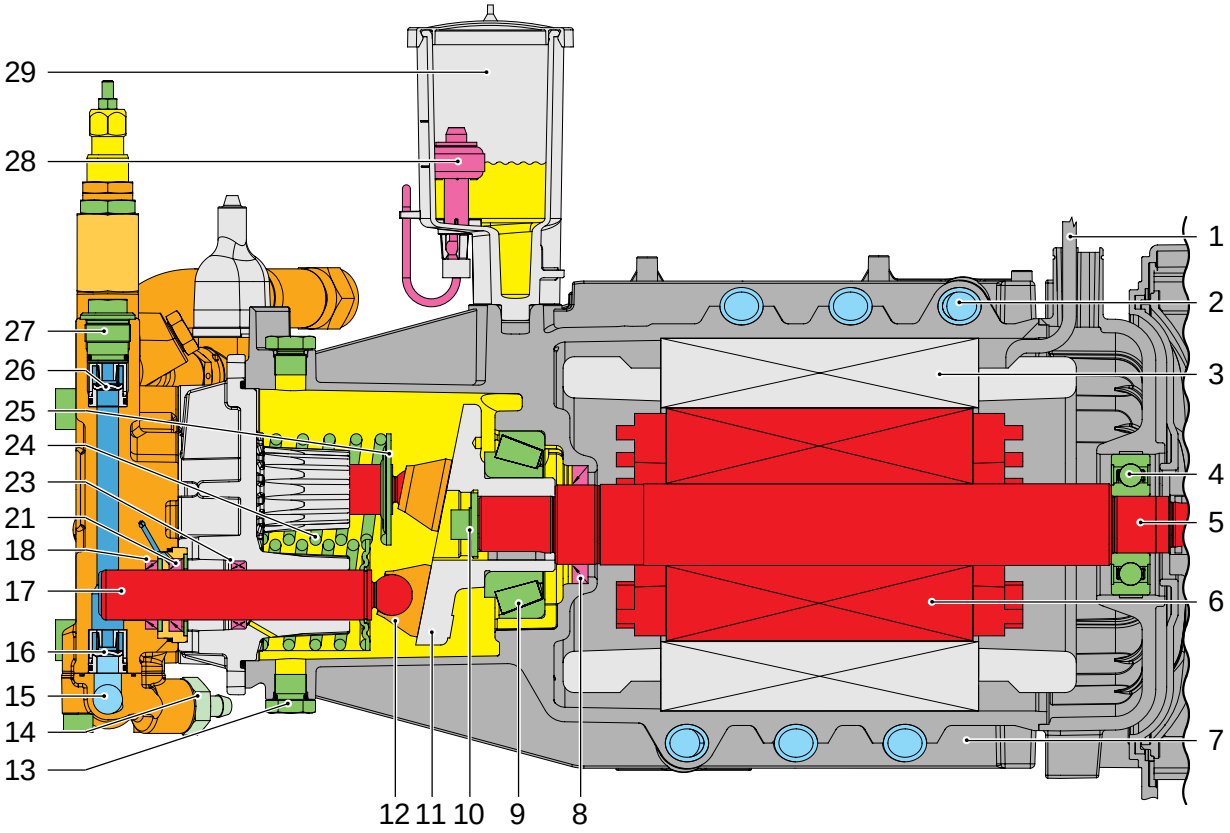
Oil refill container (10) with oil level sensor (9)

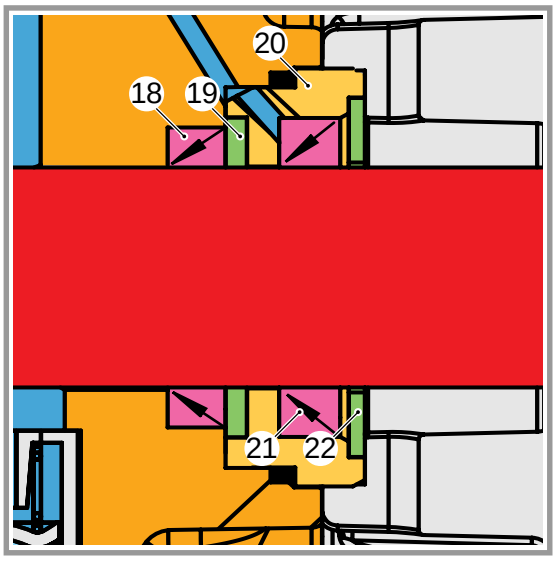
Oil drain plug

The oil drain plug is located on the underside of the pump housing.

1 Electrical box, motor
2 Burner fan
3 Cooling coil, motor cooler
4 Fuel pump
5 Solenoid valve, fuel pump
6 Motor retainer, LH (2x)
7 Motor retainer, RH (2x)
8 Pump head
9 Oil level sensor
10 Oil refill container
11 Handle, pressure and flow control valve
12 Cover, oil refill container

2.14 Motor (water-cooled)

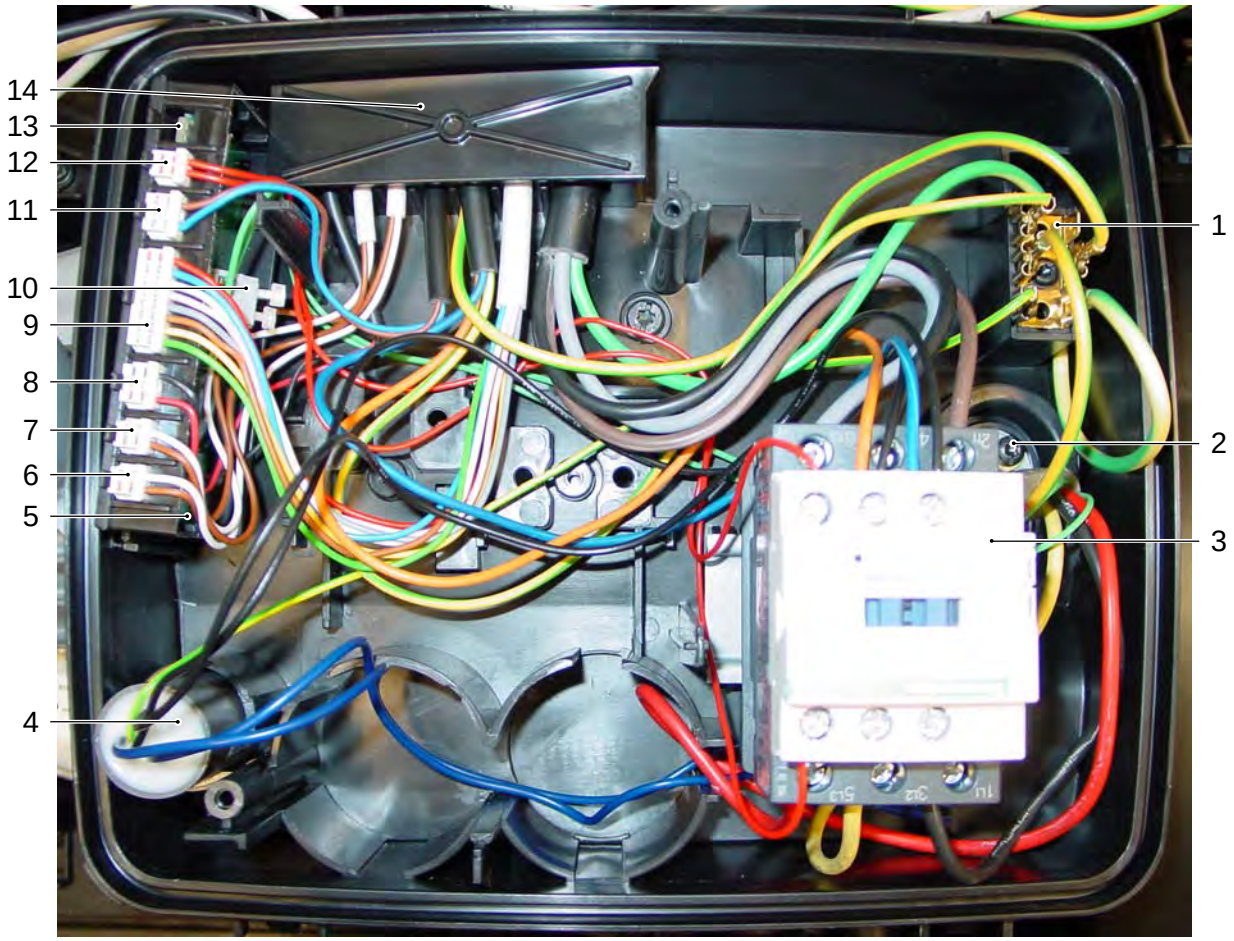




Piston seals

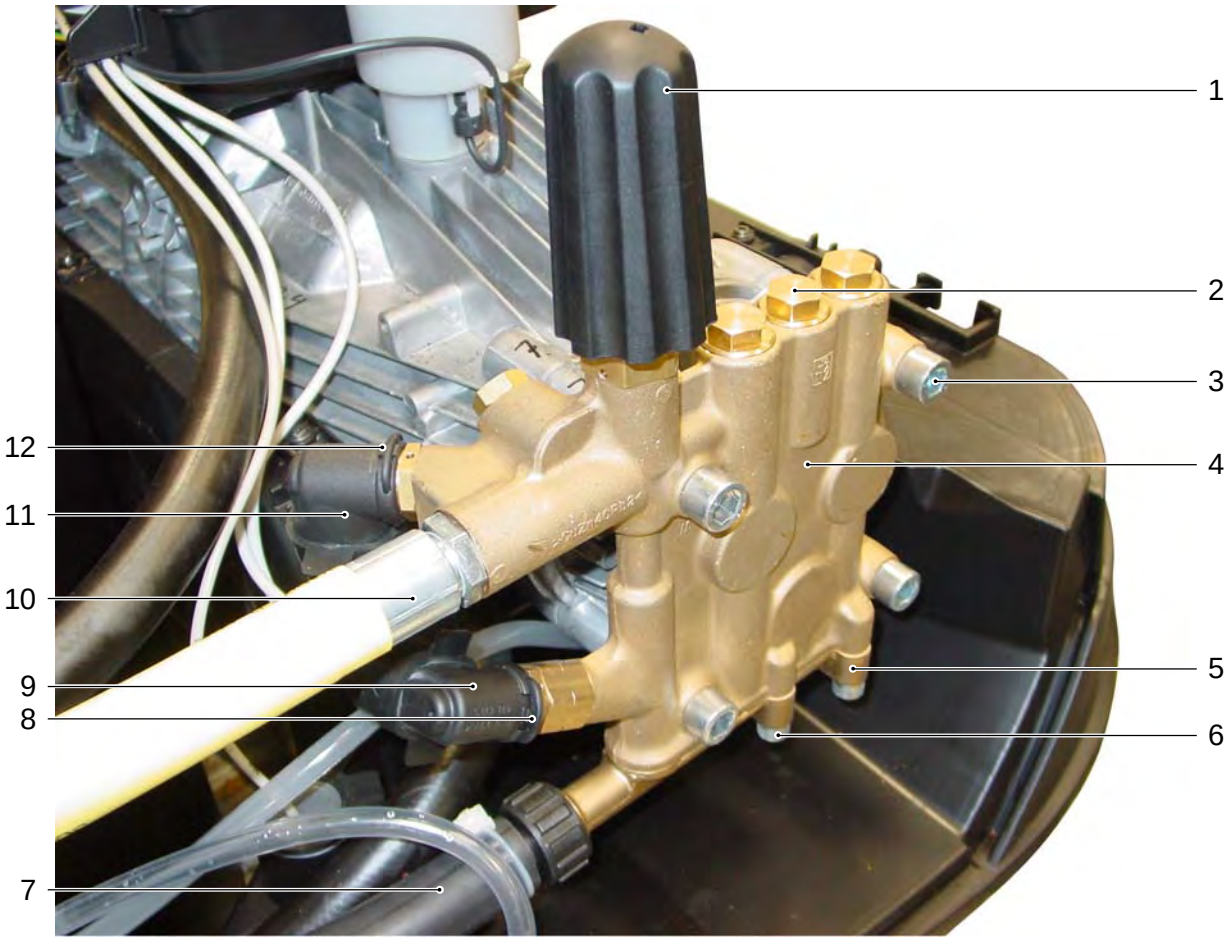
1 Connection cable, motor
2 Cooling coil, motor cooler
3 Stator
4 Motor bearing, rear (B bearing)
5 Motor shaft
6 Rotor
7 Housing, motor
8 Shaft seal, motor shaft
9 Motor bearing, front (A bearing)
10 Retaining screw, swash plate
11 Swash plate
12 Guide shoe
13 Oil drain plug
14 Cleaning agent intake
15 Suction side, pump
16 Suction valve
17 Piston
18 High-pressure seal
19 Washer
20 Bushing
21 Low-pressure seal
22 Washer
23 Oil seal
24 Piston spring
25 Fixing plate for piston spring
26 Pressure valve
27 Valve screw
28 Oil level sensor
29 Oil refill container

2.15 Electrical box, water-cooled motor



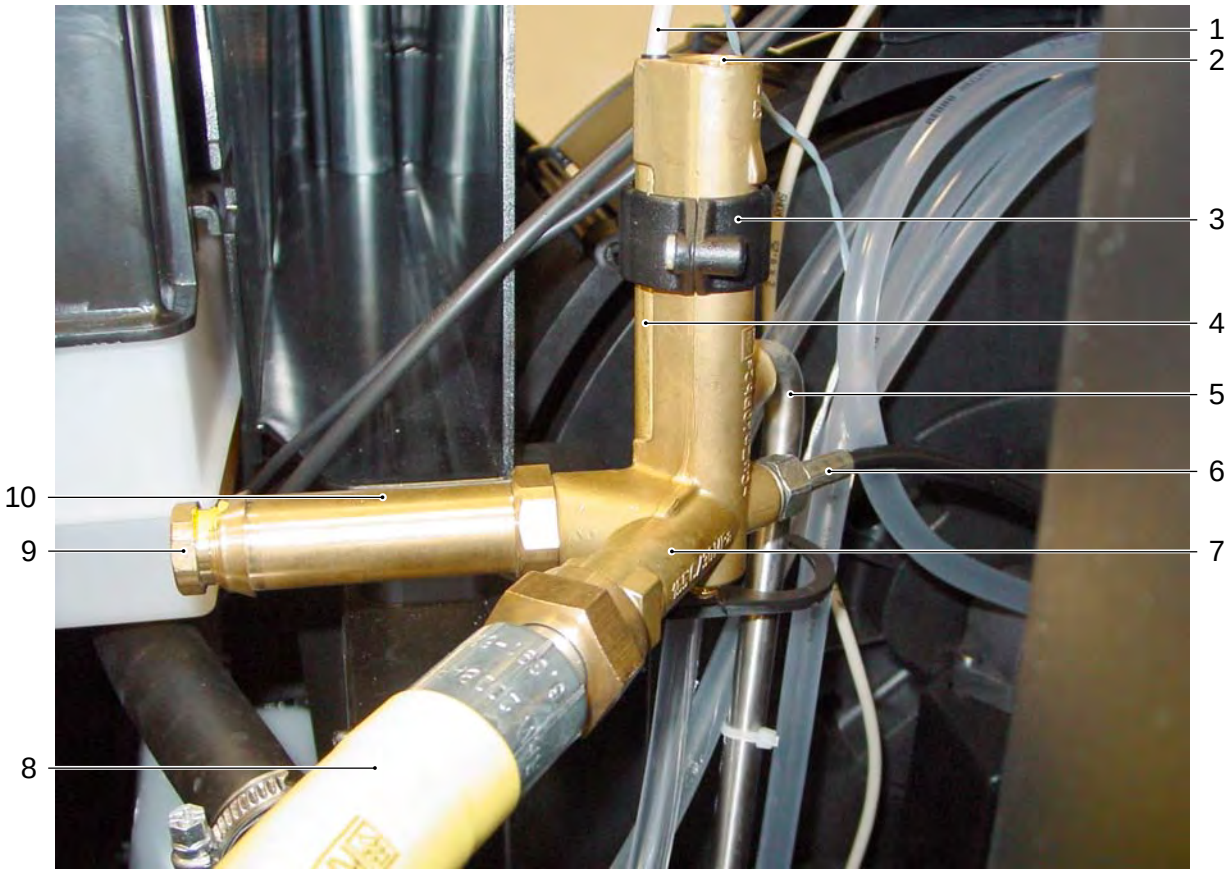
1 Earth point
2 Earth connection, motor housing
3 Motor contactor (K1)
4 Interference suppression filter
5 Printed circuit board, motor distributor
6 Connection, „ON“ pressure switch
7 Connection, „OFF“ pressure switch
8 Connection, oil level sensor
9 Connection, control panel printed circuit board
10 Connection, motor thermal contact
11 Connection, fuel solenoid valve
12 Connection, motor contactor
13 Connection, soft start (optional)
13 Cable comb

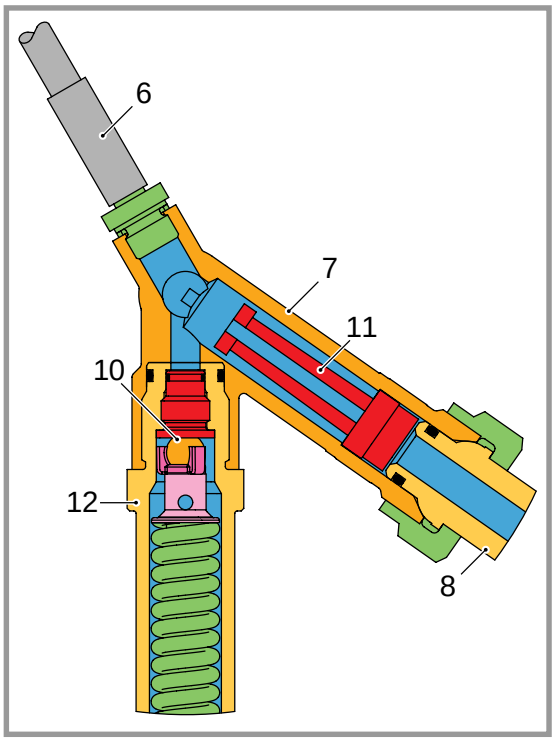
2.16 Pump



1 Handle, pressure and flow control valve
2 Screw plug, pressure side (3x)
3 Pump head screw (4x)
4 Pump head
5 Suction bridge with water connection
6 Screw plug, suction side (4x)
7 Water hose, suction side
8 Locking clamp, „OFF“ pressure switch
9 Pressure switch, „OFF“
10 SDS hose, to the safety block
11 Pressure switch, „ON“
12 Locking clamp, „ON“ pressure switch

2.17 Safety block

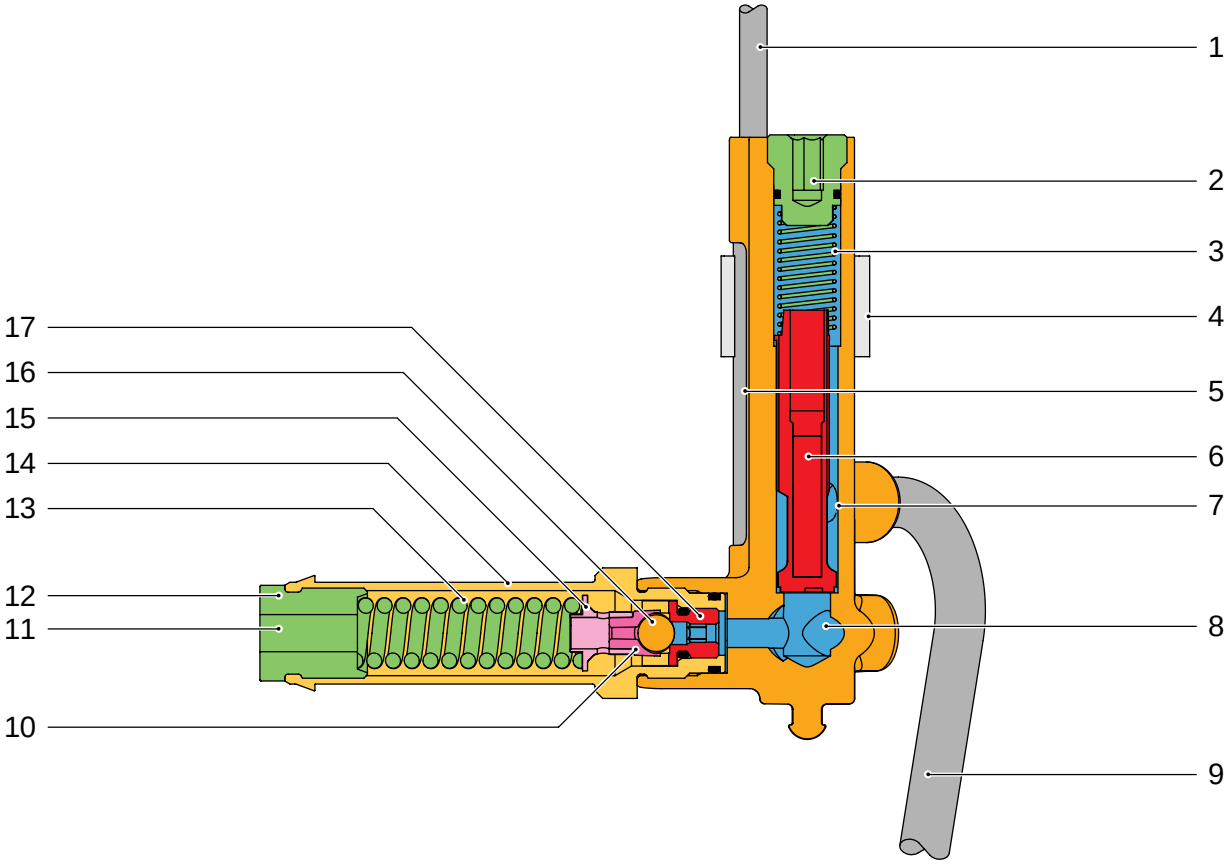




Safety block, sectional view from above

1 Connection cable, reed switch
2 Screw plug, low-water protection
3 Clamp holder, reed switch
4 Reed switch, low-water protection
5 High-pressure pipe to the continuous flow heater
6 Connection hose, pressure gauge
7 Safety block with water strainer
8 SDS hose, from the high-pressure pump
9 Adjusting screw with drillhole, safety valve
10 Valve ball, safety valve
11 Water strainer
12 Safety valve

2.17 Safety block



1 Connection cable, reed switch
2 Screw plug, low-water protection
3 Spring
4 Clamp holder, reed switch
5 Reed switch, low-water protection
6 Magnetic piston
7 Drillhole, high-pressure outlet
8 Water inlet from the high-pressure pump
9 High-pressure pipe to the continuous flow heater
10 Moulded part, ball guide
11 Water outlet, safety valve
12 Adjusting screw with drillhole, safety valve
13 Spring, safety valve
14 Housing, safety valve
15 Spring cup
16 Valve ball, safety valve
17 Valve seat, safety valve

2.17 Safety block

Safety valve

If the pressure switch or overflow valve are defective, the safety valve feeds the whole flow rate of the pump to the float tank and therefore protects the unit and accessories against impermissibly high overpressure.

When the handgun is open the safety valve is closed and the whole delivery volume of the pump is pumped to the handgun with operating pressure.

If the pressure in the high-pressure system rises by approx. 20 bar above the allowable operating pressure, the valve ball (16) is lifted from the valve seat (17) and part of the delivery volume flows into the float tank. The opening pressure of the safety valve is set using the adjusting screw (12). Turn it to the right to increase the opening pressure and to the left to reduce the opening pressure.

The safety valve is a safety component and therefore sealed at the adjusting screw (12).

Note:
The safety value is adjusted with the help of the pressure rise in the system with the burner switched on, so that it limits the pressure rise to the maximum allowable value for the closed handgun (see Technical Specifications). Then seal the setting.

Low-water protection and dry running protection

The low-water protection prevents the burner from switching on if there is no or insufficient water and therefore protects the continuous-flow heater against overheating.

When the handgun is open and the water flow is sufficient, the magnetic piston (6) is pressed against the spring (3). The magnetic piston (6) causes the contact of the reed switch (5) to close. This opens the fuel solenoid valve and the burner ignites.

The strainer in the water inlet of the safety block prevents dirt from getting into the low-water protection.

The low-water protection is a safety component and is therefore sealed at the screw plug (2).

Information about insufficient water is forwarded directly to the printed circuit board. There this message is evaluated as

– Low-water protection (burner shut-off, see above) and as

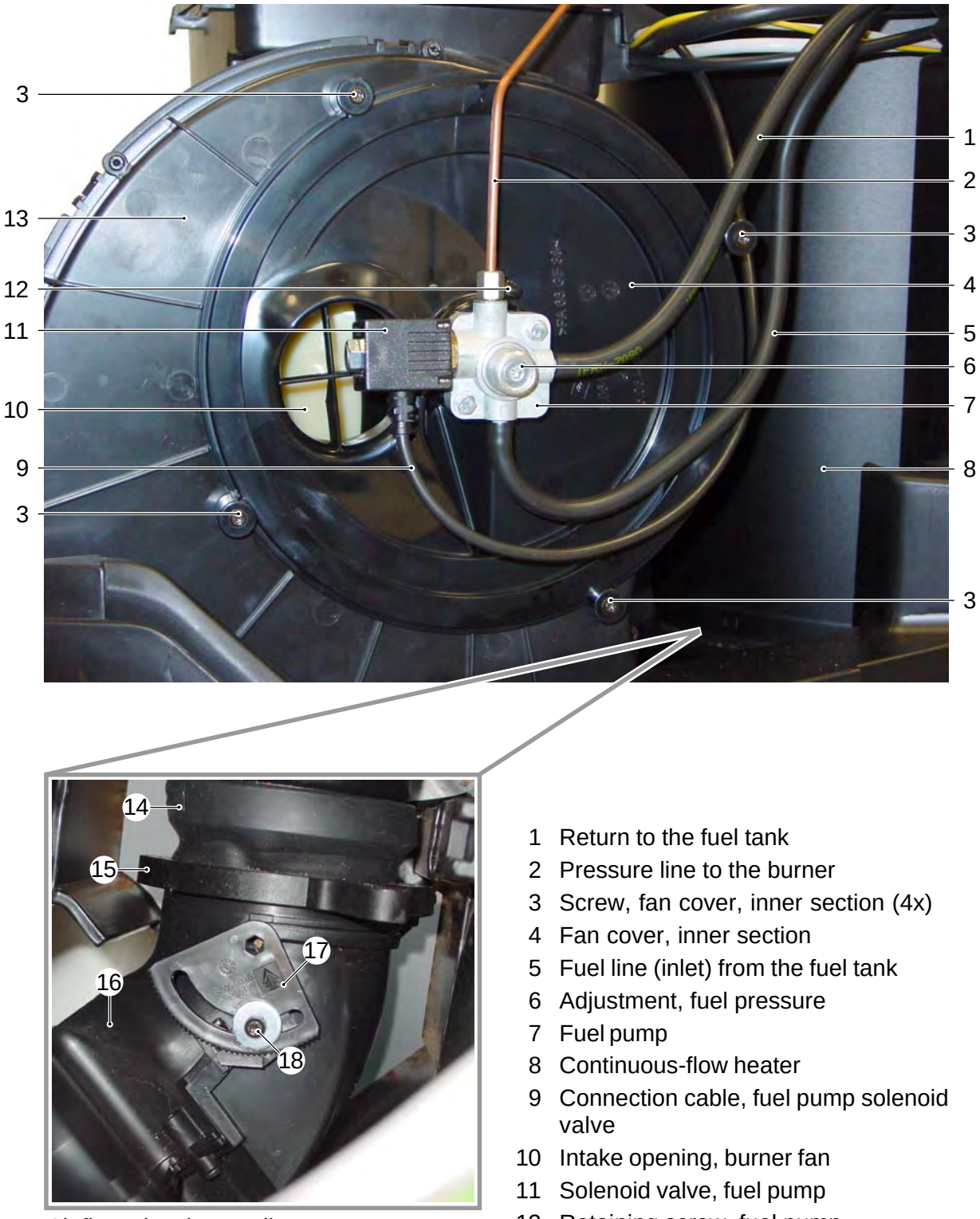
– Dry running protection for the pump (unit shut-off).

The low-water protection takes effect immediately. It immediately switches off the burner if there is insufficient water and switches it back on again when there is sufficient water.

The dry-running protection operates if the low-water protection signals an insufficient volume of water for 2 minutes. The unit switches off with a fault message and locks. The unit cannot be started up again until it has been switched off and on at the master switch.

As dry running damages the pump in the long-term, ensure an adequate water supply is provided at all times.

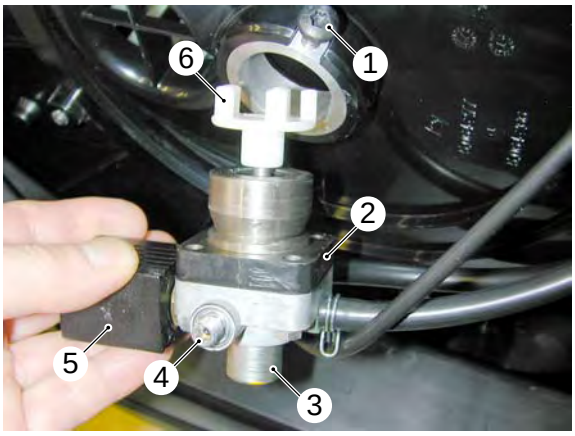
2.18 Burner fan with fuel pump



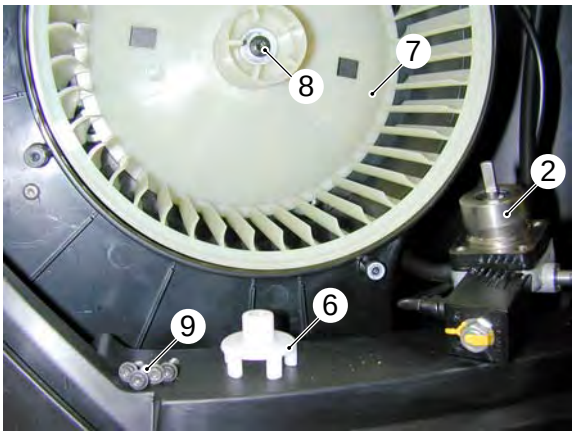
Air flap, air volume adjustment

1 Return to the fuel tank
2 Pressure line to the burner
3 Screw, fan cover, inner section (4x)
4 Fan cover, inner section
5 Fuel line (inlet) from the fuel tank
6 Adjustment, fuel pressure
7 Fuel pump
8 Continuous-flow heater
9 Connection cable, fuel pump solenoid valve
10 Intake opening, burner fan
11 Solenoid valve, fuel pump
12 Retaining screw, fuel pump
13 Fan cover
14 Rubber collar
15 Locking lever, rubber collar
16 Burner fan
17 Air flap, air volume adjustment
18 Locking screw, air flap

2.18 Burner fan with fuel pump



Fuel pump with coupling



Impeller with fuel pump removed

1 Retaining screw, fuel pump
2 Fuel pump
3 Adjustment, fuel pressure
4 Connection, pressure line to the burner
5 Solenoid valve, fuel pump
6 Coupling
7 Impeller
8 Retaining screw, impeller fan wheel
9 Retaining screw, fan cover, inner section (4x)

Fuel pump

The fuel pump (2) is directly connected to the motor shaft via the coupling (6) and the impeller (7). It pumps fuel from the tank and back again via the return, even during cold water operation. This helps to lubricate the gear pump.

During hot water operation the attached solenoid valve (5) opens and part of the fuel passes through the fuel nozzle into the burner where it is ignited.

The fuel pressure is adjusted using the central adjusting screw (3).

The fuel pump is blocked by dry running. The coupling acts as a pressure-relief joint.

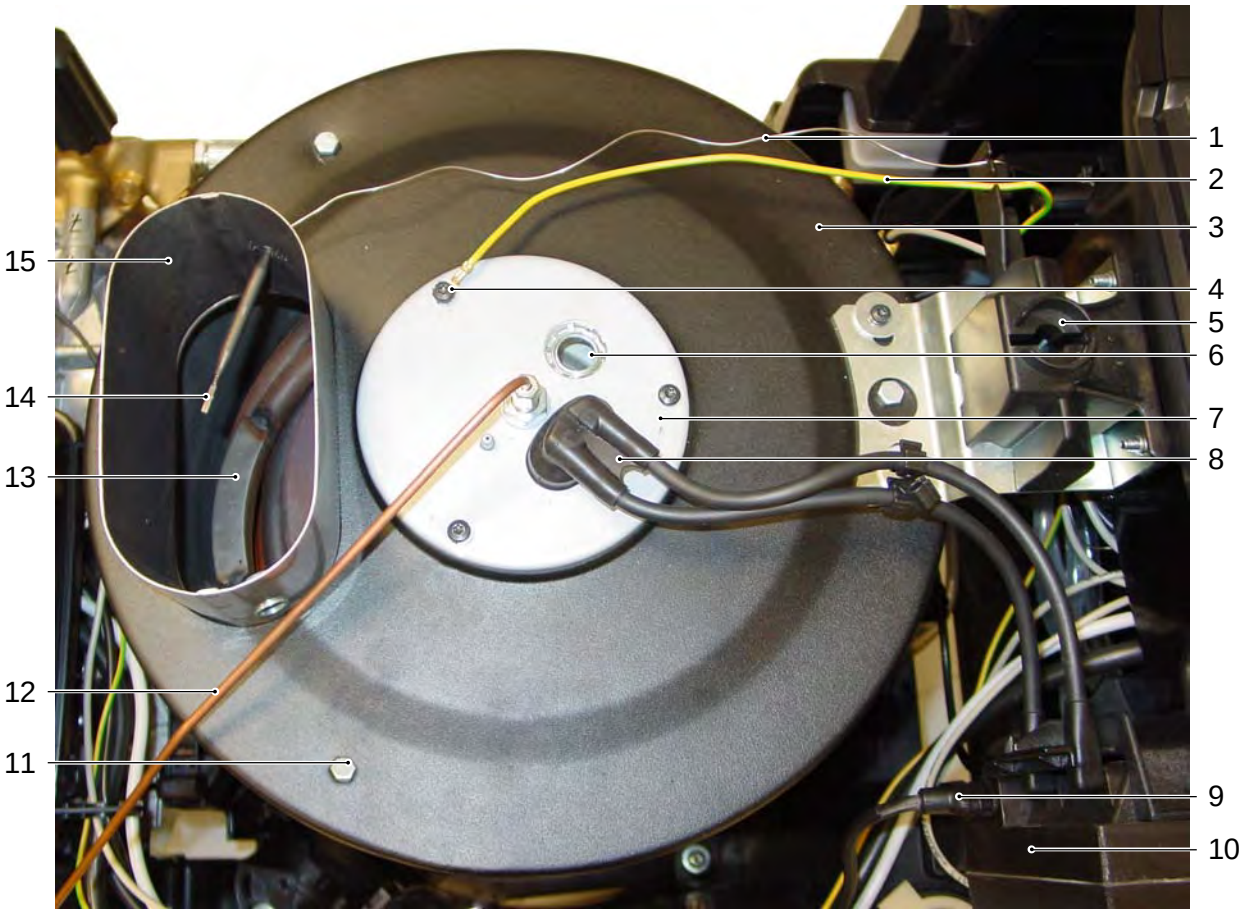
Burner fan

The fan supplies the burner with combustion air. The air flap is used to adjust the air volume to optimum combustion values. The impeller (7) is mounted on the motor shaft with 2 keys.

Removing the fuel pump

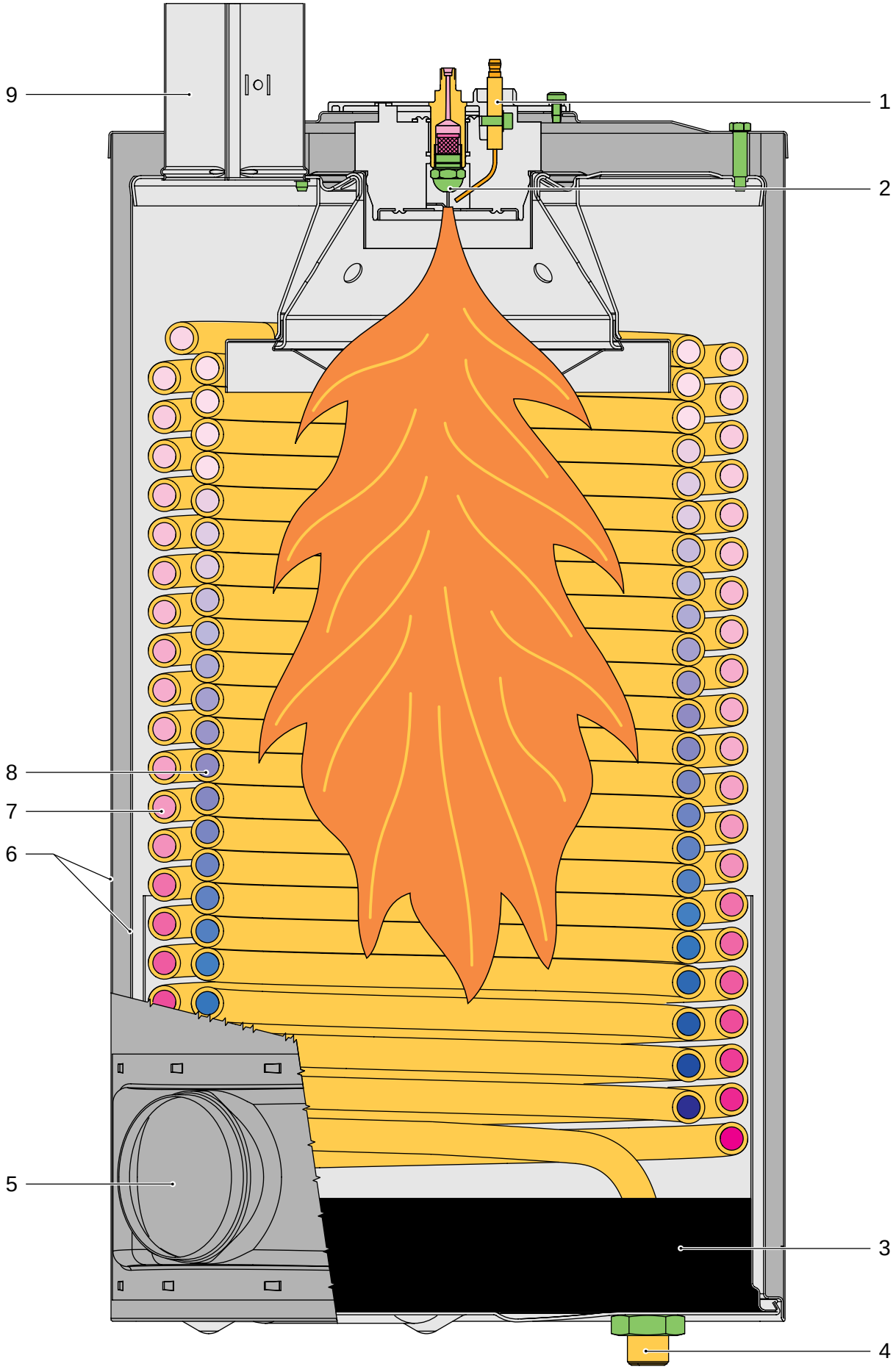
– Loosen the pressure line from the connection (3).
– Undo the fuel pump retaining screw (1).
– Remove the fuel pump (2).

2.19 Continuous-flow heater



1 Capillary tube, exhaust temperature limiter
2 Earth connection, burner
3 Cover, continuous-flow heater
4 Screw, burner (3x)
5 Latch, unit cover
6 Inspection glass, flame monitoring system (optional)
7 Burner
8 Ignition cable
9 Connection cable, ignition transformer
10 Ignition transformer
11 Screw, continuous flow heater cover (3x)
12 Fuel line, from the fuel pump
13 Heating coil with rating plate, continuous flow heater
14 Exhaust temperature sensor
15 Exhaust gas flue, continuous-flow heater

2.19 Continuous-flow heater



2.19 Continuous-flow heater

1 Ignition electrodes
2 Fuel nozzle
3 Boiler base
4 Boiler inlet
5 Air supply from burner fan
6 Boiler jacket, double-walled
7 Heating coil winding, external
8 Heating coil winding, internal
9 Exhaust connecting sleeve

The water from the high-pressure pump enters the internal heating coil winding (8) from underneath, is heated as it flows through and exits downwards again from the external heating coil winding (7).

The fuel is atomised by the fuel nozzle (2) and is ignited by the ignition sparks of the ignition electrodes (1).

The combustion air from the fan (5) first flows from underneath and upwards through the double-walled boiler jacket (6), then downwards with the flame and passes up through the exhaust gas flue (9) into the open air as exhaust.

The boiler base (3) is made from fire-resistant insulating cement. It prevents radiation of the heat and helps to divert the flames.

The burner is adjusted to good emission values using the air flap on the fan (air volume) and using the adjusting screw on the fuel pump (fuel pressure).

The temperature increase at full water volume is approx. 60-65 °C. If the water volume is reduced by the pressure and flow control valve, the water can be heated to approx. 100 °C; if the steam nozzle is used it can be heated up to 155 °C*.

Optimum burner performance is only possible if the heating coil is neither sooted up nor are there any internal deposits. In addition, the ignition electrodes, the fuel volume and the air volume must be correctly set.

Steam operation

The following preparations have to be made for steam operation:

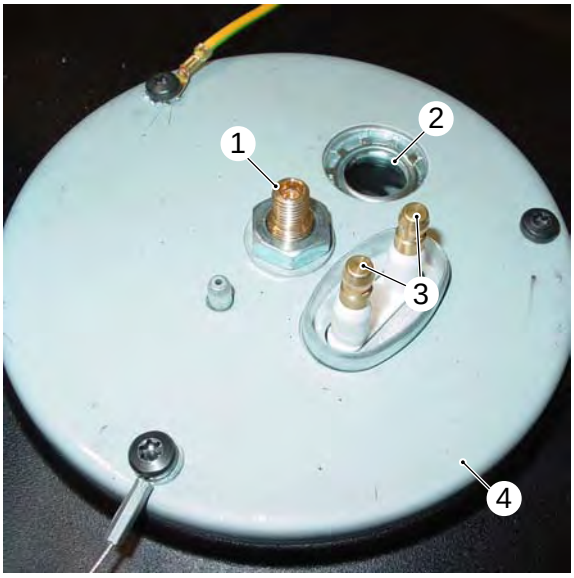
– Install the steam nozzle

– Adjust operating pressure at the pump's pressure and flow control valve to the smallest value.

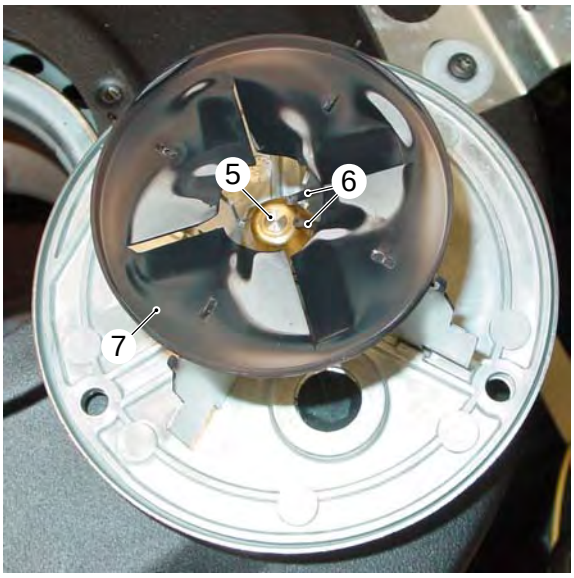
– Set the required steam temperature at the control panel.

*** Note on steam operation**
According to the Pressure Equipment Directive, the operating pressure in the unit must be less than 32 bar for steam operation. This is ensured by reducing the operating pressure at the pressure and flow control valve and using the steam nozzle supplied.

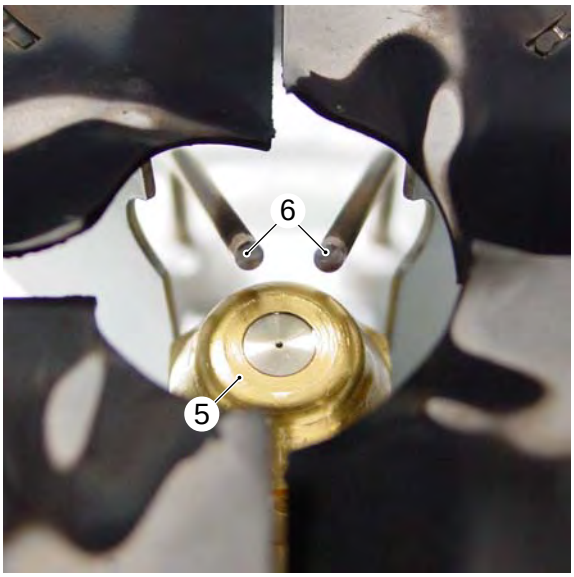
2.20 Burner



Burner, view from above



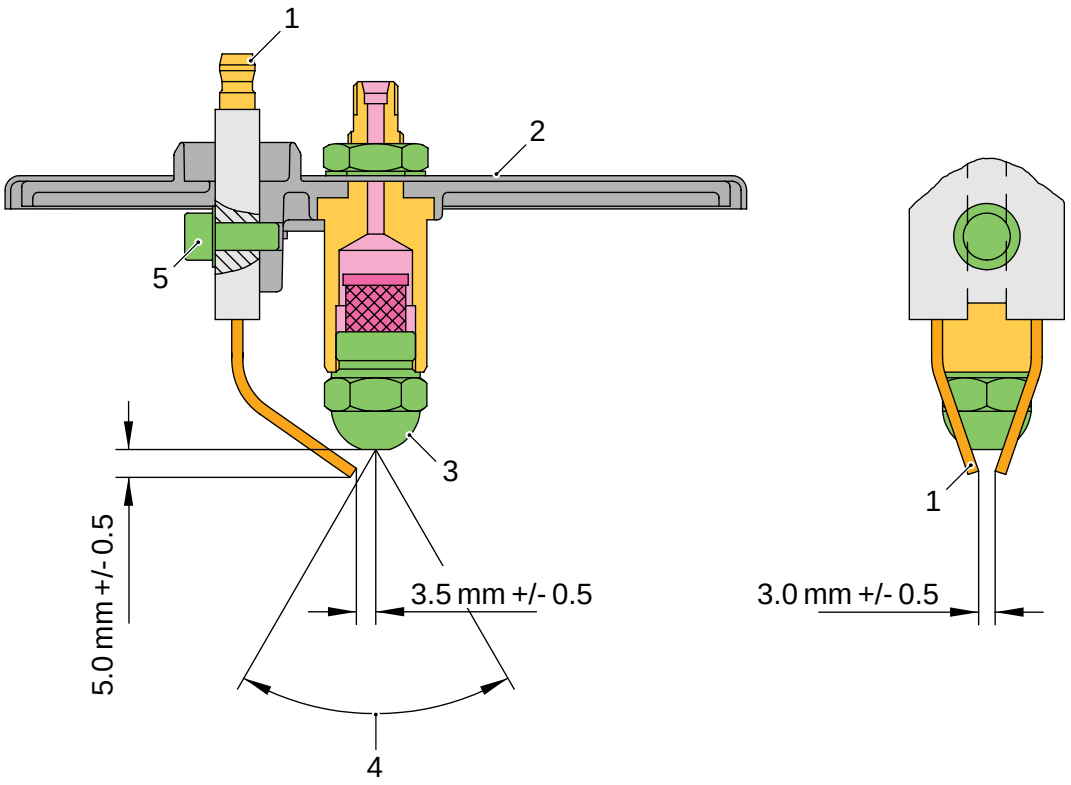
Burner, removed, view from below



Fuel nozzle and ignition electrodes

1 Connection, pressure line for fuel
2 Inspection glass, flame monitoring system
3 Connection, ignition electrode (2x)
4 Burner cover
5 Fuel nozzle
6 Ignition electrode
7 Baffle plate

2.20 Burner



1 Ignition electrodes
2 Burner cover
3 Fuel nozzle
4 Spraying angle 45° or 60 °, depending on the unit type
5 Retaining screw, ignition electrodes

Ignition electrodes

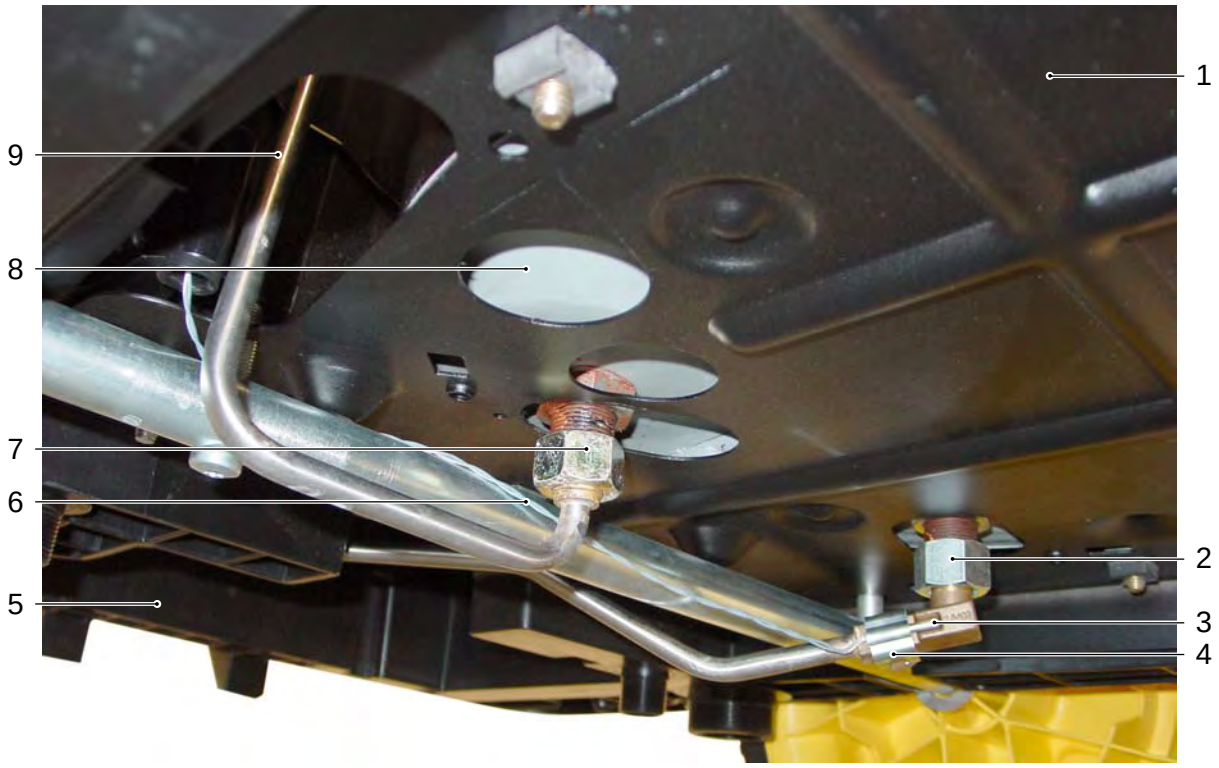
A strong ignition spark is formed between the two ignition electrodes (1) ensuring that the injected fuel is safely and reliably ignited.

The necessary ignition voltage is generated by the ignition transformer.

Exact compliance with the reference dimensions is the basic requirement for proper burner function, good emission values and long tool life of the ignition electrodes.

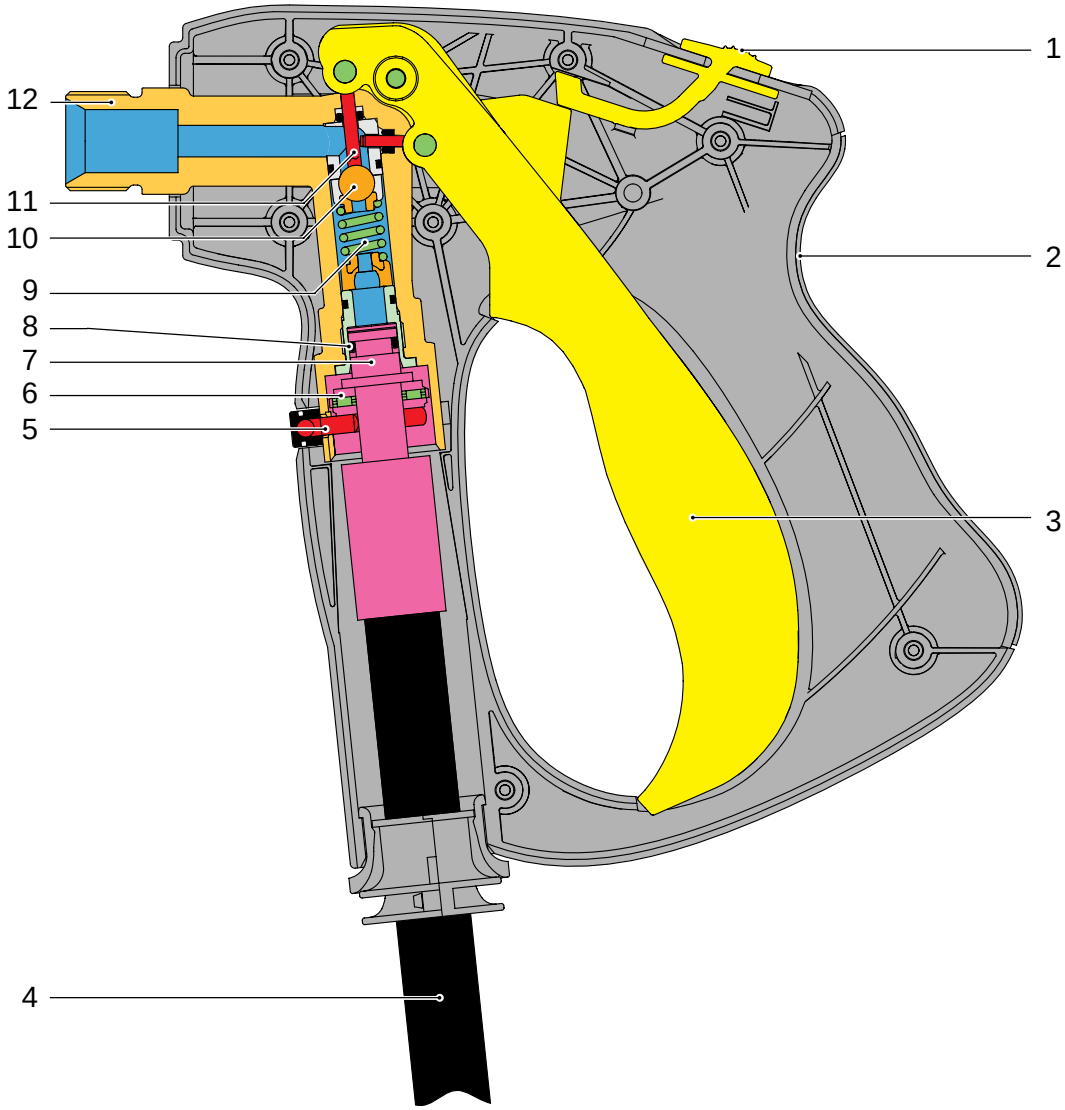
An ignition spark is always generated between the two ignition electrodes during hot and cold water operation (continuous ignition). This is a safety measure to ensure that injected fuel is always ignited and cannot collect, unburned, in the continuous flow heater (risk of deflagration).

2.21 Outlet, continuous-flow heater



1 Baseplate
2 Outlet, continuous-flow heater
3 Temperature sensor, hot water outlet
4 Clamp holder
5 Chassis
6 Connection cable, temperature sensor
7 Inlet, continuous flow heater
8 Bottom, continuous flow heater
9 Pressure line, from the safety block

2.22 Softgrip easy-press handgun

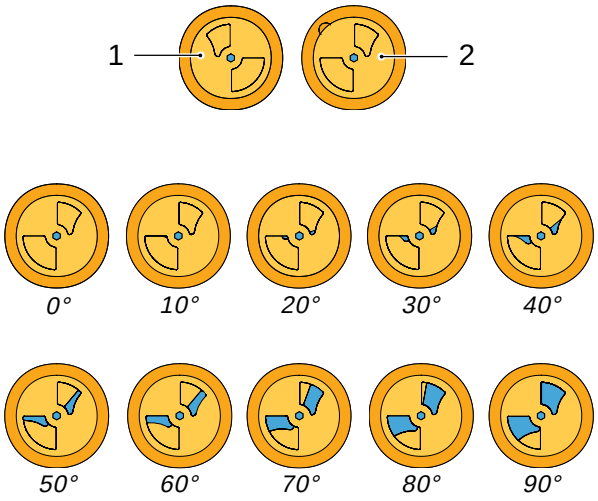


1 Safety latch
2 Handgun cover
3 Trigger lever
4 High-pressure hose
5 Safety bolt
6 Needle bearing on high-pressure hose
7 Coupling, handgun - hose
8 O-ring, hose/handgun seal
9 Spring
10 Valve ball
11 Valve piston
12 Connection for spray lance

When the trigger lever (3) is pressed, the valve piston (11) presses the valve ball (10) downwards against the spring (9). The water can flow from the hose (4) through the handgun into the spray lance.

Switch off the unit and release pressure, the hose (4) can then be pulled downwards and out of the handgun by pulling out the safety bolt (5).

2.23 Pressure and flow control valve with rotary control



Water flow at opening angle 0° - 90°

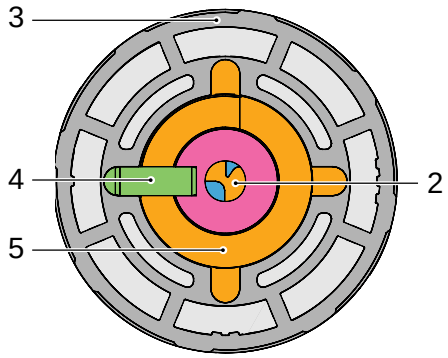
The pressure and flow control valve is designed as a rotary control between the handgun and spray lance.

There are two ceramic discs (1, 2) inside the high-pressure duct.

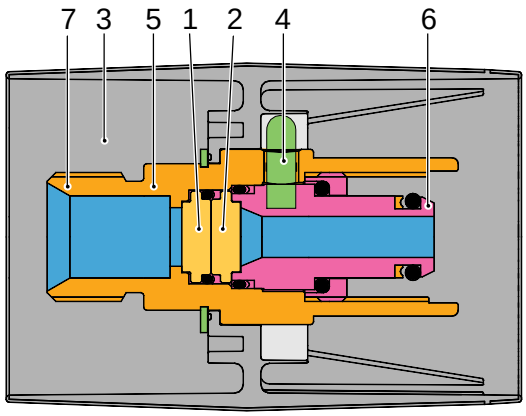
The ceramic disc (2) is rigidly connected to the handgun connection (6). The ceramic disc (1) is connected to the rotary control (5) and can therefore be adjusted. The holes in the ceramic discs (1, 2) are staggered; this enables the flow rate and pressure to be varied when the discs are rotated.

The diagram shows the two superimposed ceramic discs (1, 2) and the water flow (blue) at various opening angles of 0° - 90°.

At the minimum setting the water flows through a small hole in the middle of the ceramic discs (1, 2).



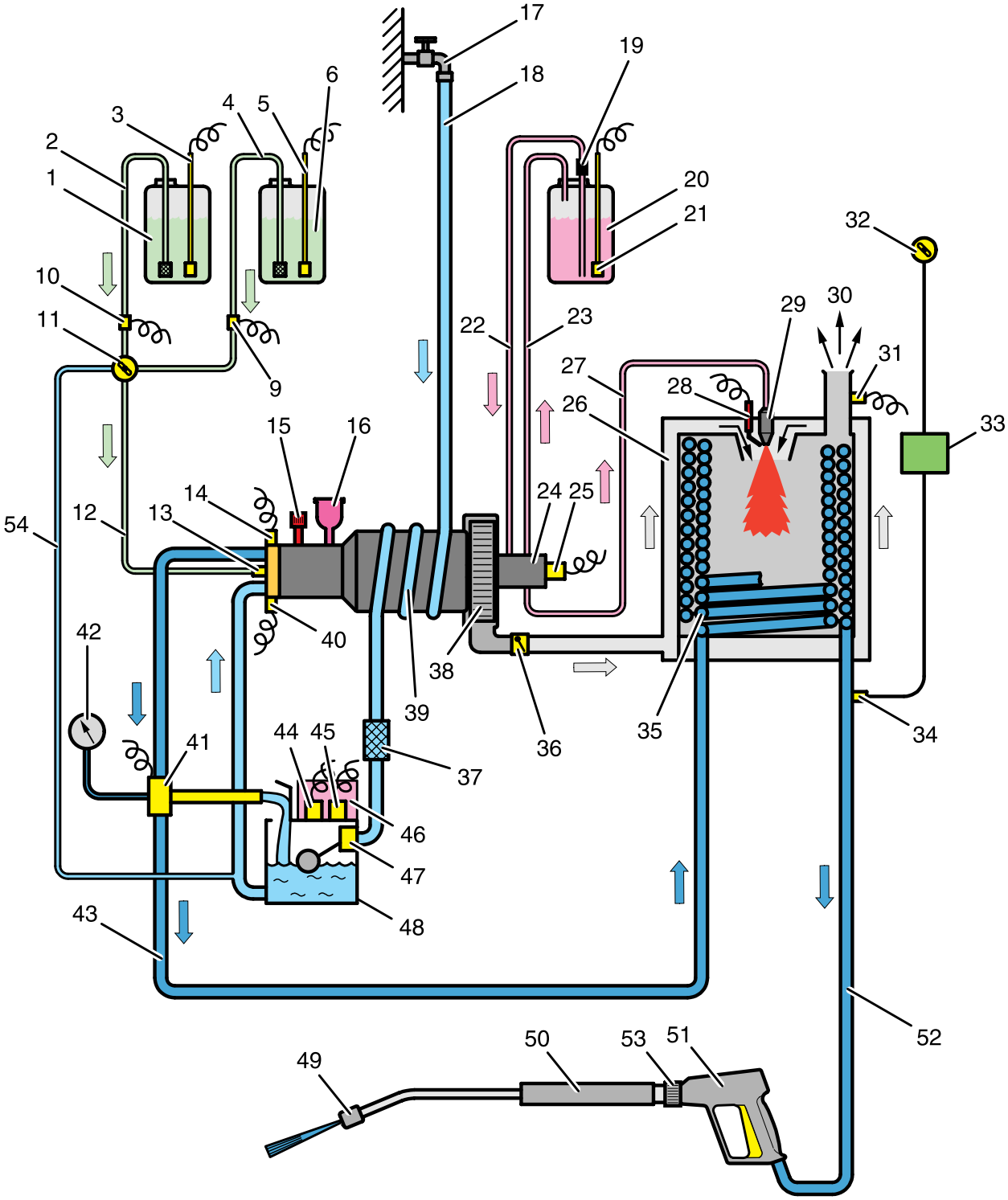
Cross-section through the rotary control (handgun side)



Long-section through the rotary control

1 Ceramic disc - spray lance side
2 Ceramic disc - handgun side
3 Handle, rotary control
4 Connecting pin
5 Housing, rotary control
6 Handgun connection
7 Spray lance connection

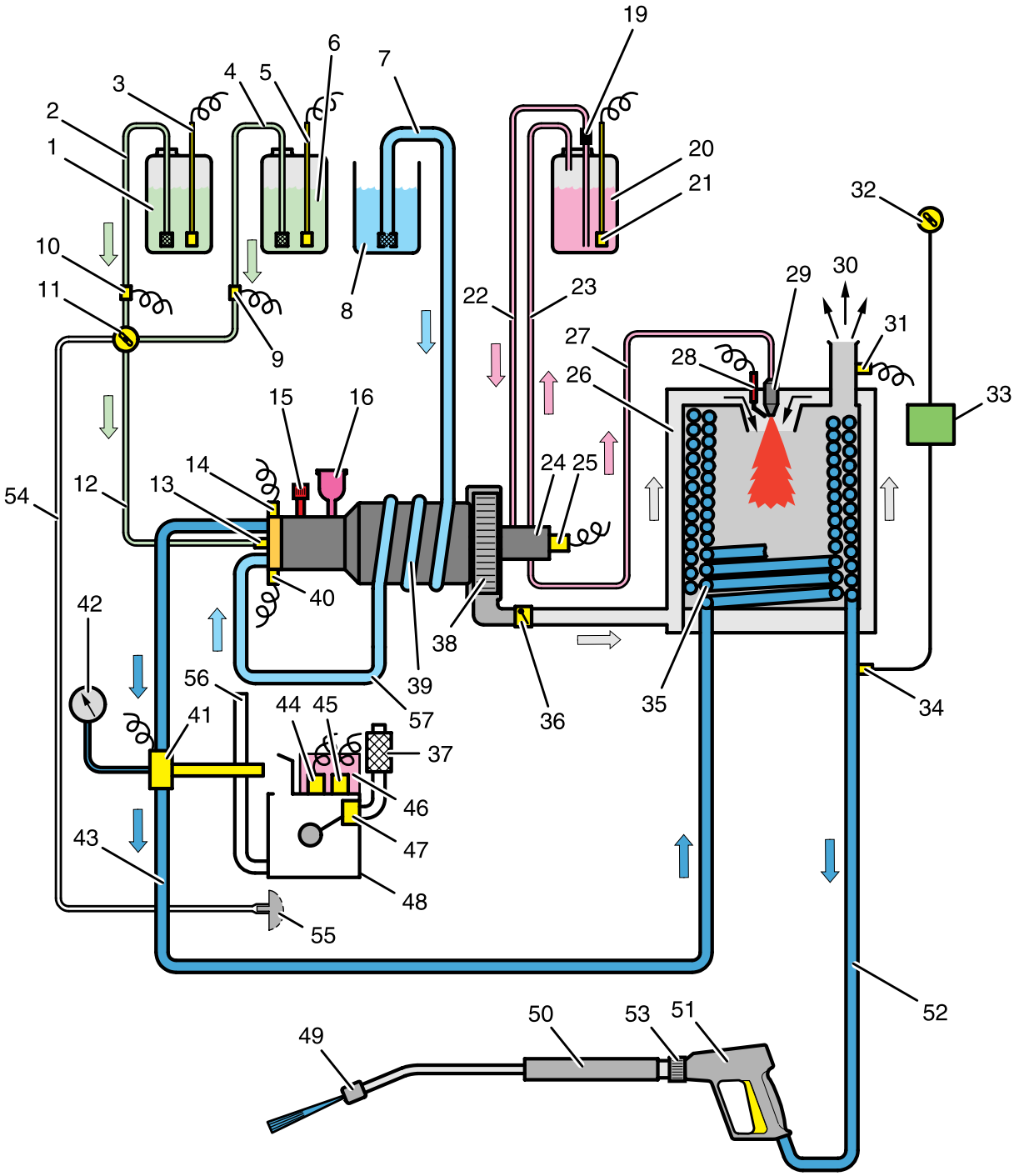
2.24 Functional diagram, pressure operation



2.24 Functional diagram, pressure operation

1 Cleaning agent tank 1
2 Cleaning agent suction hose with filter
3 Level sensor, cleaning agent tank 1 (optional)
4 Cleaning agent suction hose with filter
5 Level sensor, cleaning agent tank 2 (optional)
6 Cleaning agent tank 2
9 Cleaning agent solenoid valve 2 (optional)
10 Cleaning agent solenoid valve 1 (optional)
11 Cleaning agent metering valve
12 Cleaning agent suction hose
13 Cleaning agent non-return valve
14 Pressure switch, „ON“
15 Pressure and flow control valve
16 Oil reservoir
17 Water connection
18 Water inlet hose
19 Fuel filter
20 Fuel tank
21 Level sensor, fuel tank
22 Fuel suction line
23 Fuel return line
24 Fuel pump
25 Solenoid valve, fuel pump
26 Continuous-flow heater
27 Fuel pressure line
28 Ignition electrodes
29 Fuel nozzle
30 Exhaust connecting sleeve
31 Exhaust temperature sensor
32 Adjustment, water temperature
33 Printed circuit board
34 Temperature sensor
35 Heating coil, continuous flow heater
36 Air flap, air volume adjustment
37 Fine water filter
38 Burner fan
39 Motor housing with cooling coil (in water-cooled motor only)
40 Pressure switch, „OFF“
41 Safety block with low-water protection and safety valve
42 Pressure gauge
43 Pressure pipe
44 Solenoid valve, scale inhibitor
45 Level sensor, scale inhibitor tank
46 Scale inhibitor tank
47 Float valve
48 Float tank
49 High-pressure nozzle
50 Spray lance
51 Softgrip easy-press handgun
52 High-pressure hose
53 Rotary control for pressure and flow control valve
54 Rinsing line

2.25 Functional diagram, suction feed operation



2.25 Functional diagram, suction feed operation

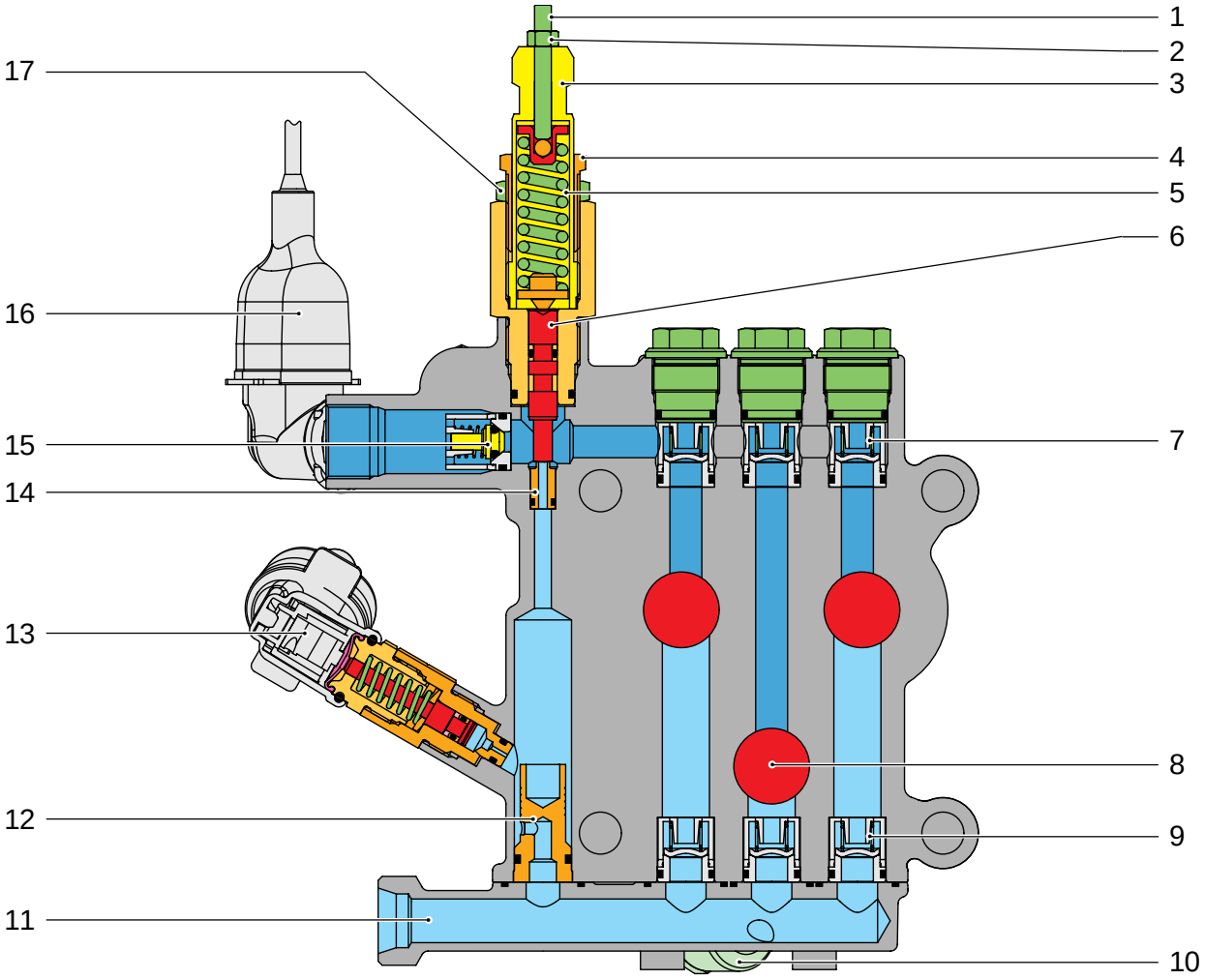
1 Cleaning agent tank 1
2 Cleaning agent suction hose with filter
3 Level sensor, cleaning agent tank 1 (optional)
4 Cleaning agent suction hose with filter
5 Level sensor, cleaning agent tank 2 (optional)
6 Cleaning agent tank 2
7 Suction hose with filter and non-return valve (optional)
8 Open tank
9 Cleaning agent solenoid valve 2 (optional)
10 Cleaning agent solenoid valve 1 (optional)
11 Cleaning agent metering valve
12 Cleaning agent suction hose
13 Cleaning agent non-return valve
14 Pressure switch, „ON“
15 Pressure and flow control valve
16 Oil reservoir
19 Fuel filter
20 Fuel tank
21 Level sensor, fuel tank
22 Fuel suction line
23 Fuel return line
24 Fuel pump
25 Solenoid valve, fuel pump
26 Continuous-flow heater
27 Fuel pressure line
28 Ignition electrodes
29 Fuel nozzle
30 Exhaust connecting sleeve
31 Exhaust temperature sensor
32 Adjustment, water temperature
33 Printed circuit board
34 Temperature sensor
35 Heating coil, continuous flow heater
36 Air flap, air volume adjustment
37 Fine water filter
38 Burner fan
39 Motor housing with cooling coil (in water-cooled motor only)
40 Pressure switch, „OFF“
41 Safety block with low-water protection and safety valve
42 Pressure gauge
43 Pressure pipe
44 Solenoid valve, scale inhibitor
45 Level sensor, scale inhibitor tank
46 Scale inhibitor tank
47 Float valve
48 Float tank
49 High-pressure nozzle
50 Spray lance
51 Softgrip easy-press handgun
52 High-pressure hose
53 Rotary control for pressure and flow control valve
54 Rinsing line
55 Plug for closing off the rinsing line during suction operation
56 Hose from float tank to the pump head
57 Hose from the motor cooler to the fine water filter/pump head

Note
During suction operation the float tank Item 48 must be bypassed.

Procedure:

– Remove hose (56) at the pump head.
– Remove hose (57) from the fine water filter.
– Connect hose (57) to the pump head.
– Pull rinsing line off the suction tube and push onto plug (55).

2.26 Pressure and flow control valve function



1 Threaded stud, max. pressure adjustment
2 Lock nut, threaded stud
3 Spindle, half-load
4 Stop sleeve, half-load
5 Spring
6 Overflow piston
7 High-pressure valve (3x)
8 Pump piston (3x)
9 Suction valve (3x)
10 Cleaning agent supply with non-return valve
11 Suction bridge with water connection
12 Sleeve with throttle bore
13 Pressure switch, „OFF“
14 Valve seat
15 Non-return valve
16 Pressure switch, „ON“
17 Lock nut, stop sleeve, half-load

2.26 Pressure and flow control valve function

2.26.1 Pressure and flow control valve, manually using handle

The pressure and flow control valve with the handle (see page 104, Item 1) is used to relieve the motor during primarily part-load operation.

If the spindle (3) is turned in a clockwise direction, the prestress in the spring (5) is reduced. This raises the overflow piston (6) even if the valve seat (14) is at a low pressure and part of the flow rate flows via the sleeve with throttle bore (12) to the suction chamber.

The pump continues to run with reduced pressure. The pressure and volume of water changes depending on the spindle setting.

2.26.2 Pressure and flow control valve using the rotary control

The pressure and flow control valve with rotary control on the handgun should be used for occasional part-load operation only.

If the pressure is reduced via the rotary control, the manual pressure and flow control valve at the pump must always be completely opened („+“ direction on the handle). Otherwise the unit switches off prematurely.

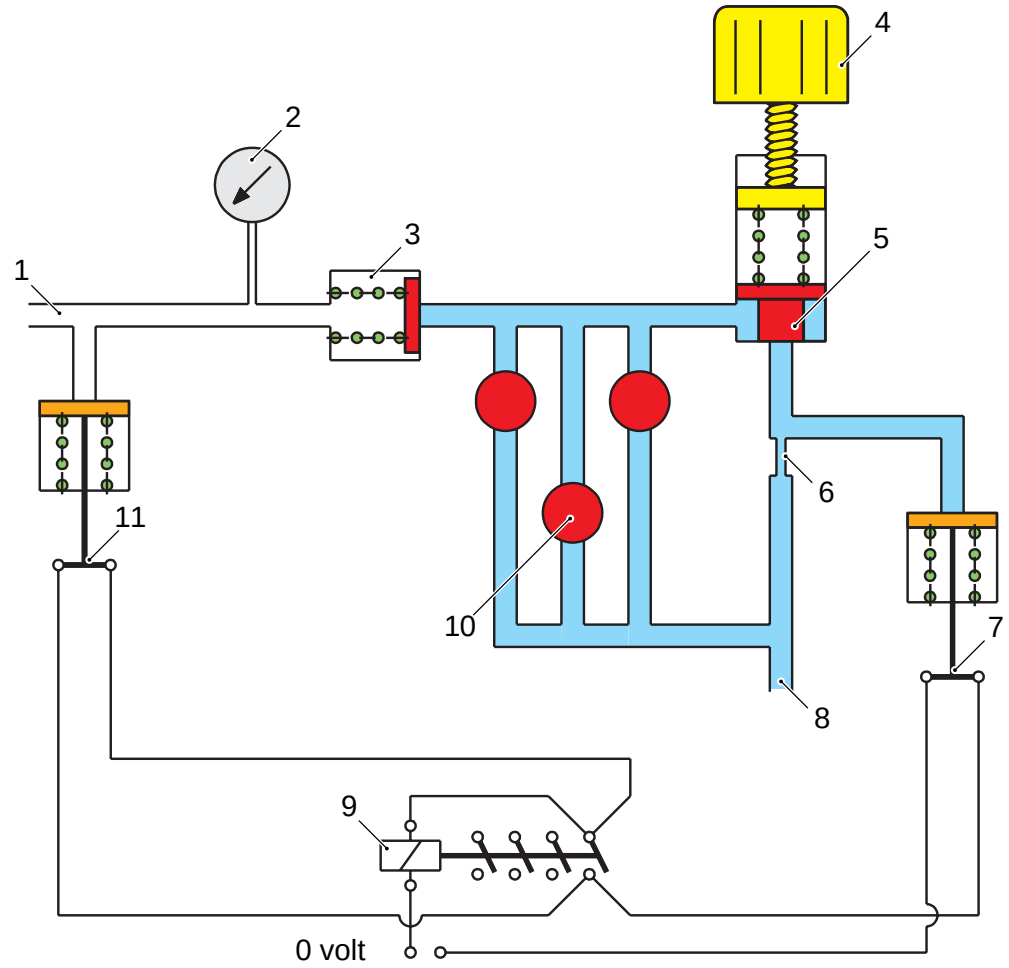
If the rotary control is partly closed the pressure in the system rises. This causes the piston (6) to be lifted from the valve seat (14), so that part of the flow rate flows via the return to the suction chamber.

The pump continues to run with a high pressure. The pressure and volume of water changes depending on the rotary control setting at the handgun.

2.26.3 Handgun closed

If the handgun is now completely closed, the piston (6) opens fully and the whole flow rate of the pump flows via the throttle bore (12) to the suction chamber. The dynamic pressure, which forms by the throttle bore of the sleeve in the return, activates the pressure switch (14), which then switches off the unit.

2.27 Pressure switch function



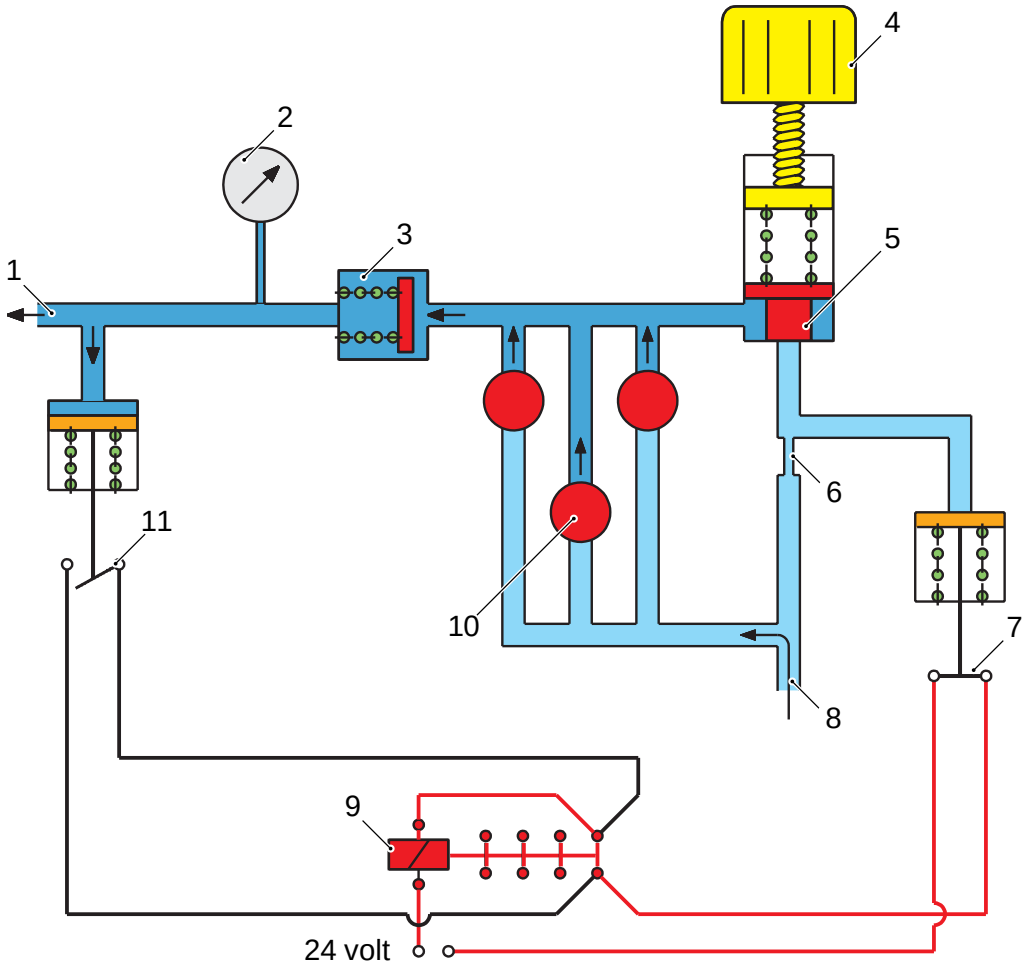
1 High-pressure outlet (unpressurised)
2 Pressure gauge (unpressurised)
3 Non-return valve (closed)
4 Rotary knob
5 Overflow valve (closed)
6 Throttle bore
7 Pressure switch, „OFF“ (closed)
8 Water inlet
9 Motor protection contacts (K1) (open)
10 Pump is at a standstill
11 Pressure switch, „ON“ (closed)

Note
The function of the pressure switches and the motor contactor described is only to help you to understand the function better. In reality the information from the two pressure switches is sent directly to the electronic control circuits and these then control the motor contactor.

2.27.1 Unit is switched off

When the unit is switched off and the handgun is open, the system is unpressurised and off-load. Both pressure switches (7) and (11) as well as the overflow valve (5) and the non-return valve (3) are closed. The motor protection contacts (9) are open (see circuit diagram).

2.27 Pressure switch function



1 High-pressure outlet, operating pressure
2 Pressure gauge, operating pressure
3 Non-return valve (open)
4 Rotary knob
5 Overflow valve (closed)
6 Throttle bore
7 Pressure switch, „OFF“ (closed)
8 Water inlet
9 Motor protection contacts (K1) (closed)
10 Pump is running
11 Pressure switch, „ON“ (open)

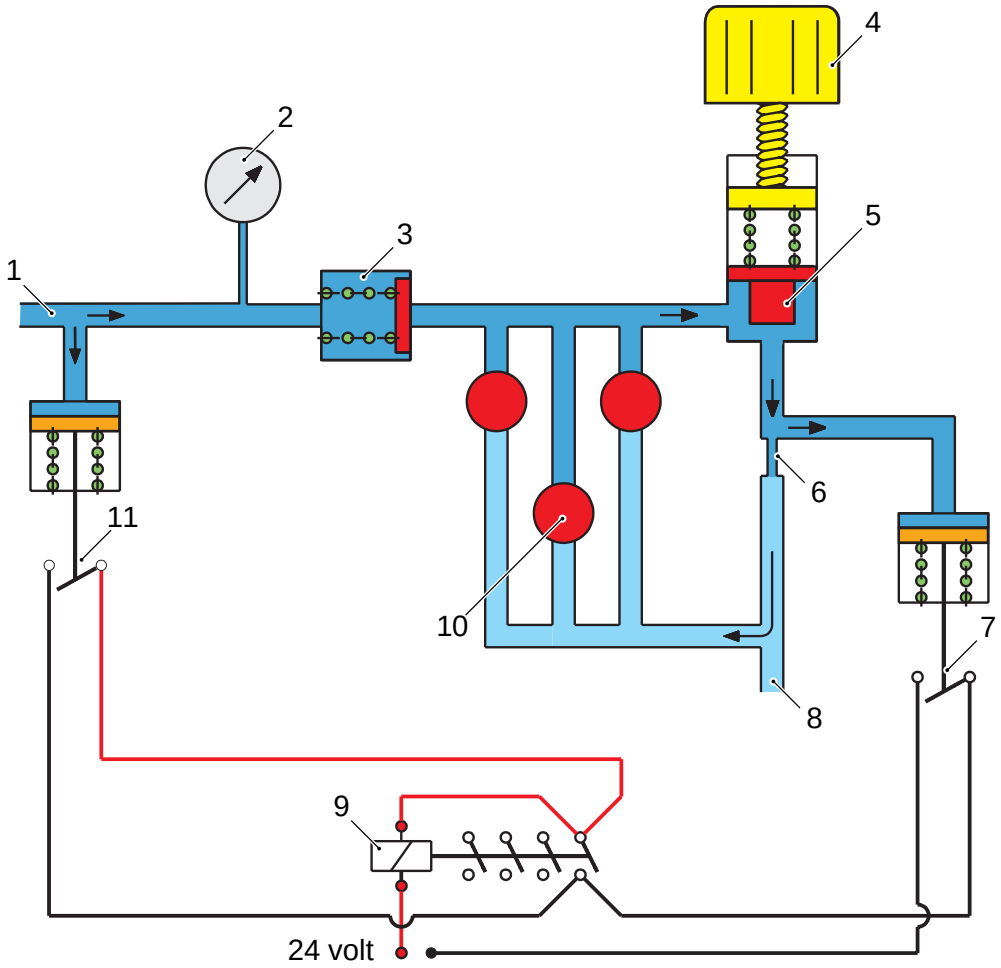
2.27.2 The unit is switched on and the handgun opened

After switching on the unit with the handgun open the motor contactor tightens and closes the contacts (9). This causes the motor to start and the pump (10) builds up the operating pressure.

Open the non-return valve (3) and pressure switch (11), the overflow valve (5) and pressure switch (7) remain closed.

The closed pressure switch (7) causes the motor protection contacts (9) to remain closed too (see circuit diagram).

2.27 Pressure switch function



1 High-pressure outlet, switch-off pressure
2 Pressure gauge, switch-off pressure
3 Non-return valve (closed)
4 Rotary knob
5 Overflow valve (open)
6 Throttle bore
7 Pressure switch, „OFF“ (open)
8 Water inlet
9 Motor protection contacts (K1) (open)
10 Pump is at a standstill
11 Pressure switch, „ON“ (open)

2.27.3 Handgun is closed

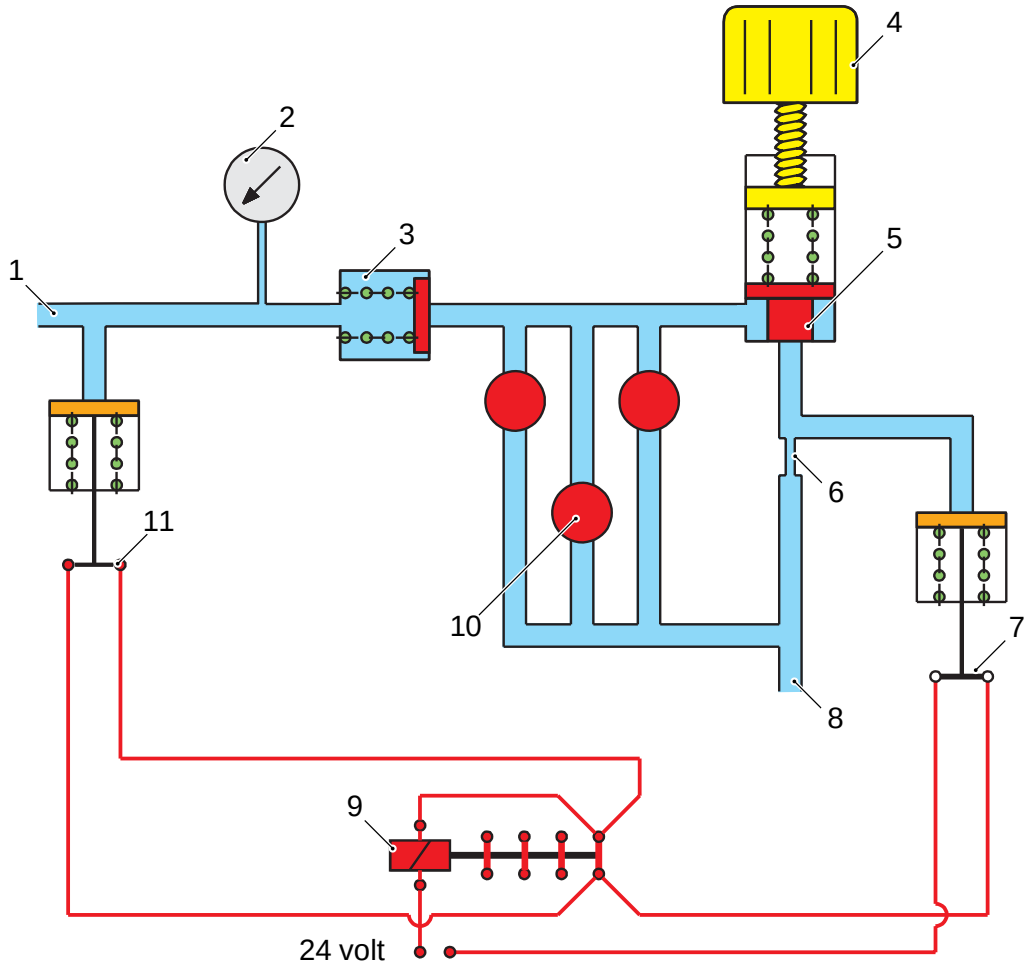
When the handgun is closed a short-term overpressure occurs in the system. This causes the overflow valve (5) to open and the whole delivery volume flows through the throttle bore (6) into the suction chamber of the pump.

As soon as the overflow valve (5) opens, the non-return valve (3) closes and the switch-off pressure is enclosed between the handgun and non-return valve (3). The enclosed switch-off pressure causes the pressure switch (11) to remain open.

At the same time, a back-pressure results in the throttle bore (6), which opens the pressure switch (7) at approx. 10 bar and this interrupts the control circuit. The motor protection contacts (9) open and the motor are switched off.

As soon as the motor is at a standstill, the overflow valve (5) and the pressure switch (7) closes. The motor protection contacts (9) continue to remain open however, as the control circuit is only interrupted by the opened pressure switch (11) (see circuit diagram).

2.27 Pressure switch function



1 High-pressure outlet (unpressurised)
2 Pressure gauge (unpressurised)
3 Non-return valve (closed)
4 Rotary knob
5 Overflow valve (closed)
6 Throttle bore
7 Pressure switch, „OFF“ (closed)
8 Water inlet
9 Motor protection contacts (K1) (closed)
10 Pump starts up
11 Pressure switch, „ON“ (closed)

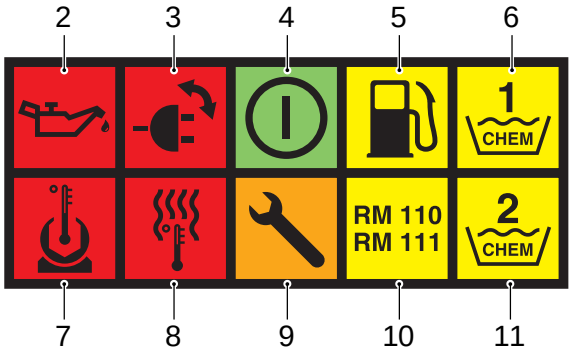
2.27.4 Handgun is reopened with unit switched on

As soon as the handgun is opened, the pressure enclosed between the non-return valve (3) and the handgun escapes. The pressure switch (11) closes.

This means the control circuit is closed again, the motor contactor (9) tightens, closes the contacts, the motor starts up and the pump builds up the operating pressure again (see circuit diagram).

3.1 Service functions with LED display

Functional selection via water temperature setting



Display of the settings via LED indicators

Change the setting using the Service switch

Service mode

If the Service switch is in the „Service“ position when the unit is switched on, the unit’s Service mode is activated (pump does not run).

Selecting the service functions

The available service functions are selected via the water temperature setting (1).

Example: 30 °C corresponds to the „ON30MIN“ function.

For several functions the functional selection must already be set when the unit is switched on and the Service switch must be held in the „SET“ position.

Example: RFIDONOFF is accessed with the setting 45 °C + „SET“ on switching on.

Changing the settings

The current setting is displayed via the 10 indicator LEDs on the control panel.

The settings can be changed with the help of the Service switch’s Inching function (turn to „SET“ position, switch jumps back to „Service“ function). The change is also displayed via the indicator LEDs.

Quitting Service mode

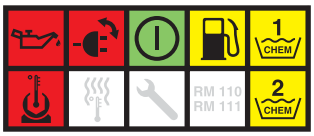
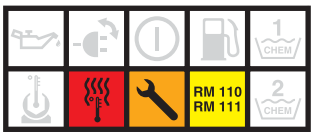
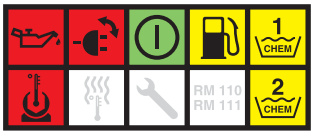
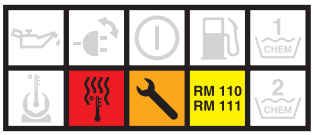
– Switch off unit.

– Set Service switch to the appropriate water hardness or „OFF“.

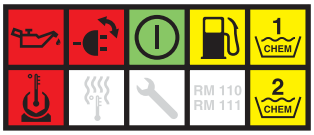
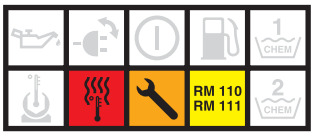
– Switch on unit.

1 Adjustment, water temperature (menu item selection)
2 Indicator LED 0, pump (red)
3 Indicator LED 1, rotational direction (red)
4 Indicator LED 2, operation (green)
5 Indicator LED 3, fuel (yellow)
6 Indicator LED 4, cleaning agent tank 1 (yellow)
7 Indicator LED 5, motor (red)
8 Indicator LED 6, burner (red)
9 Indicator LED 7, service (orange)
10 Indicator LED 8, scale inhibitor (yellow)
11 Indicator LED 9, cleaning agent tank 2 (yellow)
12 Service switch (change setting)

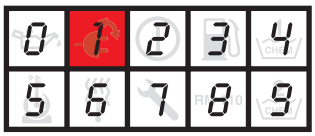
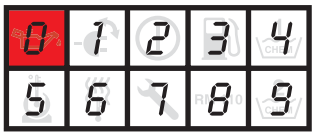
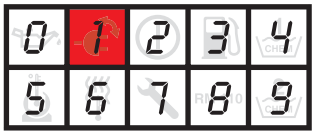
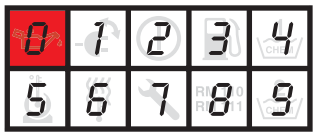
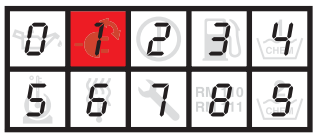
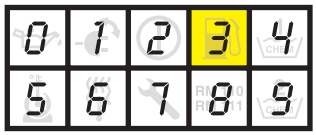
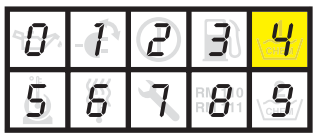
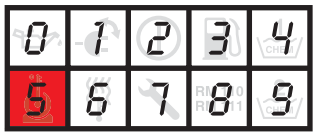
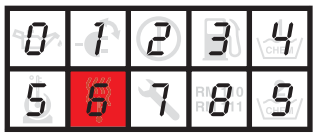
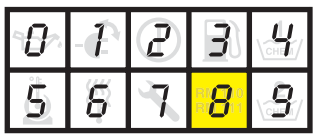
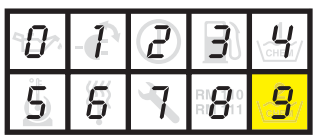
3.1.1 Adjusting the stopping behaviour

	Function	Setting	
		LED display	Meaning
30 °C	**ON30MIN** Behaviour of the unit after 30 minutes' continuous operation. Setting is saved.		Unit switches off after 30 minutes' continuous operation.
			Unit does not switch off after 30 minutes' continuous operation (manufacture settings).
35 °C	**OFF30MIN** Behaviour of the unit after 30 minutes' continuous standby operation. Setting is saved.		Unit switches off after 30 minutes' standby operation.
			Unit does not switch off after 30 minutes' standby operation (manufacture settings).

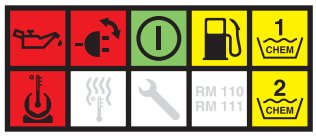
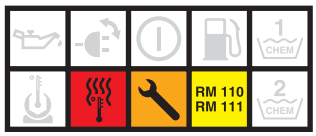
3.1.2 Adjusting the leakage behaviour

	Function	Setting	
		LED display	Meaning
40 °C	**LECKAGEONOFF** Behaviour of the unit after 10 short pump start-ups (pump running time less than 2 seconds). Setting is saved.		Unit switches off after 10 short pump start-ups (manufacture settings).
			Unit does not switch off after 10 short pump start-ups.

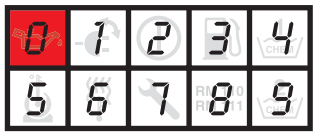
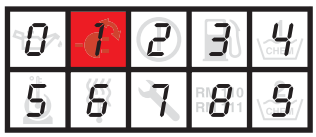
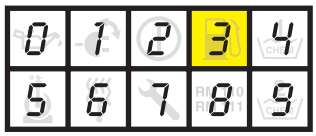
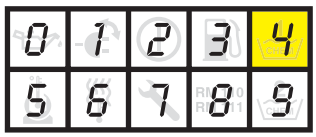
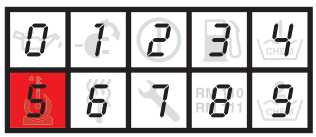
3.1.3 Flame sensor brightness value

	Function	Measured value	
		LED display	Meaning
45 °C	**LDRTEST** Display of the brightness value measured by the flame sensor. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 - 9 according to its number.  The display is repeated after a pause. **Example:** A brightness value of 1016 is measured. The LEDs light up in the following order:     - PAUSE - . . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“
	Note: A value over 471 is assessed as being „dark“. A value up to 471 is assessed as being „light“.		

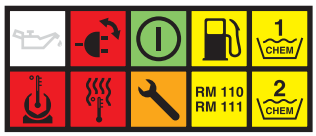
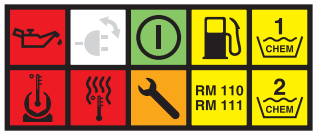
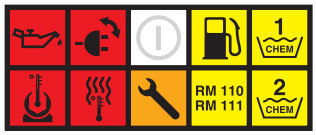
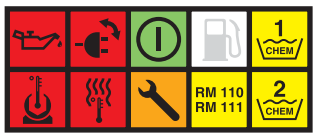
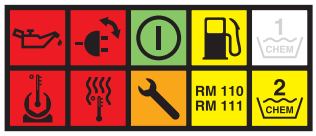
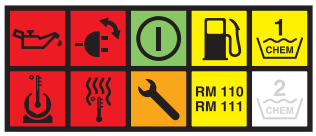
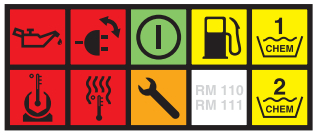
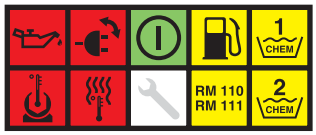
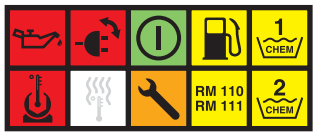
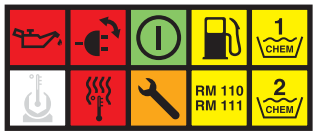
3.1.4 RFID query

	Function	Setting	
		LED display	Meaning
45 °C + „SET“	**RFIDONOFF** Info on the printed circuit board, whether the unit is equipped with metering via RFID or not.		Unit with RFID
			Unit without RFID

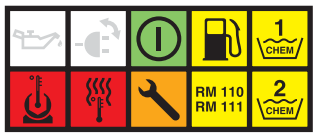
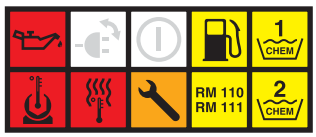
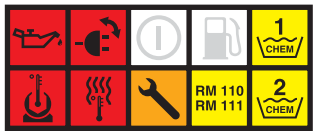
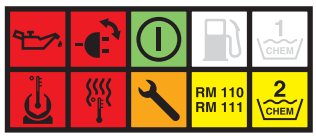
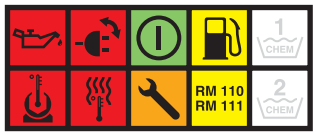
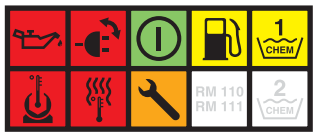
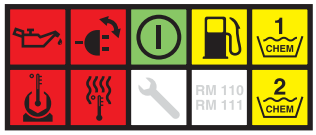
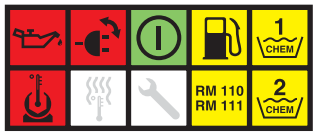
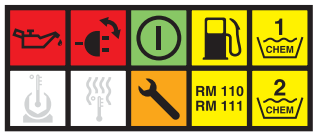
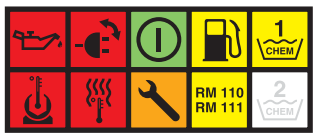
3.1.5 Testing the temperature sensor

	Function	Measured value	
		LED display	Meaning
50 °C	**NTCTEST** Display of the water temperature measured by the temperature sensor. The value is displayed by the LEDs digit for digit (see Chapter 3.1.3). The display is repeated after a pause. **Example:** A temperature of 27 °C is measured. The LEDs light up in the following order:   - PAUSE - . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
		. . .	. . .
	Note: „0“ is displayed for a temperature below 0 °C.		

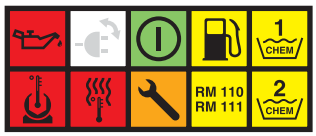
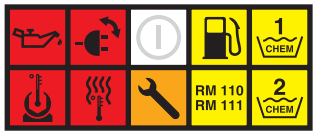
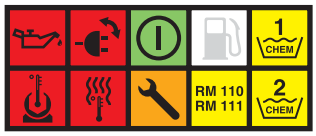
3.1.6 Testing the water temperature setting and program switch

	Function	Setting	
		LED display	Meaning
55 °C	**ENCPROGTEST** This function can be used to test the program switch and the regulator for the water temperature setting. All 10 LEDs light up on switching on. **The test is started by actuating the Inching function of the Service switch (continue turning to „SET“ position and let go) and by turning the water temperature setting to 30 °C.** If the water temperature setting is gradually increased the LED display changes as shown on the right.		30 °C
			35 °C
			40 °C
			45 °C
			50 °C
			55 °C
			60 °C
			65 °C
			70 °C
			75 °C

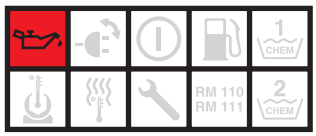
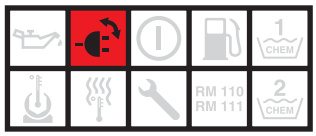
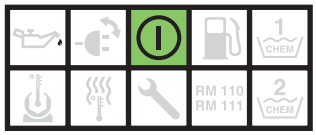
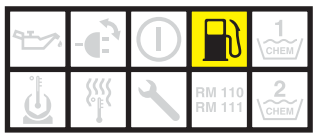
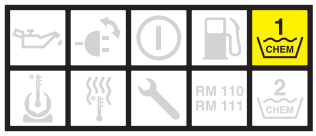
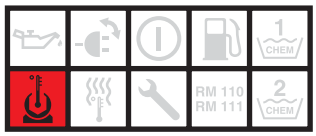
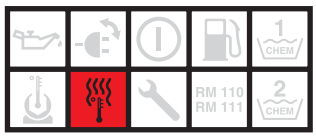
3.1.6 Testing the water temperature setting and program switch

	Function	Setting	
		LED display	Meaning
55 °C			80 °C
			85 °C
			90 °C
			95 °C
			100 °C
			112 °C
			125 °C
			140 °C
			155 °C
			The temperature setting must then be reset back to 55 °C.

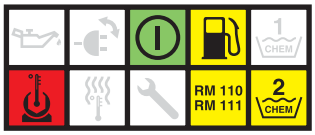
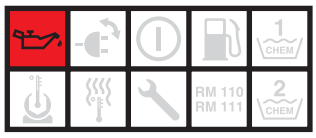
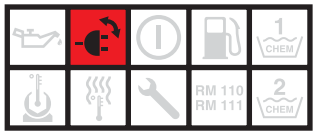
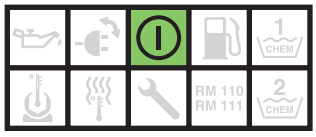
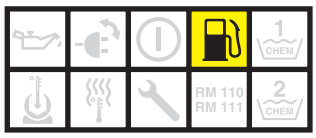
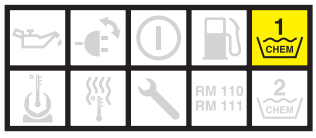
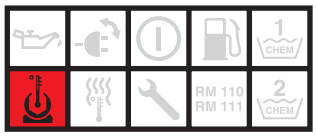
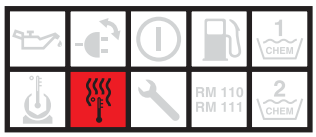
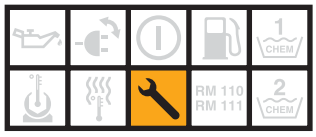
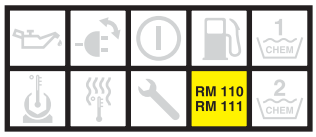
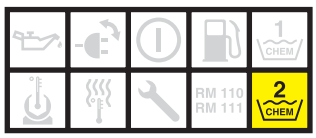
3.1.6 Testing the water temperature setting and program switch

	Function	Setting	
		LED display	Meaning
55 °C	**ENCPROGTEST** The test for the Program switch is started by actuating the Inching function of the Service switch again (continue turning to „SET“ position and let go). The LED display now depends on the position of the program switch.		Program switch „Cold“ position
			Program switch „eco“ position
			Program switch „Hot“ position
	Note: Switch off the unit to quit the ENCPROGTEST function.		

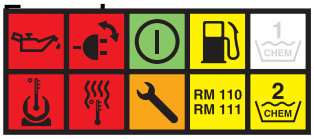
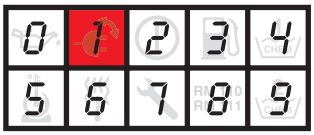
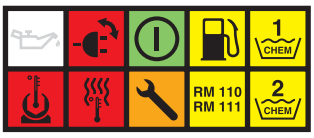
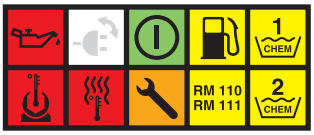
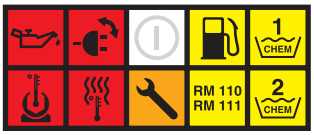
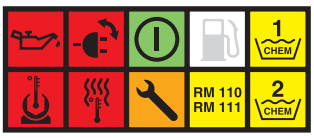
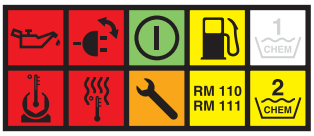
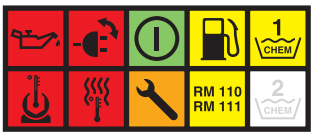
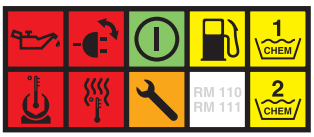
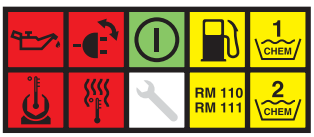
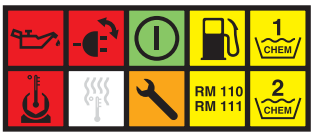
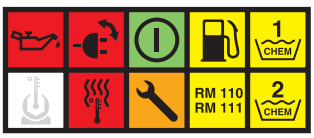
3.1.7 Testing the Service switch

	Function	Setting	
		LED display	Meaning
60 °C	**ENCDGTTEST** Display of the Service switch position.		Service switch „OFF“ position
			Service switch „1“ position
			Service switch „2“ position
			Service switch „3“ position
			Service switch „4“ position
			Service switch “Service“ position
			Service switch „SET“ position

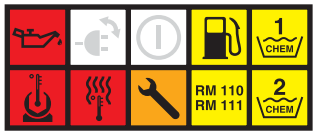
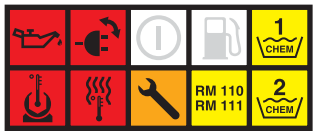
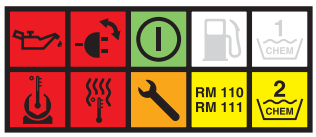
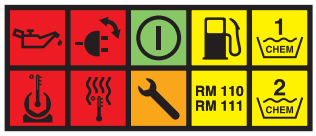
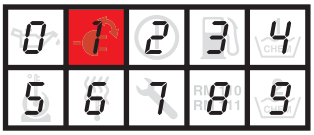
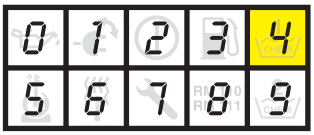
3.1.8 Testing the sensors

	Function	Setting	
		LED display	Meaning
65 °C	**INPUTTEST** This function can be used to display the states of the individual sensors. Each LED indicates the state of a specific sensor. Therefore, several LEDs can be simultaneously lit. **Example:**  This display means: – Oil level sensor open (too little oil). – „ON“ pressure switch not pressed. – Motor thermal contact closed. – „Fuel tank“ reed switch closed (tank is not empty). – „Cleaning agent tank 1“ reed switch open (tank is empty) – „Low-water protection“ reed switch closed. – „OFF“ pressure switch not pressed. – Exhaust thermostat open (burner off). – „Scale inhibitor tank“ reed switch closed (float at top) – „Cleaning agent tank 2“ reed switch open (float at top).		Oil level sensor closed (float at top)
			„ON“ pressure switch open (pressure switch pressed)
			Motor thermal contact closed
			„Fuel tank“ reed switch closed (float at top)
			„Cleaning agent tank 1“ reed switch open (float at top)
			„Low-water protection“ reed switch closed (water flow available)
			„OFF“ pressure switch open (pressure switch pressed)
			Exhaust thermostat closed
			„Scale inhibitor tank“ reed switch closed (float at top)
			„Cleaning agent tank 2“ reed switch open (float at top)

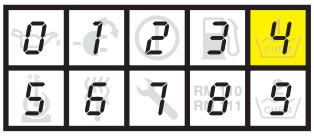
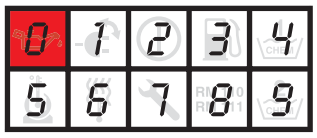
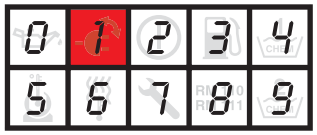
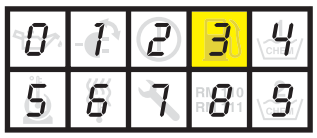
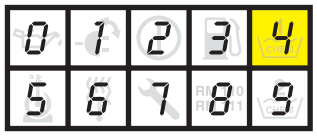
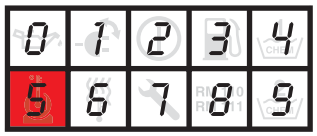
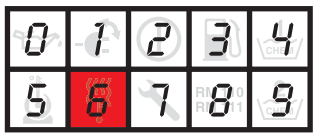
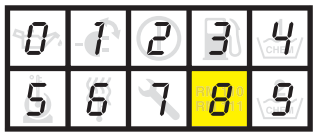
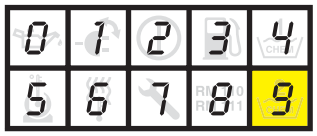
3.1.9 Fault memory

	Function	Fault types	
		LED display	Meaning
70 °C	**ERRORS** This function is used to read out the fault memory. The faults are displayed in 2 steps: 1. LED display of the fault type (see right-hand side). 2. Display of the pump running time in hours which have passed since the fault occurred via the numerical values of the LEDs (see Chapter 3.1.3).  - P A U S E -   **Explanation:** The pump has been in operation for 14 hours since the „Motor thermal contact open“ fault occurred. **Note:** Actuate the Inching function to switch to the next fault.		Overvoltage detected in Transformer 1.
			Undervoltage detected in Transformer 1.
			Overcurrent detected.
			Current asymmetry detected.
			Motor thermal contact is open.
			Pump dry running detected.
			„Sticking“ low-water protection detected (closed although pump is off).
			„Oil refill container empty“ detected.
			Leakage (10 short start-ups each < 2 seconds).
			Exhaust thermostat is open.
		Continued on the next page ...	

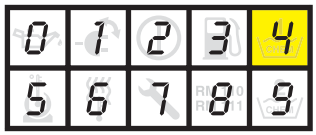
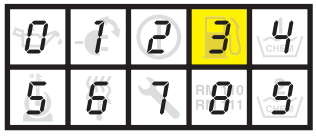
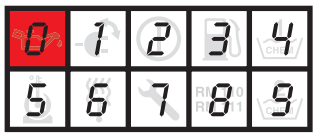
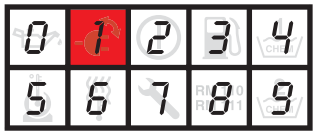
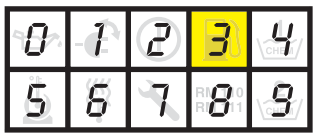
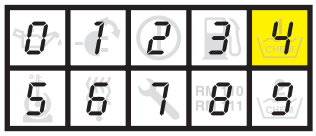
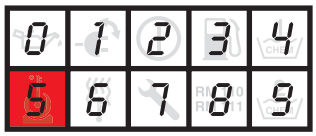
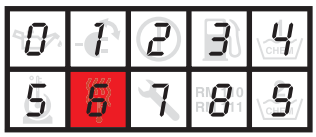
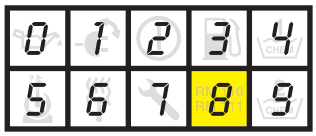
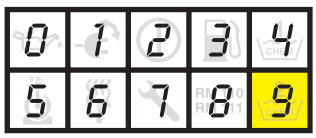
3.1.9 Fault memory

	Function	Fault types	
		LED display	Meaning
70 °C			Temperature sensor fault. Short circuit or cable break.
			Flame sensor detects no or too little light.
			Flame sensor detects light.
			RFID read-write electronics are defective.
			End of the fault memory. The version of the installed software is displayed here instead of the operating hours. **Example:**   Software Version 1.4

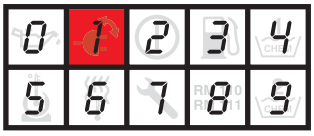
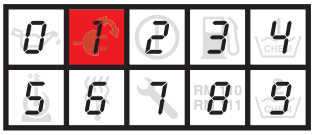
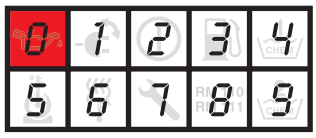
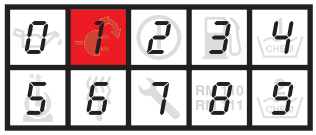
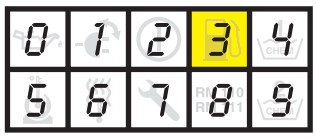
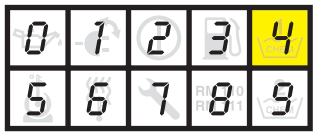
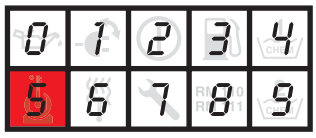
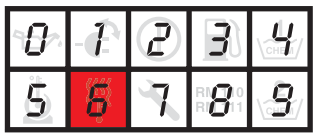
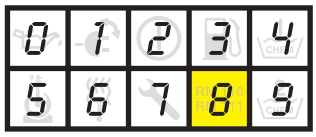
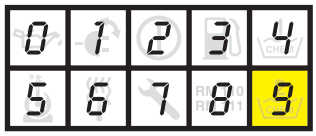
3.1.10 Operating hours

	Function	Value	
		LED display	Meaning
75 °C	**STUNDENPWR** Display of the operating time (unit switched on) in hours. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. **Example:** The unit has an operating time of 42 hours. The LEDs light up in the following order:   - PAUSE - . . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“

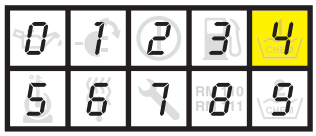
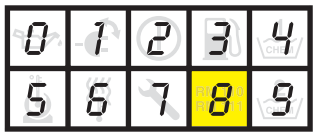
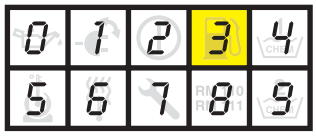
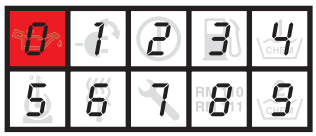
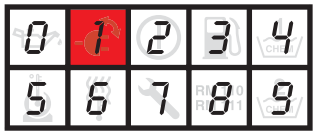
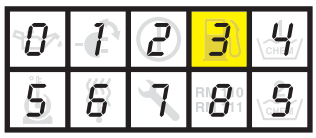
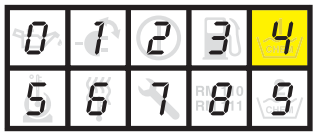
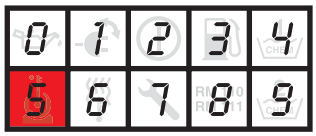
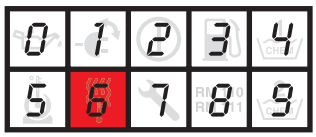
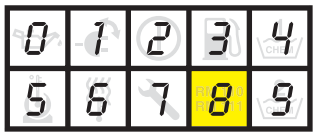
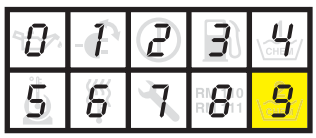
3.1.11 Handgun switchings since the handgun service

	Function	Value	
		LED display	Meaning
80 °C	**SI_PISTOLE** Display of the handgun switchings since the last time the handgun was serviced. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. **Example:** The handgun has been actuated 430 times since the last handgun service. The LEDs light up in the following order:    - PAUSE - . . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“

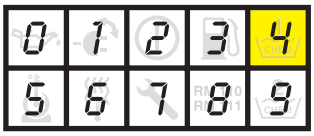
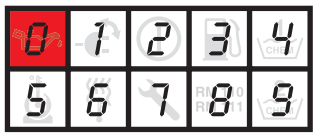
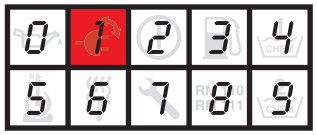
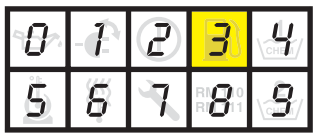
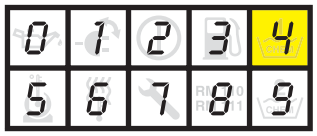
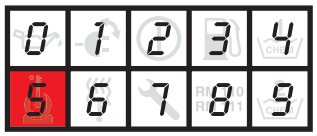
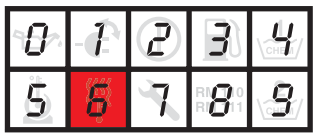
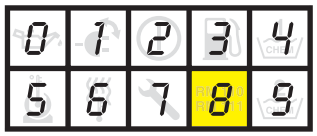
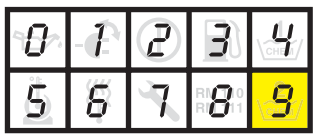
3.1.12 Handgun services

	Function	Value	
		LED display	Meaning
85 °C	**SCTR_PISTOLE** Handgun service display. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. Example: The handgun has been serviced 11 times since initial operation of the unit started. The LEDs light up in the following order:   - PAUSE - . . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“
85 °C + „SET“	When the unit is switched on the handgun switchings since the handgun service (SI_PISTOLE) are set to „0“, the handgun service counter (SCTR_PISTOLE) is increased by 1 and the fault memory is deleted.		

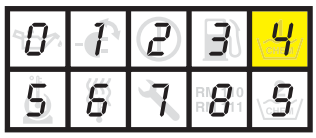
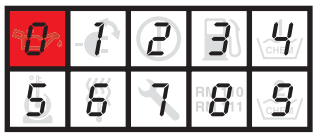
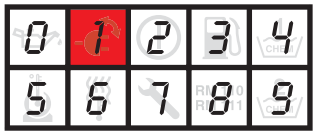
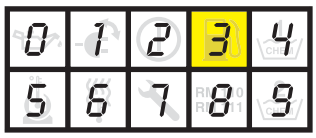
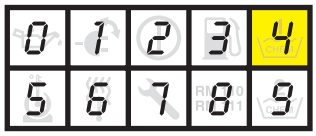
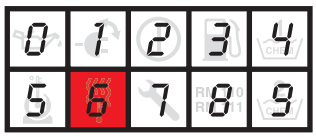
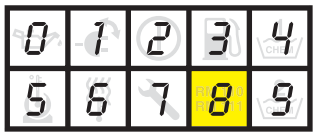
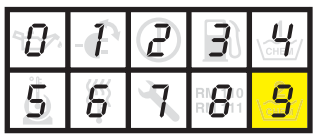
3.1.13 Handgun switchings since initial operation

	Function	Value	
		LED display	Meaning
90 °C	**TOTALPISTOLE** Display of the handgun switchings since initial operation of the unit. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. **Example:** The handgun has been actuated 9483 times since initial operation of the unit. The LEDs light up in the following order:     - PAUSE - . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“

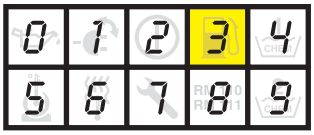
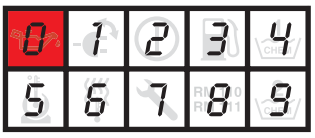
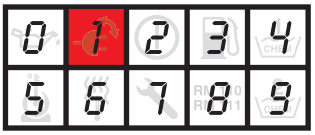
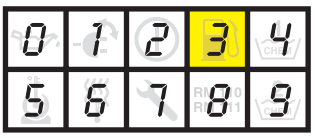
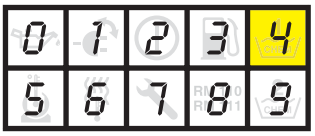
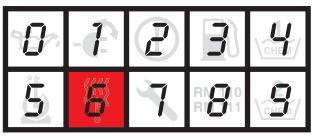
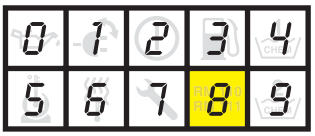
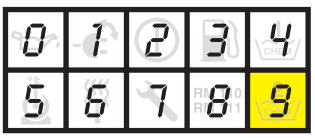
3.1.14 Operating time of the burner since the burner service

	Function	Value	
		LED display	Meaning
95 °C	**SI_BRENNER** Display of the burner's operating time in hours since the burner was last serviced. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. **Example:** The burner has been in operation for 47 hours since the last time the burner was serviced. The LEDs light up in the following order:   - PAUSE - . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“

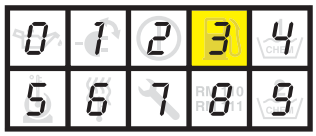
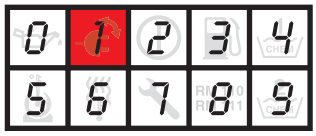
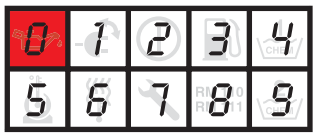
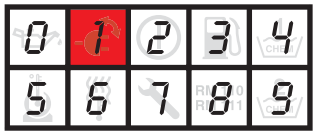
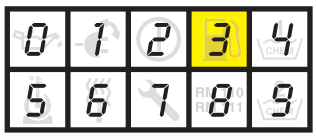
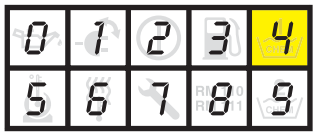
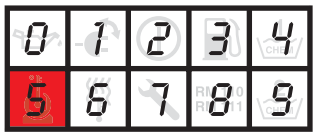
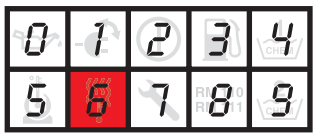
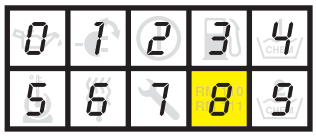
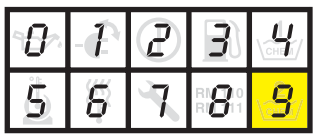
3.1.15 Burner services

	Function	Value	
		LED display	Meaning
100 °C	**SCTR_BRENNER** Burner service display. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. **Example:** The burner has been serviced 4 times since the initial operation of the unit. The LEDs light up in the following order:  - PAUSE - . . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“
100 °C + „SET“	When the unit is switched on the burner operating time since the burner service (SI_BRENNER) is set to „0“, the burner service counter (SCTR_BRENNER) is increased by 1 and the fault memory is deleted.		

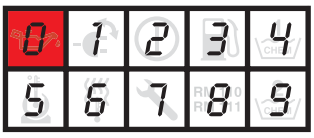
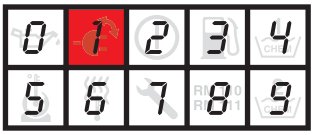
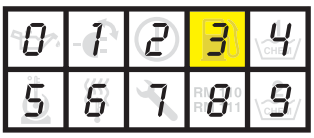
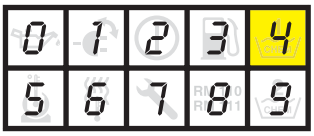
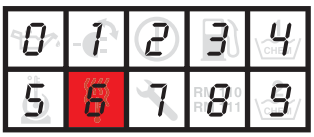
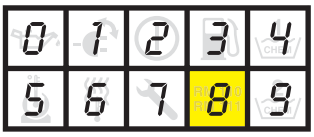
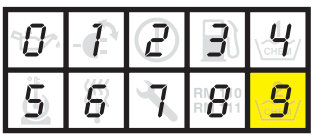
3.1.16 Burner operation since initial operation

	Function	Value	
		LED display	Meaning
112 °C	**TOTALBRENNER** Display of the burner's operating time in hours since initial operation of the unit. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. **Example:** The burner has been in operation for 32 hours since initial operation of the unit. The LEDs light up in the following order:   - PAUSE - . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“

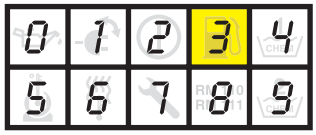
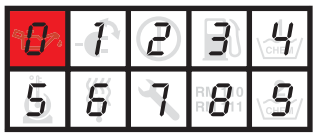
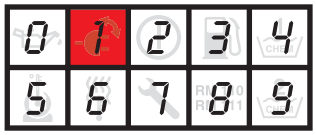
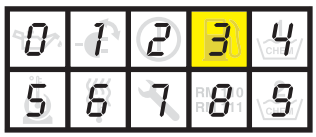
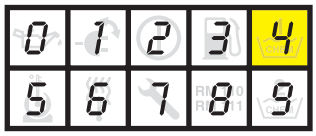
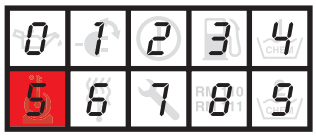
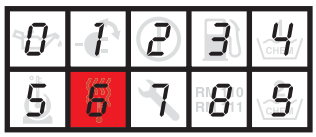
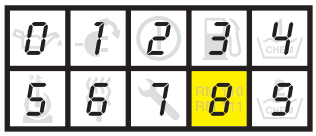
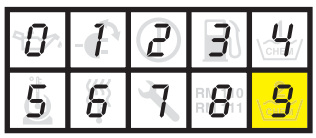
3.1.17 Operating time of the pump since the pump service

	Function	Value	
		LED display	Meaning
125 °C	**SI_PUMPE** Display of the pump's operating time in hours since the pump was last serviced. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. **Example:** The pump has been in operation for 31 hours since the last time the pump was serviced. The LEDs light up in the following order:   - PAUSE - . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“

3.1.18 Pump services

<table>
<tr><th>  </th><th>Function</th><th colspan="2">Value</th></tr>
<tr><th></th><th></th><th>LED display</th><th>Meaning</th></tr>
<tr><td>140 °C</td><td>SCTR_PUMPE
Pump service display. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.
 
The display is repeated after a pause.
Example:
The pump has been serviced 7 times since the initial operation of the unit.
The LEDs light up in the following order:
 
- PAUSE -
.
.
.</td><td>  </td><td>Numerical value „0“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „1“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „2“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „3“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „4“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „5“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „6“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „7“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „8“</td></tr>
<tr><td></td><td></td><td>  </td><td>Numerical value „9“</td></tr>
<tr><td>140 °C
+
„SET“</td><td colspan="3">When the unit is switched on the pump operating time since the pump service (SI_PUMPE) is set to „0“, the pump service counter (SCTR_PUMPE) is increased by 1 and the fault memory is deleted.</td></tr>
</table>

3.1.19 Pump operation since initial operation

	Function	Value	
		LED display	Meaning
155 °C	**TOTALPUMPE** Display of the pump's operating time in hours since initial operation of the unit. The value is displayed by the LEDs, digit for digit, whereby each LED stands for a numerical value from 0 to 9 according to its number.  The display is repeated after a pause. **Example:** The pump has been in operation for 32 hours since initial operation of the unit. The LEDs light up in the following order:   - PAUSE - . .		Numerical value „0“
			Numerical value „1“
			Numerical value „2“
			Numerical value „3“
			Numerical value „4“
			Numerical value „5“
			Numerical value „6“
			Numerical value „7“
			Numerical value „8“
			Numerical value „9“

3.2 Service functions with display

Functional selection via water temperature setting

The settings are shown in the display

Change the setting using the Service switch

Service mode

If the Service switch is in the „Service“ position when the unit is switched on, the unit’s Service mode is activated (pump does not run).

Selecting the service functions

The available service functions are selected via the water temperature setting (1).

Example: 30 °C corresponds to the „Shut-off after 30 minutes’ continuous operation“ function.

For several functions the functional selection must already be set when the unit is switched on and the Service switch must be held in the „SET“ position.

Example: „RFID Detection“ is accessed with the setting 45 °C + „SET“ on switching on.

Changing the settings

The current setting is displayed in the control panel display.

The settings can be changed with the help of the Service switch’s Inching function (turn to „SET“ position, switch jumps back to „Service“ function). The change is also shown on the display.

Quitting Service mode

– Switch off unit.

– Set Service switch to the appropriate water hardness or „OFF“.

– Switch on unit.

1 Adjustment, water temperature (menu item selection)

2 Display

3 Service switch (change setting)

3.2.1 Adjusting the stopping behaviour

	Display	Explanation	Note
30 °C		Shut-off after 30 min continuous operation is activated.	Switchover with SET
		Shut-off after 30 min continuous operation is not activated (manufacture settings).	Switchover with SET
35 °C		Shut-off after 30 min continuous pause is activated.	Switchover with SET
		Shut-off after 30 min continuous pause is not activated (manufacture settings).	Switchover with SET

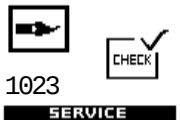
3.2.2 Adjusting the leakage behaviour

	Display	Explanation	Note
40 °C		Shut-off after 10 short start-ups activated (manufacture settings).	Switchover with SET
		Shut-off after 10 short start-ups is not activated.	Switchover with SET

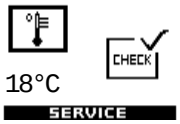
3.2.3 RFID query

	Display	Explanation	Note
45 °C + „SET“		Unit is equipped with RFID.	Menu access: Select 45°C. Switch off unit. Hold SET. Switch on unit. Release SET. Select with SET setting.
		Unit is not equipped with RFID.	Menu access: Select 45°C. Switch off unit. Hold SET. Switch on unit. Release SET. Select with SET setting.

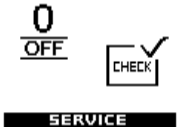
3.2.4 Flame sensor brightness value

	Display	Explanation	Note
45 °C		Flame sensor test. Brightness value display.	<471: light >=471: dark

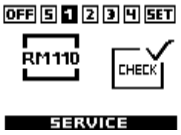
3.2.5 Testing the temperature sensor

	Display	Explanation	Note
50 °C		Temperature sensor test. Temperature display.	Less than 0°C is displayed as 0°C.

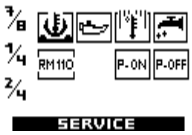
3.2.6 Testing the water temperature setting and program switch

	Display	Explanation	Note
55 °C		Initial image for temperature selector switch test	Use SET to access the temperature selector switch test
		You are in temperature selector switch test. The temperature selected at the temperature selector switch is displayed.	When you have finished with the temperature selector switch test you must select 55°C again. Use SET to access the master switch test.
		You are in master switch test. The switch setting is „Cold Water Operation“	
		You are in master switch test. The switch setting is „Hot Water ECO Operation“	
		You are in master switch test. The switch setting is „Hot Water and Steam Operation“	
		You are in master switch test. The switch setting is OFF.	This display appears very briefly only, as the unit is switched off at the same time.

3.2.7 Testing the Service switch

	Display	Explanation	Note
60 °C		selected scale inhibitor setting	

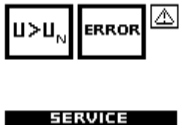
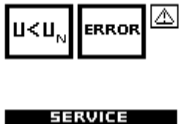
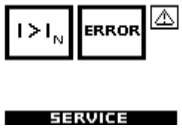
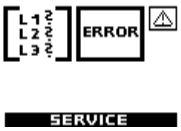
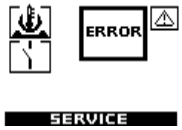
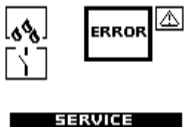
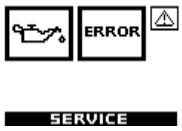
3.2.8 Testing the sensors

		Explanation	Note
65 °C		Description from left to right: Fuel sensor level (Level 7 of 8 levels) Motor thermal contact open Oil refill container is not empty Exhaust thermostat is open Low-water protection is open Cleaning agent 1 sensor level (Level 1 of 4 levels) Scale inhibitor tank empty ON pressure switch pressed OFF pressure switch pressed Cleaning agent 2 sensor level (Level 2 of 4 levels)	If there is a cable break in a level sensor, no level is displayed.
		Description from left to right: Fuel sensor level (Level 7 of 8 levels) Motor thermal contact closed Oil refill container empty Exhaust thermostat closed Low-water protection closed Cleaning agent 1 sensor level (Level 1 of 4 levels) Scale inhibitor tank full ON pressure switch not pressed OFF pressure switch not pressed Cleaning agent 2 sensor level (Level 2 of 4 levels)	If there is a cable break in a level sensor, no level is displayed at all.

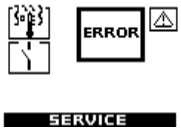
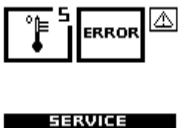
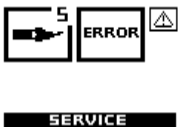
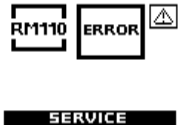
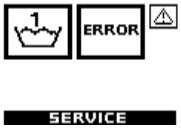
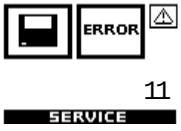
3.2.9 Fault memory

Note
Use SET to switch to the next fault.

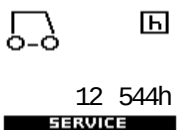
The fault memory can be deleted with switch OFF - hold SET - switch ON.

	Display	Explanation	Note
70 °C		Mains voltage too high	Check mains voltage
		Mains voltage too low	Check mains voltage
		Motor current too high	Motor sluggish or phase has failed Check mains connection
		Motor current is asymmetrical	Phase has failed Check mains connection
		Motor thermal contact open	Motor is overheated Motor is sluggish Check mains connection
		Dry running pump	Ensure water supply Check low-water protection
		Low-water protection sticks	Check low-water protection
		Oil refill container empty	Top up lubricating oil Check oil refill container float
		10 short start-ups have occurred due to leakage	Remove leak in the high-pressure system
	Continued on the next page ...		

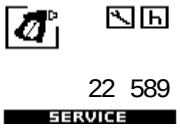
3.2.9 Fault memory

	Display	Explanation	Note
70 °C		Exhaust thermostat has tripped	Clear soot from boiler Check exhaust thermostat
		Cable break or short circuit in temperature sensor	Check temperature sensor
		Flame sensor did not detect a flame although the burner was switched on	Clean inspection glass Check fuel supply
		Flame sensor detected light, although the burner was off	External incident light at the flame sensor Scale in combustion chamber Solenoid valve does not close
		RFID read-write electronics are defective.	Check RFID read-write electronics, replace
		Cable break has occurred in fuel level sensor	Check fuel level sensor
		Cable break has occurred in cleaning agent 1 level sensor	Check RM1 level sensor
		Cable break has occurred in cleaning agent 2 level sensor	Check RM2 level sensor
		Software version 1.1	This is not a fault. Error appears for design reasons only because the display is in Error menu.

3.2.10 Operating hours

	Display	Explanation	Note
75 °C		„Control ON“ operating time	

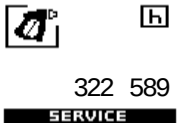
3.2.11 Handgun switchings since handgun service

	Display	Explanation	Note
80 °C		Number of handgun switchings since last maintenance (service)	

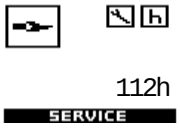
3.2.12 Handgun services

	Display	Explanation	Note
85 °C		Number of times handgun serviced	Count up maintenance: Switch off unit Hold SET switch ON Important: Fault memory is also deleted

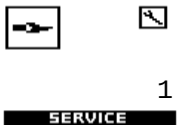
3.2.13 Handgun services since initial operation

	Display	Explanation	Note
90 °C		Total number of handgun switchings	

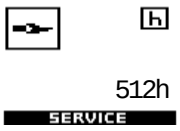
3.2.14 Operating time of the burner since the burner service

	Display	Explanation	Note
95 °C		Burner operating time since the last maintenance (service)	

3.2.15 Burner services

	Display	Explanation	Note
100 °C		Number of times burner serviced	Count up maintenance: Switch off unit Hold SET switch ON Important: Fault memory is also deleted

3.2.16 Burner operation since initial operation

	Display	Explanation	Note
112 °C		Total burner operating time	

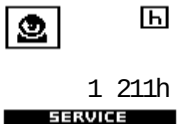
3.2.17 Operating time of the pump since the pump service

	Display	Explanation	Note
125 °C		Pump operating time since the last maintenance (service)	

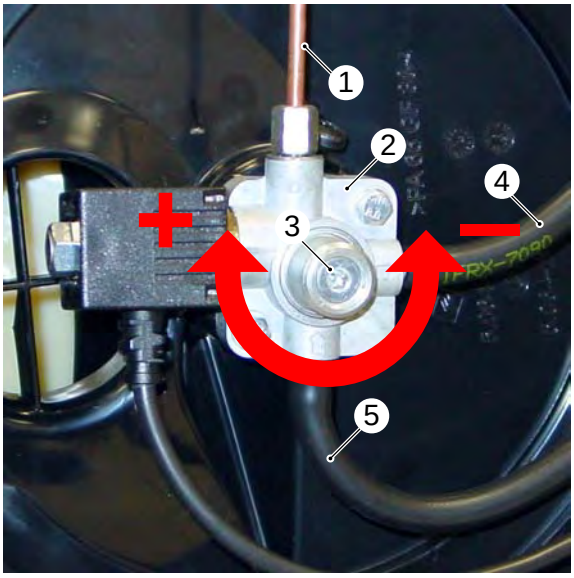
3.2.18 Pump services

	Display	Explanation	Note
140 °C		Number of times pump serviced	Count up maintenance: Switch off unit Hold SET switch ON Important: Fault memory is also deleted

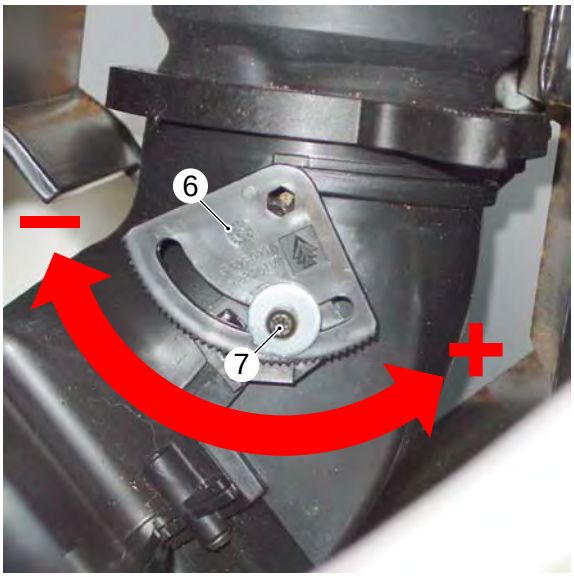
3.2.19 Pump operation since initial operation

	Display	Explanation	Note
155 °C		Total pump operating time	

3.3 Burner setting



Fuel pump, fuel pressure adjustment



Air flap, air volume adjustment

1 Pressure line to the burner
2 Fuel pump
3 Adjusting screw, fuel pressure
4 Suction hose, fuel
5 Return hose to the fuel tank
6 Air flap, air volume adjustment
7 Locking screw, air flap

Note:
Precise basic setting of the burner is only possible if the heating coil has been thoroughly cleaned of soot and the inner deposits have been removed beforehand.

Measuring the water temperature

– Install shut-off valve with thermometer (special tool) in the unit outlet.
– Switch on burner and bring unit with shut-off valve to operating pressure at full water volume.
– Let unit run in burner operation for approx. 5 minutes until the maximum water temperature is reached.
– Determine increase in water temperature (water outlet temperature minus water inlet temperature).
– For nominal value, see „Technical Specifications“
– Measure smoke number, CO_2 level and exhaust temperature (special measuring equipment tool).

Adjusting the fuel pressure

– Adjust fuel pressure (and water temperature) using adjusting screw (3) (see arrow).
– For nominal value, see „Technical Specifications“

Adjusting the smoke number

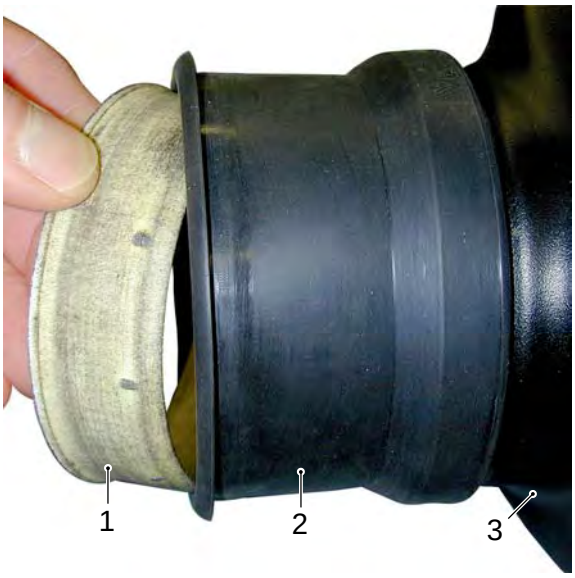
– If the smoke number is too high the air flap (6) must be opened further or the fuel pressure must be reduced.

Adjust CO_2 value

– Adjust CO_2 value by adjusting the air flap (see arrow). Open air flap, CO_2 level reduces.

Note:
After completing the basic setting, seal the fuel pump and air flap.

3.4 Installing the air circuit on the outer jacket



Insert clamping ring in the air circuit

Installed clamping ring with rubber collar locking lever

1 Clamping ring
2 Air circuit (rubber collar)
3 Outer jacket (continuous flow heater)
4 Locking lever, rubber collar

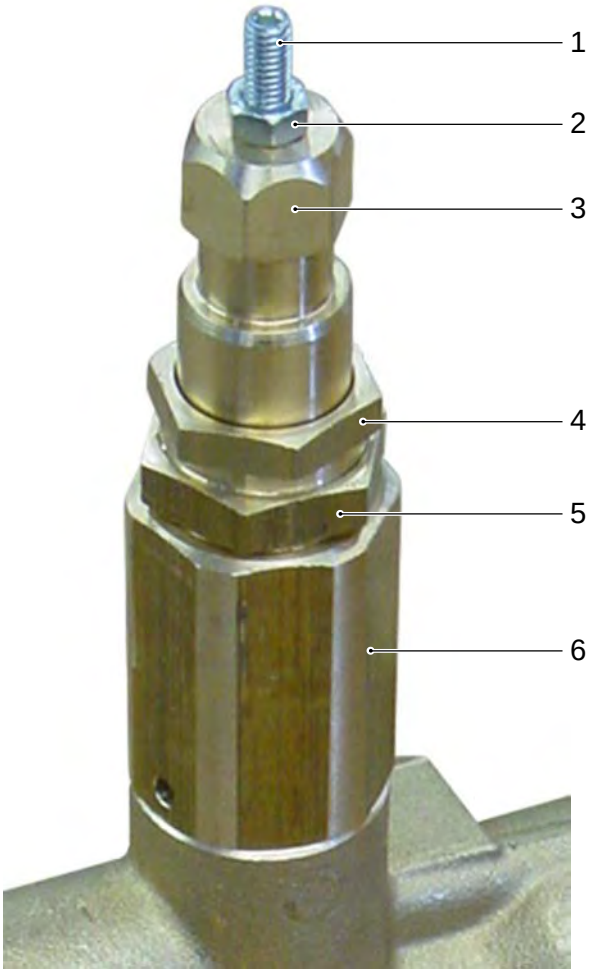
When installing the outer jacket (continuous flow heater) in the unit the air circuit (rubber collar) can fall off the outer jacket. This makes installation more difficult. An additional clamping ring will be introduced as an installation aid, probably from the summer 2008.

Please note:

– Clean air circuit and outer jacket in the installation area.
– Install air circuit, free of grease, on the outer jacket.
– Push clamping ring into the air circuit up to the perceptible stop, note the installation direction (Figure 1).
– If necessary, lightly coat the clamping ring with silicone grease before installation.
– Check air circuit for correct fit (Figure 2).

Note:
The clamping ring will be black in series production.

3.5 Adjusting the operating pressure using the rotary control on the handgun



1 Adjusting screw, high pressure
2 Lock nut, high pressure adjusting screw
3 Spindle, pressure and flow control valve
4 Adjusting screw, low pressure
5 Lock nut, low pressure adjusting screw
6 Housing, unloader valve

Adjusting the maximum operating pressure

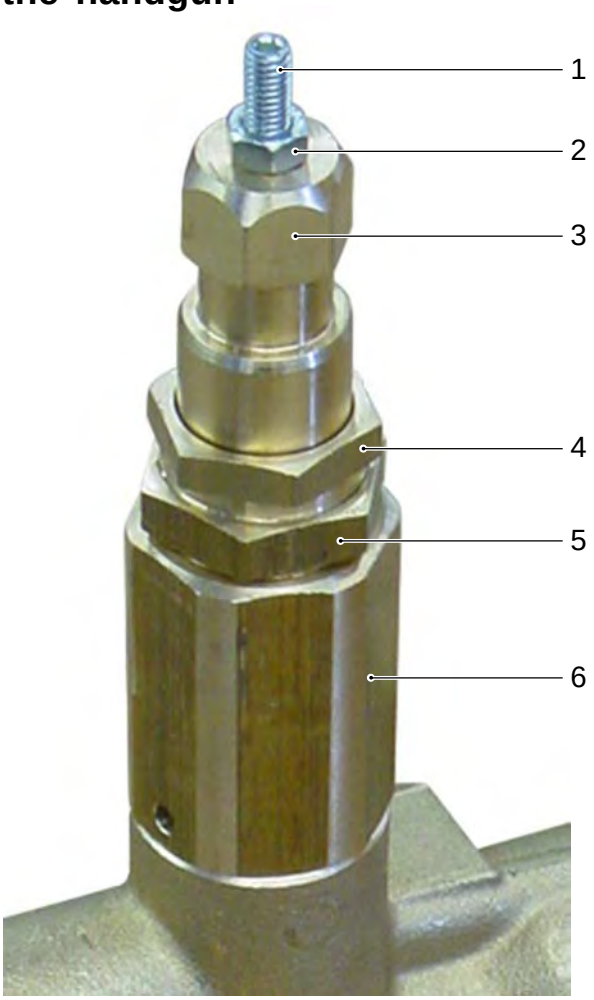
Note:
The opening pressure of the overflow valve is adjusted using the rotary control.

– Install test pressure gauge (special tool) at high-pressure connection. The high-pressure connection can be directly at the unit outlet or on the handgun in units with hose reel.
– Connect the high-pressure hose with handgun and rotary control to the test pressure gauge.
– Twist in the rotating handle of the pressure and flow control valve at the pump up to the limit stop („+“ direction).
– Turn rotary control to position for lowest pressure at the nozzle („-“ direction), open handgun and let unit run.
– Then pull off the rotating handle.
– Undo the lock nut (2) for high-pressure adjusting screw (1).
– Turn the high-pressure adjusting screw (1) so that the opening pressure from the overflow valve (see Technical Specifications, full load) at the test pressure gauge is reached.

Note:
Turn in clockwise direction to increase the pressure, turn in anti-clockwise direction to reduce the pressure.

– After adjusting, secure the high-pressure adjusting screw (1) with the lock nut (2). Re-check operating pressure, flow rate and switching points of the pressure switch.
– Finally, seal the high-pressure adjustment screw (1) and the lock nut (2) with locking compound.

3.5 Adjusting the operating pressure using the rotary control on the handgun



1 Adjusting screw, high pressure
2 Lock nut, high pressure adjusting screw
3 Spindle, pressure and flow control valve
4 Adjusting screw, low pressure
5 Lock nut, low pressure adjusting screw
6 Housing, unloader valve

Adjusting the minimum operating pressure

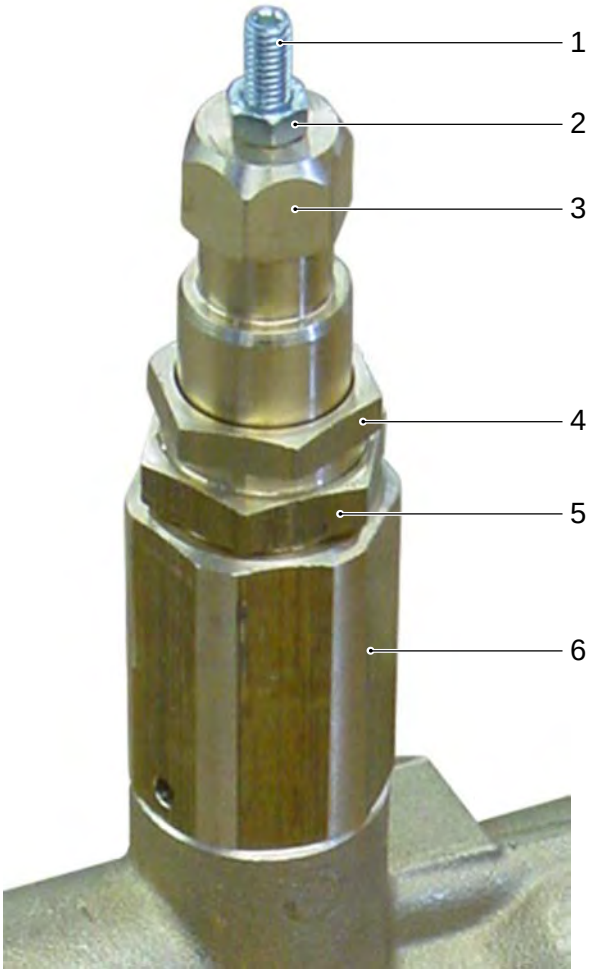
– Install test pressure gauge at high-pressure connection.
– Connect the high-pressure hose with handgun and rotary control to the test pressure gauge.
– Install the **new** high-pressure nozzle.
– Rotary control completely open (turn in „+“ direction), open handgun and let unit run.
– Unscrew the rotating handle of the pressure and flow control valve at the pump up to the limit stop („-“ direction).
– Then pull off the rotating handle.
– Loosen the lock nut (5).
– Twist the low-pressure adjusting screw (4) and spindle (3) **together** until the minimum operating pressure (see Technical Specifications, part load) is reached at the test pressure gauge.

Note:
Turn in clockwise direction to increase the pressure, turn in anti-clockwise direction to reduce the pressure.

– After adjusting, secure the low-pressure adjusting screw (4) with the lock nut (5). Re-check operating pressure, flow rate and switching points of the pressure switch.
– Finally, seal the low-pressure adjustment screw (4) and the lock nut (5) with locking compound.

Note:
At minimum pressure and flow setting and if using the steam nozzle supplied, the pressure may not exceed 32 bar.

3.6 Adjusting the operating pressure using standard handgun without rotarv control



1 Adjusting screw, high pressure
2 Lock nut, high pressure adjusting screw
3 Spindle, pressure and flow control valve
4 Adjusting screw, low pressure
5 Lock nut, low pressure adjusting screw
6 Housing, unloader valve

Adjusting the maximum operating pressure

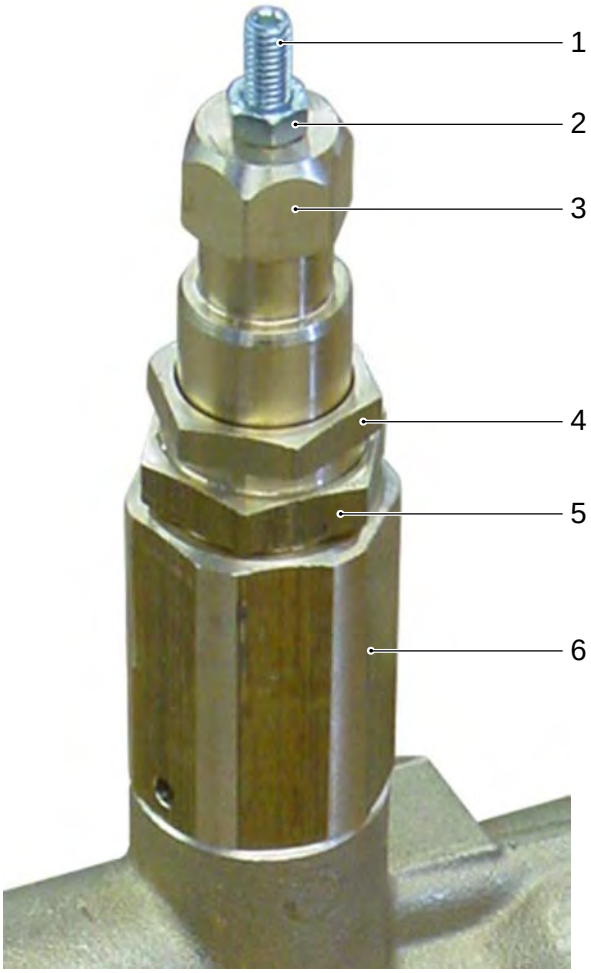
Note:
The maximum operating pressure is set using the standard handgun without rotary control.

– Install test pressure gauge at high-pressure connection. The high-pressure connection can be directly at the unit outlet or on the handgun in units with hose reel.
– Connect the high-pressure hose with standard handgun at the test pressure gauge.
– Install the **new** high-pressure nozzle.
– Open standard handgun and let the unit run.
– Twist in the rotating handle of the pressure and flow control valve at the pump up to the limit stop („+“ direction).
– Then pull off the rotating handle.
– Undo the lock nut (2) for high-pressure adjusting screw (1).
– Turn the high-pressure adjusting screw (1) so that the opening pressure from the overflow valve (see Technical Specifications, full load) at the test pressure gauge is reached.

Note:
Turn in clockwise direction to increase the pressure, turn in anti-clockwise direction to reduce the pressure.

– After adjusting the high-pressure adjusting screw (1) secure with the lock nut (2). Re-check operating pressure, flow rate and switching points of the pressure switch.
– Finally, seal the high-pressure adjustment screw (1) and the lock nut (2) with locking compound.

3.6 Adjusting the operating pressure using standard handgun without rotarv control



Adjusting the minimum operating pressure

– Install test pressure gauge at high-pressure connection.

– Connect the high-pressure hose with standard handgun at the test pressure gauge.

– Install the **new** high-pressure nozzle.

– Open standard handgun and let the unit run.

– Unscrew the rotating handle of the pressure and flow control valve at the pump up to the limit stop („-“ direction).

– Then pull off the rotating handle.

– Loosen the lock nut (5).

– Twist the low-pressure adjusting screw (4) and spindle (3) **together** until the minimum operating pressure (see Technical Specifications, part load) is reached at the test pressure gauge.

Note:
Turn in clockwise direction to increase the pressure, turn in anti-clockwise direction to reduce the pressure.

– After adjusting, secure the low-pressure adjusting screw (4) with the lock nut (5). Re-check operating pressure, flow rate and switching points of the pressure switch.

– Finally, seal the low-pressure adjustment screw (4) and the lock nut (5) with locking compound.

Note:
At minimum pressure and flow setting and if using the steam nozzle supplied, the pressure may not exceed 32 bar.

1 Adjusting screw, high pressure
2 Lock nut, high pressure adjusting screw
3 Spindle, pressure and flow control valve
4 Adjusting screw, low pressure
5 Lock nut, low pressure adjusting screw
6 Housing, unloader valve

3.7 Removing the hose reel

Hose reel, bolt-on half-shell

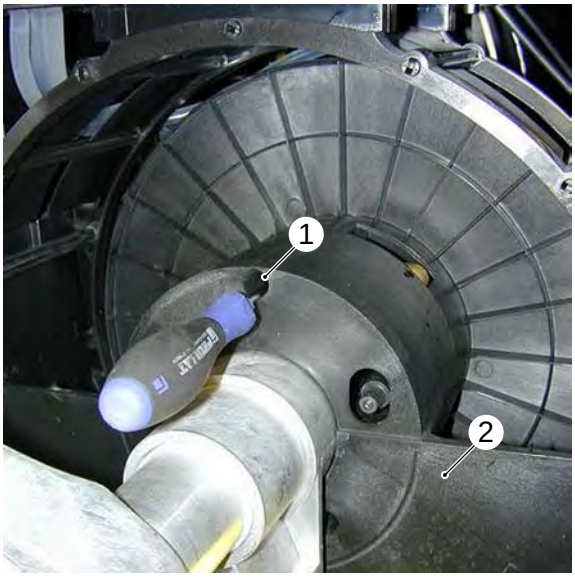
Remove retaining clip, high-pressure hose

1 Bolt-on half-shell, hose reel
2 Retaining screws, half-shell
3 Retaining clip, high-pressure hose

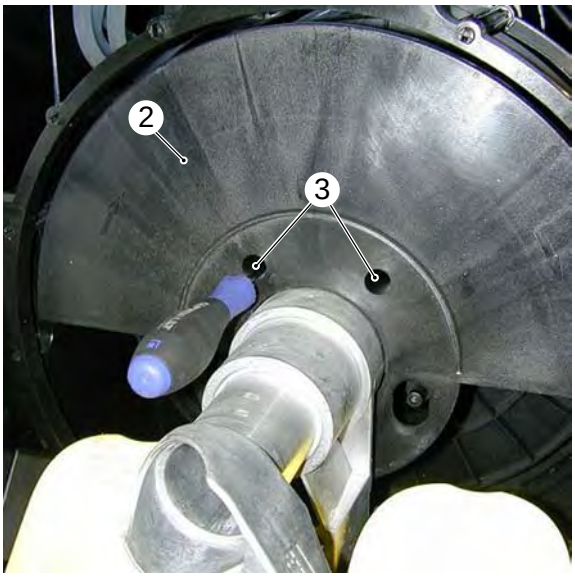
3.7.1 Replacing the high-pressure hose

– Switch off unit and release pressure.
– Completely unwind hose from the hose reel.
– Turn the hose reel until the bolted-on half-shell (1) points upwards. Remove both screws (2) and remove loosened half-shell (1).
– Lever out the retaining clip for the high-pressure hose (3) and pull out the hose.
– Insert new hose through the hose guide provided and the deflection pulley on the underside of the unit.
– Completely push the hose nipple into the connection piece of the hose reel and secure with retaining clip (3).
– Re-install the bolt-on half-shell.

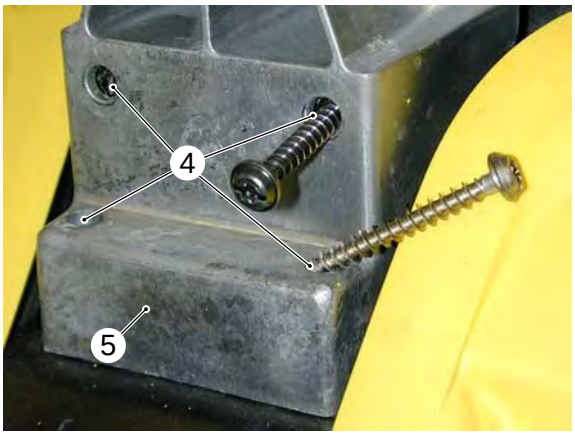
3.7 Removing the hose reel



Hose reel, concealed screw



Hose reel, concealed screws



Bearing block, hose reel

3.7.2 Replacing the rotating union seal

– Remove bolt-on half-shell and high-pressure hose (see Chapter 3.7.1).

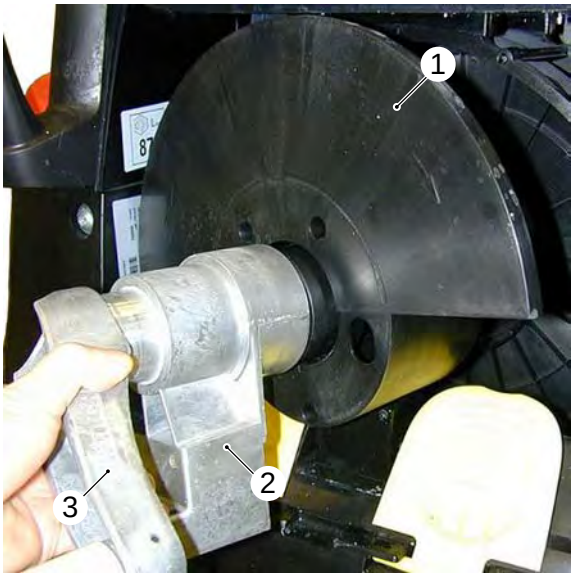
– Remove countersunk screw (1).

– Turn hose reel (2) until the half-shell points upwards and remove another two countersunk screws (3).

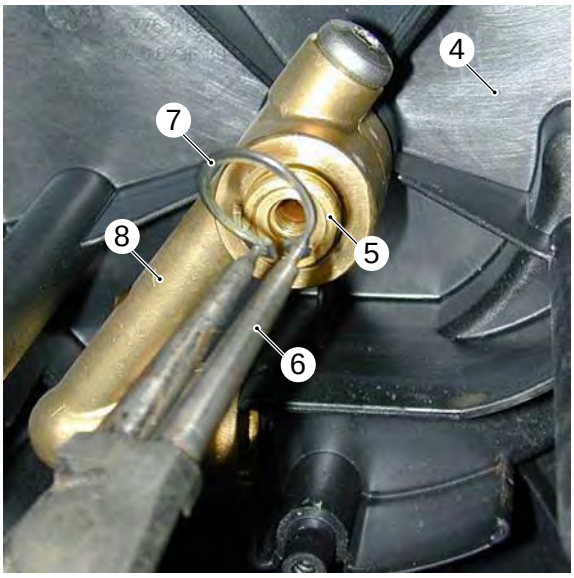
– Remove four screws (4) (2 x long and 2 x short) on the front bearing block (5).

1 Countersunk screw
2 Half-shell, hose reel
3 Countersunk screws (2x)
4 Retaining screws, bearing block
5 Bearing block, hose reel

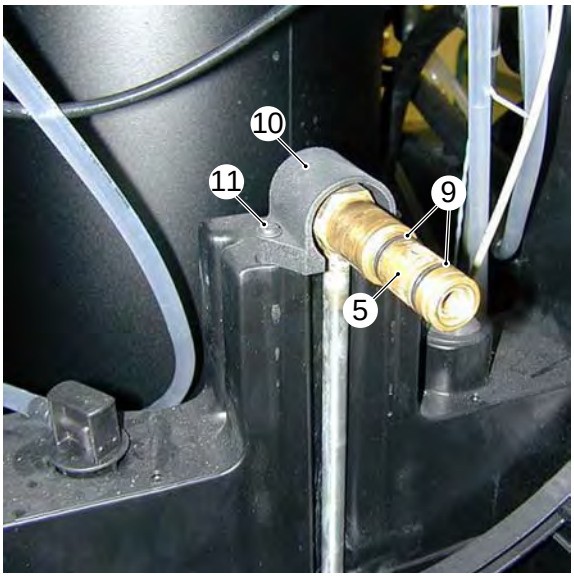
3.7 Removing the hose reel



Remove hose reel with bearing block



Circlip, rear hose reel section



Seals, hose reel axle

3.7.2 Replacing the rotating union seal (continued)

– Remove half-shell (1) with bearing block (2) and crank (3).

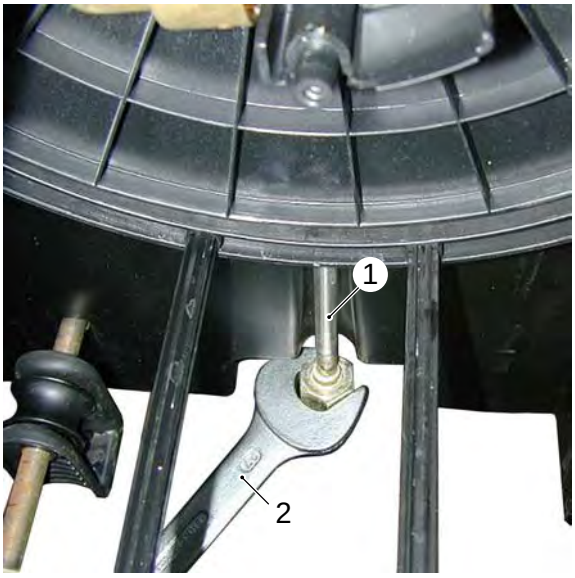
– Use pliers (6) to remove circlip (7) from the axle (5).

– Remove rear part of the hose reel (4).

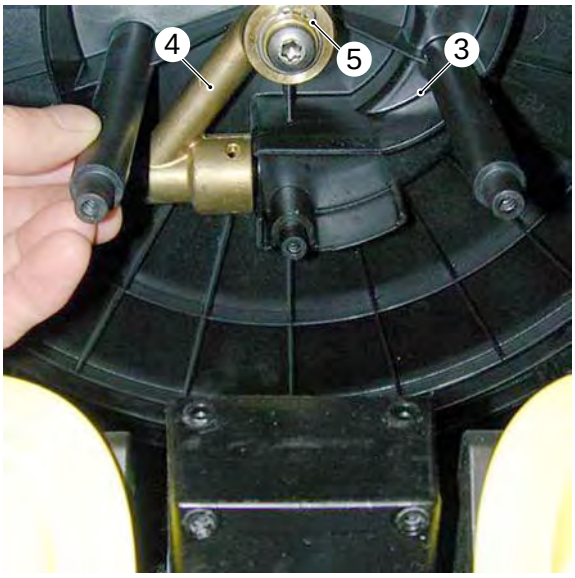
– Renew seals (9) and grease with PFAE grease (6.288-088). Check axle (5) and connection piece (8) for traces of wear in the area of the seals.

1 Half-shell, hose reel
2 Bearing block, hose reel
3 Crank
4 Hose reel, rear shell
5 Axle, hose reel
6 Pliers, circlip
7 Circlip
8 Connection piece
9 Seal, hose reel (2x)
10 Rear bearing block, hose reel
11 Retaining screw, rear bearing block (2x)

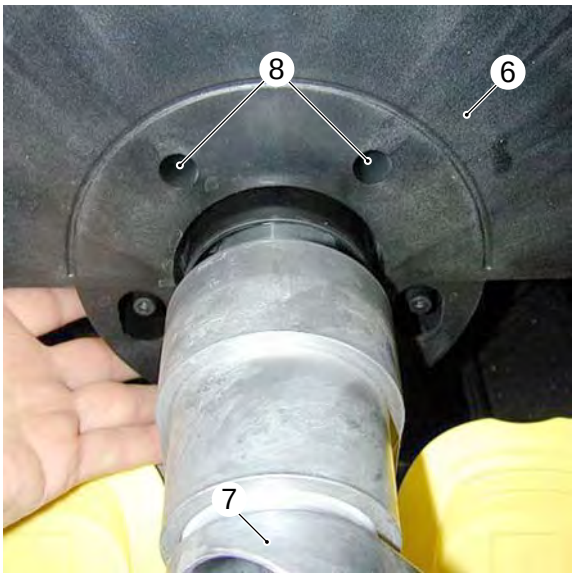
3.7 Removing the hose reel



Undo high-pressure line



Rear hose reel shell



Concealed screws in front half-shell

3.7.2 Replacing the rotating union seal (continued)

– **Only if necessary:** Undo the high-pressure line (1) using open-end spanner (SW 27) and remove the two screws in the rear bearing block (see page 101 Item 10 and 11).

– Re-install the hose reel. Push rear hose reel shell (3) onto axle, insert connection piece (4) and install circlip (5). Move hose reel into the displayed position.

– Insert front hose reel half-shell (6) with crank (7) and ensure it is correctly positioned.

– Install the two countersunk screws (8).

– Turn hose reel (6) through 180° and install another countersunk screw (see page 100, Item 1).

– Install front bearing block with four screws.

– Insert new hose through the hose guide provided and the deflection pulley on the underside of the unit.

– Completely push the hose nipple into the connection piece of the hose reel and secure with clip (see page 99, Item 3).

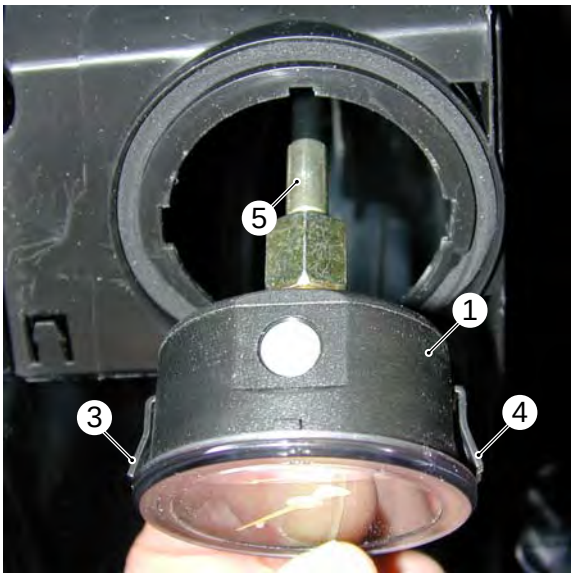
– Re-install the second half-shell (see page 99, Item 1).

1 High-pressure line to the connection piece
2 Open-ended spanner (SW 27)
3 Hose reel, rear shell
4 Connection piece
5 Axle, hose reel
6 Half-shell, hose reel
7 Crank

3.8 Removing the pressure gauge

Push in left-hand retaining clip by hand.

Push in right-hand retaining clip with screwdriver.



Remove pressure gauge.

Removing the pressure gauge

– Remove control panel retaining screws and open control panel.

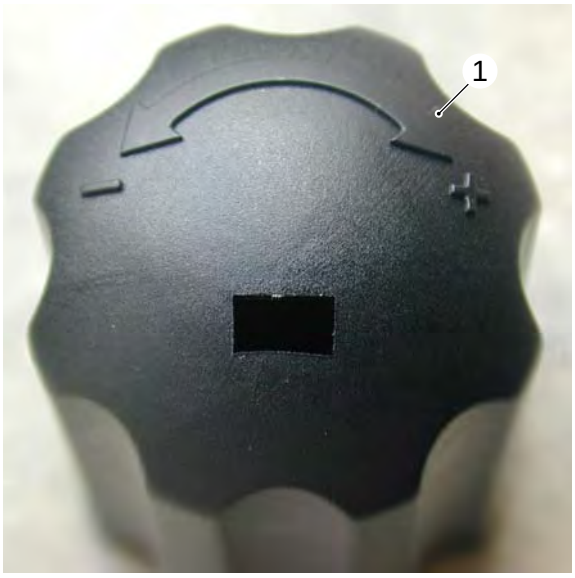
– Push in the left-hand retaining clip (3) behind the pressure gauge (1) by hand.

– Push in the right-hand retaining clip (4) with a screwdriver (2) and remove the pressure gauge (1).

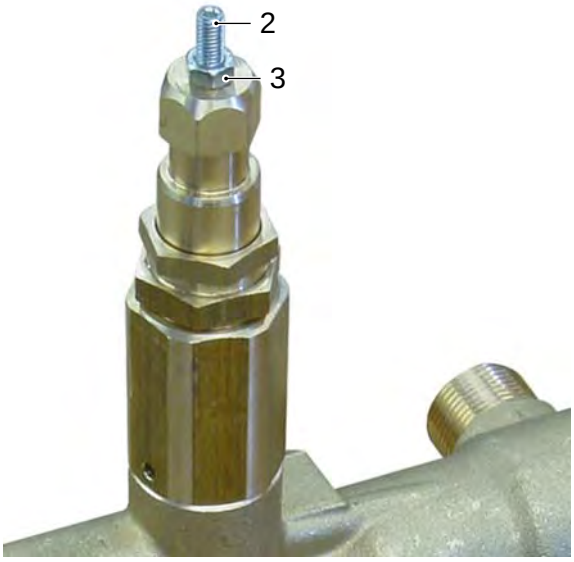
– If necessary, undo the pressure gauge hose (5).

1 Pressure gauge
2 Screwdriver
3 Retaining clip, LH
4 Retaining clip, RH
5 Pressure gauge hose

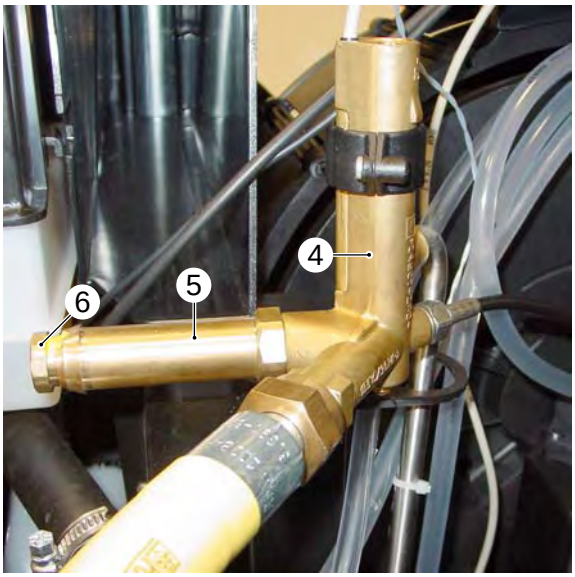
3.9 Adjusting the safety valve



Rotating handle of the pressure and flow control valve



Pressure and flow control valve



Safety block

Adjusting the safety valve

– Twist in the rotating handle (1) of the pressure and flow control valve at the pump up to the limit stop („+“ direction).

– Pull off the rotating handle (1) from above.

– Undo the lock nut (3) for high-pressure adjusting screw (2).

– Twist in threaded stud up to the limit stop. This blocks the overflow valve.

– Install shut-off valve with thermometer and pressure gauge (special tool) at the high-pressure connection and switch on the unit. The high-pressure connection can be directly at the unit outlet or on the handgun in units with hose reel.

– Slowly turn the shut-off valve until it is shut and watch the pressure gauge to check the pressure at which water drips out of the outlet of the safety valve (5). Should be: 20 bar above max. operating pressure, see Technical Specifications.

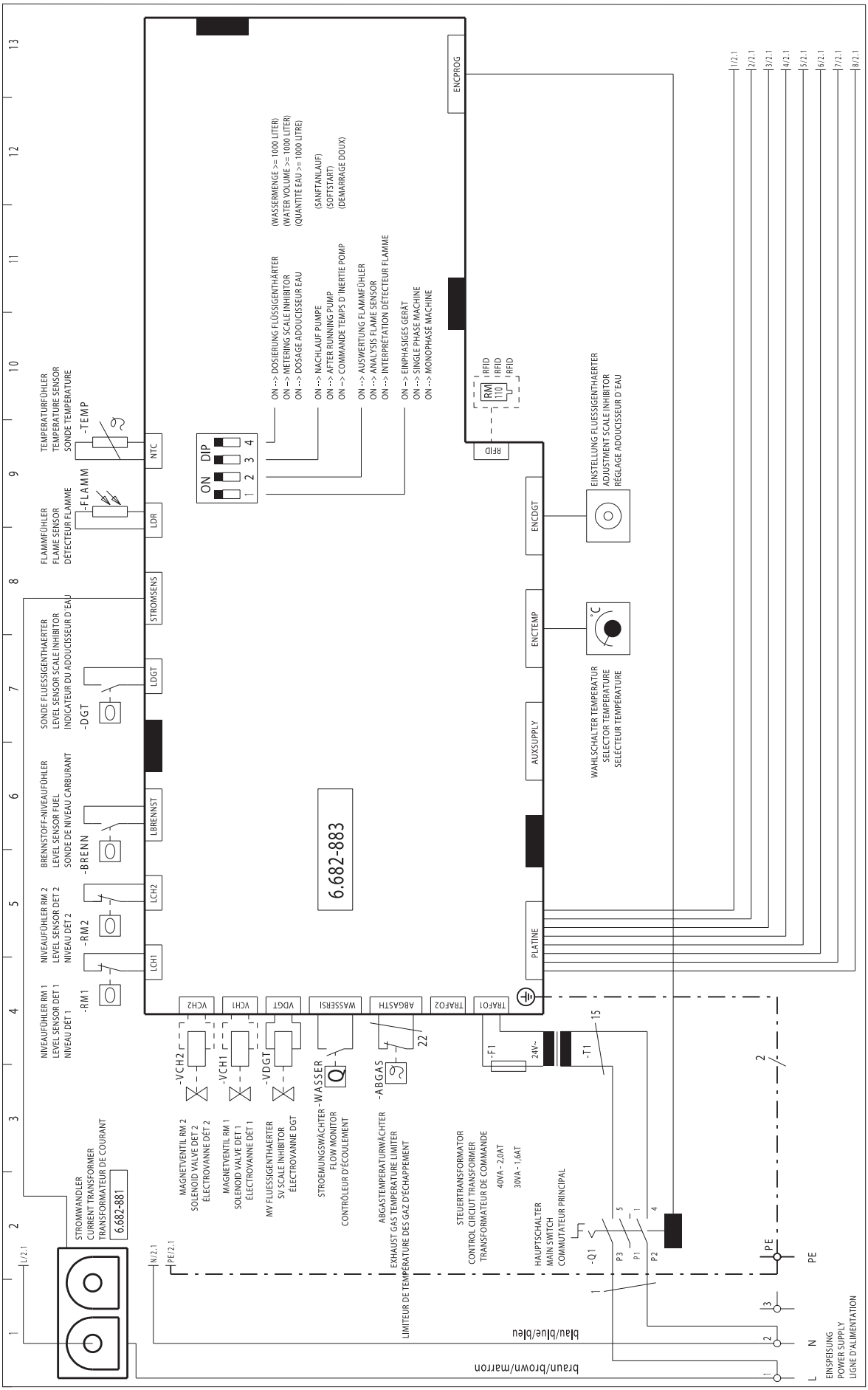
– If the pressure is too high, turn the adjusting screw (6) at the safety valve (5) to the left (relax compression spring).

– If the pressure is too low, turn the adjusting screw (6) to the right (tighten compression spring), until the correct opening pressure is reached, see Technical Specifications.

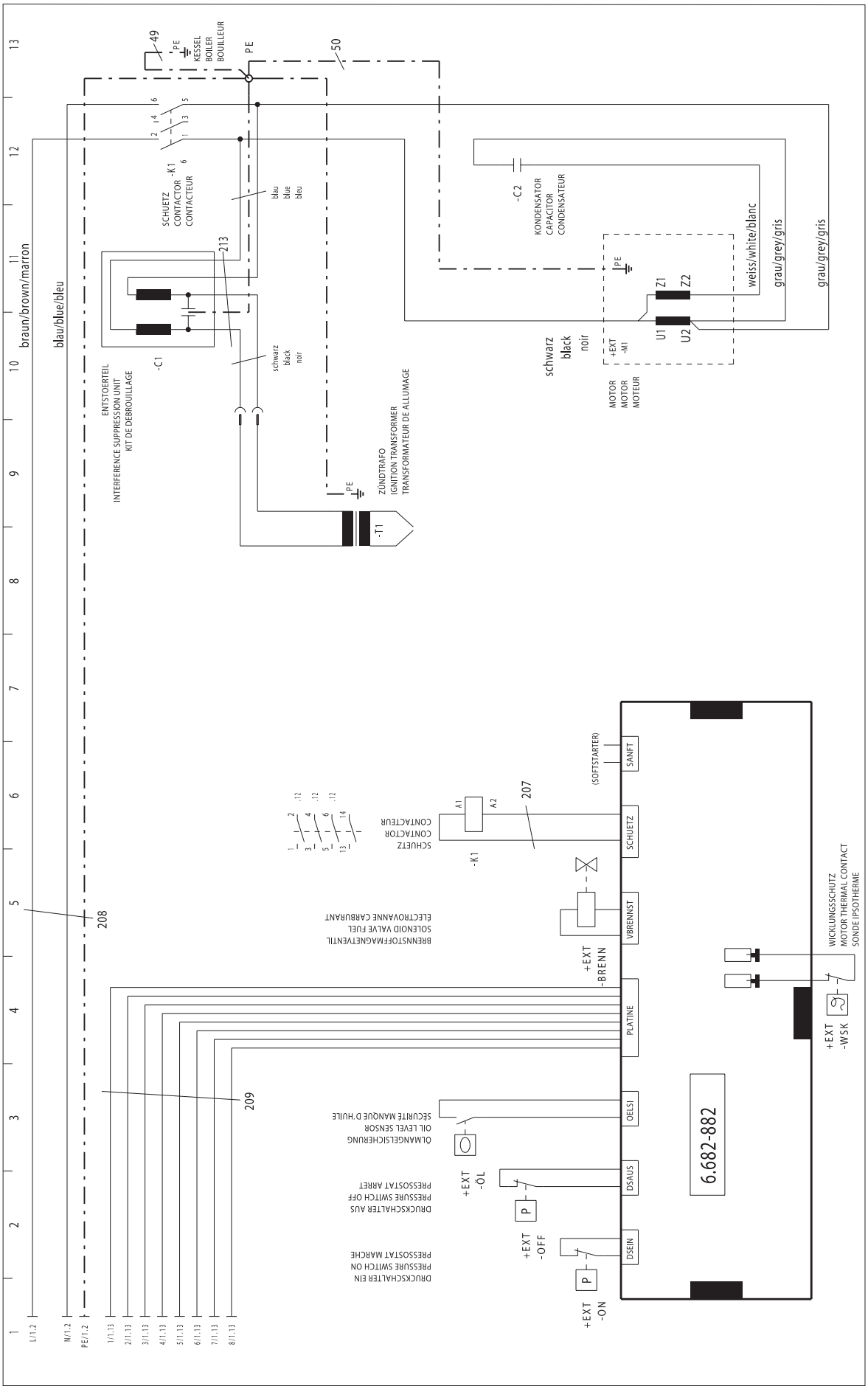
– Then seal the adjusting screw and reset the pressure and flow control valve, see 3.5 and 3.6.

1 Rotating handle
2 Adjusting screw, high pressure
3 Lock nut, high pressure adjusting screw
4 Safety block
5 Safety valve
6 Adjusting screw, safety valve

4.1 Circuit diagram – 0.088-021 (HDS 7/12)



4.1 Circuit diagram – 0.088-021 (HDS 7/12)

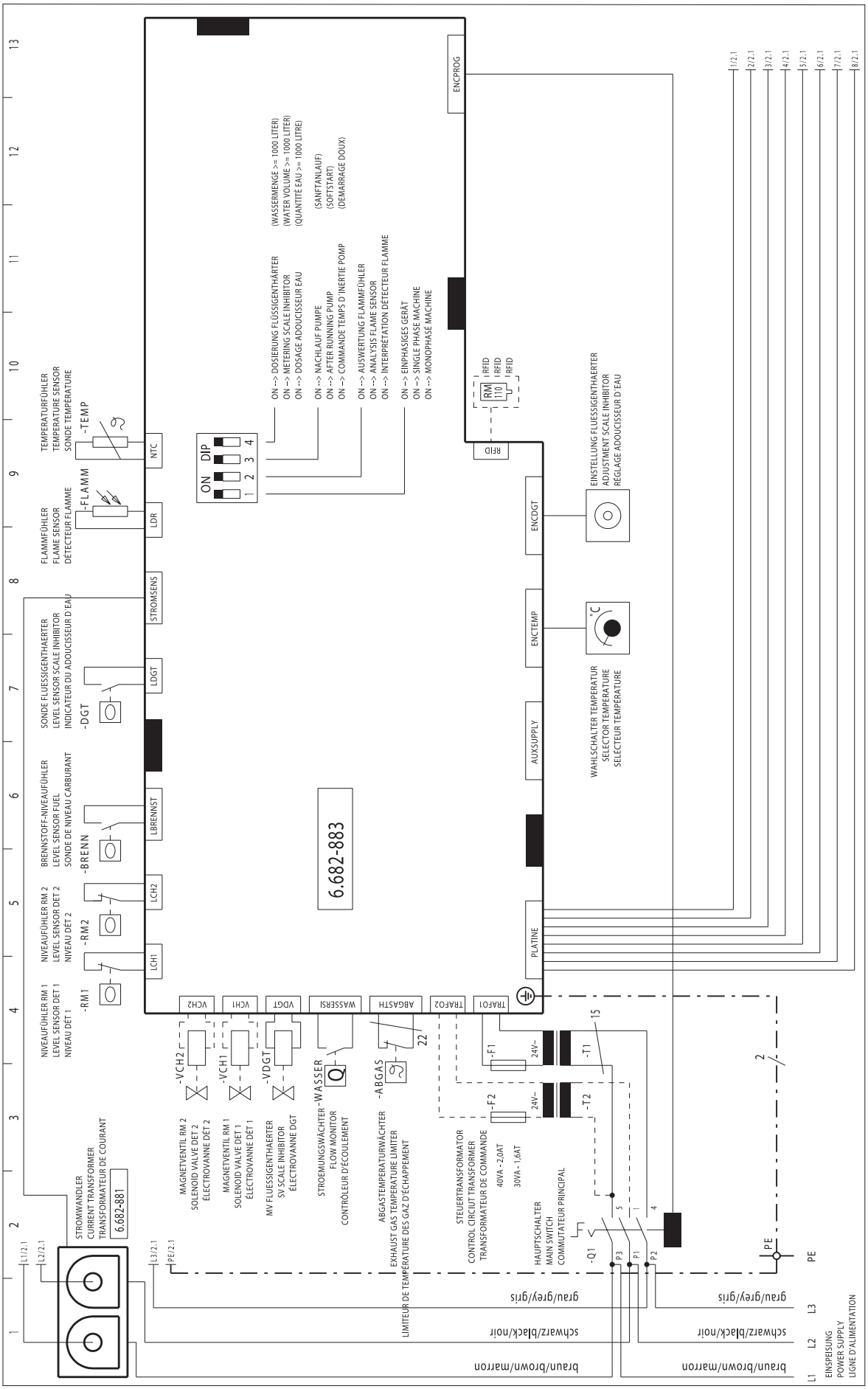


4.1 Circuit diagram – 0.088-021 (HDS 7/12)

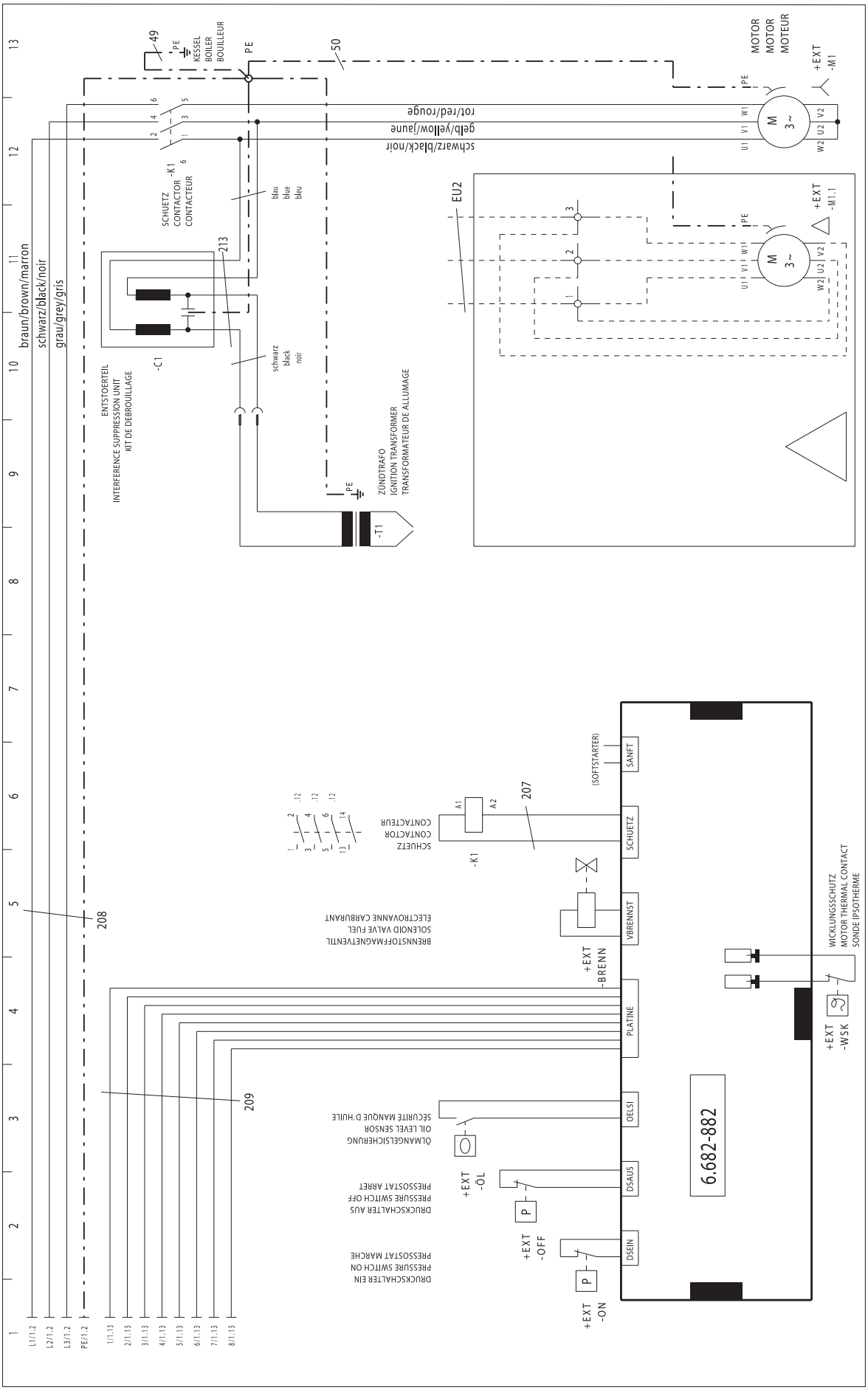
POS.	Ort	Beschreibung	Teilenummer	Kabelquer-schnitt (mm²)	Kabellänge (mm²)	Kabelfarbe	Bearbeitung Kabel Anfang	Bearbeitung Kabel Ende	Anschluss Kabel Anfang	Anschluss Kabel Ende
3.1	+HS	Anschluss Hauptschalter	4.822-508 4.822-508	1x 1,5 mm² 1x 1,5 mm²	420 mm 420 mm	schwarz schwarz	Aderendhülse 11mm Aderendhülse 11mm	Flachstecker 6,3mm Flachstecker 6,3mm	Einspeisung Klemme 1 Einspeisung Klemme 2	Hauptschalter Q1 / 1 Hauptschalter Q1 / 4
3. 22	+HS	Abgasthermostat	6.649-383	2x 0,35 mm²	700 mm	rot	RAST-Stecker	Flachstecker 6,3mm	Elektronik 6.682-883	Abgasthermostat
3. 15	+HS	Steuertrafo 1	siehe Stückliste	———	———	schwarz schwarz braun braun	Steuertrafo 1 Steuertrafo 1 Steuertrafo 1 Steuertrafo 1	Flachstecker 6,3mm Flachstecker 6,3mm RAST-Stecker RAST-Stecker	Steuertrafo 1 Steuertrafo 1 Steuertrafo 1 Steuertrafo 1	Hauptschalter Q1 / P1 Hauptschalter Q1 / P2 Elektronik 6.682-883 (Trafo 1) Elektronik 6.682-883 (Trafo 1)
3. 2	+HS	PE-Elektronik	4.822-510	1x 1,5 mm²	320 mm	grün/gelb (PE)	Flachstecker 6,3mm	Flachstecker 6,3mm	Einspeisung PE-Verteiler	Elektronik 6.682-883 (PE-Anschluss)

POS.	Ort	PE-Kessel	Teilenummer	Kabelquer-schnitt (mm²)	Kabellänge (mm²)	Kabelfarbe	Flachstecker 6,3mm	Kabelschuh M5	Einspeisung PE-Verteiler	Kessel
1. 49	+HS	PE-Kessel	4.821-099	1x 1,5 mm²	1600 mm	grün/gelb (PE)	Flachstecker 6,3mm	Aderendhülse 11mm	Einspeisung Klemme 1	Schütz K1 / Klemme 2
1. 208	+Front	Verbindungsleitung E-Schränke (Laststromkreis)	6.649-388	3x 1,5 mm²	1770 mm	braun blau grün/gelb (PE)	Aderendhülse 11mm Aderendhülse 11mm Flachstecker 6,3mm	Aderendhülse 11mm Aderendhülse 11mm Flachstecker 6,3mm	Einspeisung Klemme 2 Einspeisung PE-Verteiler braun durch Stromwandler!	Schütz K1 / Klemme 6 PE-Verteiler
1. 209	+Front	Verbindungsleitung E-Schränke (Steuerstromkreis)	6.649-341	8x 0,35 mm²	1570 mm	———	RAST-Stecker	RAST-Stecker	Elektronik 6.682-883	Verteilerplatine 6.682-882
									Schütz K1 / Klemme 5	Kondensator C2
1. 207	+Front	Schützspule	6.649-384	2x 0,35 mm²	350 mm	rot	RAST-Stecker	Aderendhülse 8,5mm	Verteilerplatine 6.682-882	Schütz K1 / Klemme A1 + A2
1. 50	+Front	PE-Motor	4.822-512	1x 1,5 mm²	150 mm	grün/gelb (PE)	Flachstecker 6.3mm	Kabelschuh M4	PE-Verteiler	Motor
1. 213	+Front	Entstörteil	6.661-286	———	———	schwarz schwarz blau blau grün/gelb (PE)	Entstörteil Entstörteil Entstörteil Entstörteil Entstörteil	Flachstecker 6,3mm Flachstecker 6,3mm Aderendhülse 11mm Aderendhülse 11mm Flachstecker 6,3mm	Entstörteil Entstörteil Entstörteil Entstörteil Entstörteil	Zündtrafo Zündtrafo Schütz K1 / Klemme 22 Schütz K1 / Klemme 14 PE-Verteiler

4.2 Circuit diagram – 0.088-025 (HDS 8/17, HDS 9/18)



4.2 Circuit diagram – 0.088-025 (HDS 8/17, HDS 9/18)

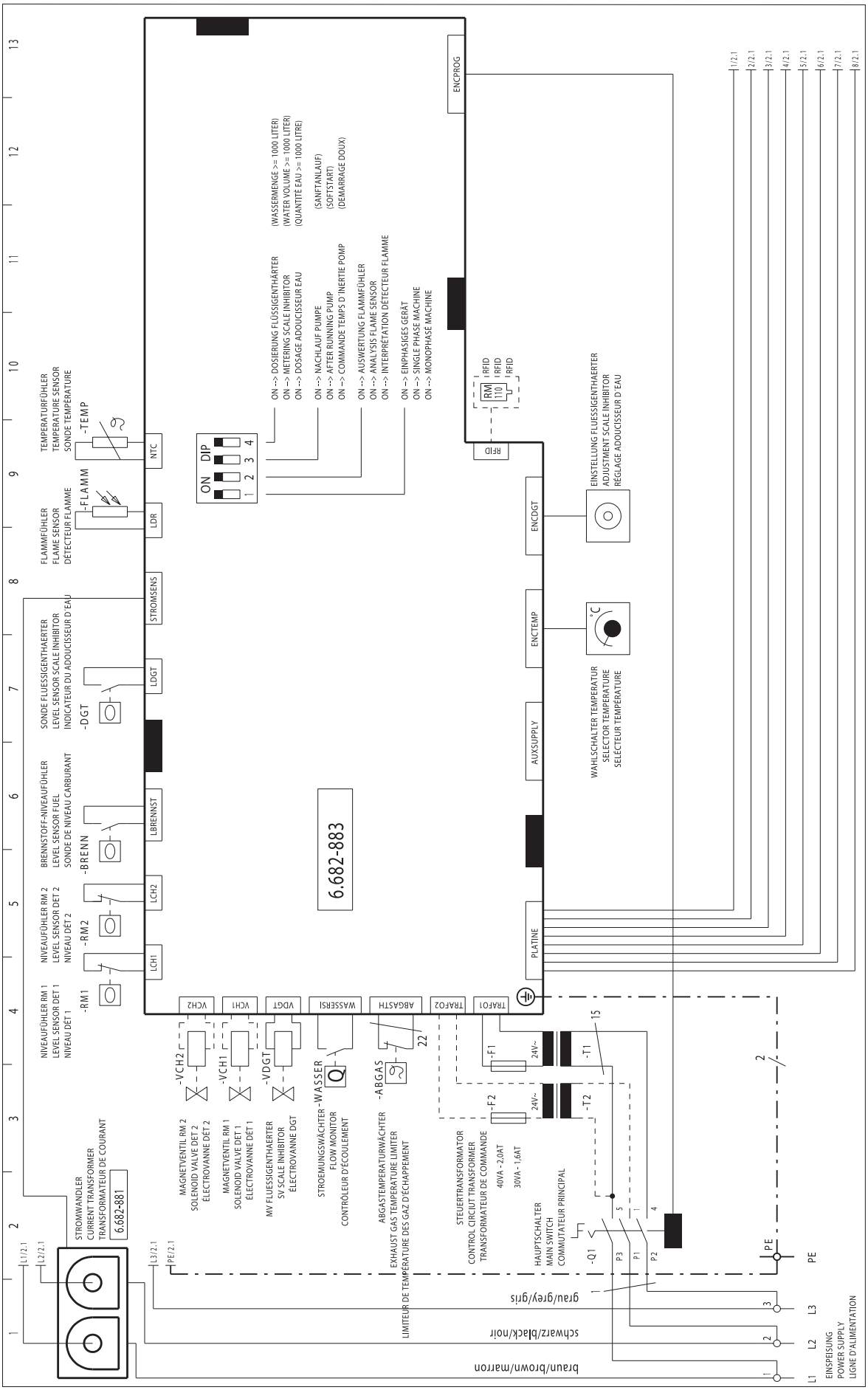


4.2 Circuit diagram – 0.088-025 (HDS 8/17, HDS 9/18)

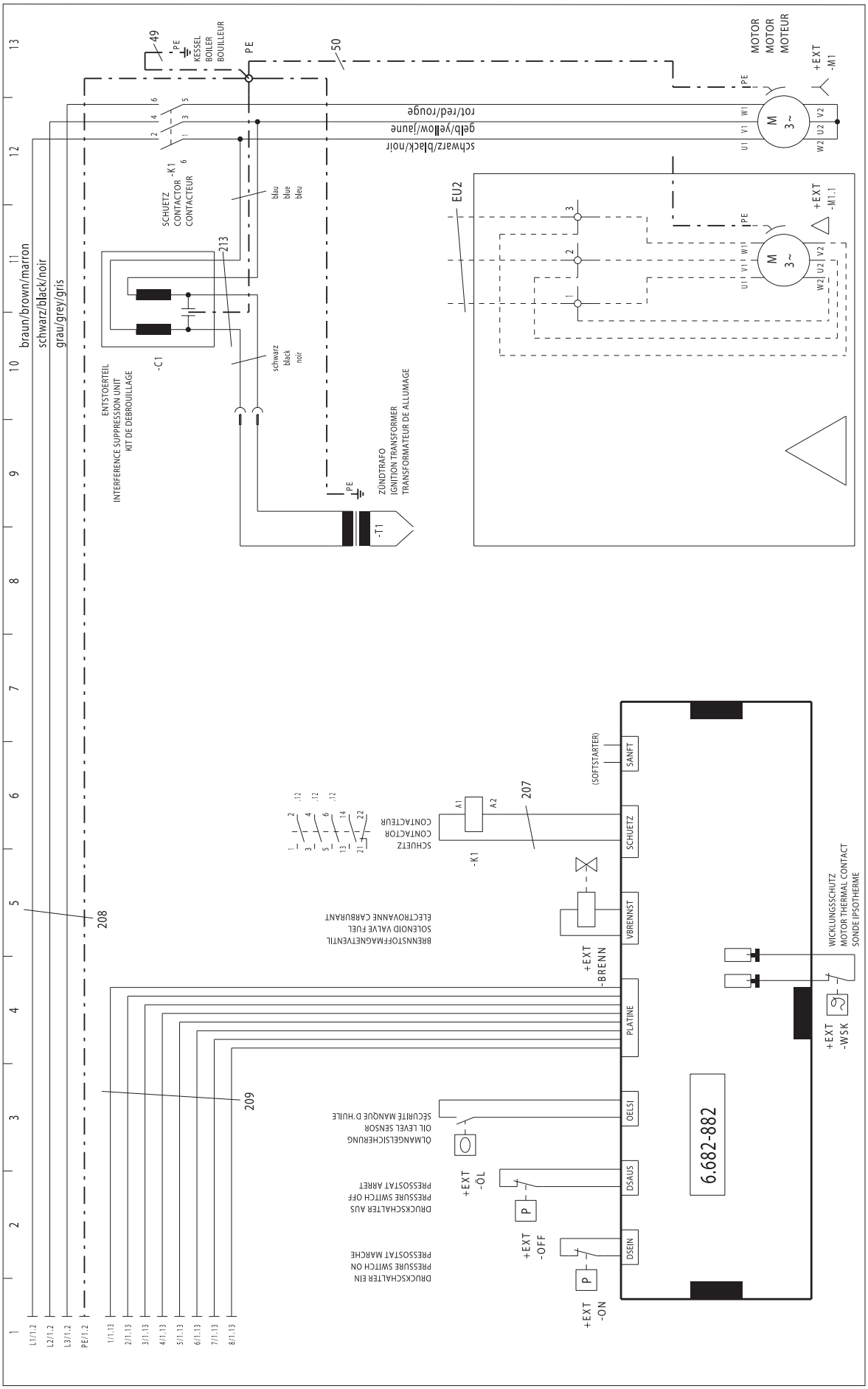
POS.	Ort	Beschreibung	Teilenummer	Kabelquer-schnitt (mm²)	Kabellänge (mm²)	Kabelfarbe	Bearbeitung Kabel Anfang	Bearbeitung Kabel Ende	Anschluss Kabel Anfang	Anschluss Kabel Ende
3. 22	+HS	Abgasthermostat	6.649-383	2x 0,35 mm²	700 mm	rot	RAST-Stecker	Flachstecker 6,3mm	Elektronik 6.682-883	Abgasthermostat
3. 15	+HS	Steuertrafo 1	siehe Stückliste	———	———	schwarz	Steuertrafo 1	Flachstecker 6,3mm	Steuertrafo 1	Hauptschalter Q1 / P1
						schwarz	Steuertrafo 1	Flachstecker 6,3mm	Steuertrafo 1	Hauptschalter Q1 / P2
						braun	Steuertrafo 1	RAST-Stecker	Steuertrafo 1	Elektronik 6.682-883 (Trafo 1)
						braun	Steuertrafo 1	RAST-Stecker	Steuertrafo 1	Elektronik 6.682-883 (Trafo 1)
siehe Stückliste (Option)	+HS	Steuertrafo 2	siehe Stückliste	———	———	schwarz	Steuertrafo 2	Flachstecker 6,3mm	Steuertrafo 2	Hauptschalter Q1 / P1
						schwarz	Steuertrafo 2	Flachstecker 6,3mm	Steuertrafo 2	Hauptschalter Q1 / P3
						braun	Steuertrafo 2	RAST-Stecker	Steuertrafo 2	Elektronik 6.682-883 (Trafo 2)
						braun	Steuertrafo 2	RAST-Stecker	Steuertrafo 2	Elektronik 6.682-883 (Trafo 2)
3. 2	+HS	PE-Elektronik	4.822-510	1x 1,5 mm²	320 mm	grün/gelb (PE)	Flachstecker 6,3mm	Flachstecker 6,3mm	Einspeisung PE-Verteiler	Elektronik 6.682-883 (PE-Anschluss)

POS.	Ort	Beschreibung	Teilenummer	Kabelquer-schnitt (mm²)	Kabellänge (mm²)	Kabelfarbe	Bearbeitung Kabel Anfang	Kabelschuh M5	Einspeisung PE-Verteiler	Kessel
1. 49	+HS	PE-Kessel	4.821-099	1x 1,5 mm²	1600 mm	grün/gelb (PE)	Flachstecker 6,3mm	Kabelschuh M5	Einspeisung PE-Verteiler	Kessel
1. 208	+Front	Verbindungsleitung E-Schränke (Laststromkreis)	6.649-462	4x 1,5 mm²	2010 mm	braun	Flachstecker 6,3mm	Aderendhülse 11mm	Hauptschalter Q1 / 5	Schütz K1 / Klemme 2
						schwarz	Flachstecker 6,3mm	Aderendhülse 11mm	Hauptschalter Q1 / 1	Schütz K1 / Klemme 4
						grau	Flachstecker 6,3mm	Aderendhülse 11mm	Hauptschalter Q1 / 4	Schütz K1 / Klemme 6
						grün/gelb (PE)	Flachstecker 6,3mm	Flachstecker 6,3mm	Einspeisung PE-Verteiler braun/schwarz durch Stromwandler!	PE-Verteiler
1. 209	+Front	Verbindungsleitung E-Schränke (Steuerstromkreis)	6.649-341	8x 0,35 mm²	1570 mm	———	RAST-Stecker	RAST-Stecker	Elektronik 6.682-883	Verteilerplatine 6.682-882
nur bei EU2	+Front	Verbindungsleitung Schütz - Klemme bei DREIECK (EU2)	4.822-509	1x 2,5 mm²	300 mm	schwarz	Aderendhülse 11mm	Aderendhülse 11mm	Schütz K1 / Klemme 1	Klemme 1
			4.822-509	1x 2,5 mm²	300 mm	schwarz	Aderendhülse 11mm	Aderendhülse 11mm	Schütz K1 / Klemme 3	Klemme 2
			4.822-509	1x 2,5 mm²	300 mm	schwarz	Aderendhülse 11mm	Aderendhülse 11mm	Schütz K1 / Klemme 5	Klemme 3
1. 207	+Front	Schützspule	6.649-384	2x 0,35 mm²	350 mm	rot	RAST-Stecker	Aderendhülse 8,5mm	Verteilerplatine 6.682-882	Schütz K1 / Klemme A1 + A2
1. 50	+Front	PE-Motor	4.822-512	1x 1,5 mm²	150 mm	grün/gelb (PE)	Flachstecker 6,3mm	Kabelschuh M4	PE-Verteiler	Motor
1. 213	+Front	Entstörteil	6.661-283	———	———	schwarz	Entstörteil	Flachstecker 6,3mm	Entstörteil	Zündtrafo
						schwarz	Entstörteil	Flachstecker 6,3mm	Entstörteil	Zündtrafo
						blau	Entstörteil	Aderendhülse 11mm	Entstörteil	Schütz K1 / Klemme 1
						blau	Entstörteil	Aderendhülse 11mm	Entstörteil	Schütz K1 / Klemme 3
						grün/gelb (PE)	Entstörteil	Flachstecker 6,3mm	Entstörteil	PE-Verteiler

4.3 Circuit diagram – 0.088-052 (HDS 10/20, HDS 12/18)



4.3 Circuit diagram – 0.088-052 (HDS 10/20, HDS 12/18)

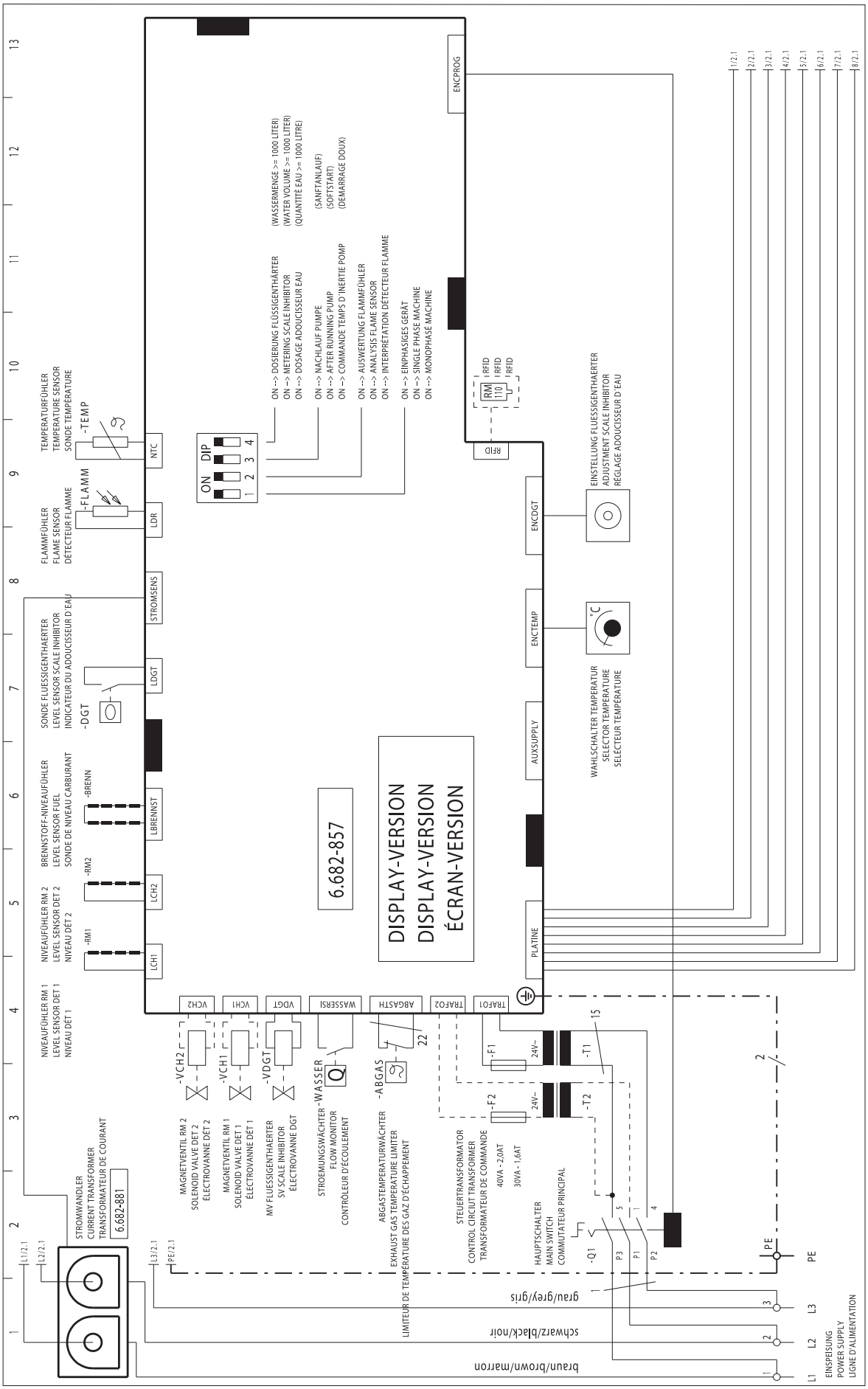


4.3 Circuit diagram – 0.088-052 (HDS 10/20, HDS 12/18)

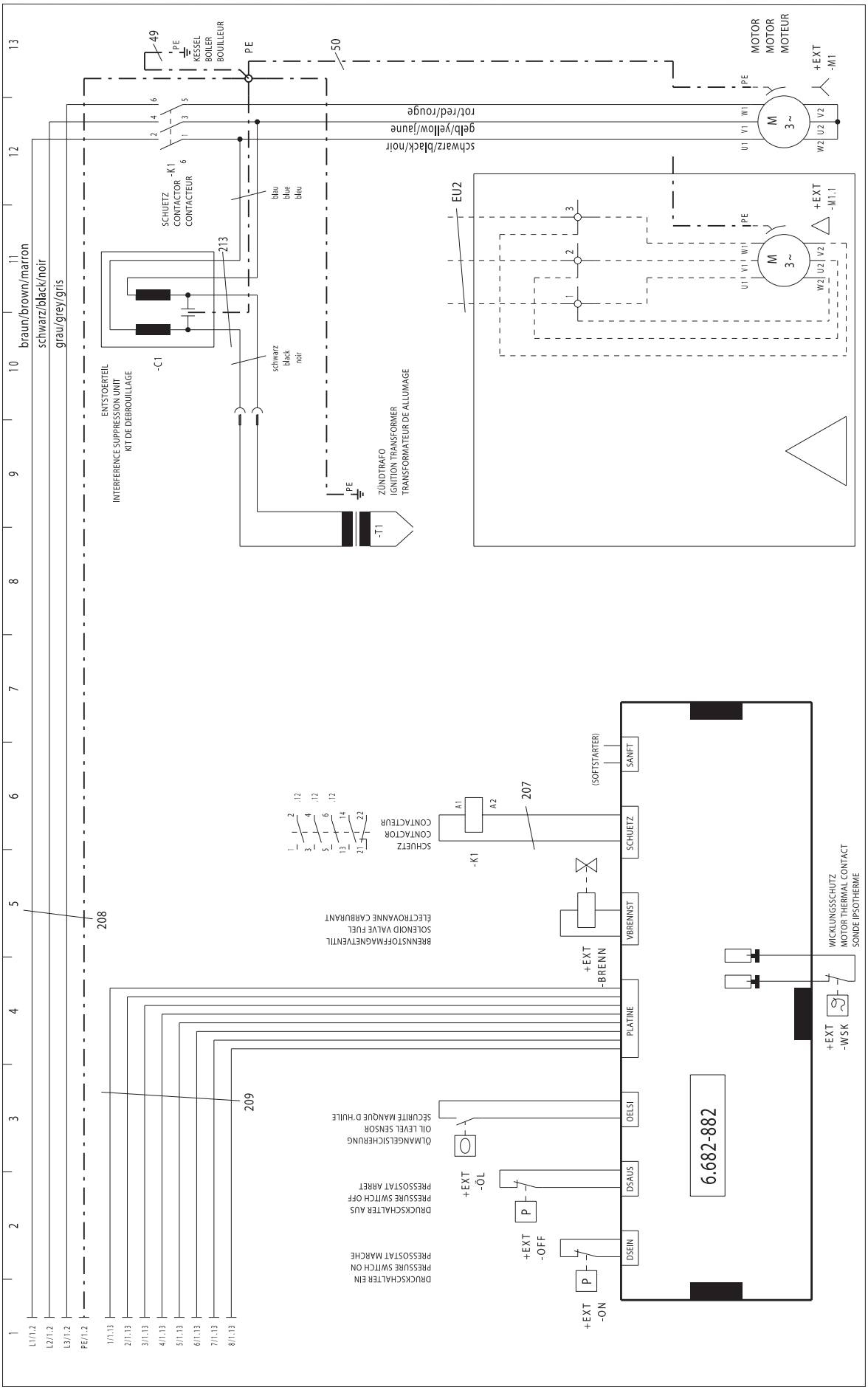
POS.	Ort	Beschreibung	Teilenummer	Kabelquer-schnitt (mm²)	Kabellänge (mm²)	Kabelfarbe	Bearbeitung Kabel Anfang	Bearbeitung Kabel Ende	Anschluss Kabel Anfang	Anschluss Kabel Ende
3.1	+HS	Anschluss Hauptschalter	4.822-508 4.822-508 4.822-508	1x 1,5 mm² 1x 1,5 mm² 1x 1,5 mm²	420 mm 420 mm 420 mm	schwarz schwarz schwarz	Aderendhülse 11mm Aderendhülse 11mm Aderendhülse 11mm	Flachstecker 6,3mm Flachstecker 6,3mm Flachstecker 6,3mm	Einspeisung Klemme 1 Einspeisung Klemme 2 Einspeisung Klemme 3	Hauptschalter Q1 / 5 Hauptschalter Q1 / 1 Hauptschalter Q1 / 4
3.22	+HS	Abgasthermostat	6.649-383	2x 0,35 mm²	700 mm	rot	RAST-Stecker	Flachstecker 6,3mm	Elektronik 6.682-883	Abgasthermostat
3.15	+HS	Steuertrafo 1	siehe Stückliste	———	———	schwarz schwarz braun braun	Steuertrafo 1 Steuertrafo 1 Steuertrafo 1 Steuertrafo 1	Flachstecker 6,3mm Flachstecker 6,3mm RAST-Stecker RAST-Stecker	Steuertrafo 1 Steuertrafo 1 Steuertrafo 1 Steuertrafo 1	Hauptschalter Q1 / P1 Hauptschalter Q1 / P2 Elektronik 6.682-883 (Trafo 1) Elektronik 6.682-883 (Trafo 1)
siehe Stückliste (Option)	+HS	Steuertrafo 2	siehe Stückliste	———	———	schwarz schwarz braun braun	Steuertrafo 2 Steuertrafo 2 Steuertrafo 2 Steuertrafo 2	Flachstecker 6,3mm Flachstecker 6,3mm RAST-Stecker RAST-Stecker	Steuertrafo 2 Steuertrafo 2 Steuertrafo 2 Steuertrafo 2	Hauptschalter Q1 / P1 Hauptschalter Q1 / P3 Elektronik 6.682-883 (Trafo 2) Elektronik 6.682-883 (Trafo 2)
3.2	+HS	PE-Elektronik	4.822-510	1x 1,5 mm²	320 mm	grün/gelb (PE)	Flachstecker 6,3mm	Flachstecker 6,3mm	Einspeisung PE-Verteiler	Elektronik 6.682-883 (PE-Anschluss)

1.49	+HS	PE-Kessel	4.821-099	1x 1,5 mm²	1600 mm	grün/gelb (PE)	Flachstecker 6,3mm	Kabelschuh M5	Einspeisung PE-Verteiler	Kessel
1.208	+Front	Verbindungsleitung E-Schränke (Laststromkreis)	6.649-340 ——— oder ——— 6.649-387	4x 1,5 mm² ——— oder ——— 4x 2,5 mm²	1770 mm ——— oder ——— 1770 mm	braun schwarz grau grün/gelb (PE)	Aderendhülse 11mm Aderendhülse 11mm Aderendhülse 11mm Flachstecker 6,3mm	Aderendhülse 11mm Aderendhülse 11mm Aderendhülse 11mm Flachstecker 6,3mm	Einspeisung Klemme 1 Einspeisung Klemme 2 Einspeisung Klemme 3 Einspeisung PE-Verteiler braun/schwarz durch Stromwandler!	Schütz K1 / Klemme 2 Schütz K1 / Klemme 4 Schütz K1 / Klemme 6 PE-Verteiler
1.209	+Front	Verbindungsleitung E-Schränke (Steuerstromkreis)	6.649-341	8x 0,35 mm²	1570 mm	———	RAST-Stecker	RAST-Stecker	Elektronik 6.682-883	Verteilerplatine 6.682-882
nur bei EU2	+Front	Verbindungsleitung Schütz - Klemme bei DREIECK (EU2)	4.822-509 4.822-509 4.822-509	1x 2,5 mm² 1x 2,5 mm² 1x 2,5 mm²	300 mm 300 mm 300 mm	schwarz schwarz schwarz	Aderendhülse 11mm Aderendhülse 11mm Aderendhülse 11mm	Aderendhülse 11mm Aderendhülse 11mm Aderendhülse 11mm	Schütz K1 / Klemme 1 Schütz K1 / Klemme 3 Schütz K1 / Klemme 5	Klemme 1 Klemme 2 Klemme 3
1.207	+Front	Schützspule	6.649-384	2x 0,35 mm²	350 mm	rot	RAST-Stecker	Aderendhülse 8,5mm	Verteilerplatine 6.682-882	Schütz K1 / Klemme A1 + A2
1.50	+Front	PE-Motor	4.822-512	1x 1,5 mm²	150 mm	grün/gelb (PE)	Flachstecker 6,3mm	Kabelschuh M4	PE-Verteiler	Motor
1.213	+Front	Entstörteil	6.661-283	———	———	schwarz schwarz blau blau grün/gelb (PE)	Entstörteil Entstörteil Entstörteil Entstörteil Entstörteil	Flachstecker 6,3mm Flachstecker 6,3mm Aderendhülse 11mm Aderendhülse 11mm Flachstecker 6,3mm	Entstörteil Entstörteil Entstörteil Entstörteil Entstörteil	Zündtrafo Zündtrafo Schütz K1 / Klemme 1 Schütz K1 / Klemme 3 PE-Verteiler

4.4 Circuit diagram – 0.088-026 (HDS 13/20)



4.4 Circuit diagram – 0.088-026 (HDS 13/20)



4.4 Circuit diagram – 0.088-026 (HDS 13/20)

POS.	Ort	Beschreibung	Teilenummer	Kabelquer-schnitt (mm²)	Kabellänge (mm²)	Kabelfarbe	Bearbeitung Kabel Anfang	Bearbeitung Kabel Ende	Anschluss Kabel Anfang	Anschluss Kabel Ende
3.1	+HS	Anschluss Hauptschalter	4.822-508	1x 1,5 mm²	420 mm	schwarz	Aderendhülse 11mm	Flachstecker 6,3mm	Einspeisung Klemme 1	Hauptschalter Q1 / 5
			4.822-508	1x 1,5 mm²	420 mm	schwarz	Aderendhülse 11mm	Flachstecker 6,3mm	Einspeisung Klemme 2	Hauptschalter Q1 / 1
			4.822-508	1x 1,5 mm²	420 mm	schwarz	Aderendhülse 11mm	Flachstecker 6,3mm	Einspeisung Klemme 3	Hauptschalter Q1 / 4
3.22	+HS	Abgasthermostat	6.649-383	2x 0,35 mm²	700 mm	rot	RAST-Stecker	Flachstecker 6,3mm	Elektronik 6.682-883	Abgasthermostat
3.15	+HS	Steuertrafo 1	siehe Stückliste	———	———	schwarz	Steuertrafo 1	Flachstecker 6,3mm	Steuertrafo 1	Hauptschalter Q1 / P1
						schwarz	Steuertrafo 1	Flachstecker 6,3mm	Steuertrafo 1	Hauptschalter Q1 / P2
						braun	Steuertrafo 1	RAST-Stecker	Steuertrafo 1	Elektronik 6.682-883 (Trafo 1)
						braun	Steuertrafo 1	RAST-Stecker	Steuertrafo 1	Elektronik 6.682-883 (Trafo 1)
siehe Stückliste (Option)	+HS	Steuertrafo 2	siehe Stückliste	———	———	schwarz	Steuertrafo 2	Flachstecker 6,3mm	Steuertrafo 2	Hauptschalter Q1 / P1
						schwarz	Steuertrafo 2	Flachstecker 6,3mm	Steuertrafo 2	Hauptschalter Q1 / P3
						braun	Steuertrafo 2	RAST-Stecker	Steuertrafo 2	Elektronik 6.682-883 (Trafo 2)
						braun	Steuertrafo 2	RAST-Stecker	Steuertrafo 2	Elektronik 6.682-883 (Trafo 2)
3.2	+HS	PE-Elektronik	4.822-510	1x 1,5 mm²	320 mm	grün/gelb (PE)	Flachstecker 6,3mm	Flachstecker 6,3mm	Einspeisung PE-Verteiler	Elektronik 6.682-883 (PE-Anschluss)

POS.	Ort	Beschreibung	Teilenummer	Kabelquer-schnitt (mm²)	Kabellänge (mm²)	Kabelfarbe	Flachstecker 6,3mm	Kabelschuh M5	Einspeisung PE-Verteiler	Kessel
1.49	+HS	PE-Kessel	4.821-099	1x 1,5 mm²	1600 mm	grün/gelb (PE)	Flachstecker 6,3mm	Kabelschuh M5	Einspeisung PE-Verteiler	Kessel
1.208	+Front	Verbindungsleitung E-Schränke (Laststromkreis)	6.649-340	4x 1,5 mm²	1770 mm	braun	Aderendhülse 11mm	Aderendhülse 11mm	Einspeisung Klemme 1	Schütz K1 / Klemme 2
			—— oder ——	—— oder ——	—— oder ——	schwarz	Aderendhülse 11mm	Aderendhülse 11mm	Einspeisung Klemme 2	Schütz K1 / Klemme 4
						grau	Aderendhülse 11mm	Aderendhülse 11mm	Einspeisung Klemme 3	Schütz K1 / Klemme 6
			6.649-387	4x 2,5 mm²	1770 mm	grün/gelb (PE)	Flachstecker 6,3mm	Flachstecker 6,3mm	Einspeisung PE-Verteiler braun/schwarz durch Stromwandler!	PE-Verteiler
1.209	+Front	Verbindungsleitung E-Schränke (Steuerstromkreis)	6.649-341	8x 0,35 mm²	1570 mm	———	RAST-Stecker	RAST-Stecker	Elektronik 6.682-883	Verteilerplatine 6.682-882
nur bei EU2	+Front	Verbindungsleitung Schütz - Klemme bei DREIECK (EU2)	4.822-509	1x 2,5 mm²	300 mm	schwarz	Aderendhülse 11mm	Aderendhülse 11mm	Schütz K1 / Klemme 1	Klemme 1
			4.822-509	1x 2,5 mm²	300 mm	schwarz	Aderendhülse 11mm	Aderendhülse 11mm	Schütz K1 / Klemme 3	Klemme 2
			4.822-509	1x 2,5 mm²	300 mm	schwarz	Aderendhülse 11mm	Aderendhülse 11mm	Schütz K1 / Klemme 5	Klemme 3
1.207	+Front	Schützspule	6.649-384	2x 0,35 mm²	350 mm	rot	RAST-Stecker	Aderendhülse 8,5mm	Verteilerplatine 6.682-882	Schütz K1 / Klemme A1 + A2
1.50	+Front	PE-Motor	4.822-512	1x 1,5 mm²	150 mm	grün/gelb (PE)	Flachstecker 6,3mm	Kabelschuh M4	PE-Verteiler	Motor
1.213	+Front	Entstörteil	6.661-283	———	———	schwarz	Entstörteil	Flachstecker 6,3mm	Entstörteil	Zündtrafo
						schwarz	Entstörteil	Flachstecker 6,3mm	Entstörteil	Zündtrafo
						blau	Entstörteil	Aderendhülse 11mm	Entstörteil	Schütz K1 / Klemme 1
						blau	Entstörteil	Aderendhülse 11mm	Entstörteil	Schütz K1 / Klemme 3
						grün/gelb (PE)	Entstörteil	Flachstecker 6,3mm	Entstörteil	PE-Verteiler

5 Troubleshooting

Fault	Measure
Unit is not running (no LED display)	– Check/replace mains voltage, connection cable and mains fuse. – Check fuse (F1). – Check/replace unit switch. – Check/replace the pressure switch. – Check/adjust/replace control circuit transformer. – Check/replace the thermal fuse. – Check/replace printed circuit board and soft start. – Check/replace contactor (K1).
Motor thermal contact has actuated	– Switch off unit and leave to cool. Correct fault and switch unit back on again.
Water pressure too low	– Check/increase water supply volume. – Check/clean/replace water fine filter. – Vent the unit. – Check /replace high-pressure nozzle. – Check pressure and suction valves for leaks/replace. – Check/adjust/replace overflow valve. – Check/adjust/replace safety valve.
Water is not heated	– Check/correct temperature setting. – Ensure adequate water supply when low-water protection is switched off/repair low-water protection. – Check/top-up fuel level in the tank. – Check/replace fuel pump solenoid valve. – Check/clean/replace fuel filter. – Check/correct fuel pump setting. – Check/replace the fuel nozzle. – Check/replace ignition cable. – Check/correct ignition electrode spacings. – Check/repair burner fan. – Check/correct air flap setting.
Indicator LED is lit	– See Chapter 3.1
Insufficient or no cleaning agent function	– Check/correct metering valve setting. – Check/top up cleaning agent tank. – Check/clean/replace cleaning agent filter. – Check/replace cleaning agent suction hose, metering valve and cleaning agent suction at the cylinder head.
Pressure drop in the high-pressure system	– Check handgun and O-rings on high-pressure hose for leaks/ replace. – Check non-return valve for leaks/replace O-rings. – Check/adjust/replace overflow valve. – Check/replace the pressure switch and control piston.

5 Troubleshooting

Fault	Measure
Water leak between cylinder head and piston housing	– Leak of 1 drip per minute and piston is allowable. – Check/replace high-pressure and low-pressure seals.
Oil leak between cylinder head and piston housing	– Replace oil seals.
Pump knocks	– Check pump for leaks/remove leaks. – Vent the unit.

6 Technical specifications

Unit type	Unit No.	Circuit diagram	Operating instructions	Spare parts list
HDS 7/12-4 M	1.077-401	0.089-021	5.962-127	5.970-808
HDS 7/12-4 MX	1.077-451	0.089-021	5.962-127	5.970-808
HDS 8/17-4 M	1.077-601	0.089-025	5.962-127	5.970-796
HDS 8/17-4 MX	1.077-651	0.089-025	5.962-127	5.970-796
HDS 9/18-4 M	1.077-801	0.089-025	5.962-127	5.970-799
HDS 9/18-4 MX	1.077-851	0.089-025	5.962-127	5.970-799
HDS 10/20-4 M	1.071-401	0.088-952	5.962-127	5.970-711
HDS 10/20-4 MX	1.071-451	0.088-952	5.962-127	5.970-711
HDS 12/18-4 S	1.071-601	0.088-952	5.962-127	5.970-802
HDS 12/18-4 SX	1.071-651	0.088-952	5.962-127	5.970-802
HDS 13/20-4 S	1.071-801	0.089-026	5.962-127	5.970-812
HDS 13/20-4 SX	1.071-851	0.089-026	5.962-127	5.970-812

The technical data sheets and the current circuit diagrams will be included in the next issue of the spare parts CD-ROM (DISIS) and are available in kaercher-inside (https://kaercher-inside.com).

If required, the operating instructions and the spare parts lists can be ordered as a paper copy from the spare parts service by quoting the relevant part number.

7 Special Tools

Multimeter	6.803-022
Exhaust analyser insert	2.900-001
Shut-off valve with thermometer	2.901-030
Extraction tool for impeller	6.816-069
Dismantling pliers for pressure / suction valves and fine water filter	4.901-062
Mounting mandrel and sleeve Ø 18 mm	2.901.033
Mounting mandrel and sleeve Ø 20 mm	2.901-037
Mounting mandrel for high-pressure seal and oil seal Ø 22 mm	5.901-064
Sleeve for installation of high-pressure seal Ø 22 mm	5.901-136
Assembly mandrel for O-ring / support ring, overflow piston	5.901-163
Installation tool for overflow valve seat	5.901-162
Dismantling tool for overflow valve seat	5.901-161
Extraction tool for swash plate	4.901-038
Pressure gauge for fuel pressure	4.901-060
Testing pressure gauge for operating pressure	4.742-025
Mounting screws for piston guide housing (M8 x 75)	7.304-403
Mounting screws for piston guide housing (M6 x 110)	7.304-467

8 Tightening torque

Cylinder head screws	50 - 60 Nm
Piston housing	5 - 7 Nm
Handgun, pressure control	40 Nm
High-pressure outlet	6 - 8 Nm
Pressure valves, threaded connection	40 - 45 Nm
Pressure switch, threaded connection	30 - 35 Nm
Suction valves - threaded connection	15 - 17 Nm
Overflow valve seat	8 - 10 Nm
Swash plate	12 ± 3 Nm
Oil drain plug	20 - 25 Nm
Motor cover, rear	9 - 10 Nm
Fan wheel	7 - 8 Nm

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