HDS 7/12 M, HDS 8/18 M, HDS 9/18 M, HDS 10/20 M, HDS 12/18 S, HDS 13/20 S
Service Manual

1 Contents

2 Preface

Good service work requires extensive and practice-oriented training as well as well-structured training materials. Hence we offer regular basic and advanced training programmes covering the entire product range for all service engineers.
In addition to this, we also prepare service manuals for important appliances - these can be initially used as instruction guides and later on as reference guides.
Apart from this, we also regular information about product enhancements and their servicing.

If you should require supplements, have corrections or questions regarding this document, please address these citing the following subject to:

international-service@de.kaercher.com

Subject: ***Fall 105756***

The responsible product specialist will take care of your issue.

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www.kaercher.com

3 Safety instructions

3.1 Hazard levels

⚠ ***DANGER***
Immediate danger that can cause severe injury or even death.

⚠ ***WARNING***
Possible hazardous situation that could lead to severe injury or even death.

⚠ ***CAUTION***
Possible hazardous situation that could lead to mild injury to persons or damage to property.

4 Technical Features

4.1 General

Mobile hot water high-pressure cleaners in various performance classes for commercial use.
- High performance burner with upright heating coal and continuous ignition
- Built-in calcification protection
- Steam operation (water temperatures up to 155 °C) with separate steam nozzle
- Burner blower and fuel pump directly on the electric motor
- ECO - mode for 60°C (+/- 9 K)

4.2 Connection performance of appliance

- 3,4 kW (HDS 7/12-4 M/MX)
- 5,5 kW (HDS 8/18-4 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)

4.3 Pump

- 3 piston axial pump with stainless steel piston; some models feature ceramic coating
- Cylinder head made of brass
- High-pressure and suction valve faces made of stainless steel
- Working pressure: 3-20 MPa (30-200 bar)
- Water quantity: 350-1,300 l/h
- Manometer
- Overflow valve with pressure and quantity regulation
- Float tank
- Safety valve
- Water fine filter

4.4 Electronics system

- Program selection switch
- Flame sensor (option)
- Water temperature regulation with temperature sensor
- Exhaust temperature monitor
- Water shortage safeguard
- Dry-run protection for the pump
- Level sensor for fuel, liquid softener and detergent tanks (optional in some cases)
- Operating hour counter
- Error memory
- Component tests
- Fault monitoring
- Monitoring of rotation direction

4.5 Detergent

- 2 detergent tanks
- Detergent inlet with fine filter
- Dosing valve on the device with automatic clear rinsing in zero position.
- Detergent with low pressure and high pressure

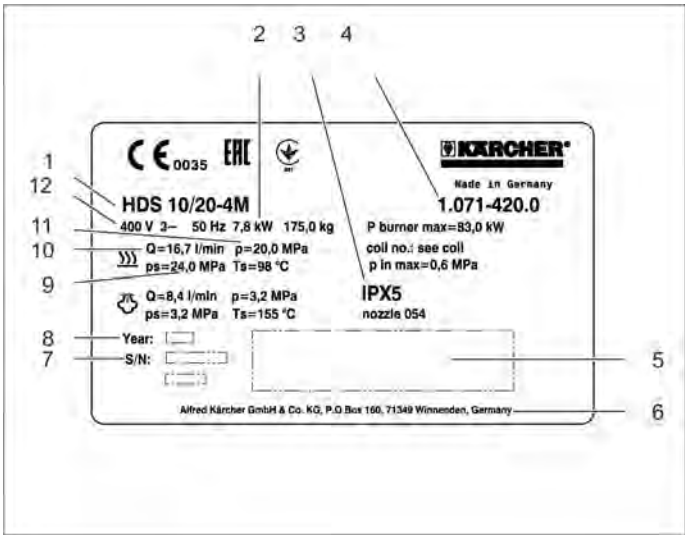
4.6 Accessories

- Rotary regulator for pressure and quantity regulation
- Soft grip - easy press gun
- Stainless steel spray lance, rotating
- Power nozzle (stainless steel)
- Steam nozzle (brass)

4.7 Field of application

- HDS 7/12-4 M/MX
- HDS 8/18-4 M/MX
- HDS 9/18-4 M/MX
- HDS 10/20-4 M/MX
- HDS 12/18-4 S/SX
- HDS 13/20-4 S/SX

4.8 Type plate



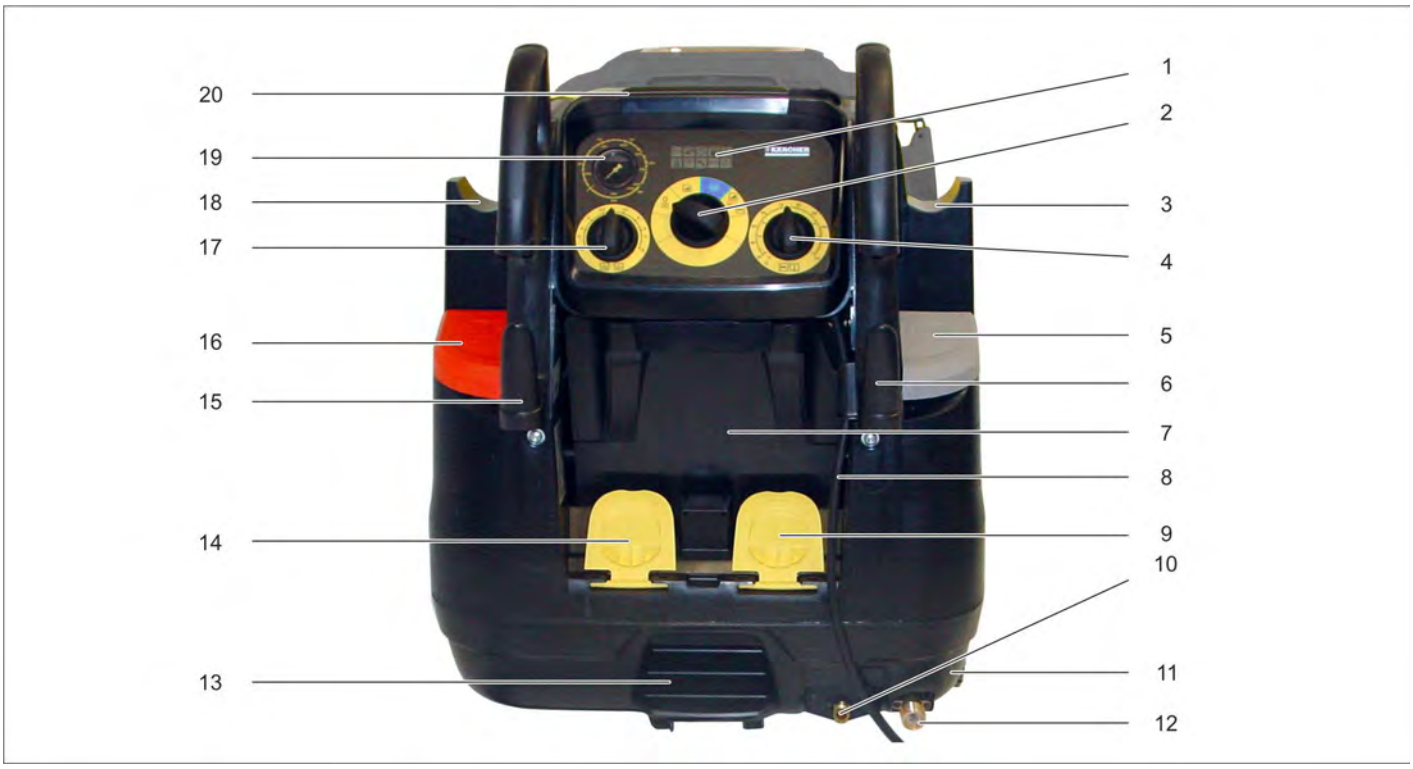
1 Appliance description
2 Connection output
3 Type of protection
4 Part number
5 Bar code. Contains part and serial number.
6 Address of manufacturer
7 Serial number
8 Year of manufacture
9 Max. operating over-pressure
10 Flow rate
11 Working pressure
12 Main Supply

5 Parts of the system

5.1 Front view

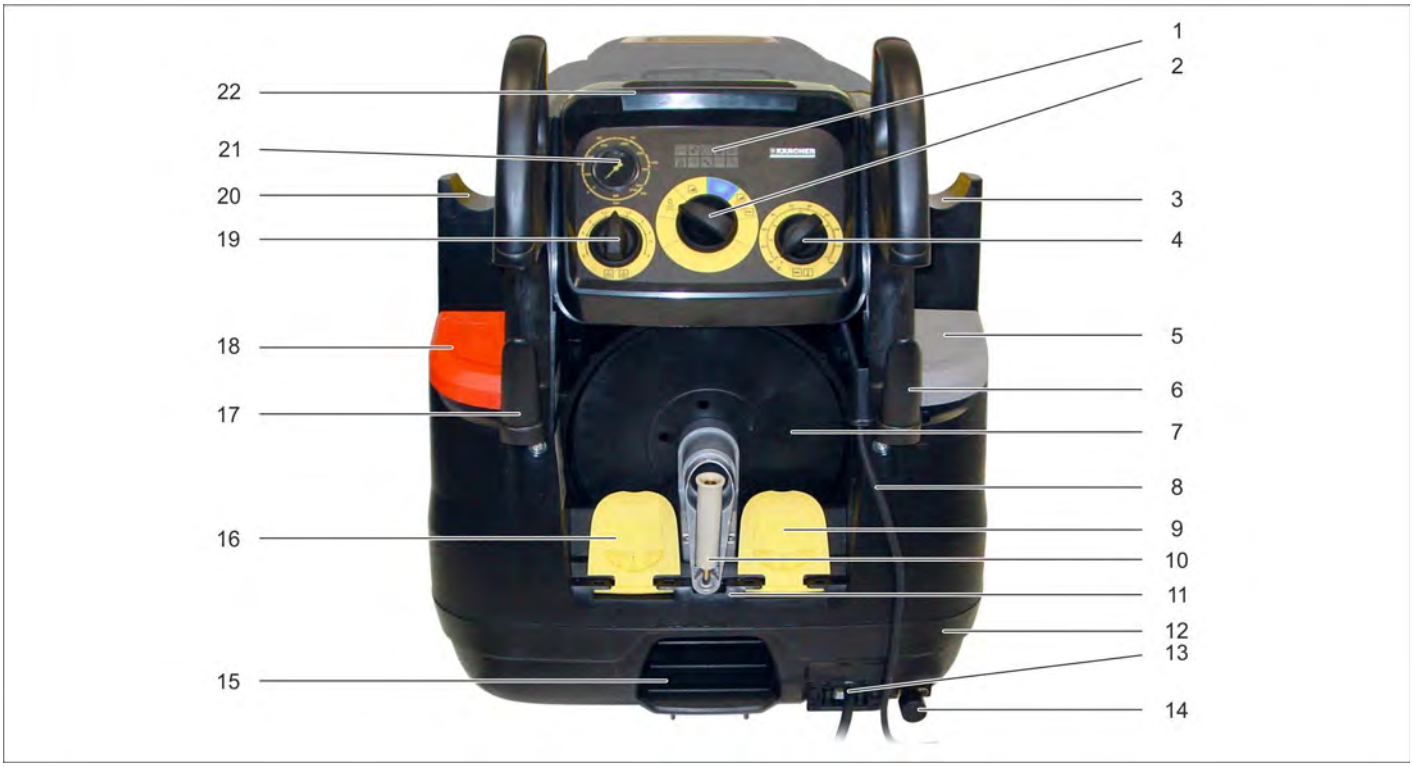
1 Push handle
2 Cover, upper storage compartment
3 Safety catch, soft grip - easy press gun
4 Rotating regulator
5 Hand lever
6 Soft grip - easy press gun
7 Lock for fuel tank
8 High pressure hose
9 Rotating spray lance
10 High pressure nozzle
11 Transport wheel (2x)
12 Transport bracket
13 Steering roller
14 Steering roller with fixed position brake
15 Chassis
16 Cover
17 Exhaust nozzle
18 Lock of appliance hood

5.2 View from the back, (device without hose reel)



1 Indicator lamps
2 Programme selector switch (Q1)
3 Storage spray pipe
4 Setting, water temperature
5 Closure, liquid softener tank
6 Storage, power cord
7 Storage compartment
8 Supply Cord
9 Closure detergent tank 2
10 High pressure outlet
11 Chassis
12 Water connection with water fine filter
13 Tread
14 Closure detergent tank 1
15 Storage high-pressure hose
16 Closure fuel tank
17 Setting detergent dosing unit
18 Storage spray pipe
19 Manometer
20 Cover, upper storage compartment

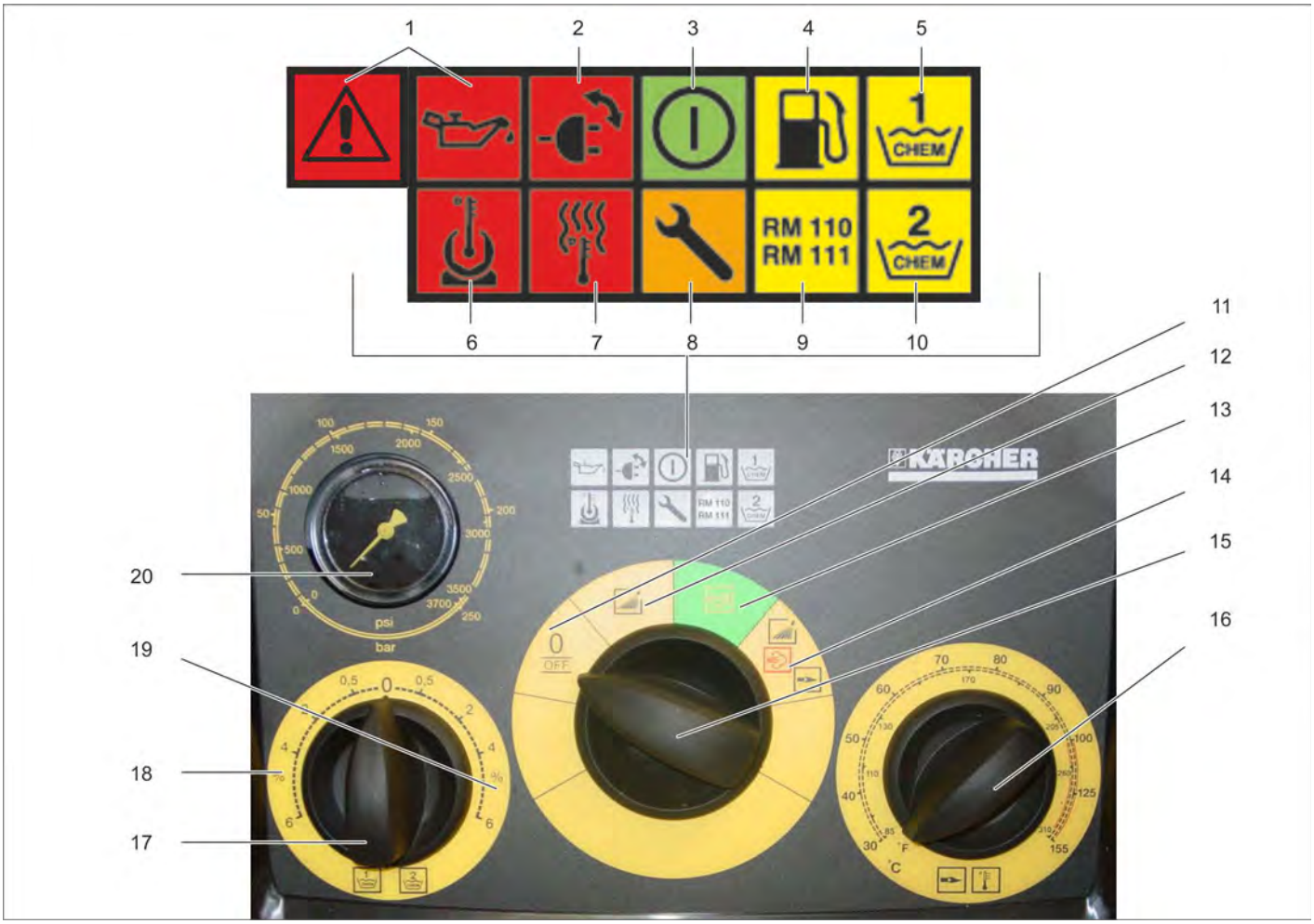
5.3 View from the back, (device with hose reel)



1 Indicator lamps
2 Programme selector switch (Q1)
3 Storage spray pipe
4 Setting, water temperature
5 Closure, liquid softener tank
6 Storage, power cord
7 Hose reel, high-pressure hose
8 Supply Cord
9 Closure detergent tank 2
10 Crank, hose drum
11 Recess hose reel lock
12 Chassis
13 High pressure hose
14 Water connection with water fine filter
15 Tread
16 Closure detergent tank 1
17 Storage high-pressure hose
18 Lock for fuel tank
19 Setting detergent dosing unit
20 Storage spray pipe
21 Manometer
22 Cover, upper storage compartment

5.4 Operator console

5.4.1 Control panel with LED indicator



1 Control LED 0, pump (red)
Note
Symbol depending on unit model.
2 Control LED 1, rotation direction (red)
3 Control LED 2, operation (green)
4 Control LED 3, fuel (yellow)
5 Control LED 4, detergent tank 1 (yellow)
6 Control LED 5, motor (red)
7 Control LED 6, burner (red)
8 Control LED 7, service (orange)
9 Control LED 8, liquid softener (yellow)
10 Control LED 9, detergent tank 2 (yellow)
11 Programme switch position "Off"
12 Programme switch position "Cold water operation"
13 Programme switch position "ECO mode"
14 Programme switch position "Hot water / steam operation"
15 Programme switch
16 Setting, water temperature
17 Dosage valve for detergent
18 Dosing range detergent tank 1
19 Dosing range detergent tank 2
20 Manometer

Note
In the "ECO mode“ the water temperature is maintained at 60? (+/- 9 K). Set water temperatures < 60°C are effective, <60 ? remain ineffective.

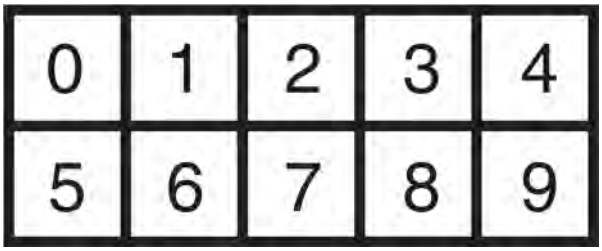
LED no.	Symbol	Activity	Meaning / measure
0		1 x blinking	Lack of oil. Check/fill oil level of the high pressure pump; repair leaks.
		2 x blinking	Leakage. 10 short startups. Check the high-pressure system for leaks.
		3 x blinking	Dry running (2 minutes). Check / ensure the water supply.
		4 x blinking	Reed switch or solenoid is sticky. Check safety block/ repair reed switch.
1		1 x blinking	Motor turns in the wrong direction. Switch off the device and turn the phase inverter in the unit plug by 180°.
2		glow	The appliance is now ready for operation.
		1 x blinking	Either the device was in continuous operation for 30 minutes or in standby mode for 30 minutes.
3		glow	Fuel tank empty; fill fuel.
4		glow	Detergent tank 1 is empty. Refill detergent (only HDS 12/18)
5		1 x blinking	Fault in the motor contactor (motor current below 1.5 A for 3 seconds although the contactor has switched). Check / replace the contactor.
		2 x blinking	Coiling protection contact open/defective. Determine/eliminate cause. Replace the engine.
		3 x blinking	Current asymmetry or low voltage or overvoltage. Check the mains connection.
		4 x blinking	Excessive power consumption. Check mechanics for resistance. Check the mains connection.

LED no.	Symbol	Activity	Meaning / measure
6		1 x blinking	Exhaust thermostat open. Check/replace emission temperature/ thermostat. Perform maintenance on the burner.
		2 x blinking	Flame sensor reports burner fault. Clean and check the burner, ignition and fuel system.
		3 x blinking	RFID write-read electronics is defective - replace.
		4 x blinking	Fault water temperature sensor. Cable break (temperature below -5°C, although the burner is on) or short circuit (temperature above 220°C for a longer period of time). The device switches off after approx. 10 seconds.
7		glow	Service tasks due: – 400h burner – 600h pump – 80000 gun switching operations
8		glow	Softener level switch detects empty condition or the units on the tag of the softener bottle have been consumed.
		1 x blinking	5 hours of after-running time elapsed, burner is locked. Insert new softener bottle.
9		glow	Detergent tank 2 is empty. Refill detergent (only HDS 12/18)

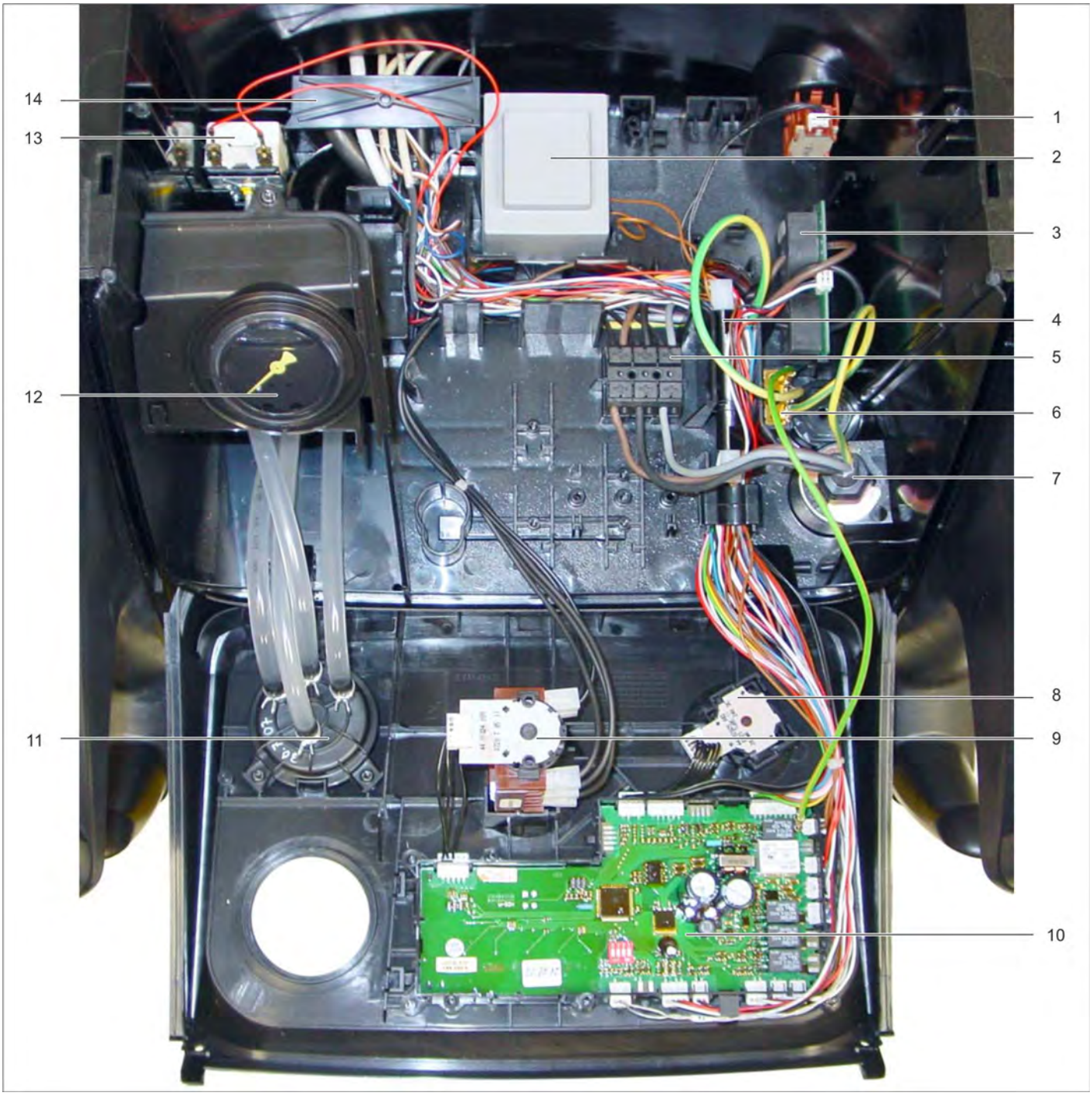
Note
Tag is an electronic component on the new square softener bottle. The tag is located behind the bottle label. The tag can be read and written on electronically (also see 6.10.3 "Functionality RFID").

5.4.2 Template numerical value display

For the better distinguishability of numeric value displays in the service functions the template below can be placed on the LED displays of the control panel.

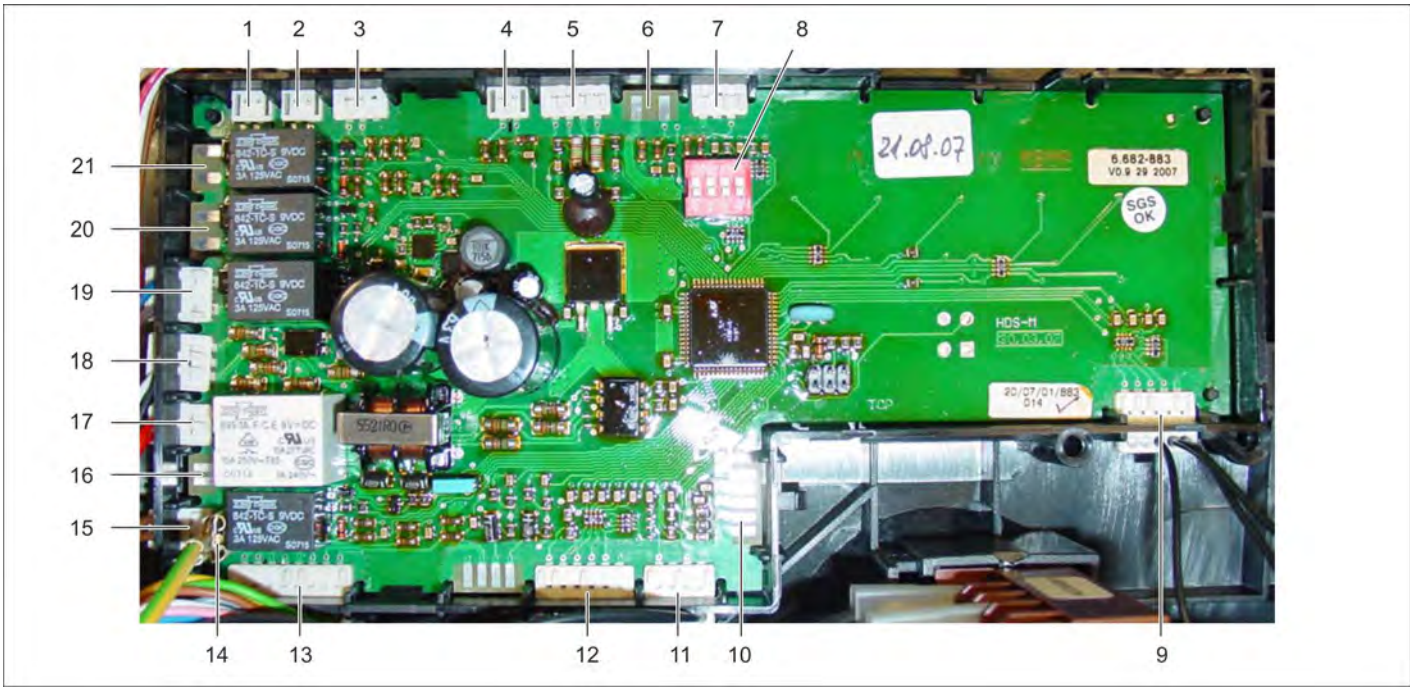


5.4.3 Control panel, view from the inside



1	Service switch and dosing liquid softener	
2	Control transformer	T1
3	Transducer	
4	Fuse 2.0 AT for control transformer	AT: (6.644-052)
5	Terminal strip	
6	Ground point	
7	Supply Cord	
8	Setting, water temperature	
9	Programme switch	
10	Control chip	
11	Detergent dosing valve	
12	Manometer	
13	Exhaust temperature monitor	
14	Cable comb	

5.4.4 Printed circuit board, control panel

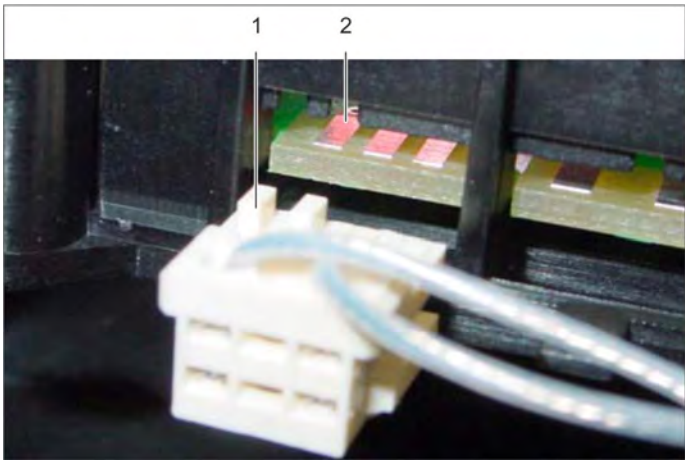


1 Connection, level sensor detergent tank 1
2 Connection, level sensor detergent tank 2
3 Connection of level sensor for fuel tank
4 Connection of level sensor for liquid softener
5 Transducer connection
6 Connection flame sensor
7 Temperature sensor connection
8 DIP switch
9 Connection programme switch
10 Connection RFID
11 Service switch connection
12 Connection water temperature setting
13 PCB motor distributor connection
14 Grounding connection control PCB
15 Control transformer T1 connection
16 Connection control transformer T2 (option)
17 Connection exhaust temperature monitor
18 Connection, lack of water fuse
19 Connection of solenoid valve for liquid softener
20 Connection without function
21 Connection without function

DIP switch
By changing these settings the following functions can be activated:
DIP1 on:
One-phase device
DIP1 off:
Three-phase device
DIP2 on:
With flame sensor.
DIP2 off:
Ohne Flammfühler.
DIP3 off:
Standard setting. Must not be changed.
DIP4 on:
Dosing softener liquid for devices from 1000 l/h onwards
DIP4 off:
Dosing softener liquid for devices up to 1000 l/h

Note
Settings upon delivery in the replacement.
DIP 1 to 3:
Off
DIP 4:
On
– Dosing RM 110/111 via RFID.

Adjust the settings after installation accordingly.



1 Encoding pin
2 Recess for encoding pin

Plug coding
The plugs for the PCB connections are designed with encoding pins and their matching recesses in the PCB base so that only the matching plug can be attached to the respective connection.

5.4.5 Control panel with display indication (HDS 13/20 only)

1 Display
2 Programme switch position "Cold water operation"
3 Programme switch position "ECO mode*"
4 Programme switch position "Hot water / steam operation"
5 Programme switch
6 Setting, water temperature
7 Dosage valve for detergent

Note
In the "ECO mode“ the water temperature is maintained at 60? (+/- 9). Set water temperatures < 60°C are effective, settings <60? remain without any effect.

8 Dosing range detergent tank 1
9 Dosing range detergent tank 2
10 Programme switch position "Off"
11 Manometer
12 Filling level detergent tank 2
13 Filling level detergent tank 1
14 Filling level fuel

6 Function

6.1 Operating displays

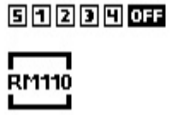
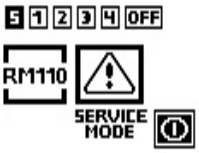
Note
Operating and maintenance displays are shown one after the other like in a slide show. Each picture for 3 seconds. The fault displays remain until the device is switched off.

Display	Explanation	Remark
	Upper bar: Level fuel (8 stages) Centre bar: Level detergent 1 (4 stages) Lower bar: Level detergent 2 (4 stages) In case of a cable break the relevant bar is not displayed.	
	Maintenance for pump due after 600 h.	Perform maintenance procedure. Reset pump hours.
	Maintenance for burner due after 400 h.	Perform maintenance procedure. Reset burner hours.
	Maintenance for accessory due after 80000 gun switching operations.	Perform maintenance procedure. Reset gun switching operations.

6.2 Maintenance operating fluids

Display	Explanation	Remark
	Empty liquid softener.	Insert new bottle.
	The bottle of the liquid softener is missing or the 5 hours afterrunning time have elapsed. The burner is locked.	Insert new bottle.
	Oil refill container HP pump is empty.	Replenish oil.

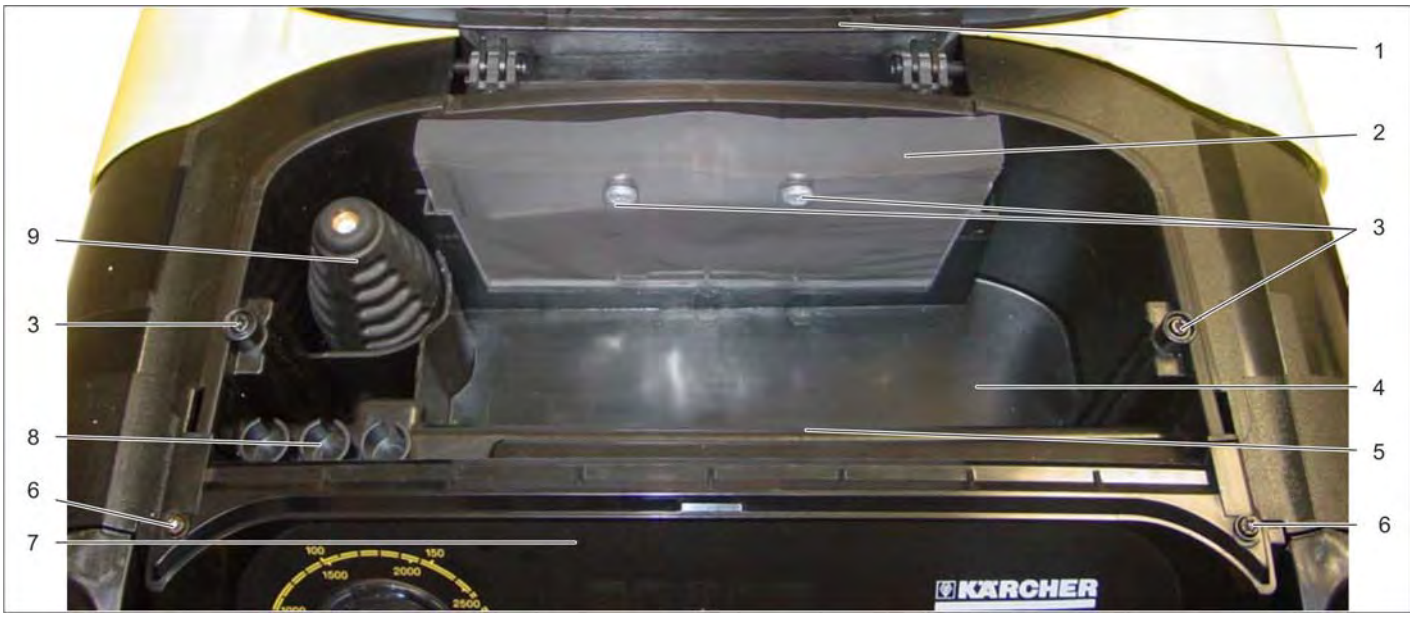
6.3 Setting liquid softener

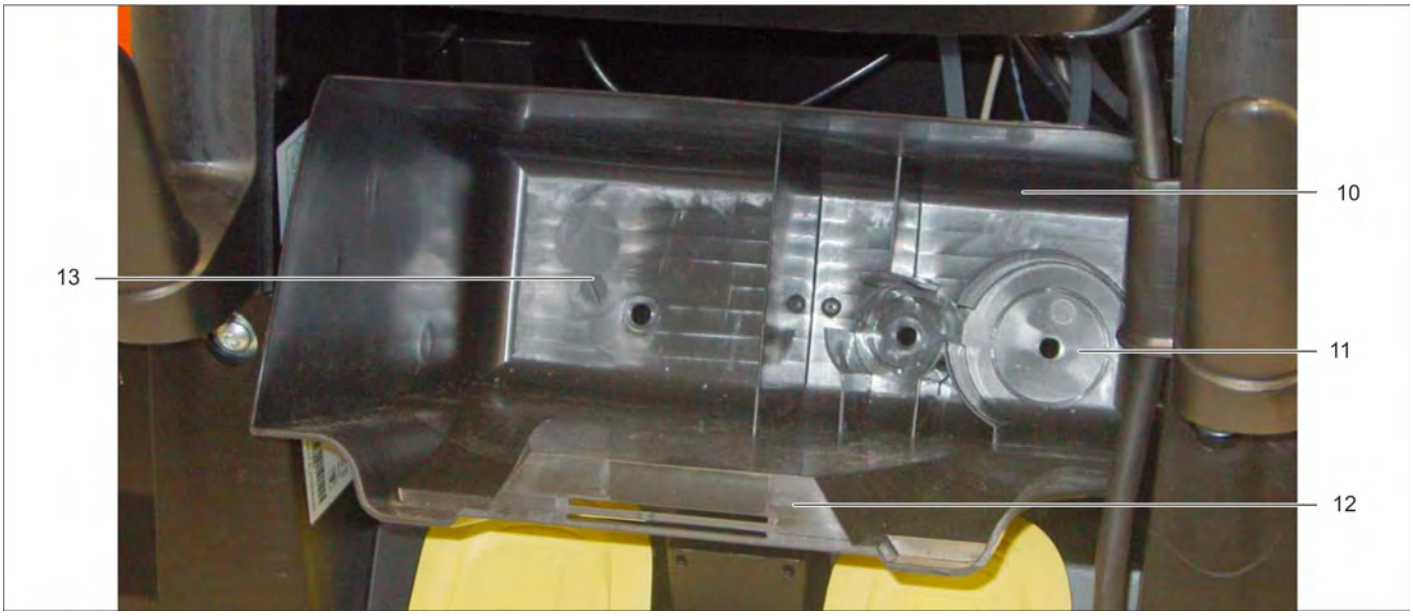
Display	Explanation	Remark
	Set liquid softener dosing in accordance with the water hardness. This display appears for 3s if the liquid softener setting is changed.	
	Attention service mode position. After the restart, the device will be in the service mode. This display remains until another liquid softener setting is selected.	

6.4 SB mode

Display	Explanation	Remark
	Insertion of money required.	Only with operation with SB board.

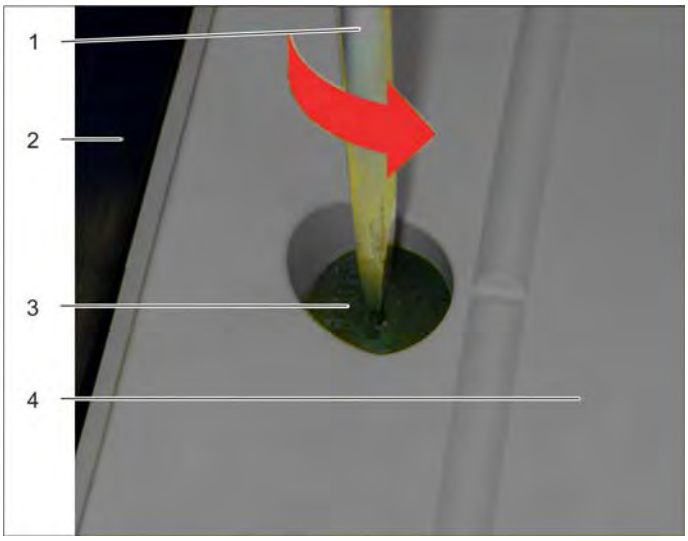
6.5 Storage compartments





1 Cover, upper storage compartment
2 Storage operating instructions
3 Fastening screws upper storage compartment (4x)
4 Storage compartment top
5 Nameplate
6 Fastening screw control panel
7 Operator console
8 Storage replacement nozzles
9 Storage dirt grinder
10 Storage compartment bottom
11 Bottle holder for round liquid softener bottle or detergent bottle
12 Recessed grip
13 Bottle holder for two RFID liquid softener bottles

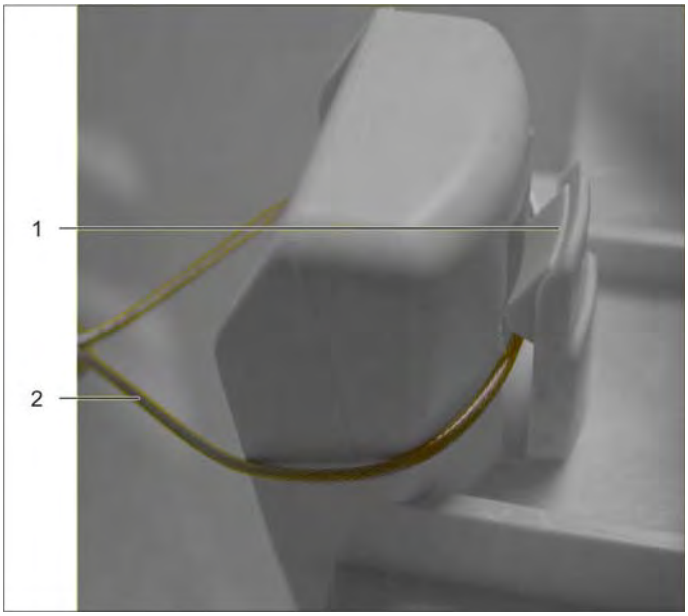
6.6 Cover



Note
Open cover and dismantle if necessary

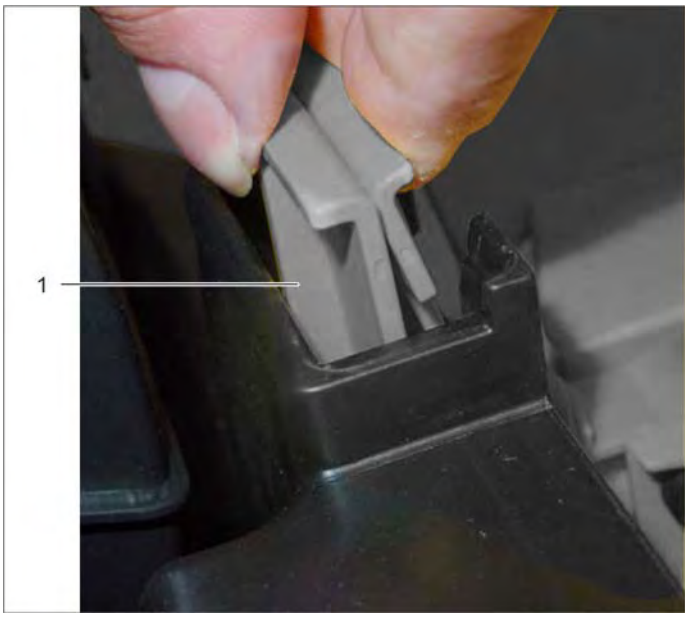
1 Screwdriver
2 Storage compartment top
3 Lock of appliance hood
4 Cover

➔ Push in the locking mechanism of the cover and turn it by 90°.
➔ Open the appliance hood.



1 Locating lug arrestor cable
2 Arrestor cable cover

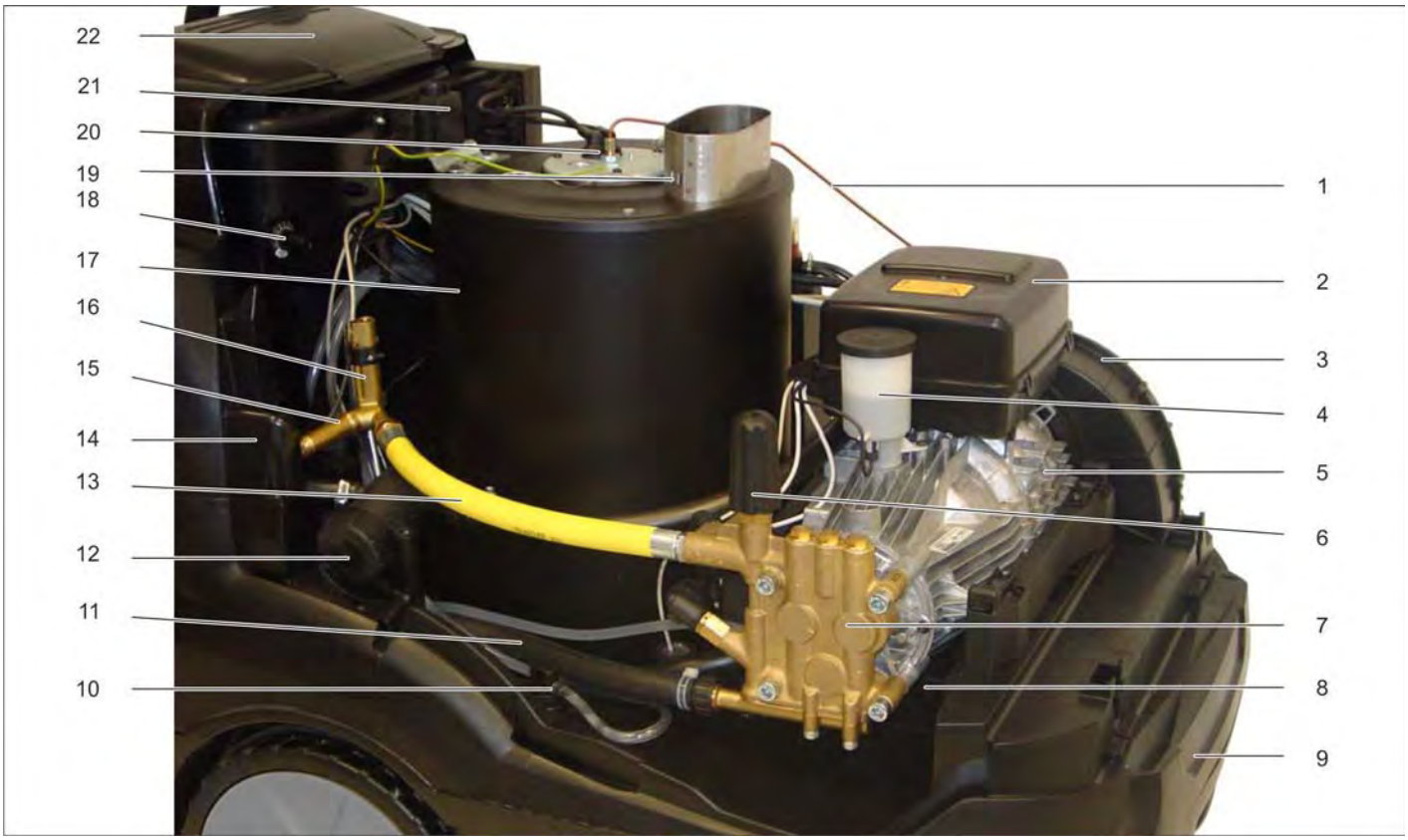
➔ Unhook the arrestor cable from the locating lug.



1 Hinge cover (2x)

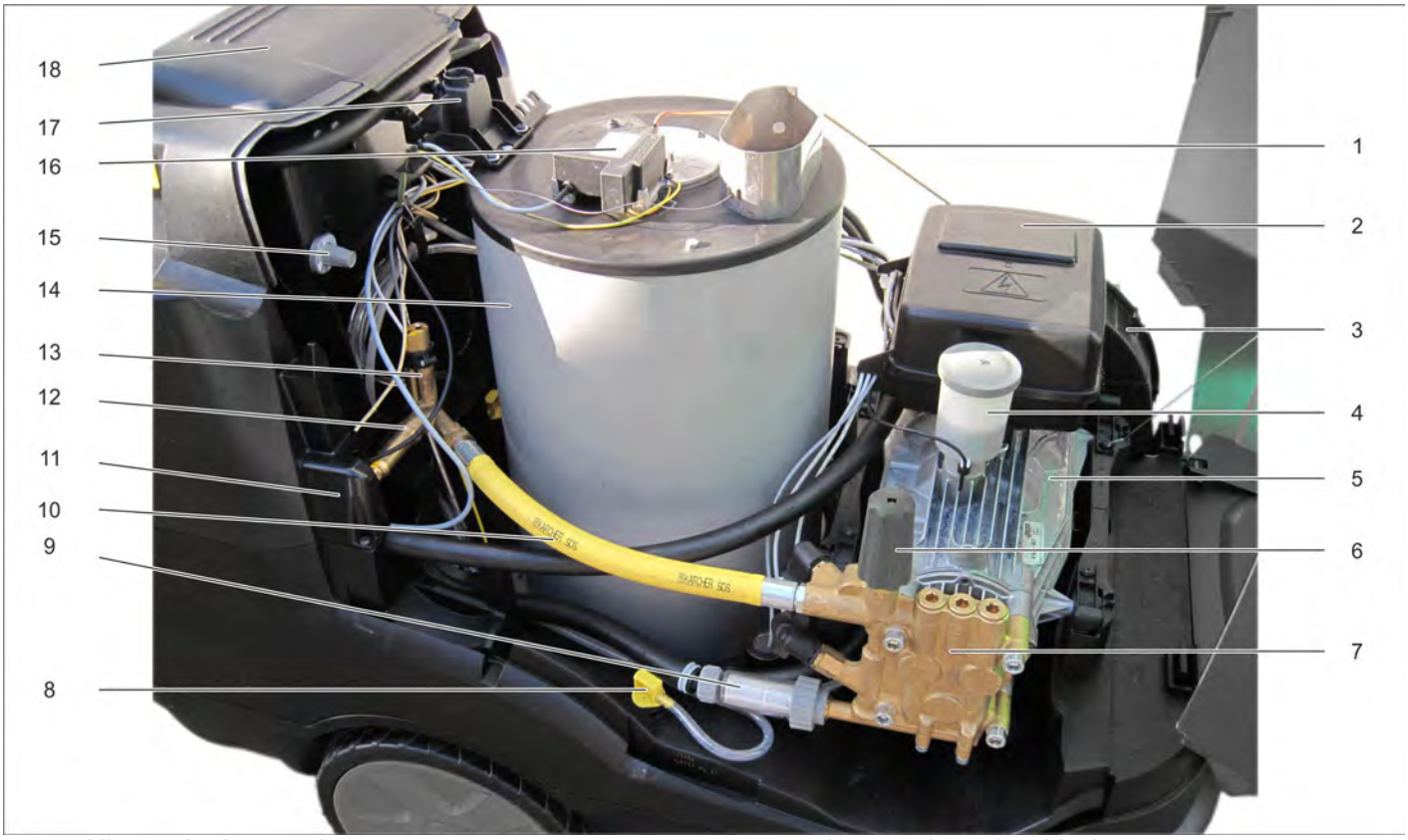
➔ Unclip hinges.
➔ Remove the appliance cover.

6.7 View from the right, cover removed



1 Fuel line to the booster heater
2 Electric box, motor
3 Burner blower
4 Oil refill container pump
5 Motor
6 Handle, pressure and volume regulation
7 Pump head
8 Oil drain screw
9 Chassis
10 Plug detergent tank 2
11 Water hose to the pump
12 Casing water fine filter
13 SDS hose to the safety block
14 Splashboard, safety valve
15 Safety valve
16 Water shortage safeguard
17 Continuous heater
18 Service switch and setting liquid softener
19 Exhaust nozzle, on-demand heater
20 Burner, booster heater
21 Locking block cover
22 Cover, storage compartment top

6.7.1 Revised device design (with filter before the pump and electronic ignition transformer)



1 Fuel line to the booster heater
2 Electric box, motor
3 Burner blower
4 Oil refill container pump
5 Motor
6 Handle, pressure and volume regulation
7 Pump head
8 Plug detergent tank 2
9 Filter
10 SDS hose to the safety block
11 Splashboard, safety valve
12 Safety valve
13 Water shortage safeguard
14 Continuous heater
15 Service switch and setting liquid softener
16 Burner, booster heater
17 Locking block cover
18 Cover, storage compartment top

6.8 Service switch

1 Position marking
2 Service switch

Setting the water hardness
The setting of the liquid softener dosing is done in accordance with the local water hardness (ask your local water supply company or determine by means of a hardness tester).

Hardness tester	6.768-004.0

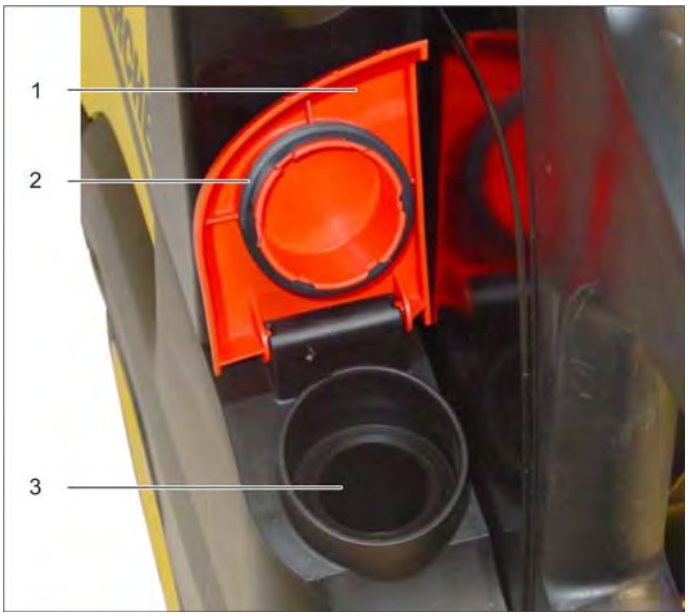
Water hardness	Adjustments	° dH
very soft	OFF position	up to 3.0
soft	Position 1	3,1 - 7,0
medium	Position 2	7,1 - 14,0
hard	Position 3	14,0 - 21,0
very hard	Position 4	> 21,0

Note
When using RM 111, do not fall below position 3. Observe setting DIP 4 on the printed circuit board.

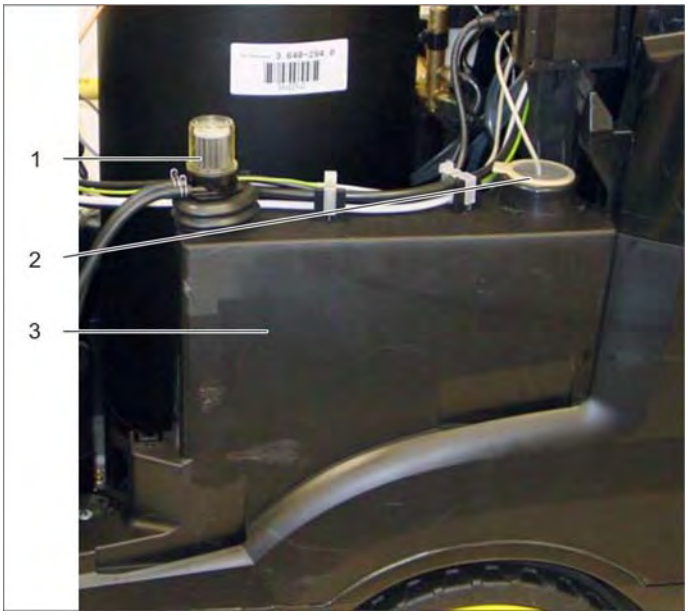
Service position
In the "Service" position the settings of the device can be edited by means of the service switch and the control panel.
From the "Service" position, the service switch can be turned a little further to the "SET" position. From this position, the switch returns to the "Service" position after releasing it. The "SET" position merely fulfils a pushbutton function.

Note
The setting options are described in Chapter 7.4 or 7.24 "Service functions with LED display".

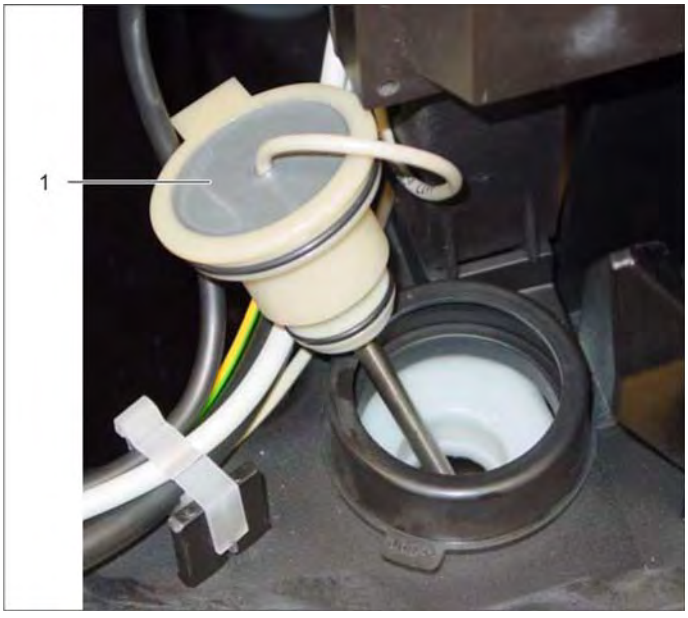
6.9 Fuel tank



1 Closure fuel tank
2 Seal fuel tank closure
3 Filler neck



1 Fuel filter
2 Level sensor for fuel tank
3 Fuel tank



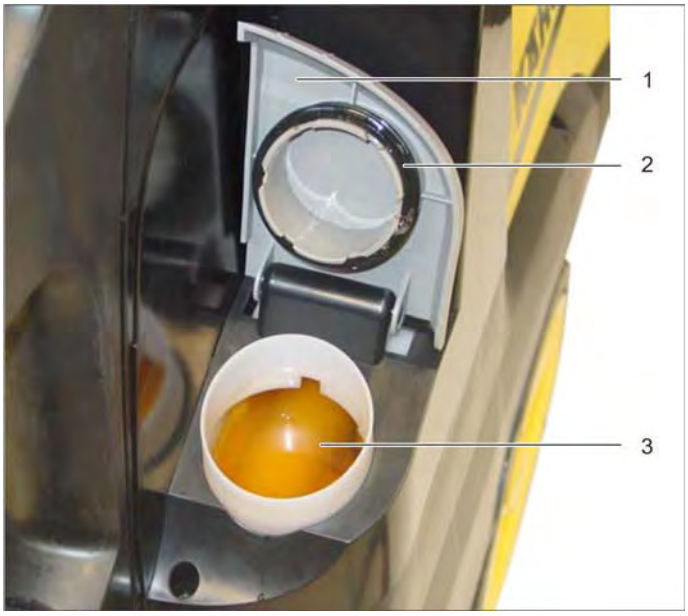
1 Level sensor for fuel tank

6.10 Liquid softener

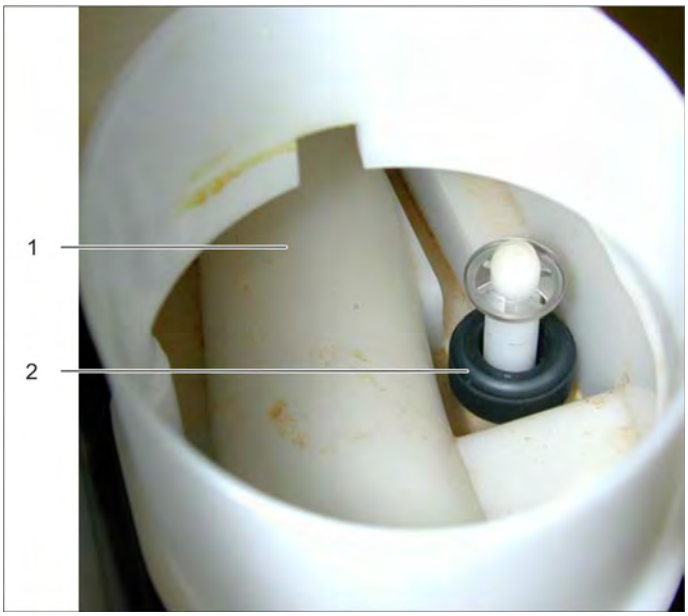
6.10.1 Feed via tank (export variant)

The feed of the liquid softener takes place in accordance with the setting on the service switch. The setting is described under 6.8 "Service switch". The feed only takes place in the programme switch position "ECO" and "Warm water" at a set water temperature ≥ 50°C.
Bottle counter is increased by 1 after 2000 impulses.
The empty message takes place via the level sensor and is shown via an indicator lamp or display.
The burner operation is also possible without liquid softener. With hard water, however, malfunctions due to lime deposits must be expected.

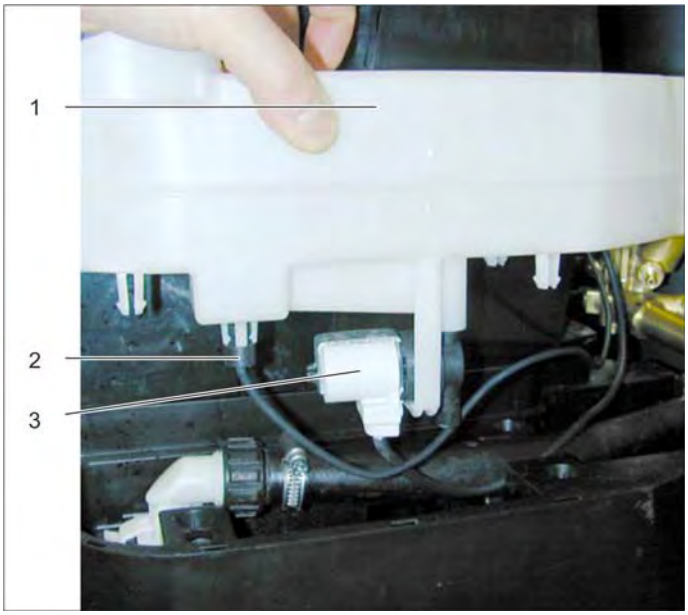
Note
The dosing unit must not be switched off when using RM 111.



1 Lock
2 Washer
3 Liquid softener reservoir



1 Liquid softener reservoir
2 Level sensor

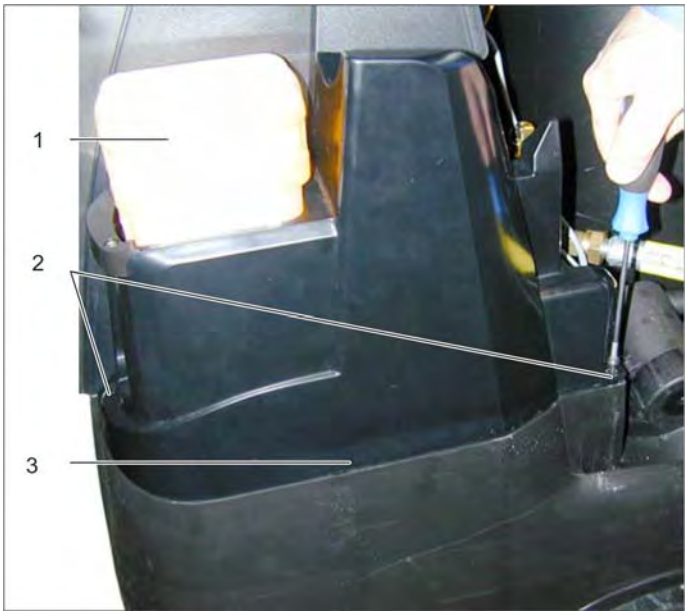


1 Liquid softener reservoir
2 Level sensor
3 Dosing valve

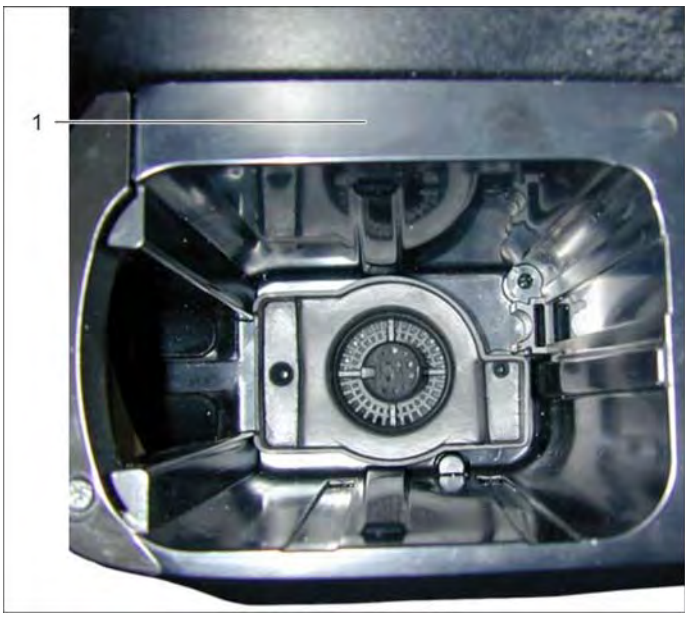
6.10.2 Feed via RFID (Europe variant)

The feed of the liquid softener takes place in accordance with the setting on the service switch. The setting is described under 6.8 "Service switch". The feed only takes place in the programme switch position "ECO" and "Warm water" at a set water temperature ≥ 50°C.
Bottle counter is increased by 1 after 2000 impulses.
The empty message takes place via the level sensor in the liquid softener tank or via the write-read electronics in combination with the tag on the bottle. The liquid softener bottle must be inserted within 5 operating hours, otherwise the burner switches off for the protection against calcification and a corresponding malfunction appears.
The burner operation is only enabled again by inserting a new original liquid softener bottle. A bottle that has already been empty but refilled will not be accepted.
The bottle works with an internal vacuum. If the bottle is damaged or a hole is drilled into the bottle, it will drain within a short period of time.
During burner operation with hard water without liquid softener malfunctions due to lime deposits must be expected.

Note
The dosing unit must not be switched off when using RM 111.
RM 111 was specially developed for the protection against black water. In order that the corrosion protection works optimally, it is also added in cold water operation. RFID recognises RM 111 over the day on the bottle and doses accordingly.



1 Liquid softener bottle
2 Screws
3 RFID - attachment



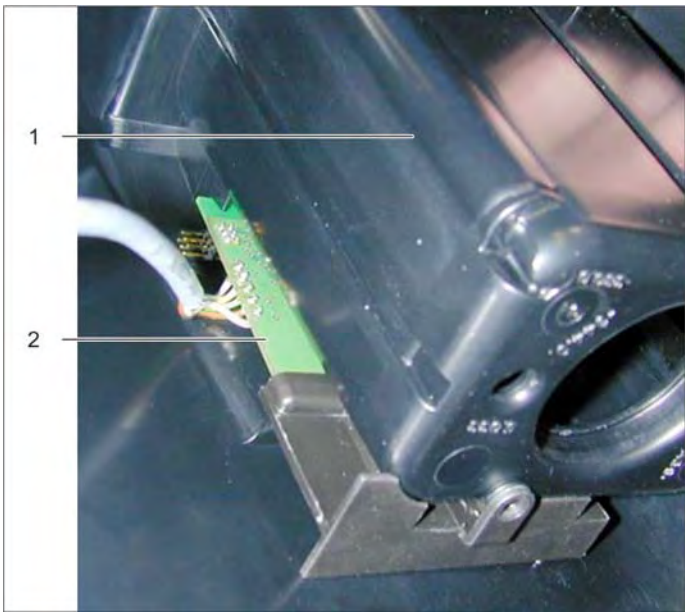
1 RFID - attachment
2 Bottle opener - insertion

1 Liquid softener bottle
2 Sealing

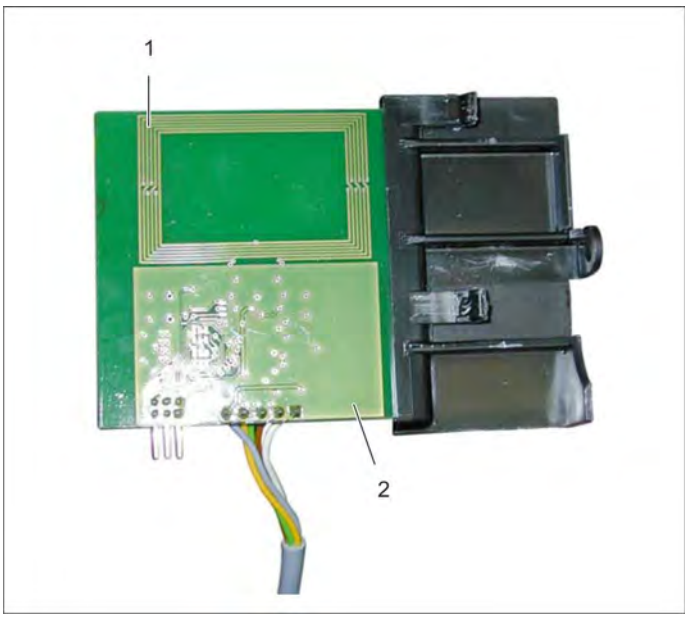
Note
The sealing is pierced upon inserting the bottle.

6.10.3 Functionality RFID

RFID (Radio Frequency Identification) stands for the identification by means of high frequency.
There is a transponder under the label on the softener bottle (microchip with antenna, also called tag).
The write-read electronics installed in the RFID attachment can read data from the tag and also write data to the tag.
The tag obtains the power supply from the high frequency field of the write-read electronics. The data transfer takes place by changes of the field intensity.
The write/read electronics query the type of detergent and saves the dosed units to the tag.
When the bottle is empty (after 2000 units) or when the level switch in the softener container reports empty, an after-running time of 5 hours is started. This after-running time is counted on the tag.
When the after-running time has elapsed or if the empty bottle is removed, the burner is switched off.
Once a bottle has been detected to be empty, it is blocked electronically and can no longer be used. Therefore, you must insert a new original softener bottle.



1 RFID - attachment
2 Write-read electronics



1 Antenna
2 Write-read electronics

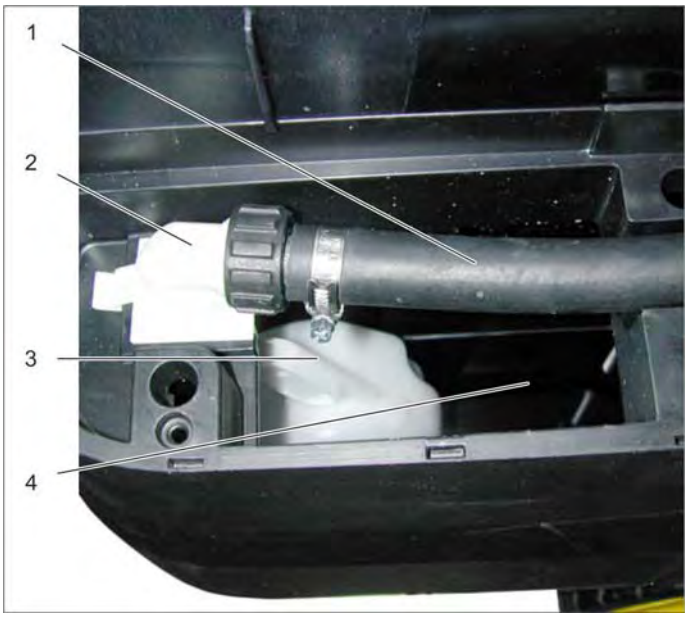
1 Label
2 RFID tag, behind the label

Note
Tag is an electronic component on the new square softener bottle. The tag is located behind the bottle label. The tag can be read and written on electronically.

6.11 Swimmer tank

Float tank
The float container is integrated in the chassis. It is located on the right, under the liquid softener reservoir.
The swimmer reservoir supplies the pump evenly with water. It is also used to separate the water inlet and the pump and prevents detergent from entering the water supply line in case of damage.

Swimmer valve
Water flows into the float container through the opened float valve.
When the water level is rising, the float ball rises and closes the float valve.
The float valve is adjusted permanently and must not be readjusted.



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

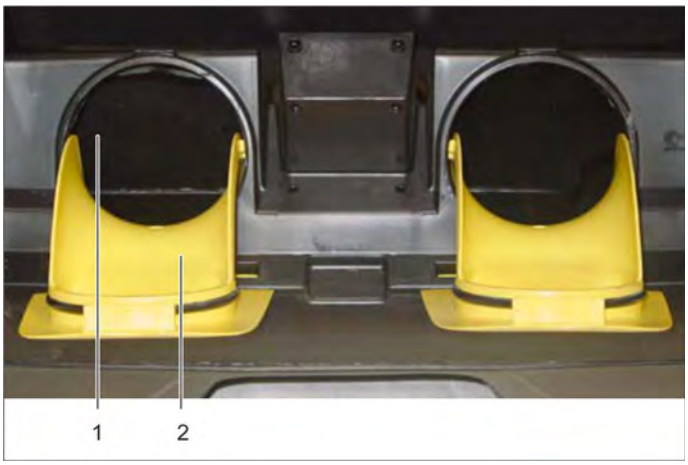
6.12 Detergent Tank

6.12.1 Detergent tank 1

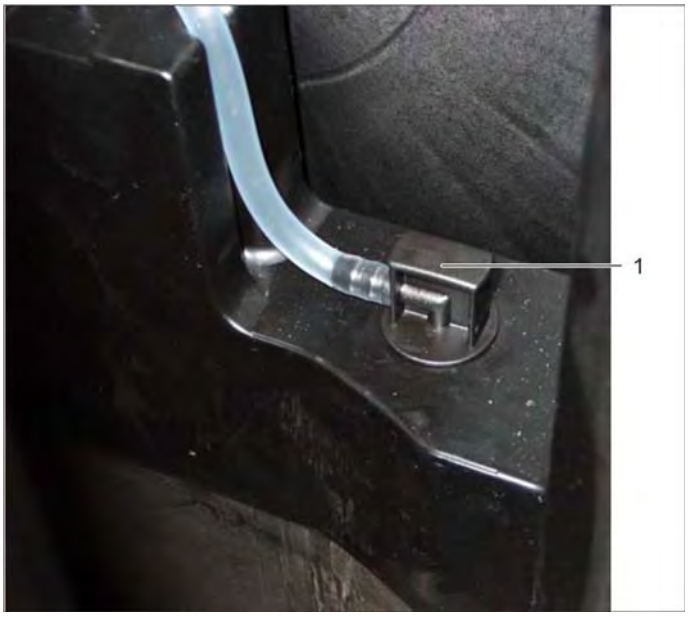
Detergent tank 1 (volume 10l)
The detergent tank 1 is located in the rear part of the chassis.

Suction hose
The plug with the connection of the suction hose is located between the booster heater and the lower storage compartment or the hose reel.

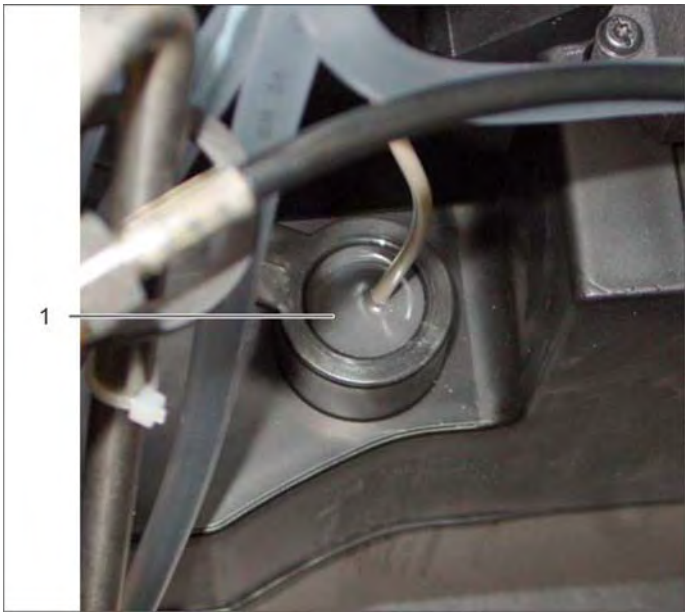
Level sensor (option)
The level sensor contains a reed switch that is operated by means of a magnet in the float.



1 Detergent tank 1
2 Lock



1 Stopper



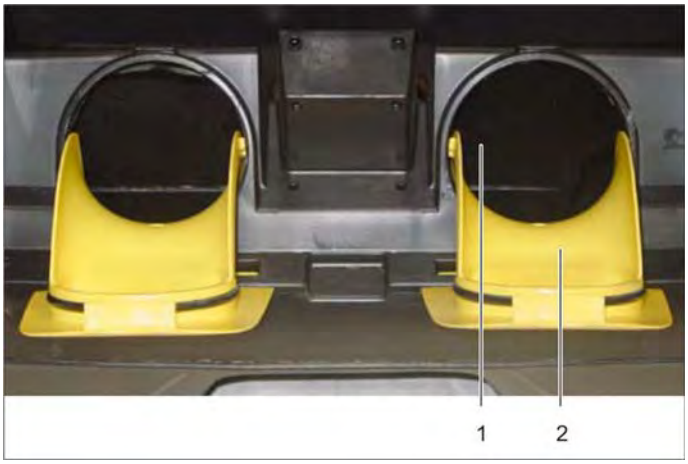
1 Level sensor (option)

6.12.2 Detergent tank 2

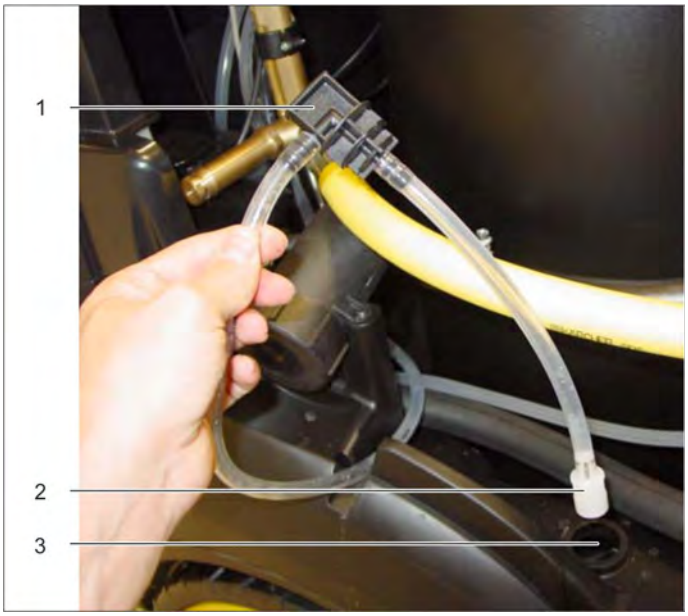
Detergent tank 2 (volume 20l)
The detergent tank 2 is located in the right part of the chassis.

Suction hose
The plug with the connection of the suction hose is located above the right transport wheel. A detergent filter is attached at the end of the suction hose

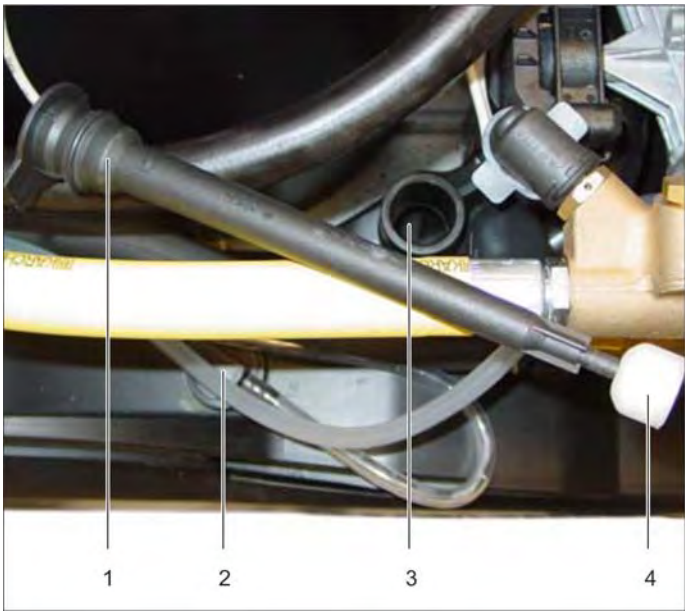
Level sensor
The level sensor contains a reed switch that is operated by means of a magnet in the float.



1 Detergent tank 2
2 Lock



1 Stopper
2 Cleaning agent filter
3 Detergent tank 2



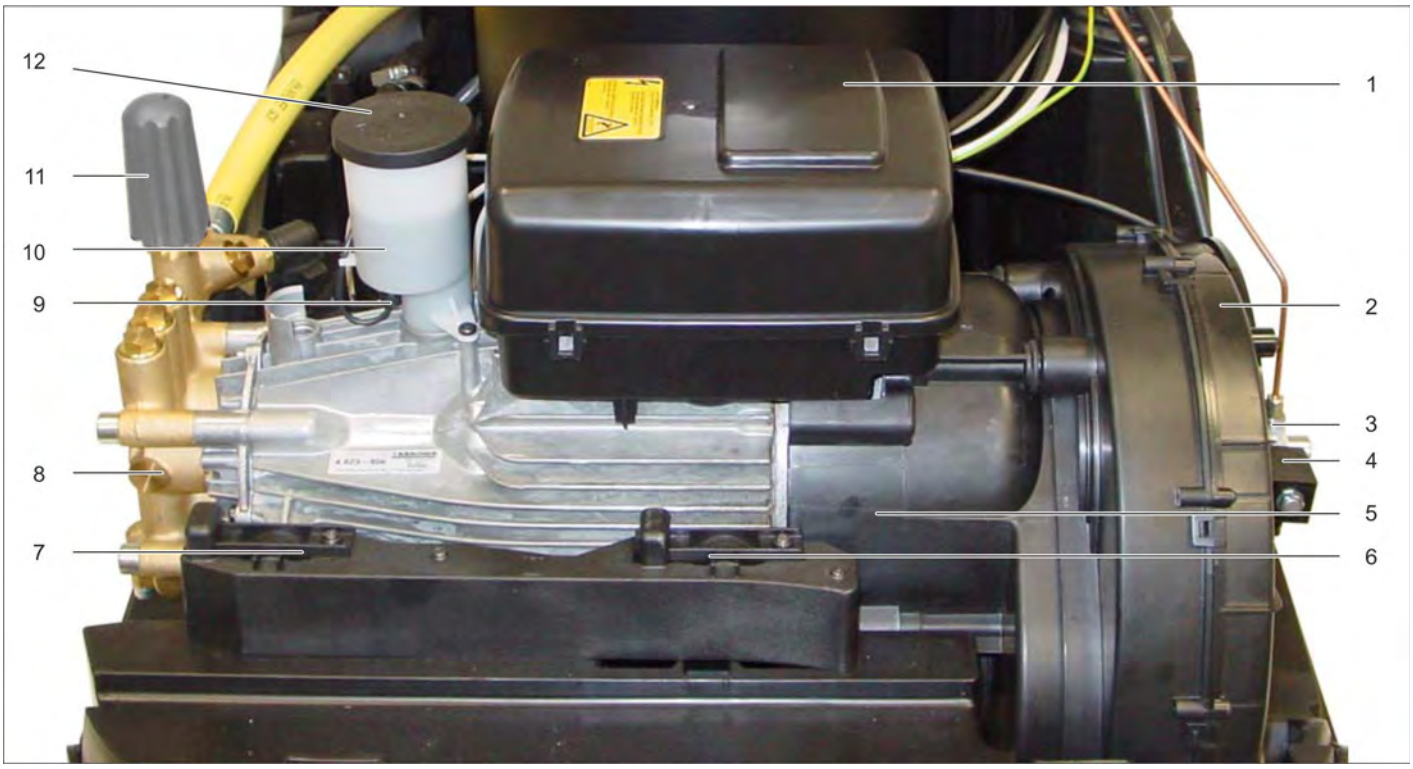
1 Level sensor (option)
2 Stopper
3 Detergent tank 2
4 Float

6.13 Detergent dosing valve

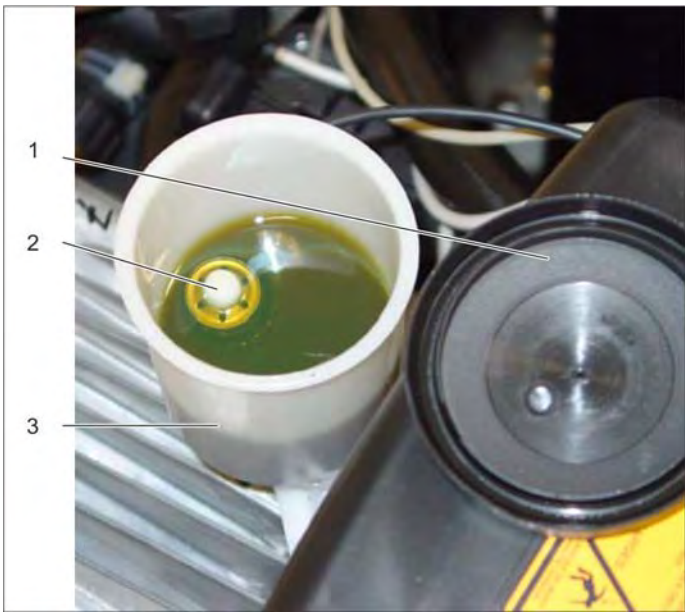
Detergent dosing valve with automatic clear rinsing in zero position

1 Water
2 Detergent tank 1
3 Detergent tank 2
4 Pump

6.14 Motor (air-cooled)



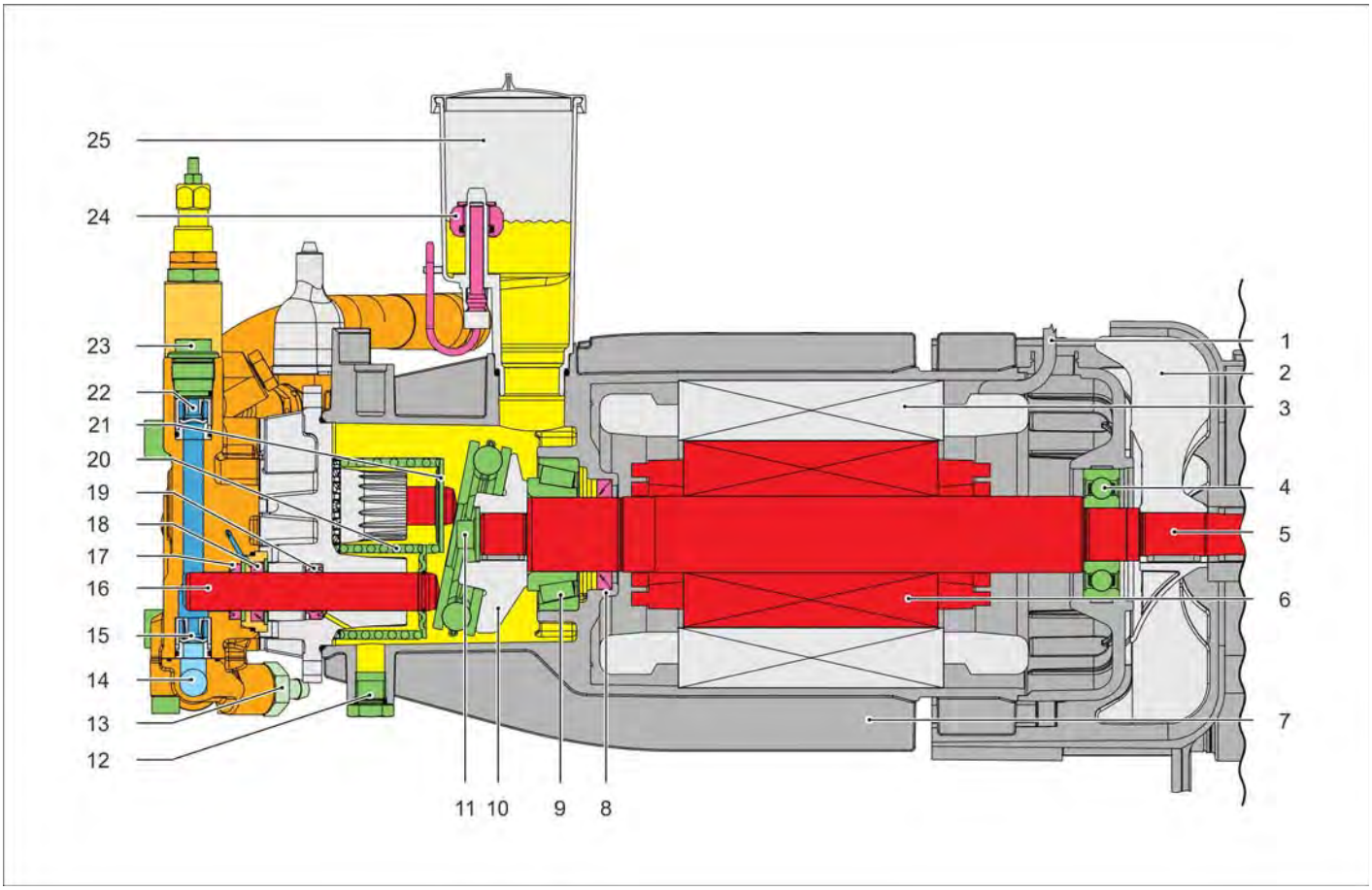
1 Electronics system
2 Burner blower
3 Fuel pump
4 Solenoid valve
5 Blower, motor cooling
6 Engine mount, left
7 Engine mount, right
8 Pump head
9 Oil level sensor
10 Oil fill container
11 Handle, pressure and volume regulation
12 Cover



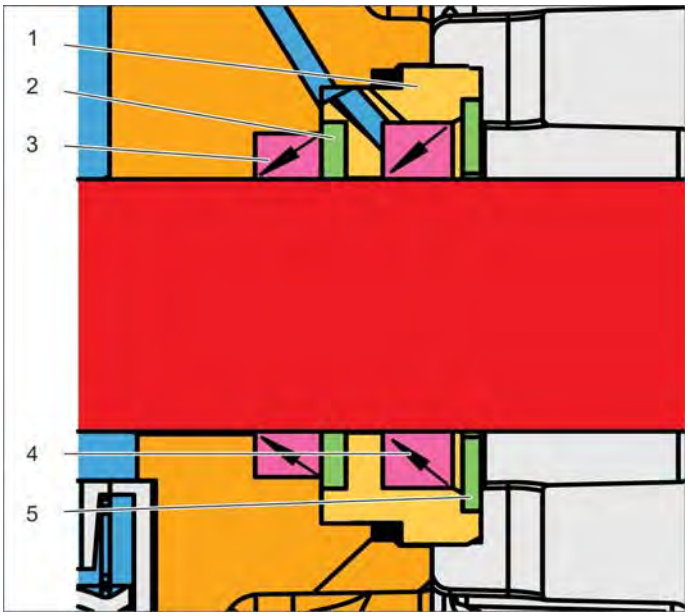
1 Cover
2 Oil level sensor
3 Oil fill container

Oil drain screw
The oil drain screw is located on the bottom of the pump casing.

6.14.1 Motor (air-cooled)

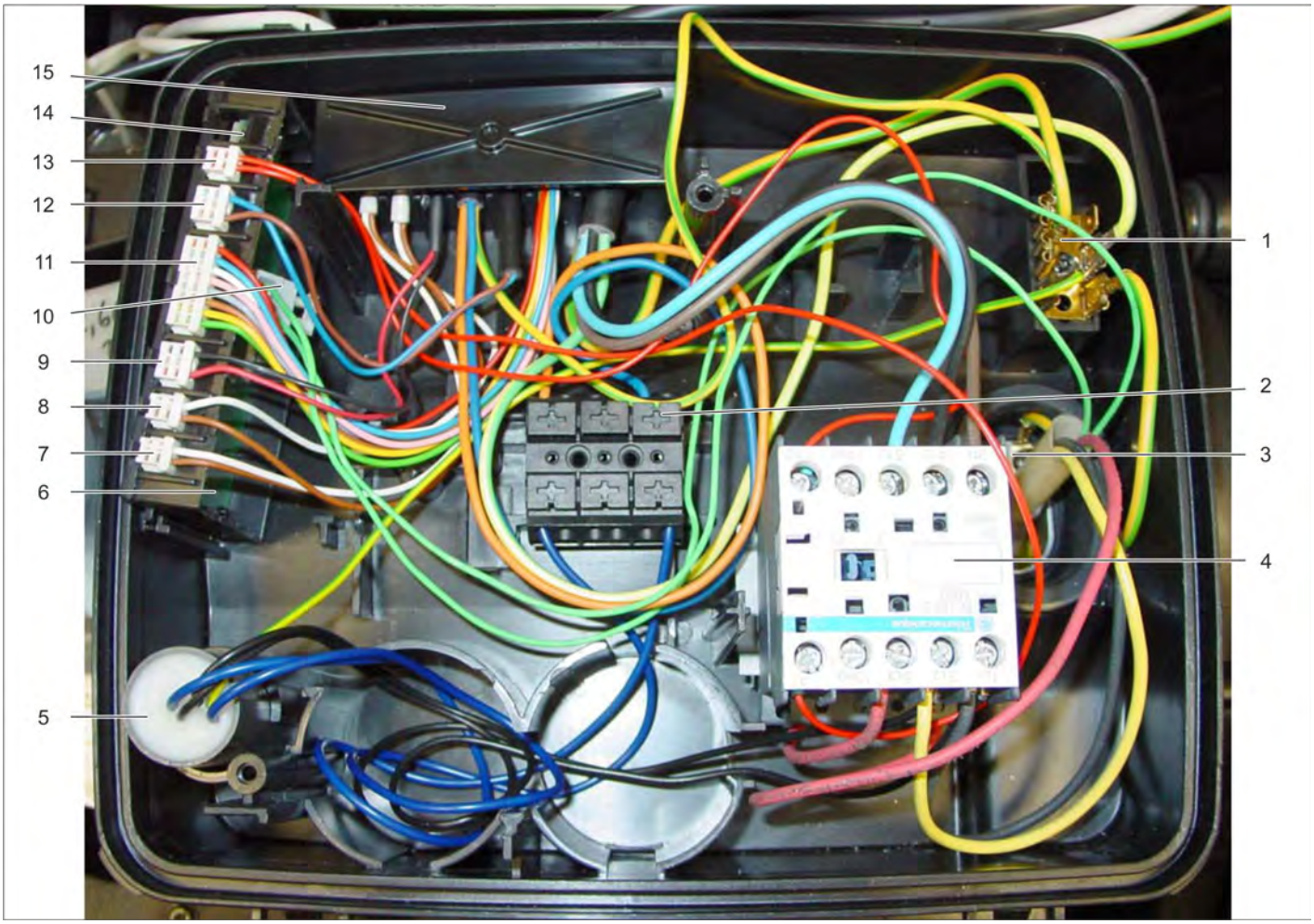


1 Connecting cable, motor
2 Fan wheel
3 Stator
4 Motor bearing, rear (B bearing)
5 Motor shaft
6 Rotor
7 Casing
8 Shaft seal ring
9 Motor bearing, front (A bearing)
10 Swash plate with axial ball bearing
11 Screw
12 Oil drain screw
13 Detergent suck in
14 Suction side
15 Suction valve
16 Piston
17 High pressure seal
18 Low pressure seal
19 Oil seal
20 Piston spring
21 Retaining plate for piston spring
22 Pressure valve
23 Valve screw
24 Oil level sensor
25 Oil fill container



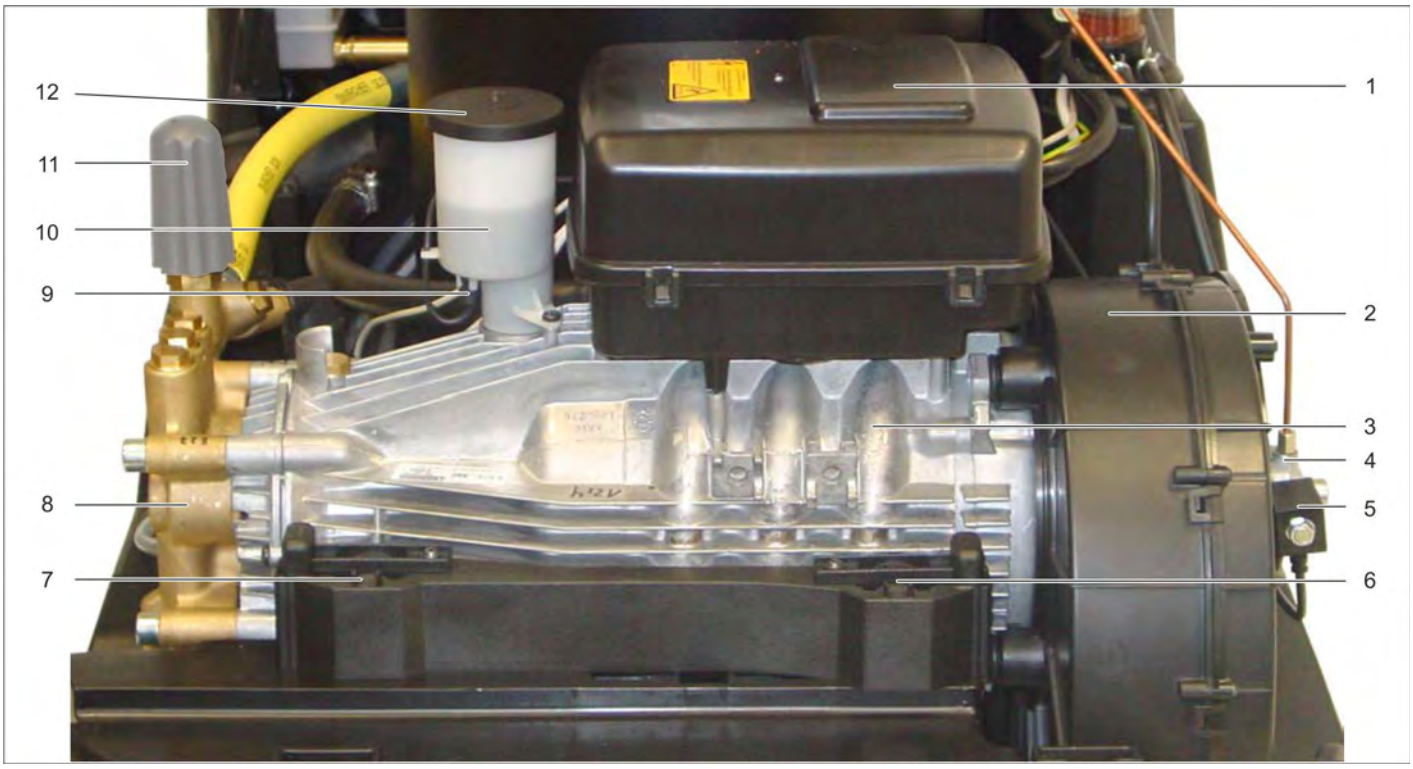
1 Bushing
2 Washer, plastic
3 High pressure seal
4 Low pressure seal
5 Washer, brass

6.15 Electrical box, air-cooled motor

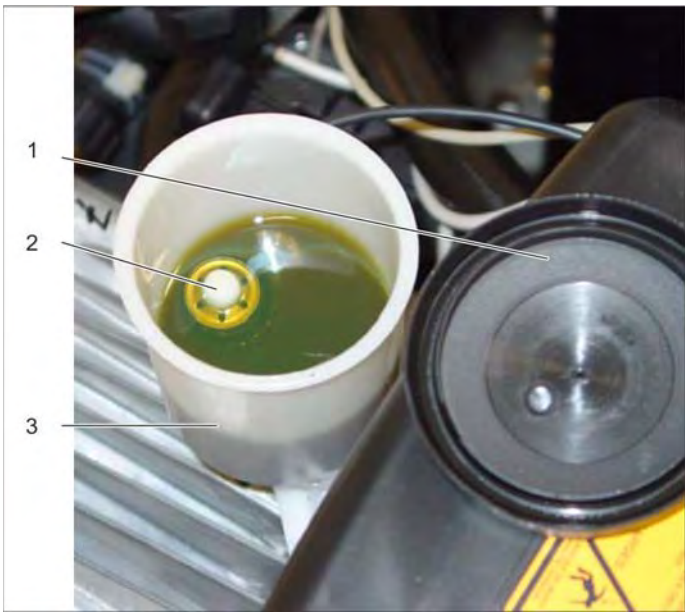


1	Ground point	
2	Terminal strip	
3	Connection to earth, motor	
4	Engine contactor	K1
5	Anti-interference filter	
6	Board, motor distributor	
7	Connection pressure switch ON	
8	Connection pressure switch OFF	
9	Oil level sensor connection	
10	Connection of coiling protection contact	
11	Connection printed circuit board, operating panel	
12	Connection fuel solenoid valve	
13	Connection motor protection	
14	Connection is not used	
15	Cable comb	

6.16 Engine (water-cooled)



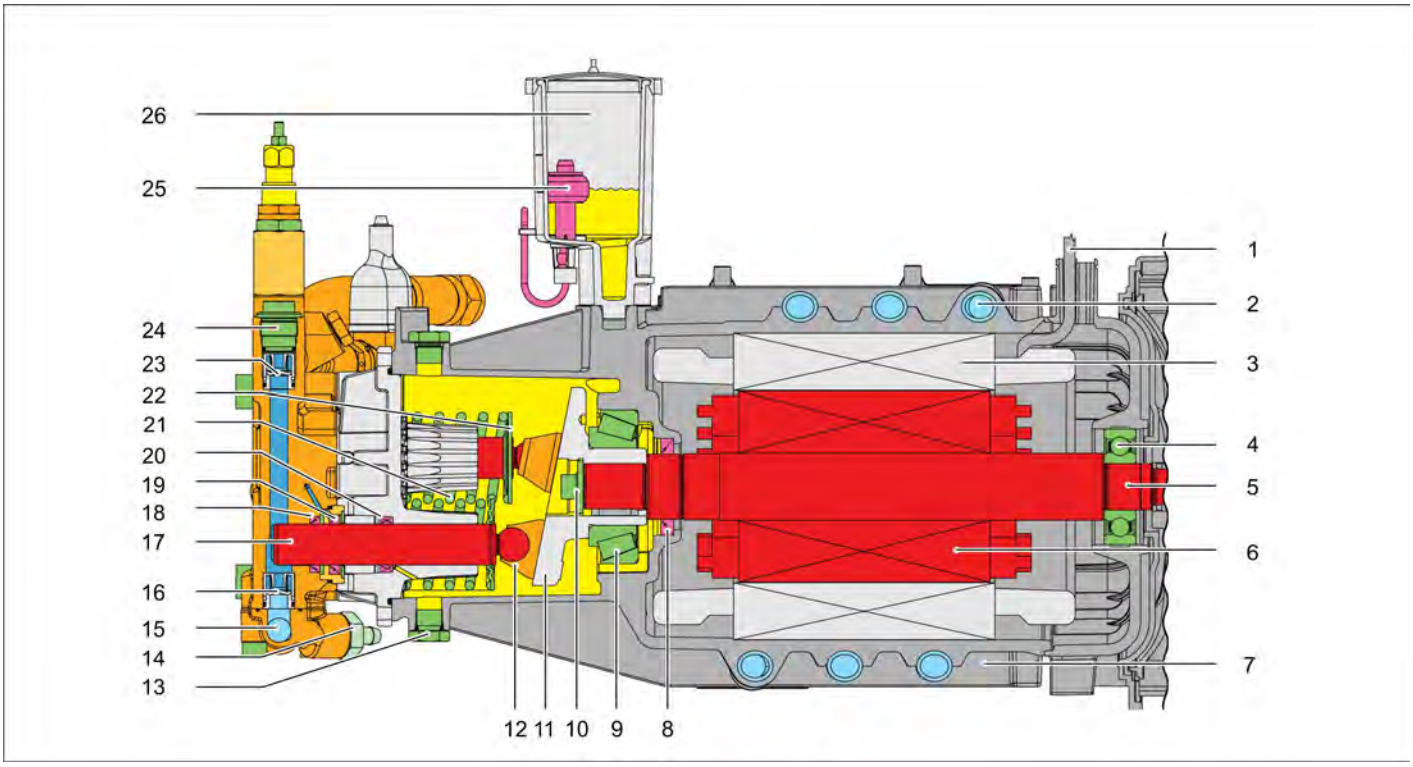
1 Electronics system
2 Burner blower
3 Cooling coil
4 Fuel pump
5 Solenoid valve
6 Engine mount, left
7 Engine mount, right
8 Pump head
9 Oil level sensor
10 Oil fill container
11 Handle, pressure and volume regulation
12 Cover



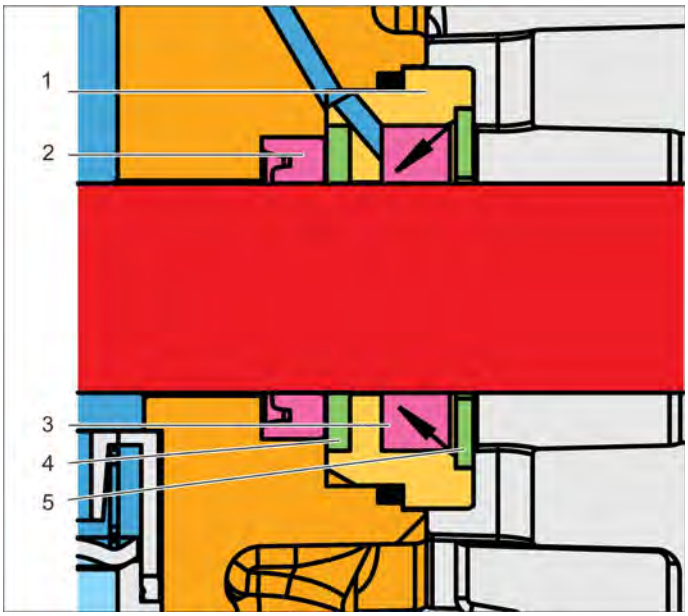
Oil drain screw
The oil drain screw is located on the bottom of the pump casing.

1 Cover
2 Oil level sensor
3 Oil fill container

6.16.1 Engine (water-cooled)

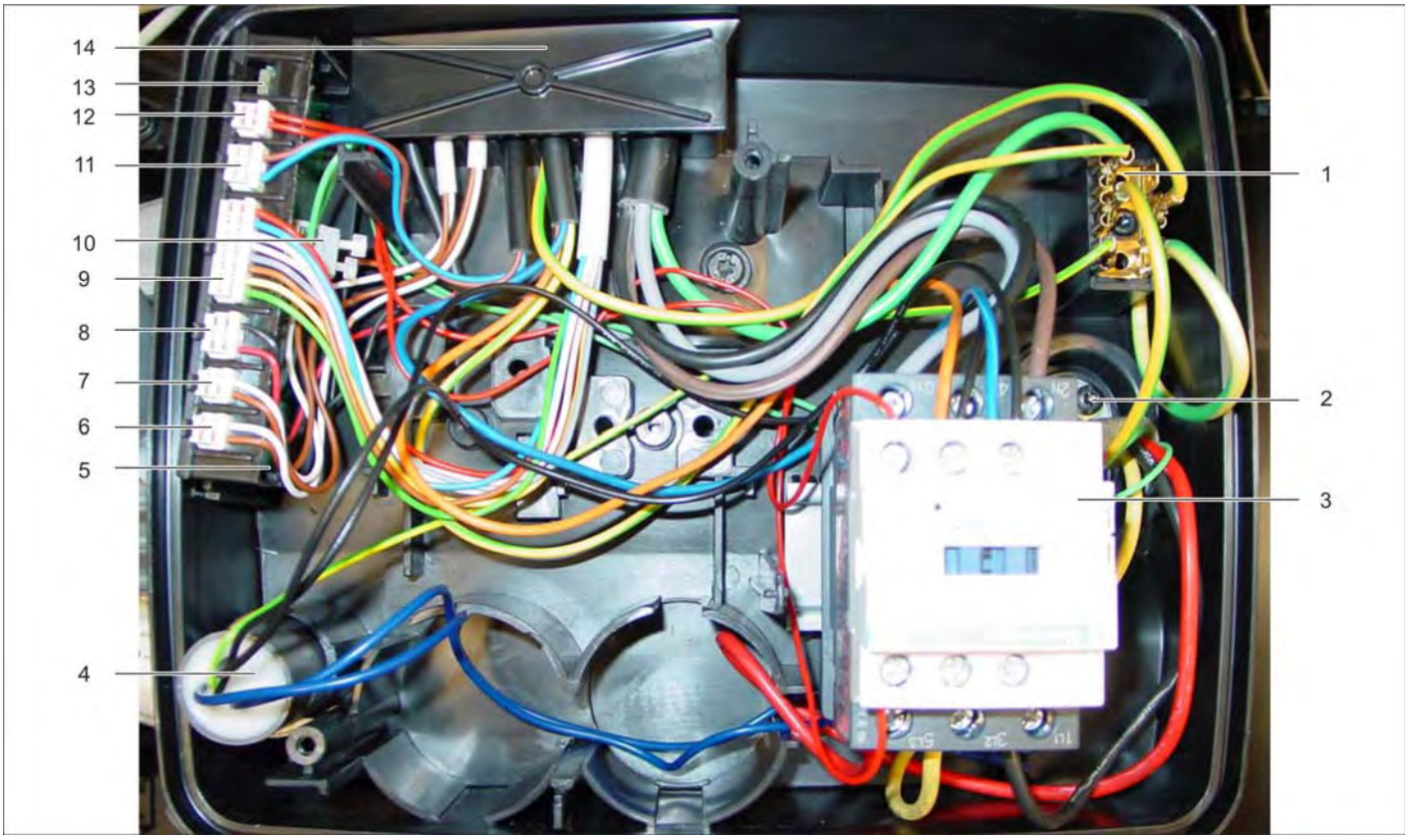


1 Connecting cable, motor
2 Cooling coil
3 Stator
4 Motor bearing, rear (B bearing)
5 Motor shaft
6 Rotor
7 Casing
8 Shaft seal ring
9 Motor bearing, front (A bearing)
10 Screw
11 Swash plate
12 Slide shoe
13 Oil drain screw
14 Detergent suck in
15 Suction side
16 Suction valve (green with HDS 13/20)
17 Piston
18 High pressure seal
19 Low pressure seal
20 Oil seal
21 Piston spring
22 Retaining plate for piston spring
23 Pressure valve
24 Valve screw
25 Oil level sensor
26 Oil fill container



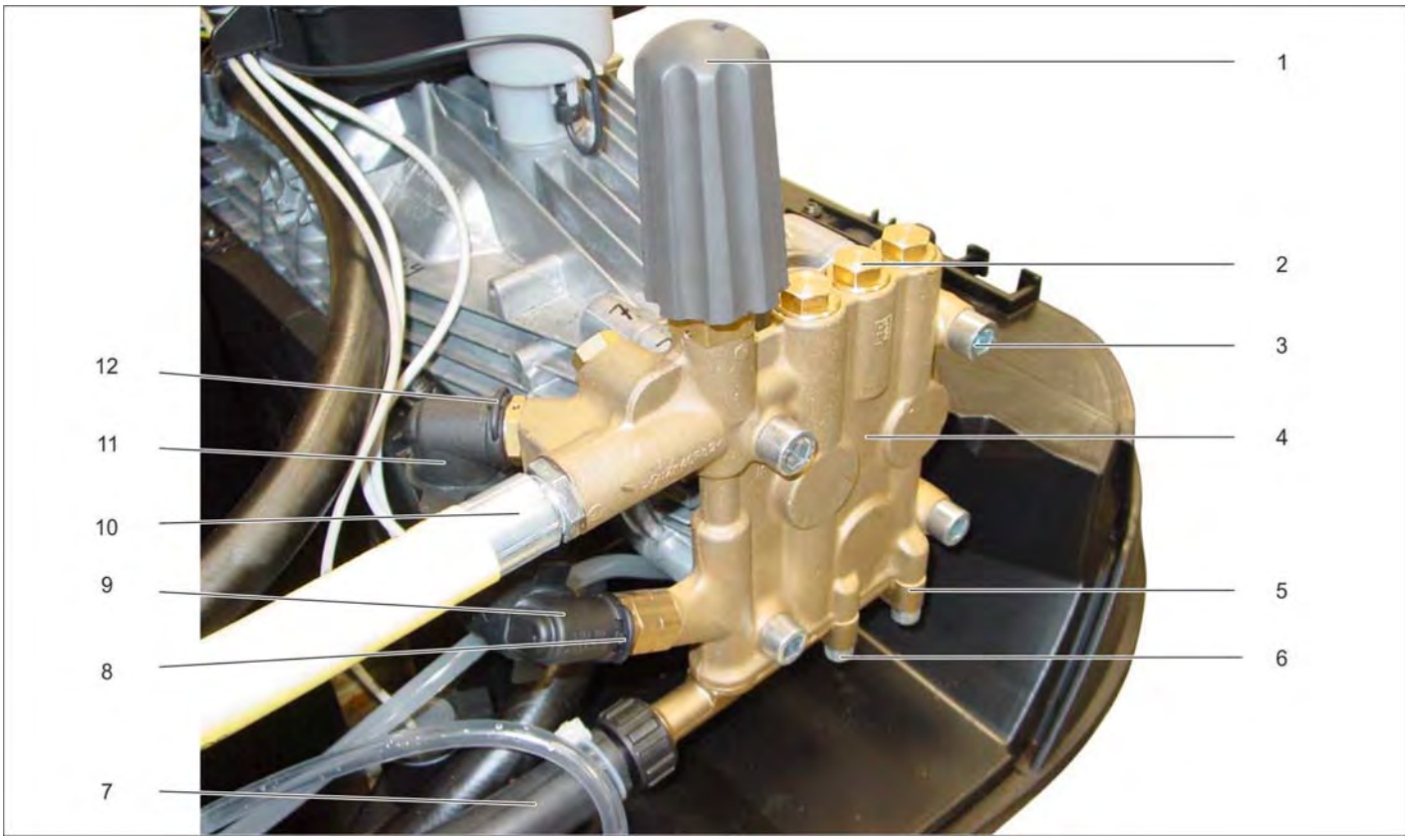
1 Bushing
2 High pressure seal
3 Low pressure seal
4 Washer, plastic
5 Washer, brass

6.16.2 Electrical box, water-cooled engine



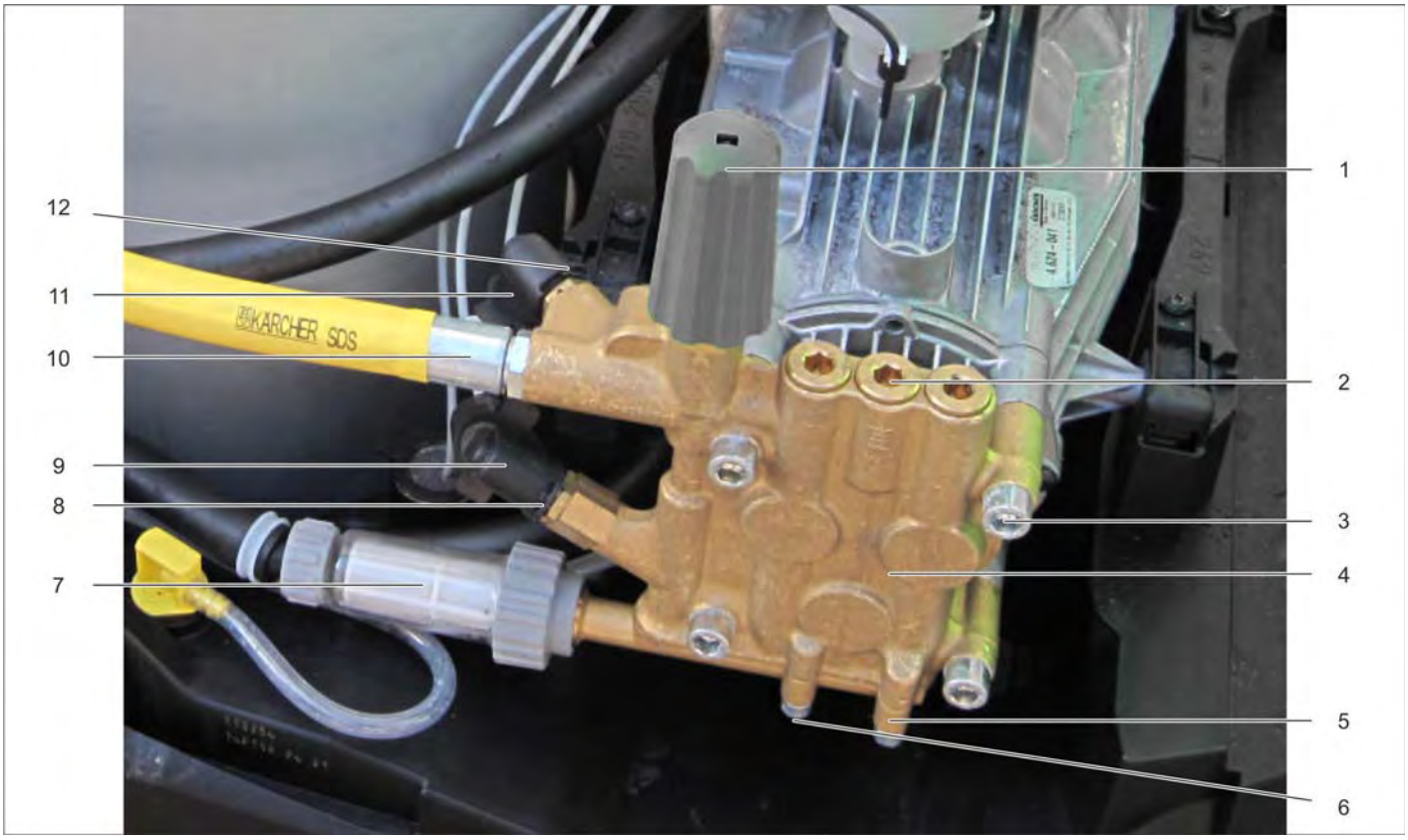
1 Ground point
2 Connection to earth, motor
3 Engine contactor
4 Anti-interference filter
5 Board motor distributor
6 Connection pressure switch ON
7 Connection pressure switch OFF
8 Oil level sensor connection
9 Connection printed circuit board, operating panel
10 Connection of coiling protection contact
11 Connection fuel solenoid valve
12 Connection motor protection
13 Connection is not used
14 Cable comb

6.17 Pump



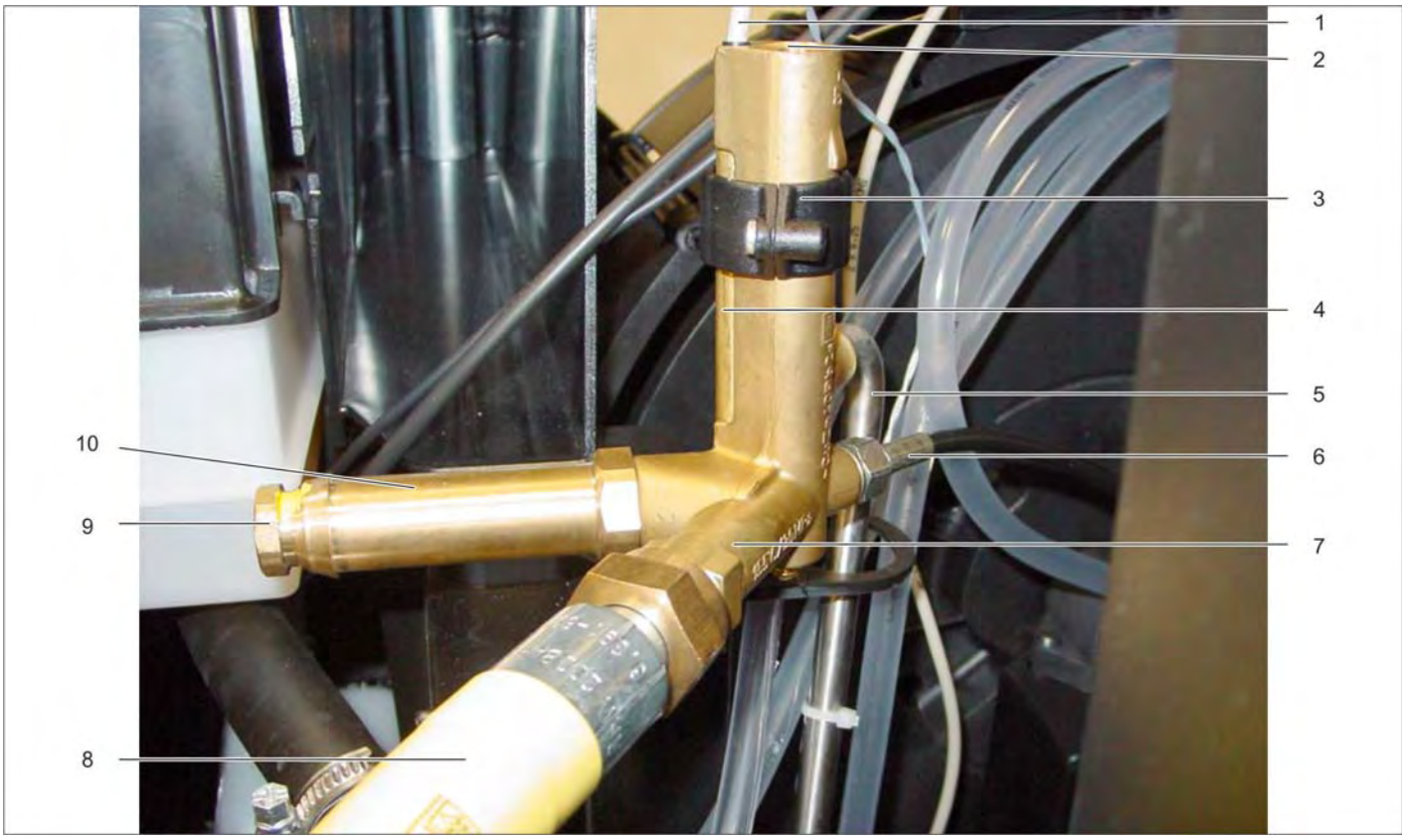
1 Handle, pressure and volume regulation
2 Screwed sealing plug
3 Screws pump head
4 Pump head
5 Suction jumper
6 Screwed sealing plug
7 Water pipes
8 Safety bracket, pressure switch OFF
9 Pressure switch OFF
10 SDS hose to the safety block
11 Pressure switch ON
12 Safety bracket, pressure switch ON

6.17.1 Revised version with filter before the pump

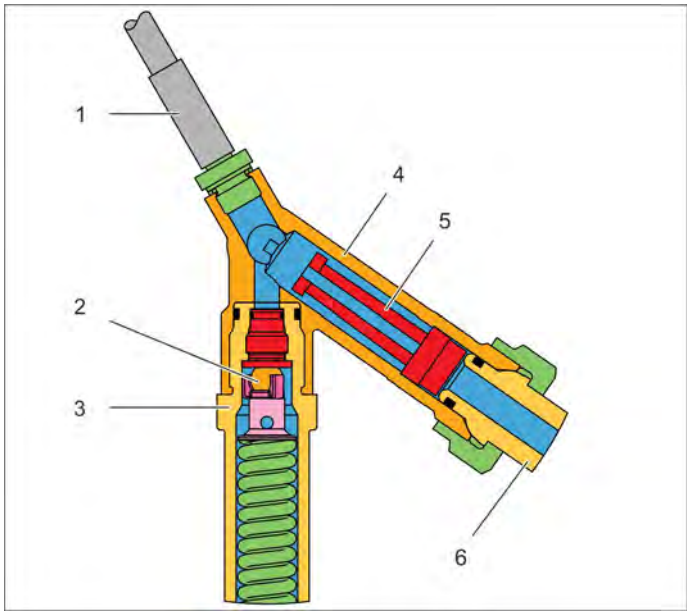


1 Handle, pressure and volume regulation
2 Screwed sealing plug
3 Screws pump head
4 Pump head
5 Suction jumper
6 Screwed sealing plug
7 Filter
8 Safety bracket, pressure switch OFF
9 Pressure switch OFF
10 SDS hose to the safety block
11 Pressure switch ON
12 Safety bracket, pressure switch ON

6.18 Safety block

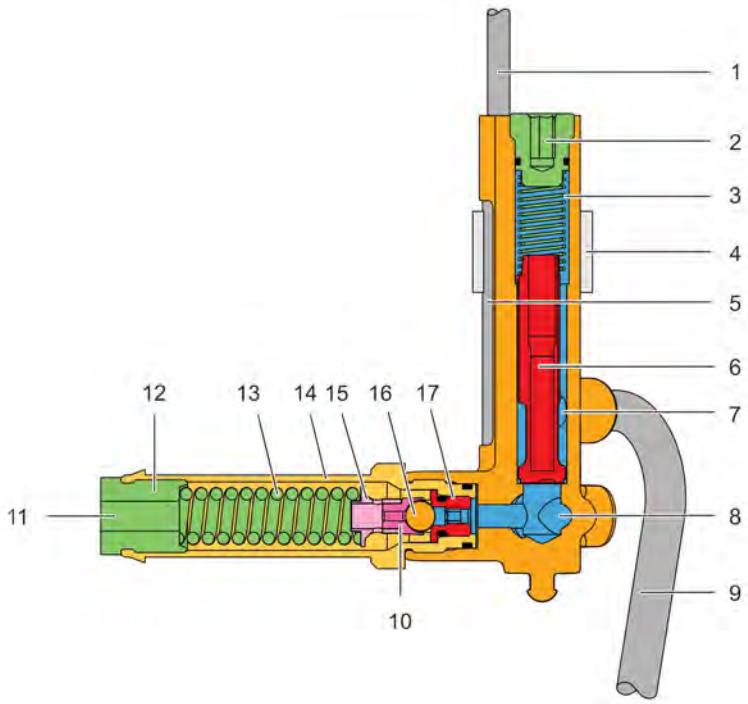


1 Connecting cable, reed switch
2 Screwed sealing plug
3 Clamping bracket
4 Reed switch
5 High pressure pipe to the on-demand heater
6 Connection hose pressure gauge
7 Safety block
8 SDS hose
9 Adjustment screw, safety valve
10 Valve ball



1 Connection hose pressure gauge
2 Valve ball
3 Safety valve
4 Safety block
5 Sieve
6 SDS hose

6.19 Safety block (water shortage safeguard old)

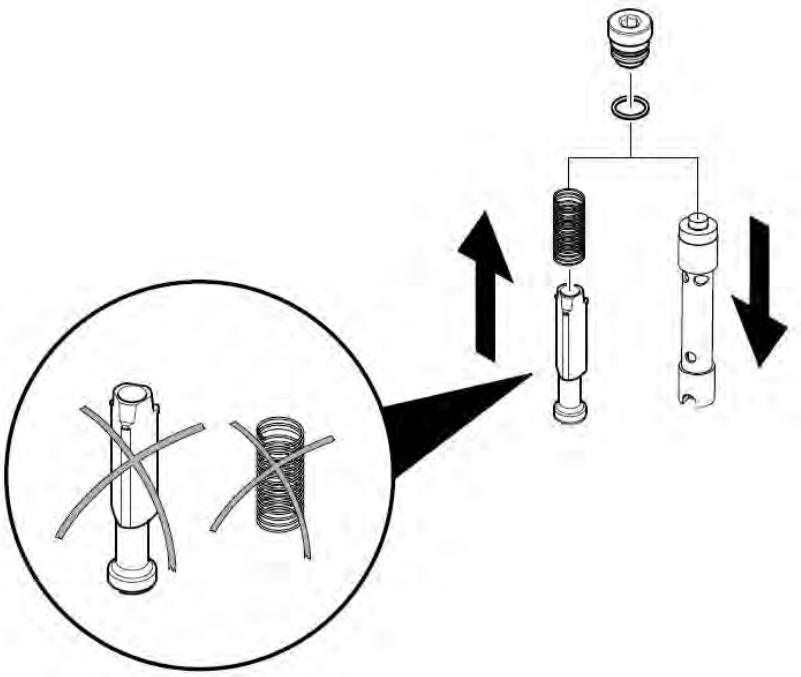


1 Connecting cable, reed switch
2 Screwed sealing plug
3 Spring
4 Clamping bracket
5 Reed switch
6 Magnetic piston
7 Holes
8 Water inlet, from the high pressure pump
9 High pressure pipe to the on-demand heater
10 Mould part
11 Water outlet
12 Adjusting screw
13 Spring, safety valve
14 Casing
15 Spring plate
16 Valve ball
17 Valve seat

6.19.1 Water shortage safeguard as cartridge

Note

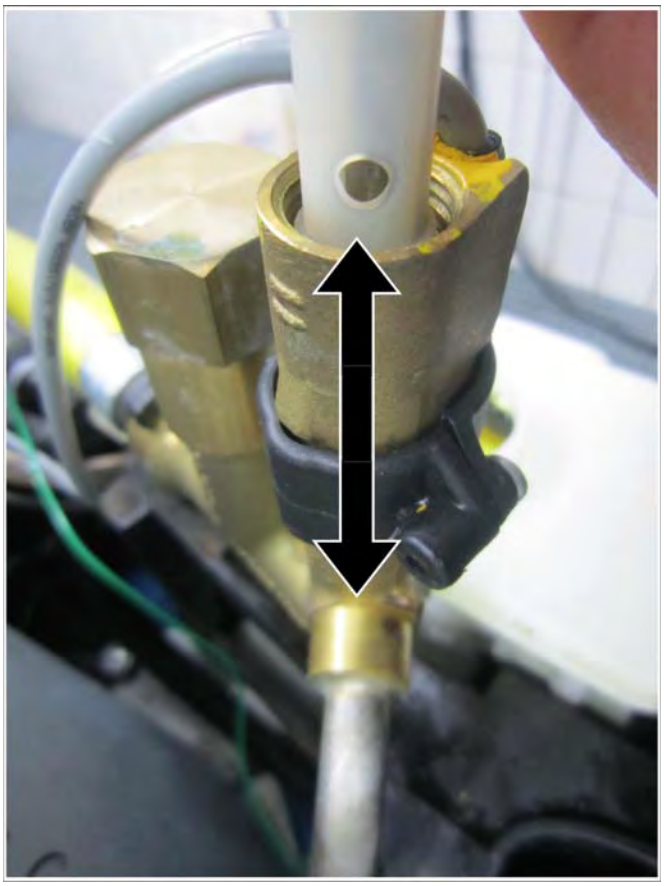
The cartridge replaces the previous design with piston and spring.



6.19.2 Safety block (water shortage safeguard new)

Note

Recommended installation direction: The lower drilled hole of the cartridge points towards the high-pressure pipe to the booster heater.



6.19.3 Function water shortage safeguard and dry-run protection

The lack of water fuse prevents the burner from switching on in case of missing or insufficient water volume and thus protects the on-demand heater from overheating.
With an opened gun and a sufficient water flow the solenoid is lifted against the force of gravity in the cartridge.
The solenoid piston closes the contact of the reed switch.
This opens the fuel solenoid valve and the burner ignites.
The sieve in the water supply of the safety block prevents the contamination of the lack of water fuse.
The lack of water fuse is a safety component and therefore its locking screw is sealed.
The information regarding insufficient water volumes is sent directly to the control PCB.
There, this message is evaluated as

– lack of water fuse (shut-off of burner, see above) and as
– Dry-run protection for the pump (switch-off device).

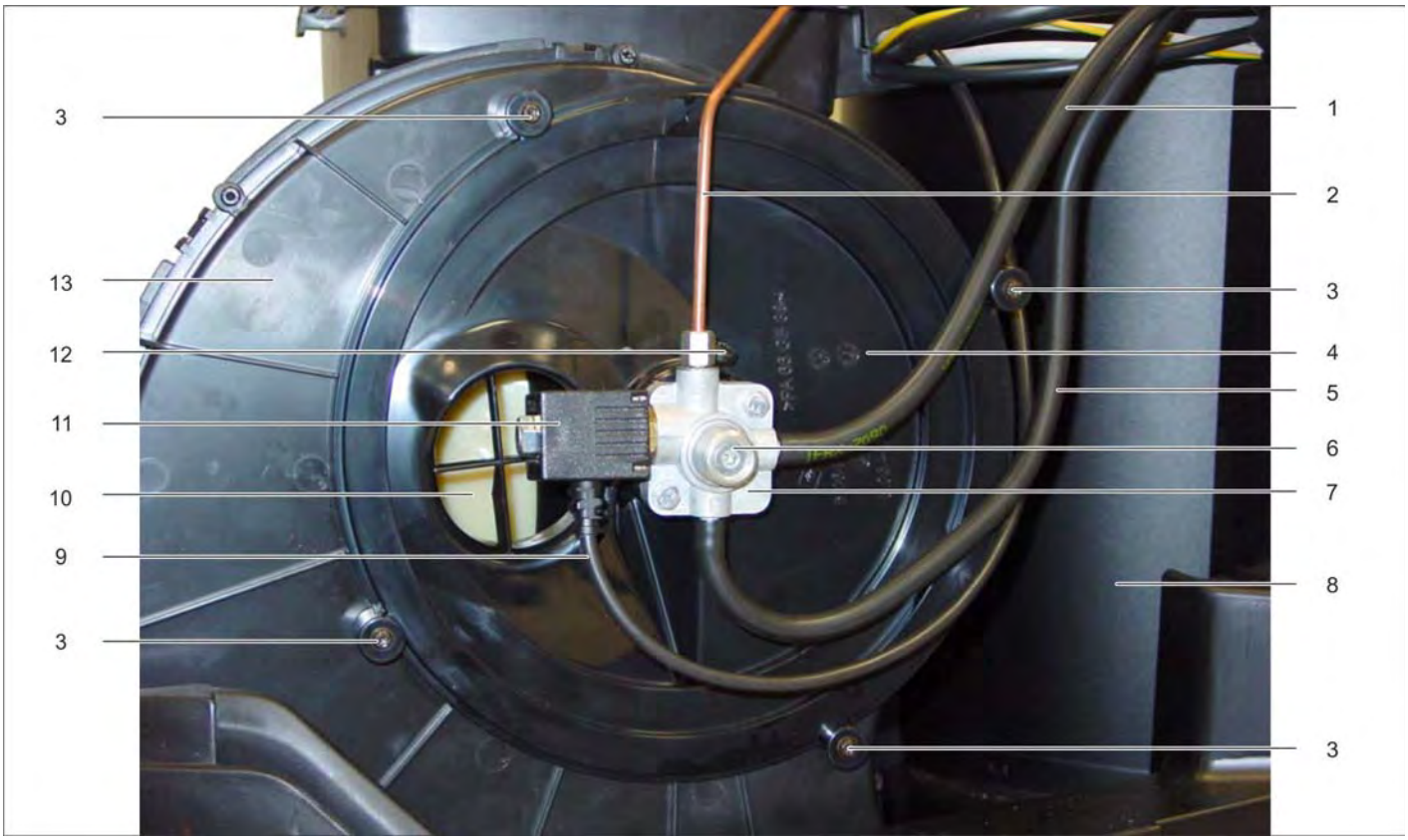
The lack of water fuse functions immediately.
It switches the burner off immediately in case of insufficient water volume and back on after the water level has been replenished.
The dry run protection is intitiated when the lack of water fuse signals insufficient water volume for 2 minutes.
The appliance shuts off with a fault message and locks up.
Only by switching the device off and back on via the main switch, it can be taken into operation again.
As the dry-run protection damages the pump in the long run, there must always be a sufficient water supply.

6.19.4 Function of safety valve

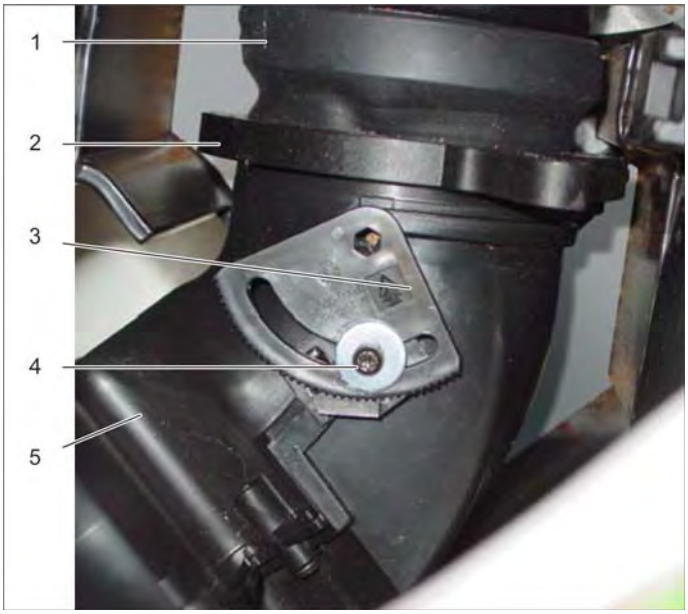
The safety valve guides the entire flow rate of the pump to the float container if the pressure switch or the overflow valve is defective and thus protects the device and accessories from inadmissibly high overpressure.
If the gun is open, the safety valve is closed and the entire flow volume of the pump is transferred to the gun at operating pressure.
If the pressure in the high pressure system rises by approx. 20 bar above the permissible operating pressure, the valve ball is lifted off the valve seat and part of the flow volume flows into the swimmer reservoir.
The opening pressure of the safety valve is adjusted with the adjustment screw.
Rotation to the right increases the opening pressure, rotation to the left decreases the opening pressure.
The safety valve is a safety component and therefore its adjustment screw is sealed.

Note
The safety valve is adjusted via the pressure increase in the system with the burner turned on, so that it limits the pressure increase to the max. permissible value (see Specifciations) with the gun closed.
Then seal the settings.

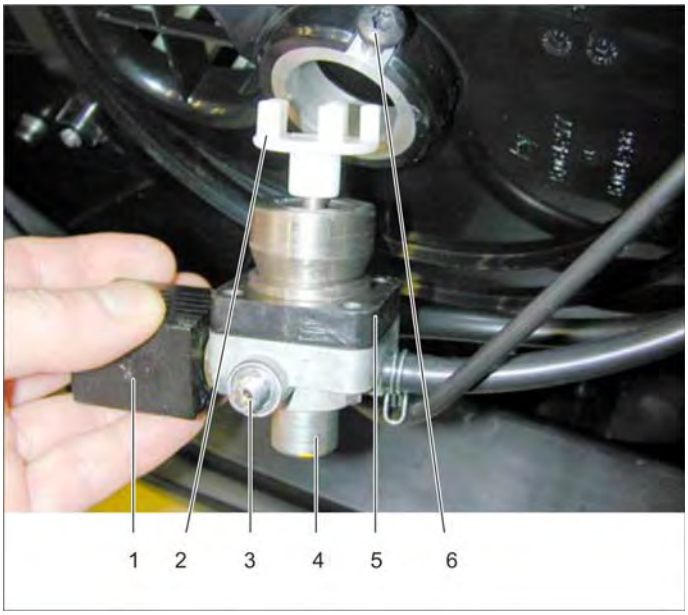
6.20 Burner blower with fuel pump



1 Return
2 Pressure line
3 Screw
4 Blower lid
5 Fuel line
6 Setting fuel pressure
7 Fuel pump
8 Continuous heater
9 Connecting cable solenoid valve
10 Suction opening, burner blower
11 Solenoid valve for fuel
12 Fastening screw fuel pump
13 Blower lid



1 Rubber collar
2 Lock
3 Air door, air volume adjustment
4 Stop screw
5 Burner blower



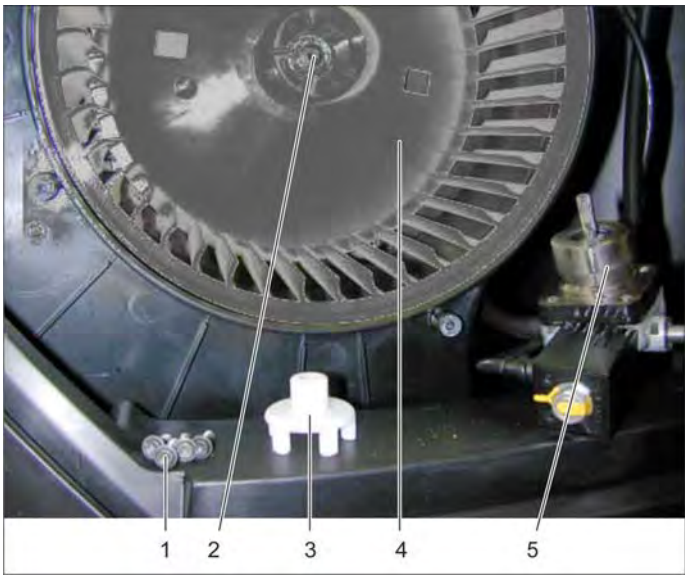
1 Solenoid valve
2 Coupling unit
3 Connection pressure line
4 Setting fuel pressure
5 Fuel pump
6 Fastening screw

Uninstall fuel pump

– Detach pressure line.
– Unscrew locking screws.
– Remove the fuel pump.

Fuel pump

The fuel pump is connected directly to the motor shaft via the coupling piece and the blower wheel. It also feeds fuel from the tank and back via the return during cold water operation. This lubricates the toothed wheel pump.
During warm water operation, the installed solenoid valve and part of the fuel reaches the burner through the fuel nozzle and is ignited there.
The fuel pressure is adjusted via the central setting screw.
During dry runs, the fuel pump will block.
The coupling piece serves as a nominal breaking point.

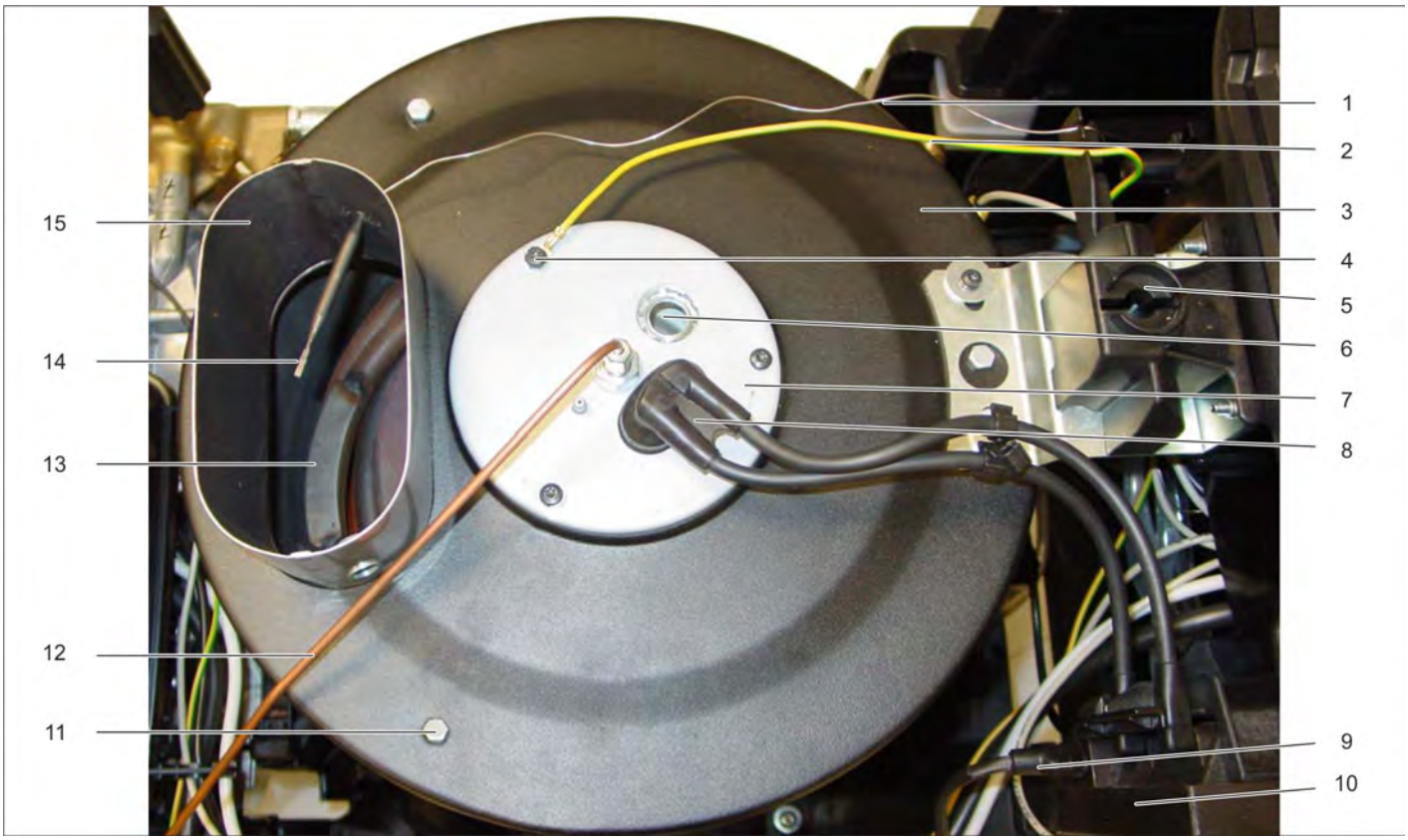


1 Fastening screws blower cover
2 Fastening screw blower wheel
3 Coupling unit
4 Blower wheel
5 Fuel pump

Burner blower

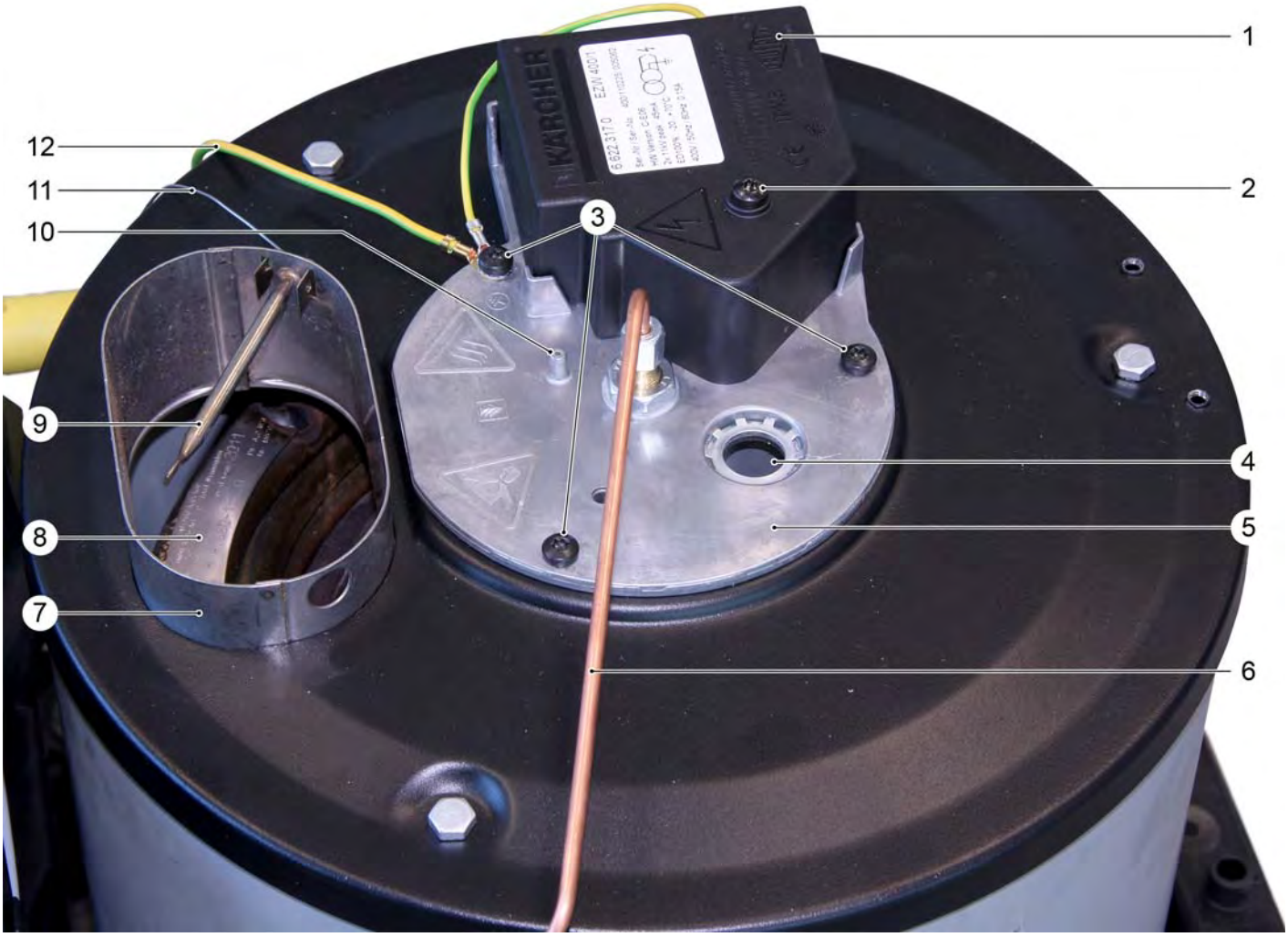
The blower supplies the burner with combustion air.
The air flap is used to adjust the air value to optimised combustion values.
The blower wheel is mounted to the motor shaft by means of 2 feather keys.

6.21 Booster heater (with ignition transformer)



1 Capillary exhaust temperature monitor
2 Protective conductor
3 Cover
4 Screws burner
5 Locking screw for appliance hood
6 Sight glass, ignition monitoring (option)
7 Burner
8 Ignition cable
9 Connection cable ignition transformer
10 Ignition transformer
11 Screw burner cover
12 Fuel line
13 Heating coil with type plate
14 Exhaust temperature sensor
15 Exhaust nozzle

6.22 Booster heater (with ignition transformer new)



1 Electronic ignition transformer
2 Fastening screw of ignition transformer
3 Screws for burner cover (3 x)
4 Sight glass, ignition monitoring (option)
5 Burner cover
6 Fuel line
7 Exhaust nozzle, on-demand heater
8 Type plate of heating coil
9 Exhaust temperature sensor
10 Connection for air pressure measurement
11 Capillary exhaust temperature monitor
12 Protective conductor

6.22.1 Type plate of heating coil

The type plate of the heating coil can be read through the exhaust stack.

1 Year of manufacture
2 Specifications
3 Part number of heating coil
4 Pressure test passed
5 Continuous plant number

6.22.2 Ignition transformer

Various ignition transformers are installed in the devices.

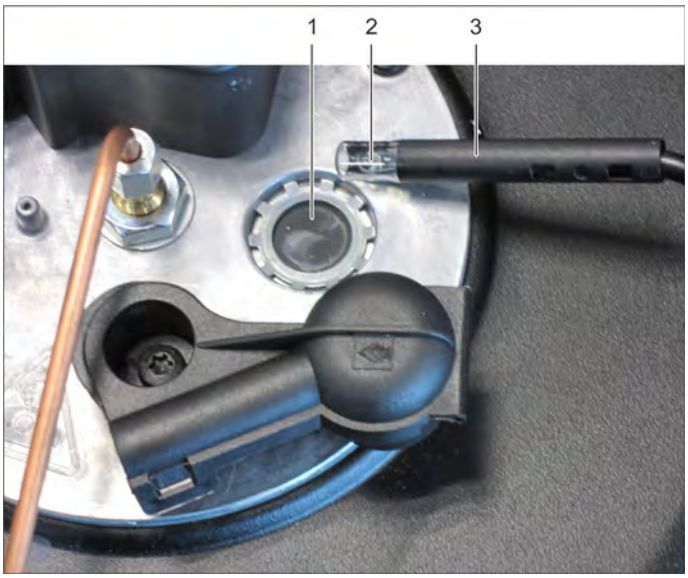
With older devices or devices for special voltages the conventional ignition transformers are still used.

Electronic ignition transformer

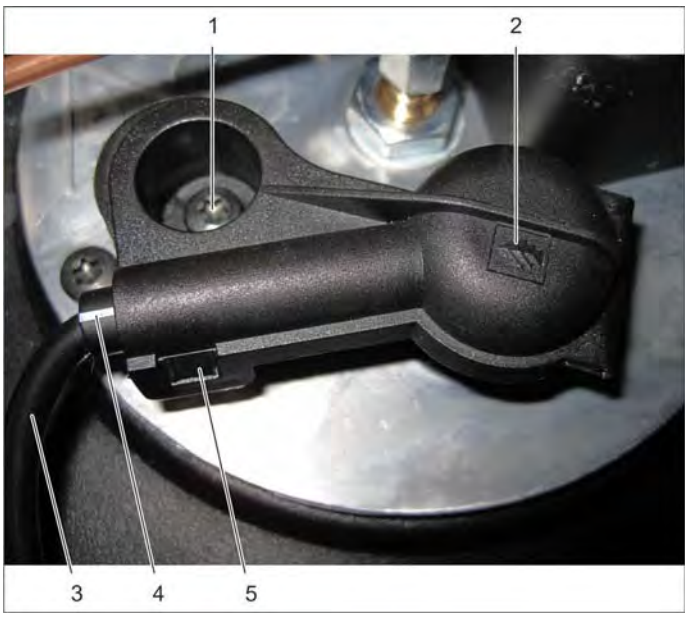
The integrated electronic ignition transformer (see picture above) is meanwhile used for all devices, except the devices for special voltages. The electronic ignition transformer is installed directly on the burner and secured with a screw that is accessible from the top. Ignition cables are not required.

Ignition transformer of conventional type with ignition cable

6.22.3 Flame sensor with holder on the burner

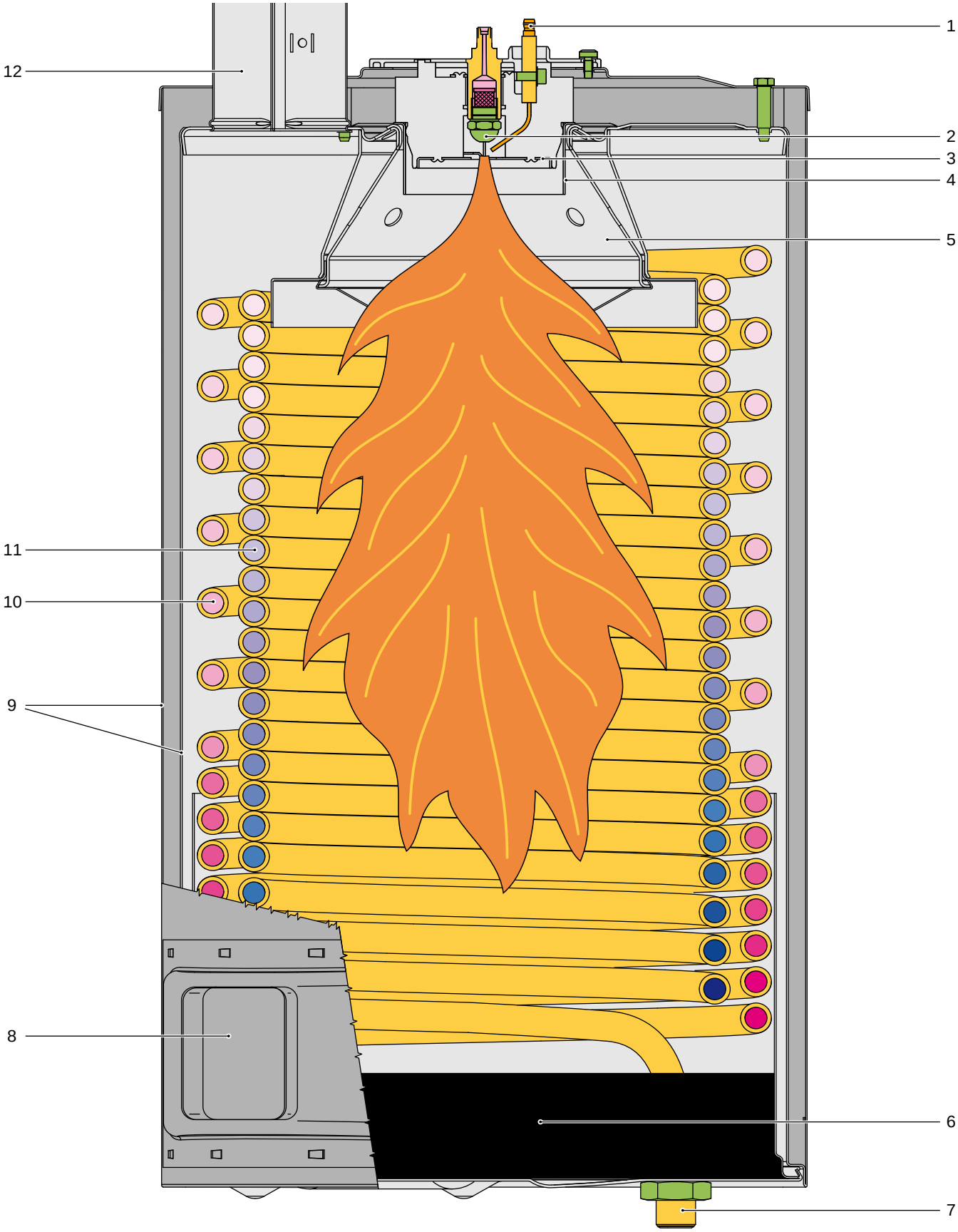


1 Looking glass
2 Light sensor
3 Flame sensor



1 Screw
2 Holder flame sensor
3 Flame sensor
4 Marking
5 Lock

6.22.4 Sectional view booster heater



1 Ignition electrodes
2 Fuel nozzle
3 Pressure plate
4 Flame ring
5 Burning chamber
6 Boiler floor
7 Boiler input
8 Air supply from burner blower
9 Boiler exterior, double-walled
10 Heating coil spiral, exterior
11 Heating coil spiral, interior
12 Exhaust nozzle, on-demand heater

Mode of operation

The water from the high pressure pump enters the interior heating coil spiral, is heated while flowing through and exits to the bottom from the heating coil spiral.

The fuel is vaporised by the fuel nozzle and ignited by the spark of the ignition electrodes.

The combustion air from the blower first flows through the double-walled boiler exterior toward the top, then it flows downward with the flame and is emitted as exhaust through the exhaust stack toward the top into the atmosphere.

The boiler floor is made of fire-resistant insulating concrete. It prevents a radiation of the heat and is used to reroute the flames.

The adjustment of the burner to good exhaust values is achieved via the air flap on the blower (air volume) and with the adjustment screw on the fuel pump (fuel pressure).

The temperature increase with the full water volume is 60-65 K independent of the device.

If the water volume is reduced via the pressure and volume control, the water can be heated to approx. 100 °C; if you use the steam nozzle, up to 155 °C.

An optimal burner performance is only possible if the heating coil is neither full of soot nor other deposits.

Furthermore, the spark electrodes, the amount of fuel and the amount of air must be adjusted properly.

Steam operation

The following preparations must be made for steam operation:

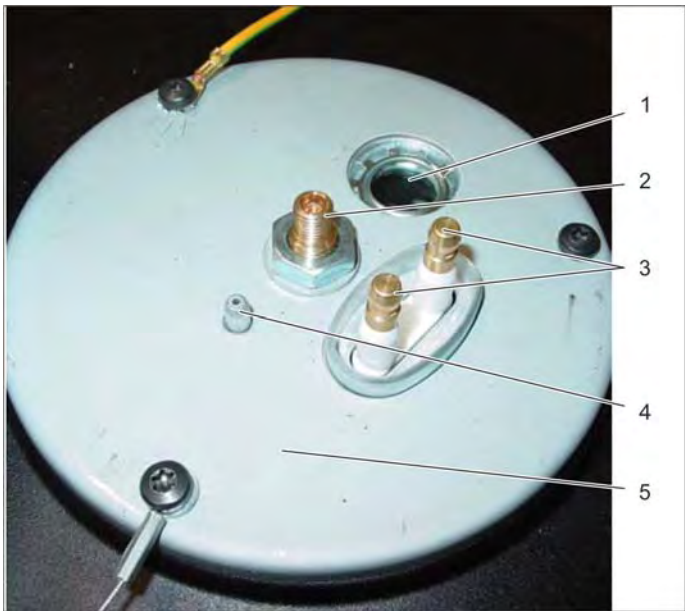
– Install steam nozzle
– Set the operating pressure on the pressure and volume control on the pump to the lowest value
– Set the desired steam temperature at the operating panel

Note

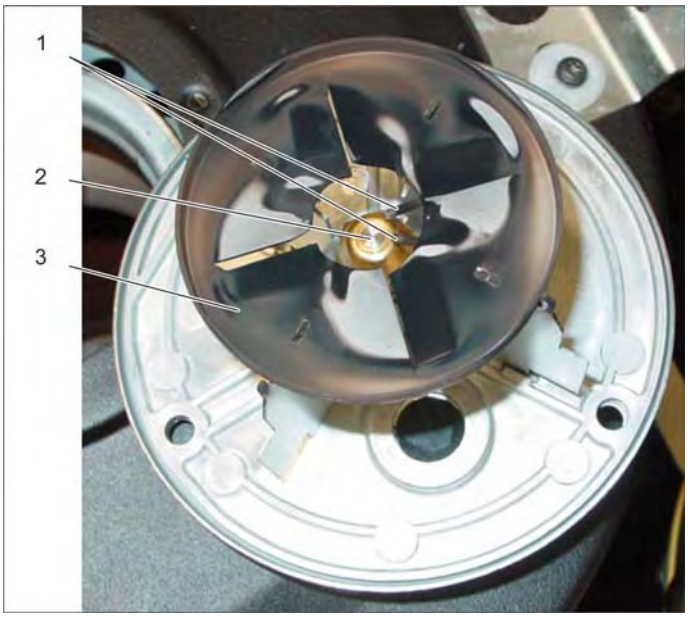
As per pressure device guidelines, the operating pressure inside the appliance must be less than 32 bars for steam operation.

This is ensured by reducing the operating pressure on the pressure and volume control and by using the supplied steam nozzle.

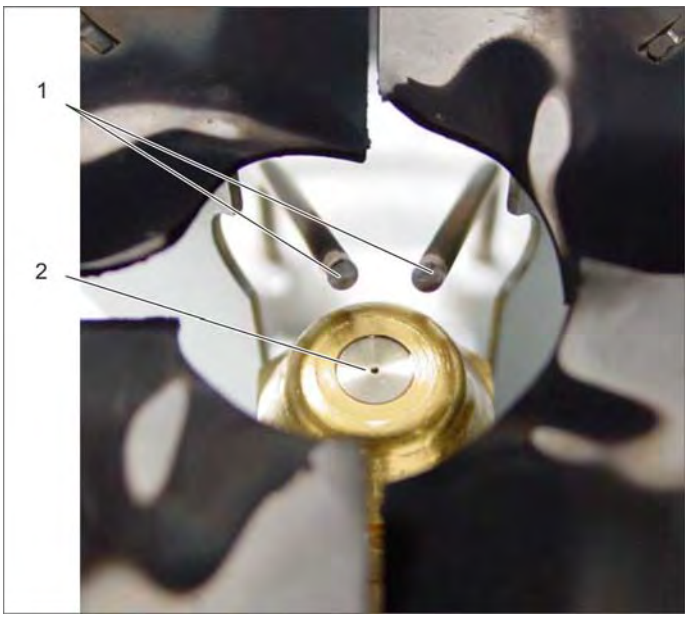
6.23 Burner



1 Looking glass
2 Connection pressure line
3 Connection ignition electrode
4 Connection for air pressure measurement
5 Burner cover

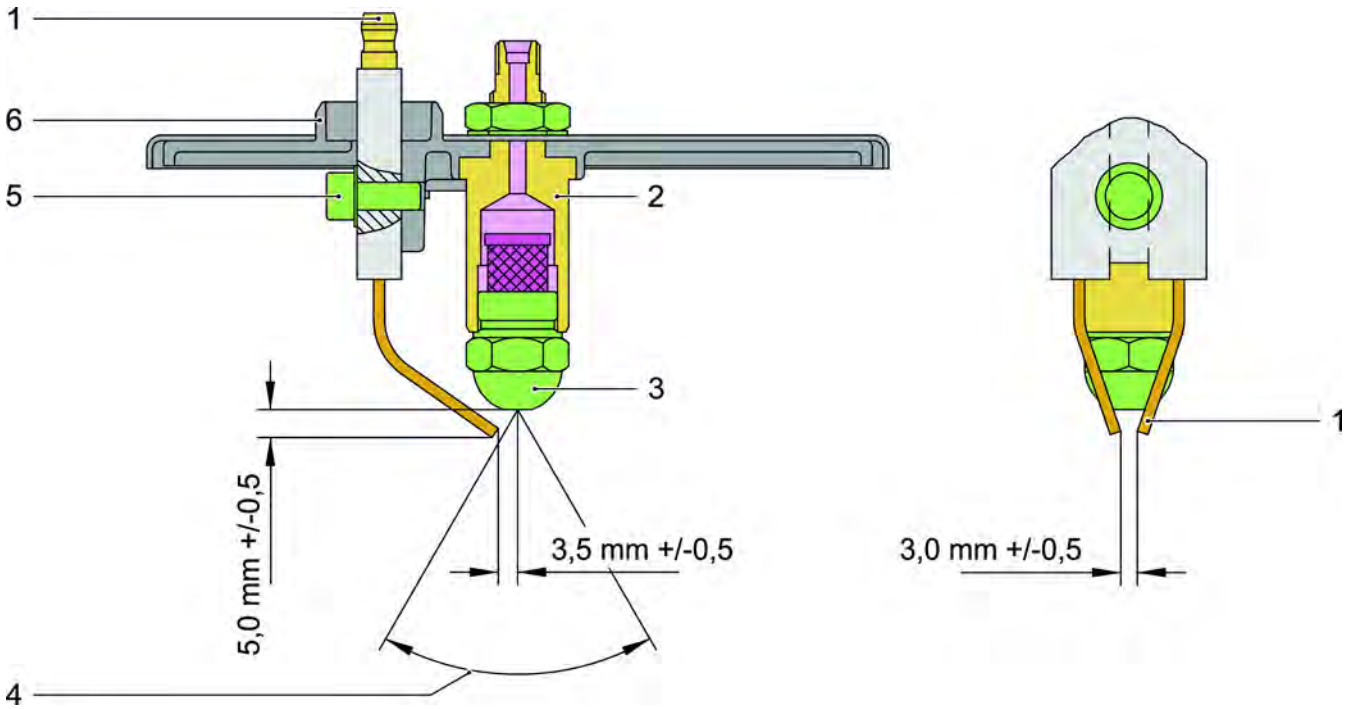


1 Ignition electrode
2 Fuel nozzle
3 Pressure plate



1 Ignition electrode
2 Fuel nozzle

6.24 Burner

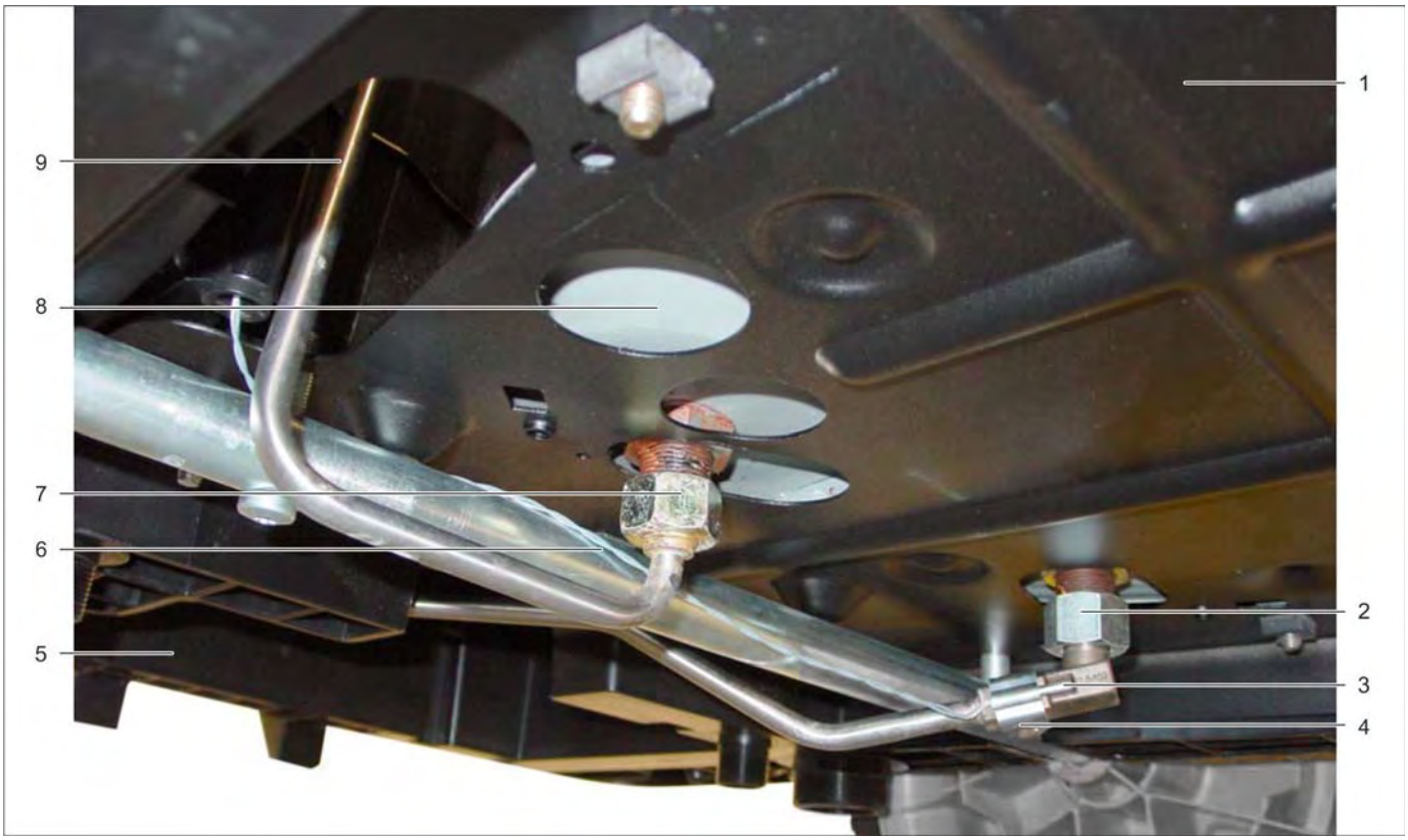


1 Ignition electrodes
2 Fuel nozzle holder
3 Fuel nozzle
4 Spray angle 45° or 60°, depending on the type of appliance
5 Screw
6 Burner cover

Burner

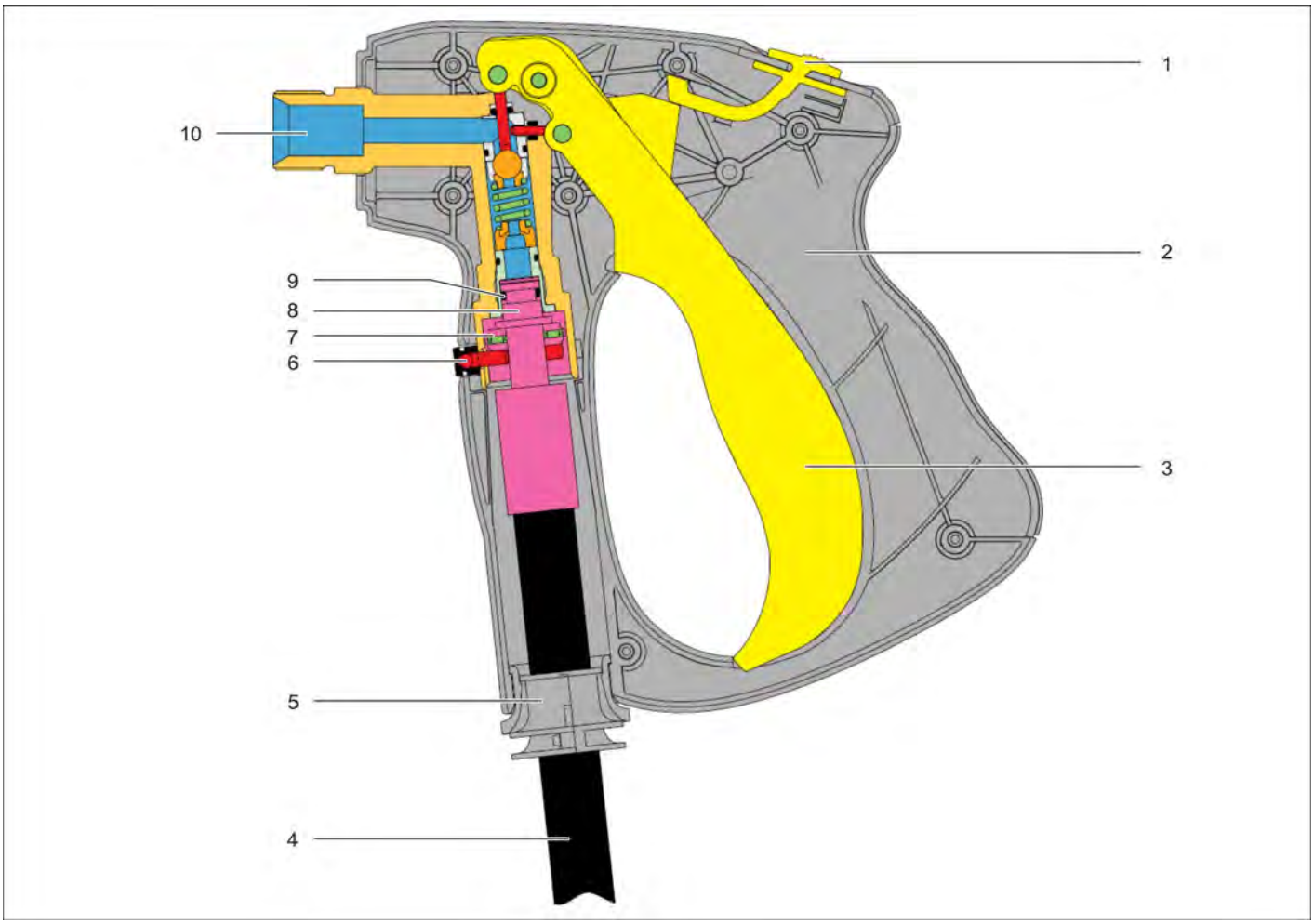
There is a strong spark created between the two ignition electrodes to ensure that the injected fuel will ignite.
The necessary ignition voltage is generated by the ignition transformer.
The exact adherence to the adjustment dimensions is a basic requirement for the proper function of the burner, for good exhaust values and the long idle time of the ignition electrodes.
There is always a ignition spark between the two ignition electrodes, during cold and hot water operation (continuous ignition).
This is a safety measure, so that injected fuel will be ignited in any case and cannot accumulate unburned in the on-demand heater (deflagration hazard).

6.25 Output, booster heater



1 Floor plate
2 Output of flow-type heater
3 Temperature sensor water
4 Clamping bracket
5 Chassis
6 Connecting cable temperature sensor
7 Input of flow-type heater
8 Bottom booster heater
9 Pressure line of the safety block

6.26 Hand spraygun

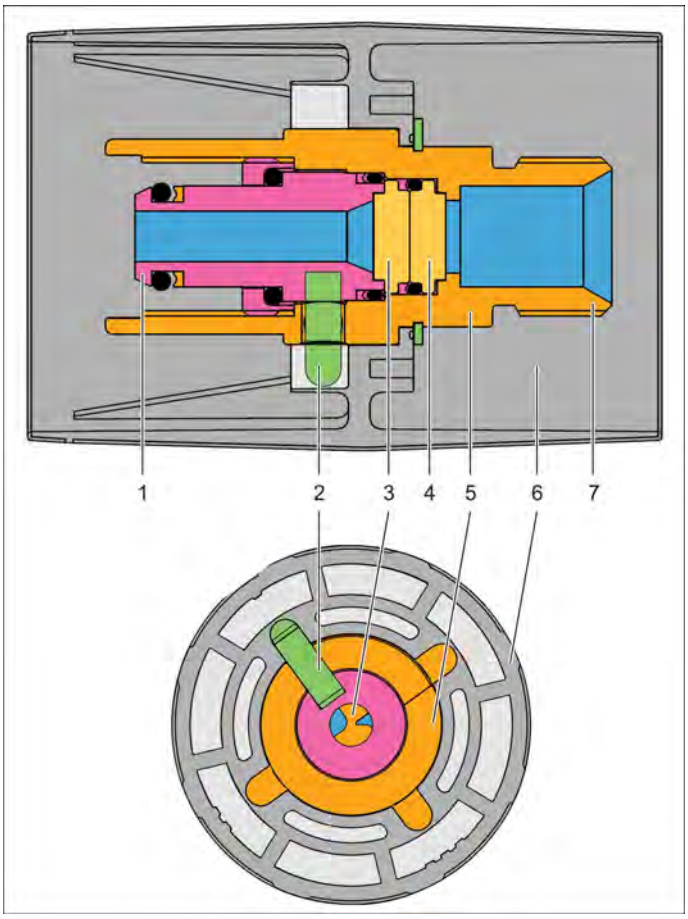


1 Lock trigger gun
2 Casing shell
3 Hand lever
4 High pressure hose
5 Hose guide
6 Safety clip
7 Needle bearing
8 Coupling high-pressure hose/trigger gun
9 O ring
10 Node piece

Function
When the manual lever is actuated, the valve in the node piece opens and the water can flow from the hose through the gun into the spray lance.

Note
The node piece cannot be repaired and must be replaced as a complete unit.
The date of manufacture is imprinted on the node piece. It is composed of the month (letters A to L for January through December) and year (1-digit number 1 for 2011, 2 for 2012, etc.).
Example: H1 = August 2011

6.27 Pressure and volume regulation

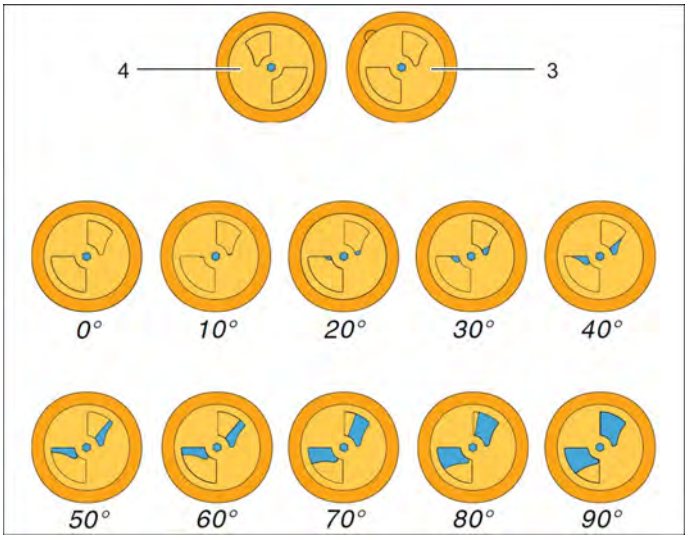


1 Connection trigger gun
2 Connecting pin
3 Ceramic disc on gun side
4 Ceramic disc on spray pipe side
5 Casing of rotating regulator
6 Handle of rotary regulator
7 Spray lance connection

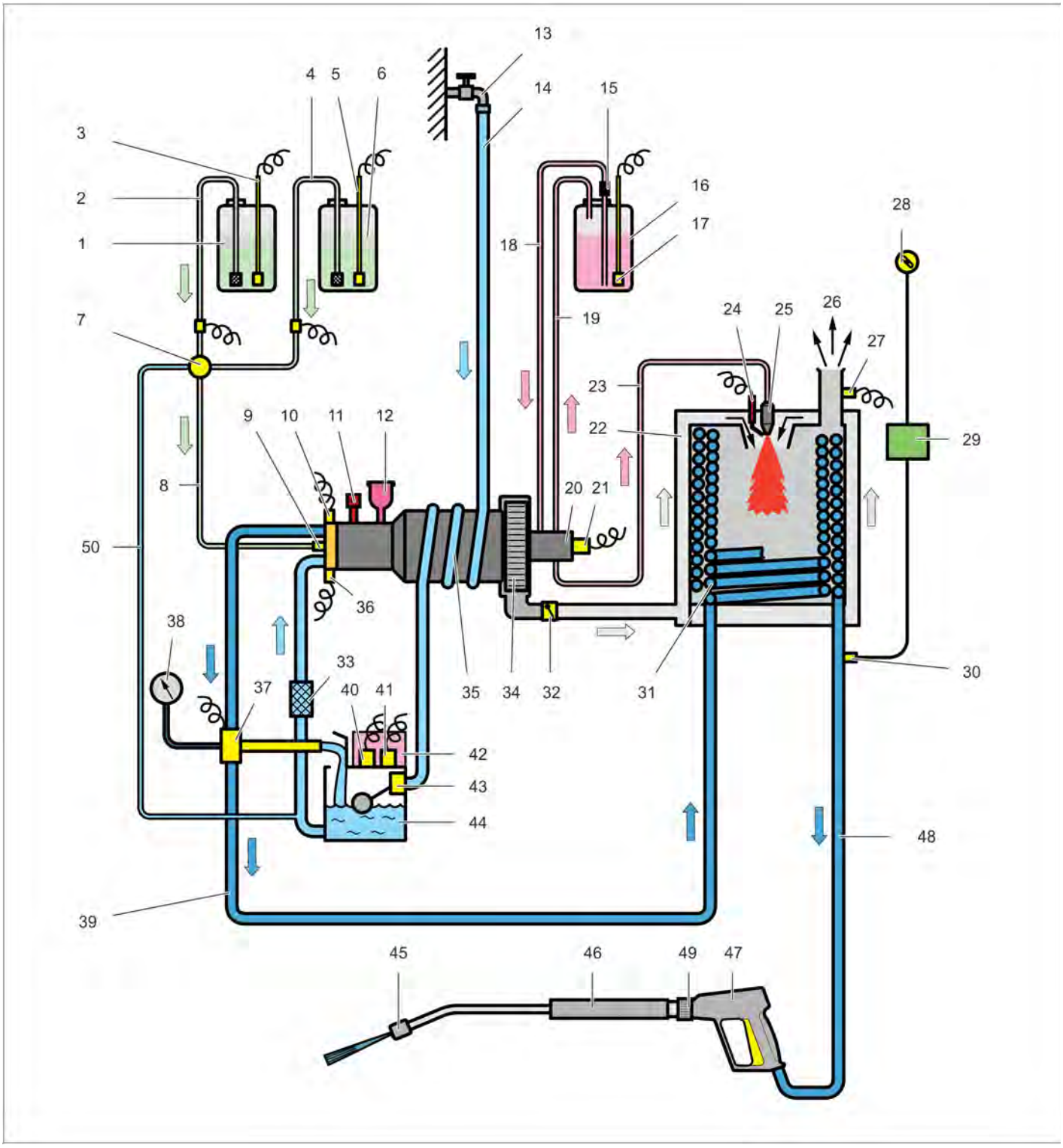
The pressure and volume regulation is designed as a rotary regulator between the trigger gun and the spray lance. There are two ceramic discs within the high pressure channel.
A ceramic disc is rigidly connected with the connection of the trigger gun. The other ceramic disc is connected to the rotating regulator and therefore adjustable. Offset holes in the ceramic discs can adjust the flow volume and the pressure when rotating the discs.
This illustration shows the two overlapping ceramic discs and the water flow (blue) with different opening angles (from 0° to 90°).
With the minimal setting, the water flows through a small hose in the middle of the ceramic discs.

Note
The rotary regulator cannot be repaired and must be replaced as a complete unit.

Water flow with opening angle 0° - 90°

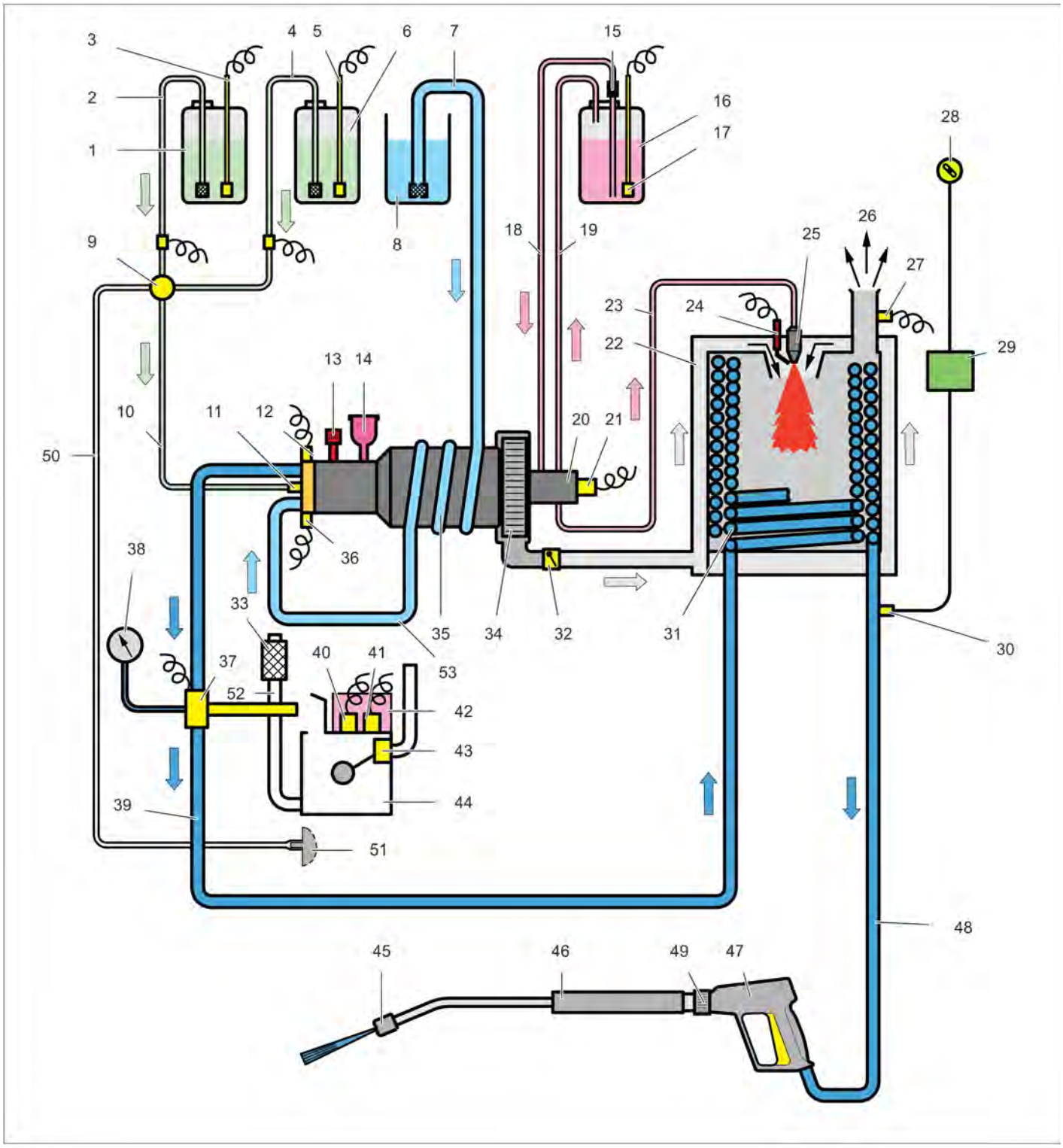


6.28 Functional diagram of pressure water operation (water-cooled motor)



1 Detergent tank 1, volume 10 l
2 Detergent suction hose with filter
3 Level sensor, detergent tank 1 (option)
4 Detergent suction hose with filter
5 Level sensor, detergent tank 2 (option)
6 Detergent tank 2, volume 20 l
7 Dosage valve for detergent
8 Suction hose for detergent
9 Detergent check valve
10 Pressure switch ON
11 Pressure and volume regulation
12 Oil tank
13 Water connection
14 Water supply hose
15 Fuel filter
16 Fuel tank
17 Level sensor for fuel tank
18 Fuel suction hose
19 Fuel return line
20 Fuel pump
21 Solenoid valve, fuel pump
22 Continuous heater
23 Fuel pressure line
24 Ignition electrodes
25 Fuel nozzle
26 Exhaust nozzle
27 Exhaust temperature sensor
28 Setting, water temperature
29 Printed circuit board (PCB)
30 Temperature sensor
31 Heating coil
32 Air flap
33 Water fine filter
34 Burner blower
35 Motor casing with cooling coil
36 Pressure switch OFF
37 Safety block with water shortage safeguard and safety valve
38 Manometer
39 Pressure pipe
40 Solenoid valve liquid softener
41 Level sensor liquid softener
42 Liquid softener reservoir
43 Swimmer valve
44 Float tank
45 High pressure nozzle
46 Spray lance
47 Trigger gun
48 High pressure hose
49 Rotary regulator for pressure and quantity regulation
50 Rinse line

6.29 Functional diagram vacuuming operation

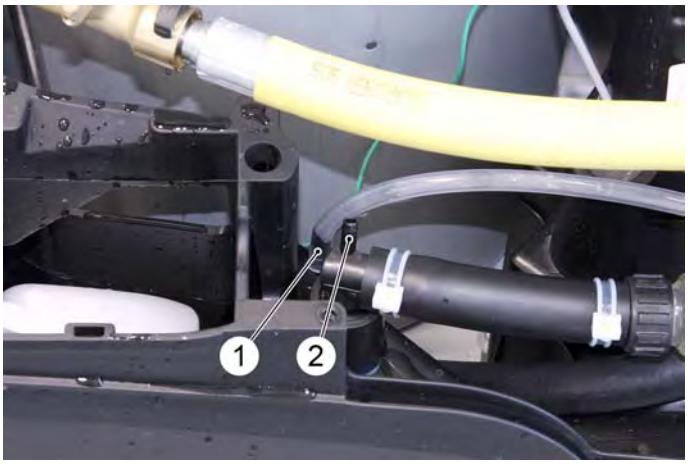


1 Detergent tank 1
2 Detergent suction hose with filter
3 Level sensor, detergent tank 1
4 Detergent suction hose with filter
5 Level sensor, detergent tank 2
6 Detergent tank 2
7 Suction hose with filter and check valve
8 Open container
9 Dosage valve for detergent
10 Suction hose for detergent
11 Detergent check valve
12 Pressure switch ON
13 Pressure and volume regulation
14 Oil tank
15 Fuel filter
16 Fuel tank
17 Level sensor for fuel tank
18 Fuel suction hose
19 Fuel return line
20 Fuel pump
21 Solenoid valve, fuel pump
22 Continuous heater
23 Fuel pressure line
24 Ignition electrodes
25 Fuel nozzle
26 Exhaust nozzle
27 Exhaust temperature sensor
28 Setting, water temperature
29 Printed circuit board (PCB)
30 Temperature sensor
31 Heating coil
32 Air flap
33 Water fine filter
34 Burner blower
35 Motor casing with cooling coil
36 Pressure switch OFF
37 Safety block with water shortage safeguard and safety valve
38 Manometer
39 Pressure pipe
40 Solenoid valve liquid softener
41 Level sensor liquid softener
42 Liquid softener reservoir
43 Swimmer valve
44 Float tank
45 High pressure nozzle
46 Spray lance
47 Trigger gun
48 High pressure hose
49 Rotary regulator for pressure and quantity regulation
50 Rinse line
51 Slot (plug) vacuuming operations
52 Hose to the fine filter
53 Hose from the motor cooling to the pump

Note
During vacuuming operations, the float container must be bypassed.

6.30 Vacuuming operations

Note
If the appliance is used for vacuuming, the rinse hose of the detergent dosing valve must be plugged onto the respective plug to prevent erroneous air suction.
Furthermore, the fine filter must be uninstalled and the water supply hose must be connected directly to the high pressure pump.



1 Slot vacuum operation (plug)
2 Slot pressure water operation (connection)

Note
The conversion to vacuuming operations requires bypassing of the float container.
➔ Remove the liquid softener bottle and turn it over immediately to avoid spills.
➔ Open the device hood.
➔ Unscrew the water filter from the high-pressure pump inlet.
➔ Unscrew the water hose from the float valve and screw it onto the high-pressure pump inlet.
➔ Pull the rinse hose off the connection on the float container output and plug it onto the stopper.

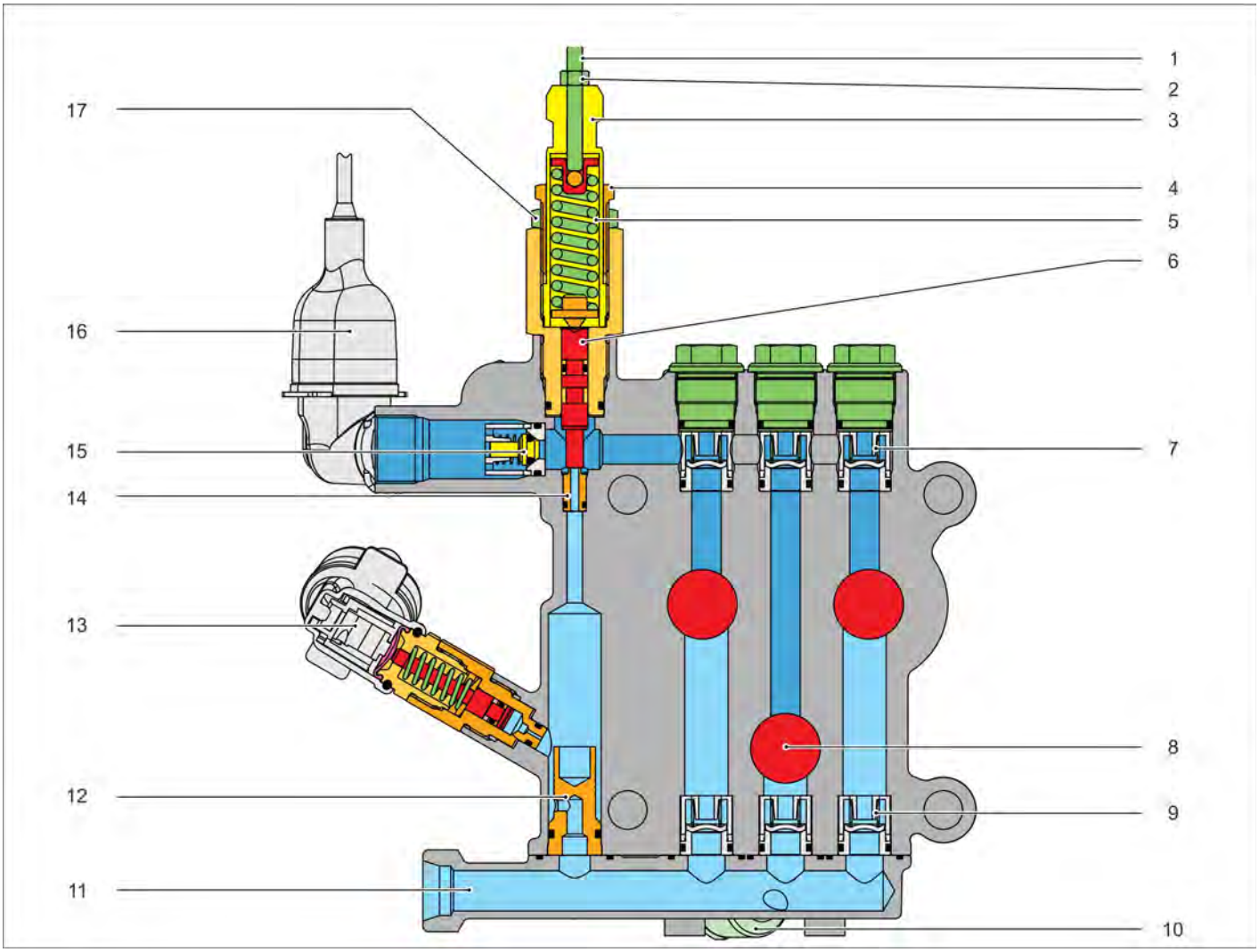
⚠ ***CAUTION***
When replacing the liquid softener reservoir, make sure that the cables from the solenoid valve and level sensor are not crushed.

➔ Place the liquid softener tank onto the swimmer reservoir.

Until the pump has sucked in water
➔ Set the pressure/quantity regulation at the pump unit to maximum quantity.
➔ Close the dosing valve for the detergent.

Note
The suction hose with filter (accessory) must have a minimum diameter of 3/4".
The suction height is max. 0.5 m.

6.31 Pressure and volume regulation



1 Threaded pin, max. pressure setting
2 Locknut threaded pin
3 Semiload spindle
4 Half-load stop sleeve
5 Pressure spring
6 Overflow piston
7 High pressure valve (3x)
8 Pump piston (3x)
9 Suction valve (3x)
10 Detergent infeed with backflow valve
11 Suction jumper with water connection
12 Sleeve with throttle bore
13 Pressure switch "OFF"
14 Valve seat
15 Pressure holding valve
16 Pressure switch "ON"
17 Locknut of semiload stop sleeve

6.31.1 Function pressure and volume regulation

Manually with a pressure regulator on the high pressure pump

The pressure and volume regulation via the handle on the high pressure pump is used to relieve the motor with mostly partial load operation.

Turning the spindle anticlockwise lowers the pretension of the pressure spring.

This will lift the overflow piston with a lower pressure from the valve seat and part of the flowing volume runs to the suction chamber via the sleeve with the throttle bore.

The pump runs at reduced pressure.

Depending on the spindle setting, the pressure and the water volume change.

With the rotary regulator on the gun

The pressure and volume regulation via the rotary regulator on the gun should only be used during occasional partial load operation.

When the pressure is reduced via the rotary regulator, the manual pressure and volume regulation on the pump must always be opened all the way (direction "+" on the handle); otherwise, the appliance will shut off prematurely.

If the rotary regulator is partially closed, the pressure in the system will increase.

This will lift the piston off the valve seat so that a part of the flowing volume flows back to the suction chamber via the return.

The pump continues to run at high pressure.

Depending on the setting of the rotary regulator on the gun, the pressure and the water volume change.

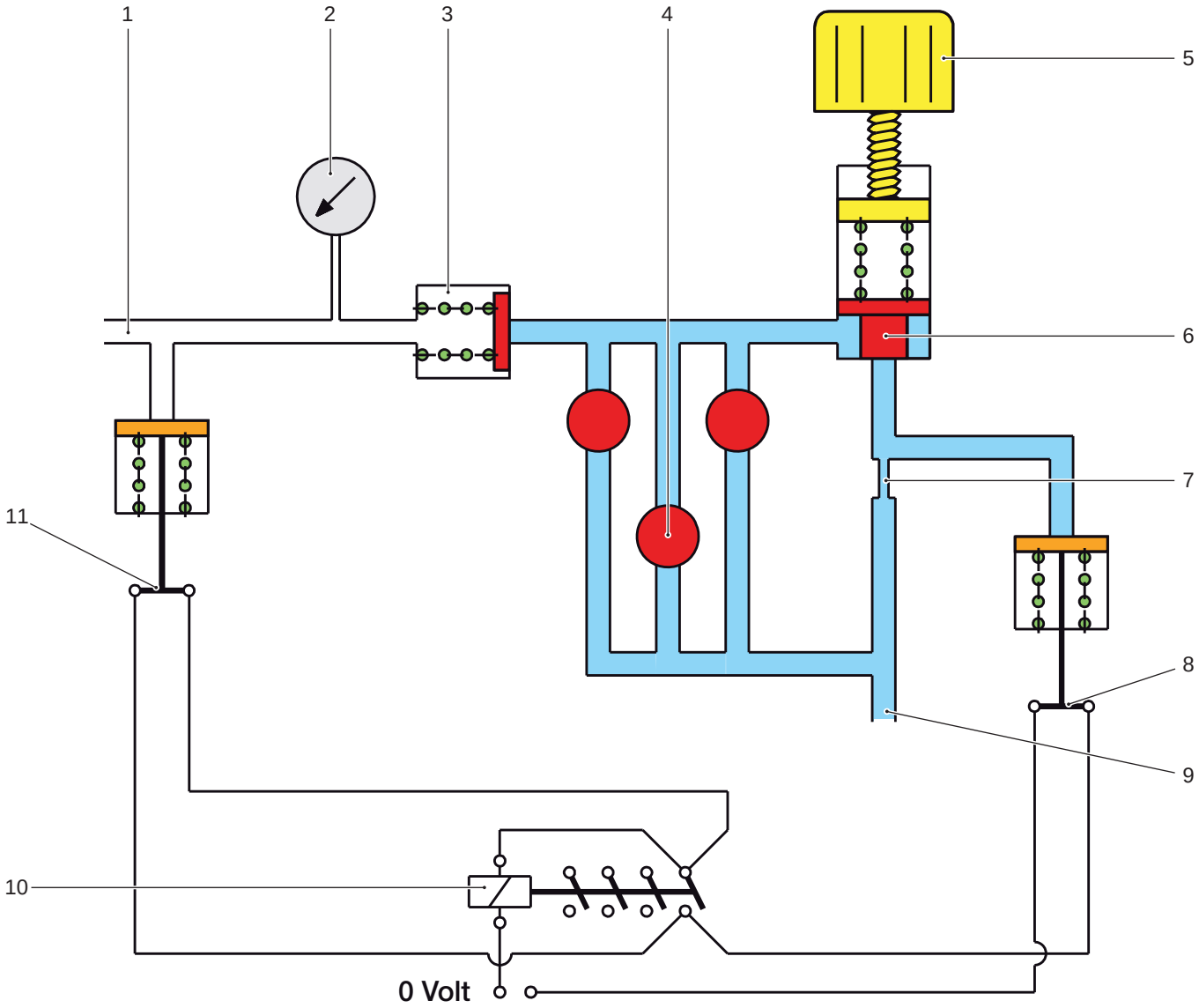
Gun closed

If the gun is closed completely, the piston will open all the way and the entire flow volume of the pump flows to the suction chamber via the throttle bore.

The dynamic pressure building up through the throttle bore of the sleeve in the return actuates the pressure switch which will in turn shut off the appliance.

6.32 Functional description of pressure switch

6.32.1 Appliance is switched off

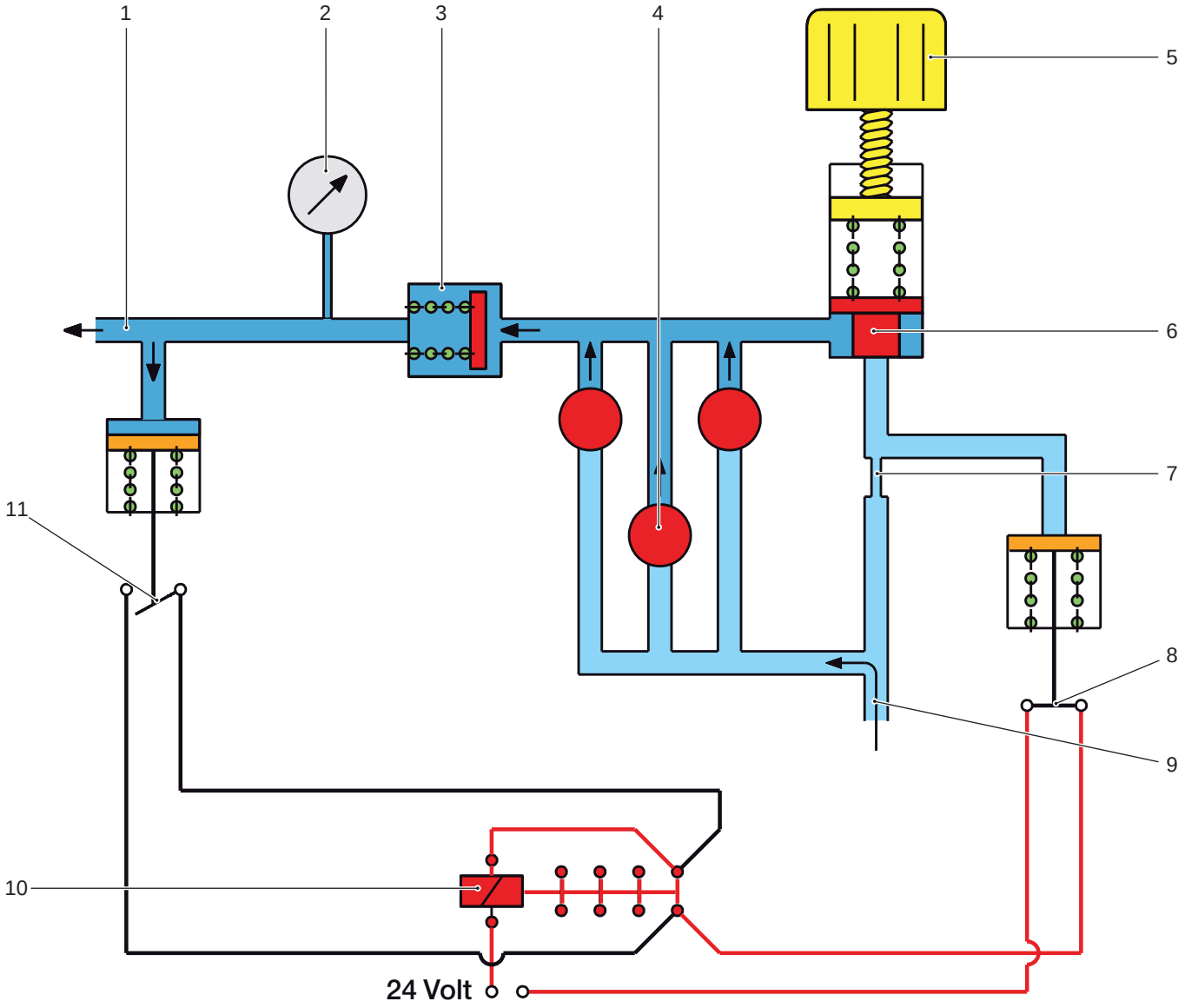


1 High pressure outlet (without pressure)
2 Manometer (without pressure)
3 Pressure retaining valve (closed)
4 Pump stands still
5 Rotary knob
6 Overflow valve (closed)
7 Reduction bore
8 Pressure switch "OFF" (closed)
9 Water inlet
10 Motor contactors (K1) (open)
11 Pressure switch "ON" (closed)

Note
The shown functions of the preessure switches and motor contactor are for understanding purposes only.
In reality, the information from the two pressure switches is transferred directly to the control electronics, which in turn controls the motor contactor.

When the appliance is switched off and the gun is open, the pressure is taken from the system and it is without voltage.
Both pressure switches as well as the overflow valve and the pressure retaining valve closed.
The motor contactors are open.

6.32.2 The appliance is switched on and the gun is open

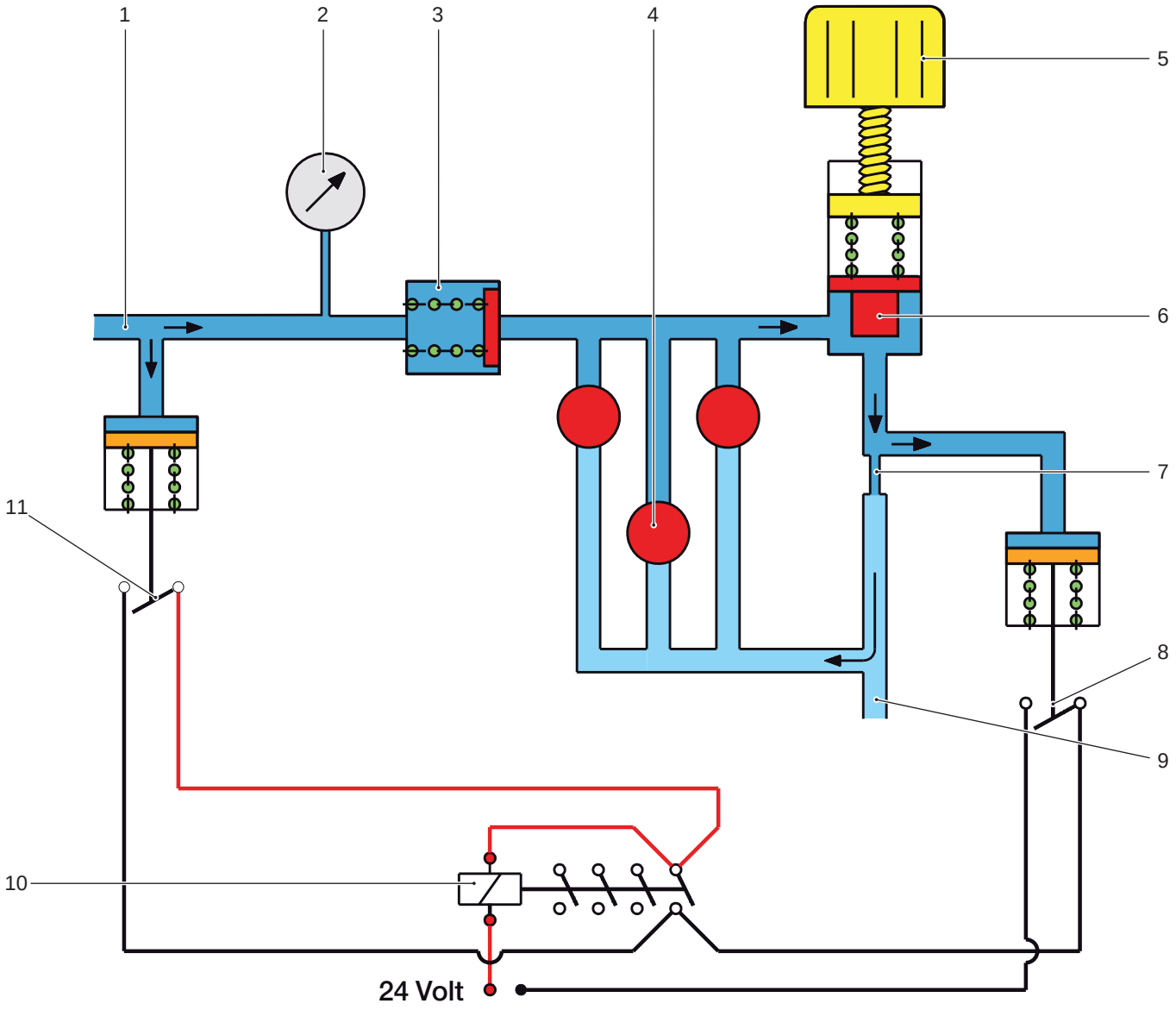


1 High pressure outlet, working pressure
2 Manometer, working pressure
3 Pressure retaining valve (open)
4 Pump is running
5 Rotary knob
6 Overflow valve (closed)
7 Reduction bore
8 Pressure switch "OFF" (closed)
9 Water inlet
10 Motor contactors (K1) (closed)
11 Pressure switch "ON" (open)

Note
The shown functions of the preessure switches and motor contactor are for understanding purposes only.
In reality, the information from the two pressure switches is transferred directly to the control electronics, which in turn controls the motor contactor.

After switching on the appliance and with the gun open, the contactor will be actuated and closes the contacts.
This will start the motor and the pump will build up the working pressure.
Open the pressure retaining valve and the pressure switch "ON", the overflow valve and the pressure switch "OFF" remain closed.
Due to the closed pressure swtich, the motor contactors also remain closed.

6.32.3 Gun is closed



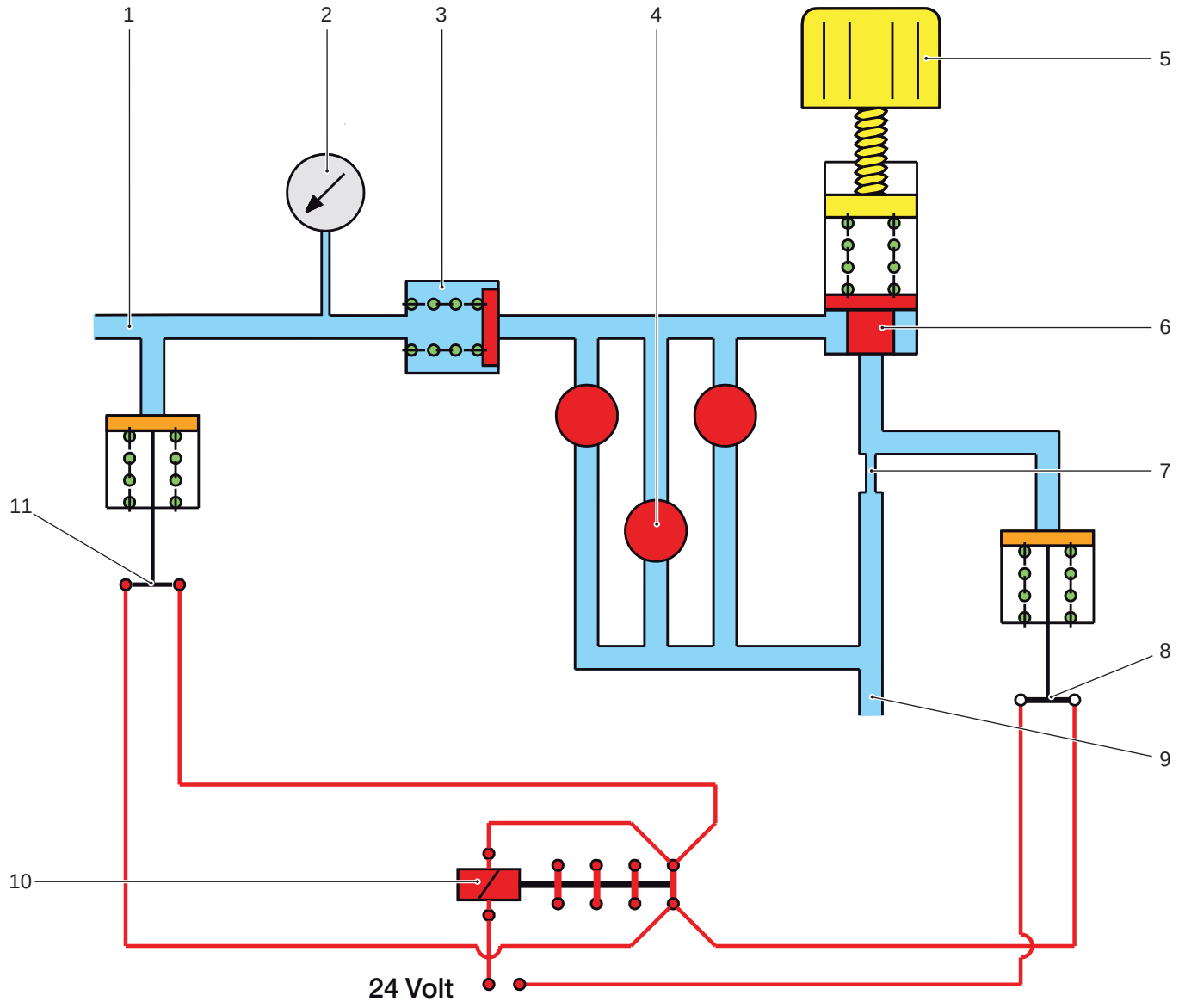
1 High pressure outlet, shut-off pressure
2 Manometer, shut-off pressure
3 Pressure retaining valve (closed)
4 Pump stands still
5 Rotary knob
6 Overflow valve
7 Reduction bore
8 Pressure switch "OFF" (open)
9 Water inlet
10 Motor contactors (K1) (open)
11 Pressure switch "ON" (open)

Note
The shown functions of the preessure switches and motor contactor are for understanding purposes only.
In reality, the information from the two pressure switches is transferred directly to the control electronics, which in turn controls the motor contactor.

There will be brief overpressure in the system when the gun is closed.
This will open the overflow valve and the entire flow volume streams into the suction chamber of the pump through the throttle bore.

As soon as the overflow valve opens, the pressure retaining valve closes and the shut-off pressure is locked between the gun and the pressure retaining valve.
Due to the locked in switch-off pressure, the pressure switch "ON" remains open.
There will be a pressure backup in front of the reduction bore, which opens the pressure switch "OFF" at about 10 bar and thus interrupts the control circuit.
The motor contactors open and the motor is shut off.
As soon as the motor has stopped, the overflow valve will close and so will the pressure switch "OFF".
However, the motor contactors will remain open as the control circuit is still interrupted by the open pressure switches "ON".

6.32.4 The gun is reopened when the appliance is switched on



1 High pressure outlet (without pressure)
2 Manometer (without pressure)
3 Pressure retaining valve (closed)
4 Pump is running
5 Rotary knob
6 Overflow valve (closed)
7 Reduction bore
8 Pressure switch "OFF" (closed)
9 Water inlet
10 Motor contactors (K1) (closed)
11 Pressure switch "ON" (closed)

Note
The shown functions of the preessure switches and motor contactor are for understanding purposes only.
In reality, the information from the two pressure switches is transferred directly to the control electronics, which in turn controls the motor contactor.

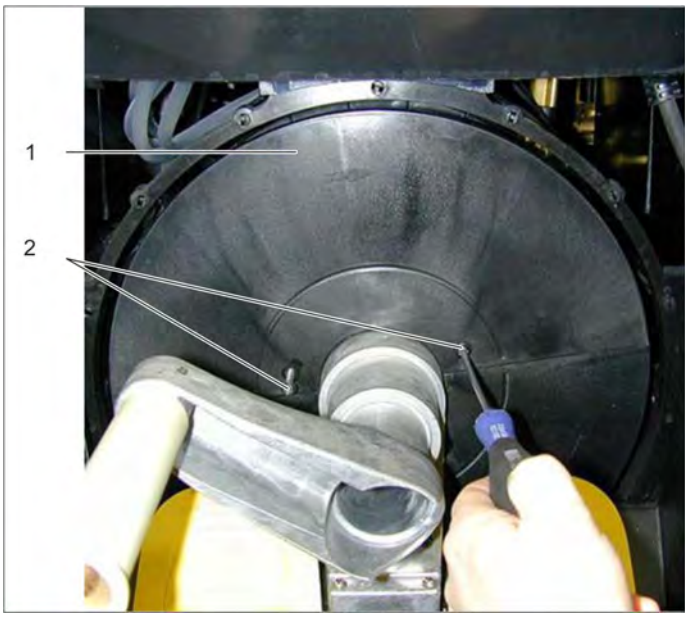
As soon as the gun is opened, the pressure that is locked in between the pressure retaining valve and the gun escapes.

The pressure switch "ON" closes, which in turn will close the control circuit.
The motor contactor is actuated, closes the contacts, the motor starts up and the pump rebuilds the working pressure.

7 Basic settings and service procedures

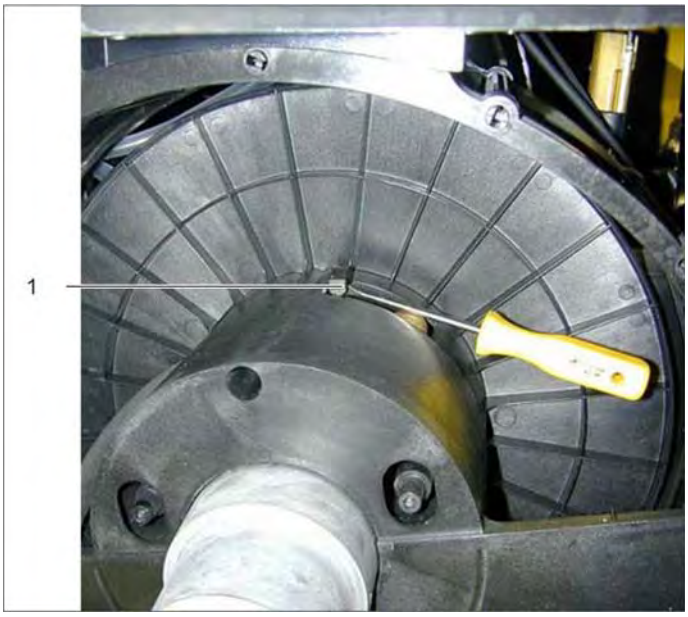
7.1 Remove the hose drum

7.1.1 Uninstall / install high-pressure hose



1 Casing shell, hose reel
2 Screws

➔ Release pressure.
➔ Unwind the HP hose from the hose reel.
➔ Unscrew the screws.
➔ Remove the casing shell.



1 Clip

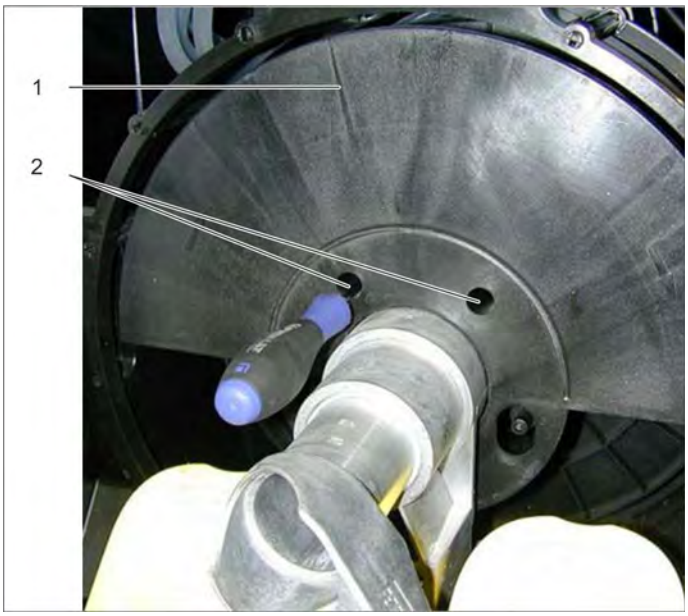
➔ Lever out the clamp.
➔ Pull out the hose.
➔ Take a new hose through the hose guide and the deflection pulley.
➔ Slide the hose into the union piece of the hose reel and secure by means of the clamp.

7.1.2 Renew O-rings axle, hose reel

■ *7.1.1Uninstall / install high-pressure hose*

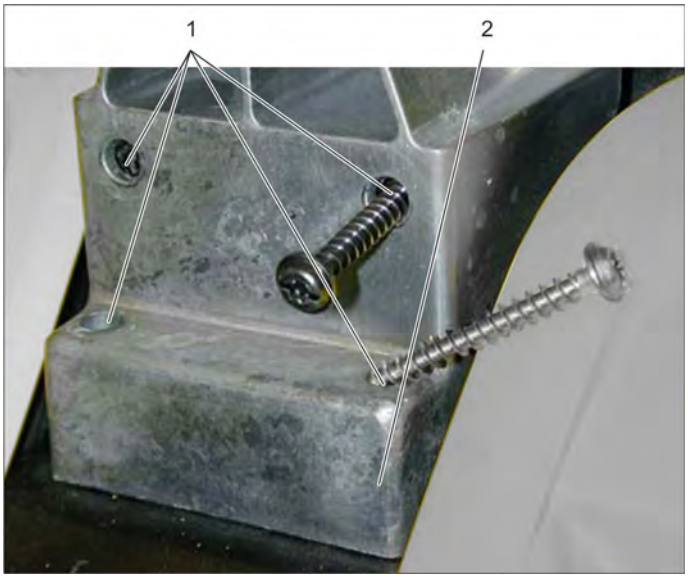
1 Screw
2 Casing shell, hose reel

➔ Loosen screws.
➔ Turn the hose reel.



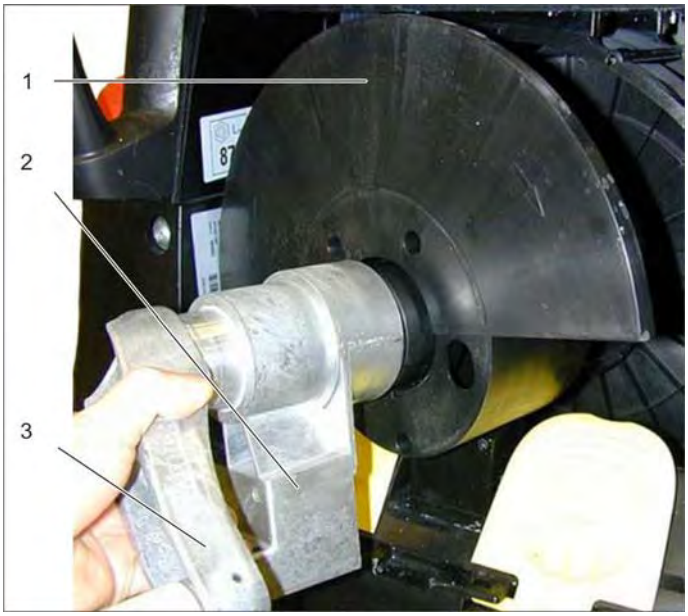
1 Casing shell, hose reel
2 Screws

➔ Unscrew the screws.



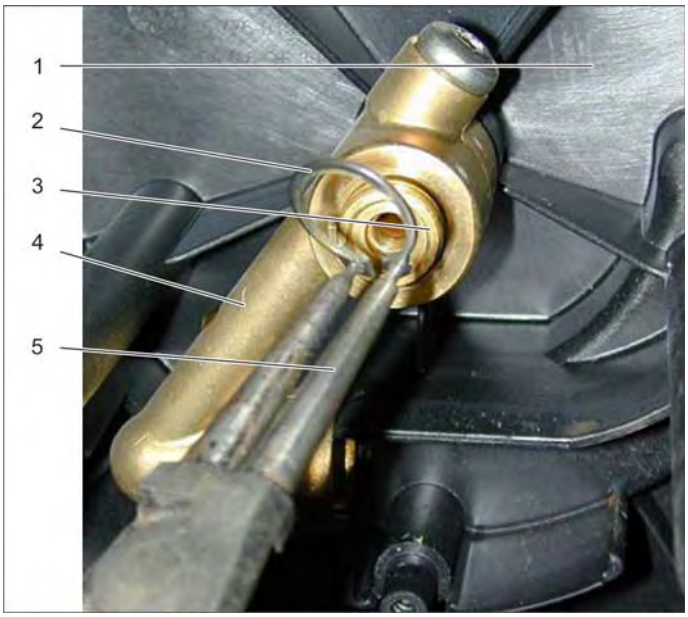
1 Screws
2 Bearing block

➔ Unscrew the screws.



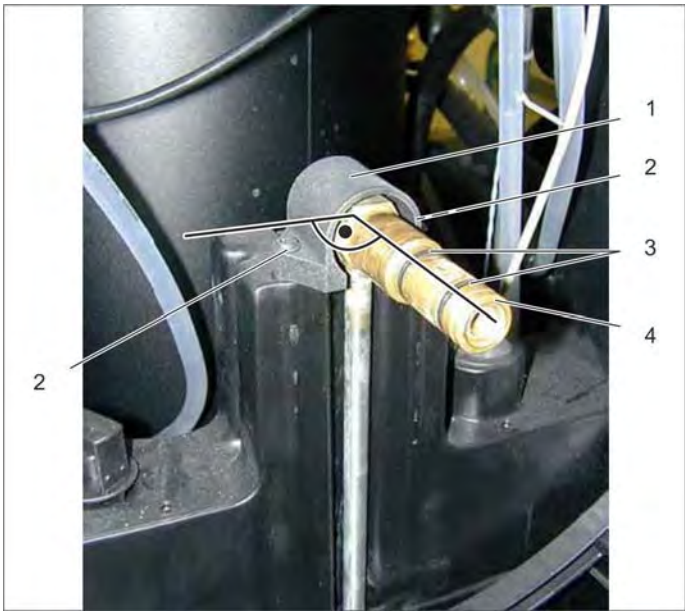
1 Casing shell, hose reel
2 Bearing block
3 Crank

➔ Remove the front part of the hose reel.



1 Hose drum
2 Safety ring
3 Pipeline with axle
4 Node piece
5 Pliers

➔ Remove the retaining ring.
➔ Remove the knot.
➔ Remove the rear part of the hose reel.



1 Rear bearing block
2 Screws
3 O rings
4 Pipeline with axle

➔ Remove O-rings.

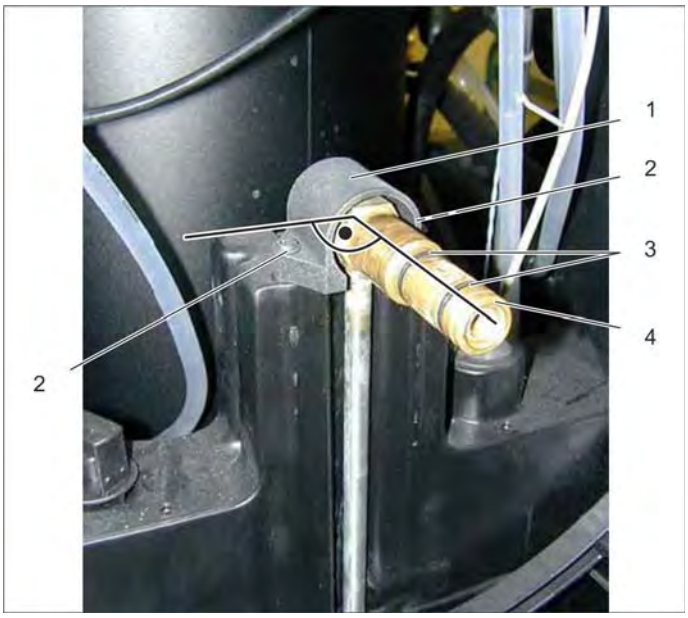
Installation information
Replace the O-rings.
Grease the O-rings.

Grease	6.288-088.0

Note
Check axle and connection piece for signs of wear.

7.1.3 Uninstall / install pipeline with axle

■ *7.1.2Renew O-rings axle, hose reel*



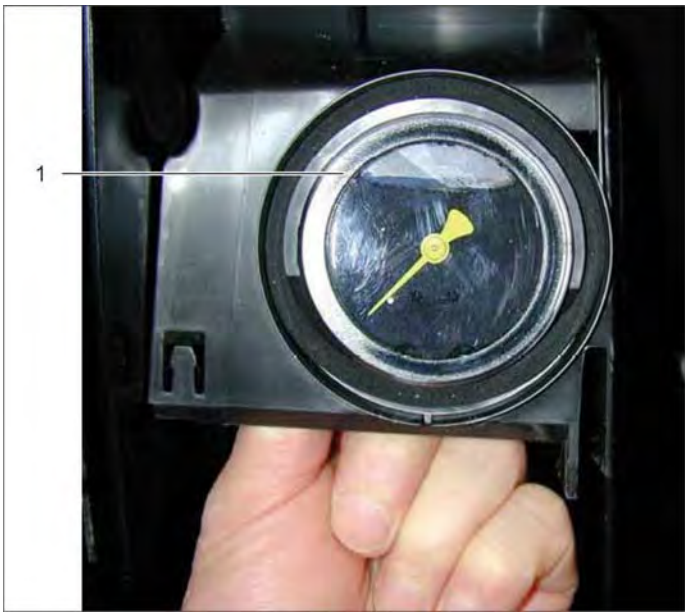
1 Rear bearing block
2 Screws
3 O rings
4 Pipeline with axle

Note
Align the pipeline with axle at a right angle to the rear bearing block.

1 Pipeline with axle
2 Screw connection
3 Wrench

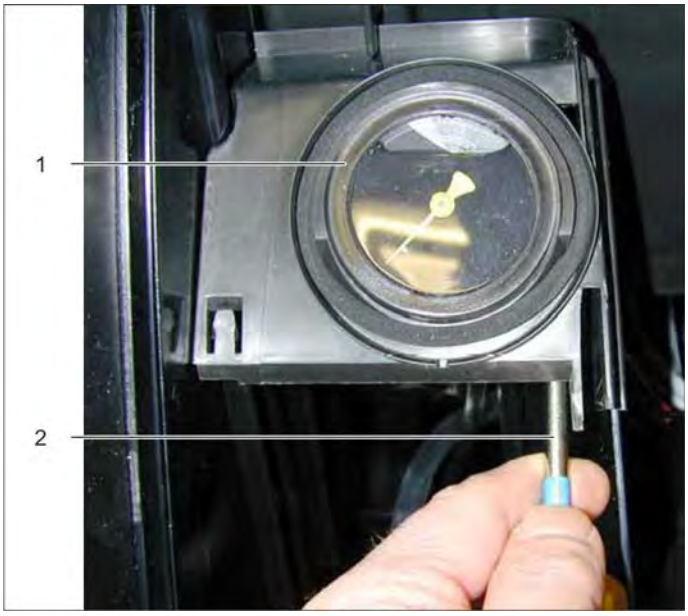
➔ Disconnect screw connection.
➔ Remove pipeline with axle.

7.2 Uninstall / install pressure gauge



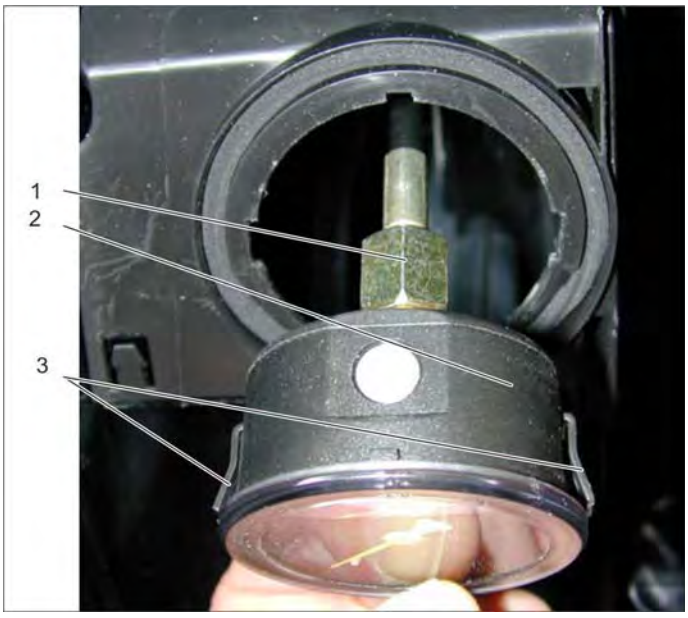
1 Manometer

➔ Unscrew the screws on the control panel.
➔ Manually push in the left clip.



1 Manometer
2 Screwdriver

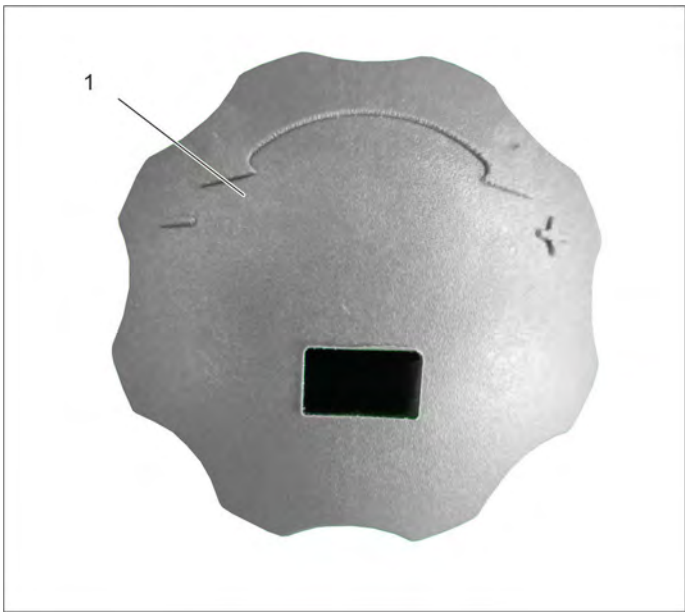
➔ Push in the right clip by means of a screwdriver.



1 Screw connection
2 Manometer
3 Clips

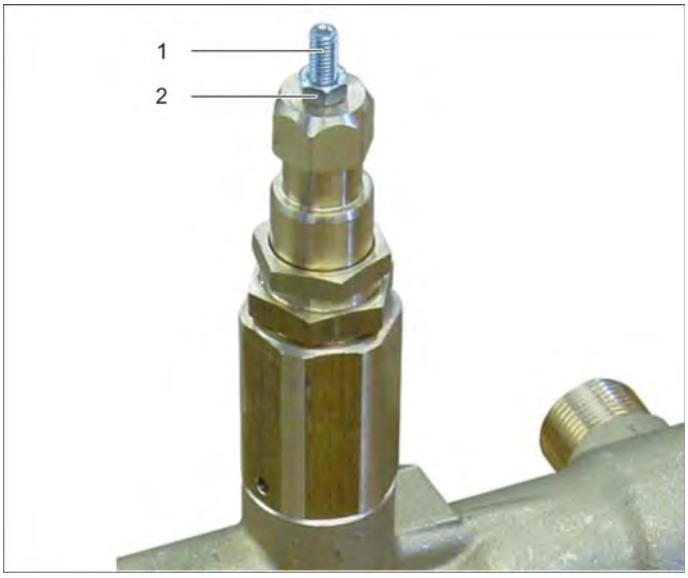
➔ Remove the pressure gauge.
➔ Disconnect screw connection.

7.3 Adjust safety valve



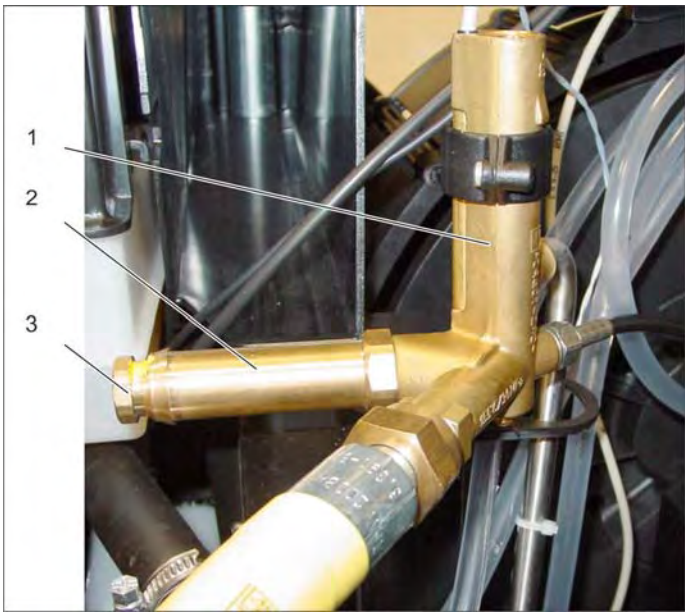
1 Turning handle

➔ Screw in the twist grip of the pressure and volume regulation on the pump all the way to the stop (towards "+").
➔ Pull off the rotary handle.



1 Adjusting screw
2 Counter-nut

➔ Loosen counter-nut.
➔ Completely screw in the adjustment screw.
➔ Install the stop valve on the high-pressure connection.
➔ Turning on the appliance.



1 Safety block
2 Safety valve
3 Adjustment screw, safety valve

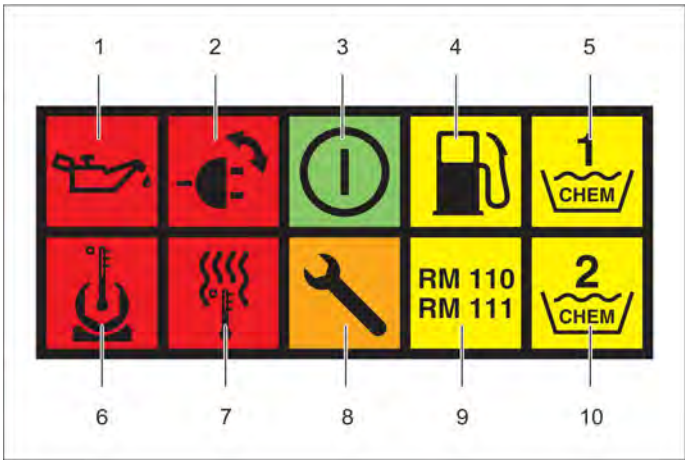
➔ Slowly close the stop valve.
➔ Observe at what pressure water is tripping.
(Nominal value: 20 bar above max. working pressure, see technical data)
➔ If the pressure is too high, turn the adjustment screw on the safety valve to the left (relax the pressure spring).
➔ If the pressure is too low, turn the adjustment screw on the safety valve to the right (tension the pressure spring).
➔ Seal the adjustment screw.
➔ Adjust the pressure/ volume regulation.

7.4 Service functions with LED display

1 Setting, water temperature

Service mode
If the service switch is in the "Service" position (screwdriver symbol) upon switching on the device, the service mode of the device is activated (pump is not running).

Selection of the service functions
The available service functions are selected via the water temperature setting.
Example: 30°C is equivalent to the function „ON30MIN“.
For some functions the function selection must already be set upon switching on the device and the service switch must be kept in the "SET" position for 2-3 seconds.
Example: RFIDONOFF is called up with the setting 45 ? (40/-- °C) + "SET" upon switch-on.



1 Control LED 0, pump (red)
2 Control LED 1, rotation direction (red)
3 Control LED 2, operation (green)
4 Control LED 3, fuel (yellow)
5 Control LED 4, detergent tank 1 (yellow)
6 Control LED 5, motor (red)
7 Control LED 6, burner (red)
8 Control LED 7, service (orange)
9 Control LED 8, liquid softener (yellow)
10 Control LED 9, detergent tank 2 (yellow)

Changing the settings
The display of the current settings takes place via the 10 indicator LEDs on the control panel. By means of the push-button function of the service switch (continue to turn to "SET" position, switch snaps back to the "Service" position) the settings can be changed. The change is also displayed via the control LEDS.

1 Service position
2 Service switch

Exiting the service mode
➔ Turn off the appliance.
➔ Set the service switch to the appropriate water hardness level or "OFF".
➔ Turn on the appliance.

Note
For the device versions with a water temperature of max. 80 °C or 60 °C, the temperature settings are indicated in parenthesis (80/60 °C)

7.5 Set up the switching off process

	Function	Adjustments	
		LED indicator	Important
30 °C (30/30 °C)	**ON30MIN** Behaviour of device after 30 minutes of continuous operation. The setting will be saved.		The device switches off after 30 minutes of continuous operation.
			The device does not switch off after 30 minutes of continuous operation (factory setting).
35 °C (34/32 °C)	**OFF30MIN** Behaviour of device after 30 minutes of continuous standby operation. The setting will be saved.		The device switches off after 30 minutes in the standby mode.
			The device does not switch off after 30 minutes in the standby mode (factory setting).

7.6 Set up the leakage behaviour

	Function	Adjustments	
		LED indicator	Important
40 °C (37/34 °C)	**LECKAGEONOFF** Behaviour of the device after 10 short startups of the pump (run time of the pump under 2 seconds). The setting will be saved.		Device switches off after 10 short startups of the pump (factory setting).
			The device does not switch off after 10 short startups of the pump.

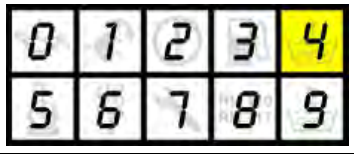
7.7 Brightness value of the flame sensor

	**Function**	**Adjustments**	
		LED indicator	**Important**
45 °C (40/35 °C)	**LDRTEST** Display of the brightness value measured by the flame sensor. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with 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 -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"
	A value above 471 is rated as "dark". A value up to 471 is rated as "bright".		

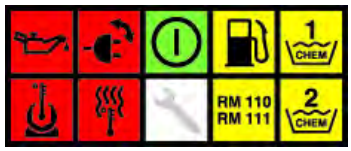
7.8 RFID query

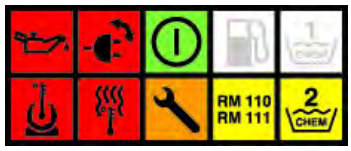
	Function	Adjustments		
		LED indicator	Important	
45 °C **+** **„SET“** (40/-- °C + „SET“)	**RFIDONOFF** Information to the printed circuit board whether the device is equipped with feed via RFID.		Device with RFID	Menu access: Select 45°C Switch off device. Hold SET. Turn on the machine. Release SET. Select settings with SET.
			Device without RFID Check the setting when replacing the printed circuit board.	

7.9 Testing the temperature sensor

	Function	Adjustments	
		LED indicator	Important
50 °C (43/36 °C)	**NTCTEST** Display of the water temperature measured by the temperature sensor. The value is shown digit by the LEDs.  **Example:** A temperature of 27°C is measured. The LEDs light up in the following order:   - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "6"
		...	...
	Note At a temperature below 0?, "0" is displayed.		

7.10 Testing the water temperature setting and the programme switch

	Function	Adjustments	
		LED indicator	Important
55 °C (46/38 °C)	**ENCPROGTEST** With this function, the programme switch and the controller for the water temperature setting can be tested. Upon switch-on, all 10 LEDs are on. **By operating the push-button function of the service switch (continue to turn to "SET" position and release) and turning the water temperature setting to 30°C, the test is started.** If the water temperature setting is gradually increased, the LED display changes as shown to the right.		30 °C (30/30 °C)
			35 °C (34/32 °C)
			40 °C (37/34 °C)
			45 °C (40/35 °C)
			50 °C (43/36 °C)
			55 °C (46/38 °C)
			60 °C (48/40 °C)
			65 °C (50/42 °C)
			70 °C (52/44 °C)
			75 °C (55/45 °C)

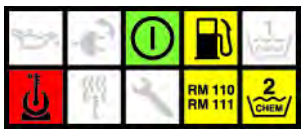
	Function	Adjustments	
		LED indicator	Important
55 °C (46/38 °C)			80 °C (58/46 °C)
			85 °C (60/48 °C)
			90 °C (63/50 °C)
			95 °C (66/52 °C)
			100 °C (68/54 °C)
			112 °C (70/55 °C)
			125 °C (74/56 °C)
			140 °C (77/58 °C)
			155 °C (80/60 °C)
			The temperature setting must finally be set back to 55 ? (46/38 °C).

	**Function**	**Adjustments**	
		LED indicator	**Important**
55 °C (46/38 °C)	**ENCPROGTEST** By operating the pushbutton function of the service switch (continue to turn to "SET" position and release) again, the test for the programme switch is started. The LED display depends on the position of the programme switch now.		Programme switch position "cold"
			Programme switch position "eco"
			Programme switch position "warm"
	Note To exit the ENCPROGTEST function, switch off the device.		

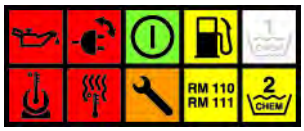
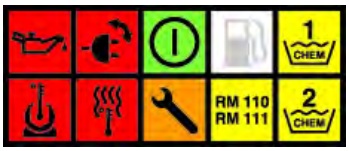
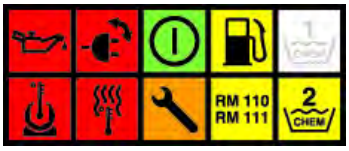
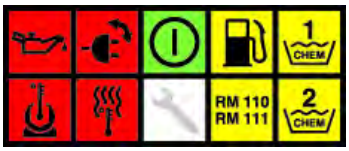
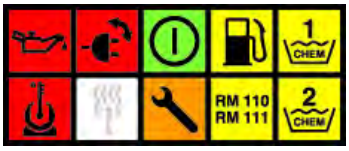
7.11 Testing the service switch

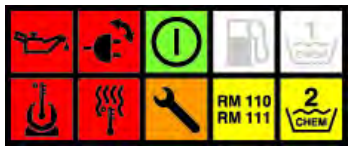
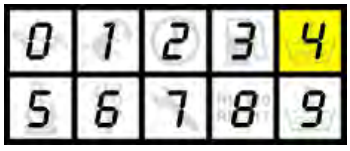
	Function	Adjustments	
		LED indicator	Important
60 °C (48/40 °C)	**ENCDGTTEST** Service switch setting display.		Service switch position "OFF"
			Service switch position "1"
			Service switch position "2"
			Service switch position "3"
			Service switch position "4"
			Service switch position "Service"
			Service switch position "SET"

7.12 Testing the sensor

	Function	Adjustments	
		LED indicator	**Important**
65 °C (50/42 °C)	**INPUTTEST** Use this function to display the status of the different sensors. Every LED displays the status of a certain sensor. Therefore, several LEDs can be on at the same time. **Example:**  This display means: – Low oil sensor open (too little oil). – "ON" pressure switch not actuated. – Thermal motor protection switch closed. – Reed switch "fuel tank" closed (tank not empty). – Reed switch "detergent tank 1" open (tank empty). – Reed switch "water shortage safeguard" closed. – "OFF" pressure switch not actuated. – Exhaust gas thermostat open (burner off). – Reed switch "liquid softener tank" closed (float up). – Reed switch "detergent tank 2" open (float up).		Lack of oil fuse closed (float up).
			"ON" pressure switch open (pressure switch actuated)
			Thermal motor protection switch closed
			Reed switch "fuel tank" closed (float up)
			Reed switch "detergent tank 1" open (float up)
			Reed switch "water shortage safeguard" closed (water flow present)
			"OFF" pressure switch open (pressure switch actuated
			Exhaust gas thermostat closed
			Reed switch "liquid softener tank" closed (float up)
			Reed switch "detergent tank 2" open (float up)

7.13 Error memory

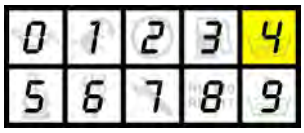
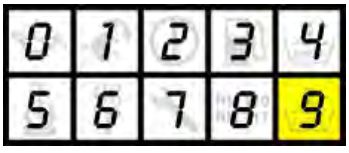
	Function	Adjustments	
		LED indicator	Important
70 °C (52/44 °C)	**ERRORS** This functions serves to read the fault memory. The faults are displayed in 2 steps: 1 LED display of the fault type (see on the right). 2 Display of the pump run time in hours that has passed since the fault had occurred via the numerical values of the LEDs **Example:**  - PAUSE -   **Explanation:** The pump has been running for 14 hours since the fault "Thermal motor protection switch open" occurred. **Note** By operating the pushbutton function on the service switch you can advance to the next fault.		Overvoltage detected on transformer 1.
			Low voltage detected on transformer 1.
			Excess current detected.
			Current asymmetry detected.
			Thermal motor protection switch open.
			Dry running of the pump detected.
			"Sticking" water shortage safeguard detected (closed although the pump is off).
			"Oil refill container empty" detected.
			Leakage (10 short startups < 2 seconds each).
			Exhaust thermostat open.

	**Function**	**Adjustments**	
		LED indicator	**Important**
70 °C (52/44 °C)			Temperature sensor fault. Short circuit or cable break.
			Flame sensor recognises no or not enough light.
			Flame sensor recognises light.
			RFID write-read electronics defective.
			End of the fault memory. Instead of the operating hours, the version of the installed software is displayed here. **Example:**   Software version 1.4
		Note Every possible fault is saved, indicating how many operating hours ago the relevant fault occurred most recently.	
		Note Delete all faults: 70°C (52/44 °C) and hold down "SET" upon switch-on.	

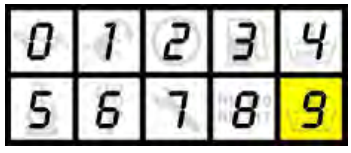
7.14 Operating hours

	Function	Adjustments	
		LED indicator	Important
75 °C (55/45 °C)	**STUNDENPWR** Indication of the consumed RM 110/111 bottles. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** The device has consumed 42 bottles of RM 110/111.   - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

7.15 Gun switching operations since gun service

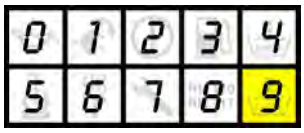
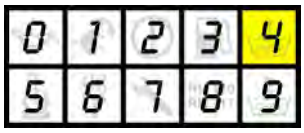
	Function	Adjustments	
		LED indicator	Important
80 °C (58/46 °C)	**SI_PISTOLE** Display of the gun switchings since the most recent gun service. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** The gun was actuated 430 times since the last gun service. The LEDs light up in the following order:    - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

7.16 Gun services

	Function	Adjustments	
		LED indicator	Important
85 °C (60/48 °C)	**SCTR_PISTOLE** Display of gun services. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** 11 gun services have been performed since the device was first used. The LEDs light up in the following order:   - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

	**Function**	**Adjustments**	
		LED indicator	**Important**
85 °C **+** **„SET“** (60/48 °C + „SET“)	When switching on the device, the gun switching operations since the gun service (SI_PISTOLE) are reset to "0", the service counter gun (SCTR_PISTOLE) is increased by 1 and the fault memory is deleted.		

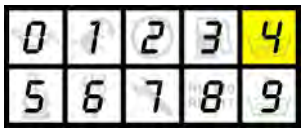
7.17 Gun switches since initial startup

	Function	Adjustments	
		LED indicator	Important
90°C (63/50 °C)	**TOTALPISTOLE** Display of the gun switchings since device was first started up. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** The gun was actuated 9483 times since the device has been put into service. The LEDs light up in the following order:     - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

7.18 Operation duration of the burner since burner service

	**Function**	**Adjustments**	
		LED indicator	**Important**
95°C (66/52 °C)	**SI_Brenner** Display of the operation duration of the burner in hours since the last burner service. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** The burner has been in operation for 47 hours since the last burner service. The LEDs light up in the following order:   - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

7.19 Burner service

	Function	Adjustments	
		LED indicator	**Important**
100°C (68/54 °C)	**SCTR_BRENNER** Display of the burner service. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** 4 burner services have been performed since the device was first used. The LEDs light up in the following order:  - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

	**Function**	**Adjustments**	
		LED indicator	**Important**
100°C **+** **„SET“** (68/54 °C + „SET“)	When switching on the device, the burner operation duration since the burner service (SI_BRENNER) is reset to "0", the service counter burner (SCTR_BRENNER) is increased by 1 and the fault memory is deleted.		

7.20 Burner operation since initial startup

	Function	Adjustments	
		LED indicator	**Important**
112°C (70/55 °C)	**TOTALBRENNER** Display of the operation duration of the burner in hours since the initial startup of the device. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** The burner has been in operation for 32 hours since the initial startup of the device. The LEDs light up in the following order:   - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

7.21 Operating hours of the pump since pump service

	Function	Adjustments	
		LED indicator	Important
125°C (74/56 °C)	**SI_PUMPE** Display of the operating time of the pump since the last pump service in hours. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** The burner has been in operation for 31 hours since the initial startup of the device. The LEDs light up in the following order:   - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

7.22 Pump service

	Function	Adjustments	
		LED indicator	Important
140°C (77/58 °C)	**SCTR_PUMPE** Display of the pump services. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** 7 pump services have been performed since the device was first used. The LEDs light up in the following order:  - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

	**Function**	**Adjustments**	
		LED indicator	**Important**
140°C **+** **„SET“** (77/58 °C + „SET“)	When switching on the device, the pump operation duration since the pump service (SI_PUMPE) is reset to "0", the service counter pump (SCTR_PUMPE) is increased by 1 and the fault memory is deleted.		

7.23 Pump operation since initial startup

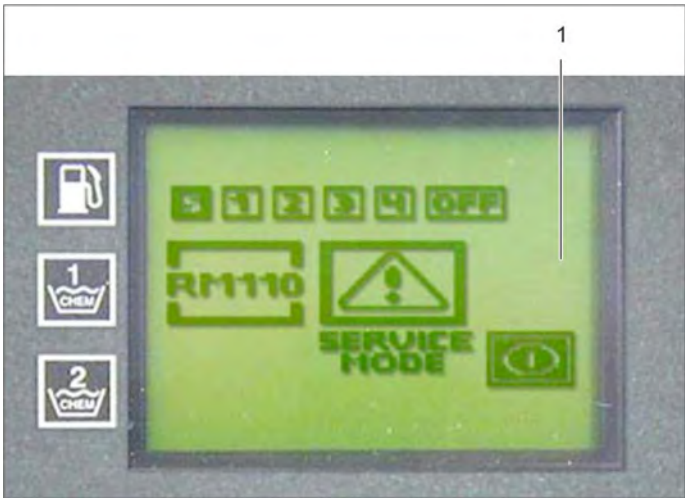
	Function	Adjustments	
		LED indicator	**Important**
155°C (80/60 °C)	**TOTALPUMPE** Display of the operating time of the pump since the initial device startup in hours. The value is displayed digit by digit by the LEDs, with every LED standing for a numeric value from 0 - 9 in accordance with its number.  The display is repeated after a pause. **Example:** The pump has been in operation for 32 hours since the initial device startup. The LEDs light up in the following order:   - PAUSE -		Digit value "0"
			Digit value "1"
			Digit value "2"
			Digit value "3"
			Digit value "4"
			Digit value "5"
			Digit value "6"
			Digit value "7"
			Digit value "8"
			Digit value "9"

7.24 Servicefunktionen mit Displayanzeige

1 Setting, water temperature

Service mode
If the service switch is in the "Service" position (screwdriver symbol) upon switching on the device, the service mode of the device is activated (pump is not running).

Selection of the service functions
The available service functions are selected via the water temperature setting.
Example: 30°C is equivalent to the function "Switch-off after 30 minutes of continuous operation".
For some functions the function selection must already be set upon switching on the device and the service switch must be kept in the "SET" position for 2-3 seconds.
Example: "RFID recognition" is called up with the setting 45°C + "SET" upon switch-on.



1 Display

Changing the settings
The indication of the current setting takes place via the display on the control panel.
By means of the pushbutton function of the service switch (continue to turn to "SET" position, switch snaps back to the "Service" position) the settings can be changed. The change is also shown on the display.

Exiting the service mode
– Turn off the appliance.
– Set the service switch to the appropriate water hardness level or "OFF".
– Turn on the appliance.

1 Service position
2 Service switch

7.25 Set up the switching off process

	Display	Explanation	Remark
30°C		Switch-off after 30 minutes of continuous operation is activated.	Switching with SET
		Switch-off after 30 minutes of continuous operation is not activated (factory setting).	Switching with SET
35°C		Switch-off after 30 minutes of continuous break is activated.	Switching with SET
		Switch-off after 30 minutes of continuous break is not activated (factory setting).	Switching with SET

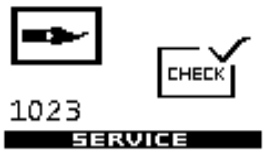
7.26 Set up the leakage behaviour

	Display	Explanation	Remark
40°C		Switch-off after 10 short startups activated (factory setting).	Switching with SET
		Switch-off after 10 short startups is not activated.	Switching with SET

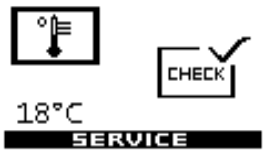
7.27 RFID query

	Display	Explanation	Remark
45°C + „SET“		Device is equipped with RFID.	Menu access: Select 45°C Switch off device. Hold SET. Turn on the machine. Release SET. Select settings with SET.
		Device is not equipped with RFID. Check the setting when replacing the printed circuit board.	Menu access: Select 45°C Switch off device. Hold SET. Turn on the machine. Release SET. Select settings with SET.

7.28 Brightness value of the flame sensor

	Display	Explanation	Remark
45°C		Test flame sensor. Display brightness value.	<471: bright >=471: dark

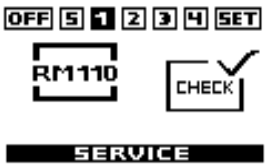
7.29 Testing the temperature sensor

	Display	Explanation	Remark
50°C		Test temperature sensor Indication temperature.	0°C is displayed when the temperature is below 0°C.

7.30 Testing the water temperature setting and the programme switch

	Display	Explanation	Remark
55°C		Output image for temperature selector switch test.	Use SET to access the temperature selector switch test.
		Temperaturwahlschaltertest. Es wird die am Temperaturwahlschalter gewählte Temperatur angezeigt.	Wenn der Temperaturwahlschaltertest fertig ist, muss wieder 55°C gewählt werden. Mit SET gelangt man in den Hauptschaltertest
		Main switch test	
		Main switch test	
		Main switch test	
		Main switch test	This display appears only very briefly as the device is also switched off here.

7.31 Test service switch

	Display	Explanation	Remark
60°C		Selected liquid softener setting.	

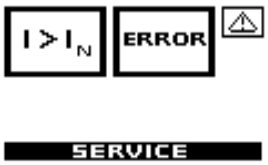
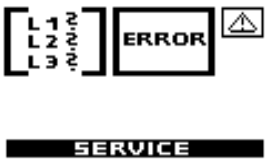
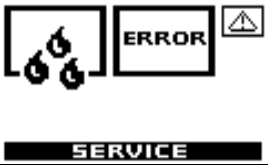
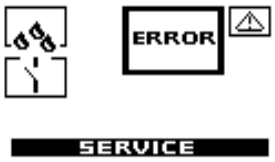
7.32 Testing the sensors

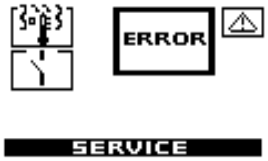
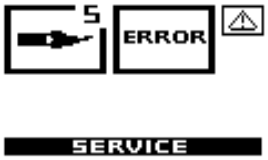
	Display	Explanation	Remark
65°C		Description from left to right: Level stage fuel sensor (stage 7 of 8) Thermal motor protection switch open. Oil refill container not empty Exhaust thermostat open. Water shortage safeguard open Level stage detergent 1 (stage 1 of 4) Liquid softener container is empty On pressure switch pressed Off pressure switch pressed Level stage detergent 2 (stage 2 of 4)	In case of a cable break with a level sensor no stage is displayed.
		Description from left to right: Level stage fuel sensor (stage 7 of 8) Thermal motor protection switch closed Oil refill container not empty Exhaust gas thermostat closed Water shortage safeguard closed Level stage detergent 1 (stage 1 of 4) Liquid softener container is full On pressure switch not pressed Off pressure switch not pressed Level stage detergent 2 (stage 2 of 4)	If a level sensor has a cable break, no stage is displayed.

7.33 Error memory

Note
Use SET to switch over to the next fault.

With switch-off - hold SET - switch-on the fault memory can be deleted.

	**Display**	**Explanation**	**Remark**
70°C		Mains voltage too high	Check the supply voltage.
		Mains voltage too low	Check the supply voltage.
		Motor current too high	Motor sluggish or phase failed. Check the mains connection.
		Motor asymmetric	Phase failed. Check the mains connection.
		Thermal motor protection switch open.	Engine is overheated Motor sluggish. Check the mains connection.
		Dry running of the pump (2 minutes)	Ensure water supply. Check water shortage safe guard.
		Water shortage safeguard is sticky (reed switch or magnetic piston)	Check water shortage safe guard.
		Oil refill container empty	Refill lubricating oil. Check the float of the oil refill container.
		10 short startups took place due to leakage	Rectify leaks in the high-pressure system.

	**Display**	**Explanation**	**Remark**
		Exhaust thermostat has triggered.	Decarbonize boiler. Check exhaust gas thermostat.
		Cable break or short circuit with water temperature sensor	Check temperature sensor.
		Flame sensor does not detect a flame although the burner was switched on	Clean the looking glass. Check fuel supply.
		The flame sensor recognised bright although the burner was off	Incidence of secondary light at the flame sensor. Combustion chamber scaled. Solenoid valve does not close.
		RFID write-read electronics defective.	RFID write-read electronics is defective - replace.
		Cable break with level sensor fuel occurred	Check level sensor fuel.
		Cable break with level sensor detergent tank 1 occurred	Check level sensor RM 1.
		Cable break with level sensor detergent tank 2 occurred	Check level sensor RM 2.
		Software version 1.1	This is no fault. Error merely appears for design reasons, because the display is in the error menu.

7.34 Operating hours

	Display	Explanation	Remark
75°C		Indication of the consumed RM 110/111 bottles.	

7.35 Gun switching operations since gun service

	Display	Explanation	Remark
80°C		Number of gun switching operations since the last maintenance	Maintenance after 80000 gun switching operations

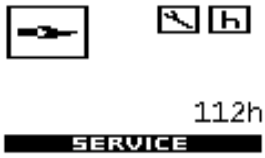
7.36 Gun services

	Display	Explanation	Remark
85°C		Number of gun maintenances	Delete service. Turn off the appliance. Hold SET (2-3 seconds). Turn on the appliance. **Note** The fault memory is also deleted.

7.37 Gun services since initial startup

	Display	Explanation	Remark
90°C		Number of total gun switching operations	

7.38 Operation duration of the burner since startup

	Display	Explanation	Remark
95°C		Operation duration burner since the last maintenance	Maintenance after 400 burner hours.

7.39 Burner service

	Display	Explanation	Remark
100°C		Number of burner maintenances	Delete service. Turn off the appliance. Hold SET (2-3 seconds). Turn on the appliance. **Note** The fault memory is also deleted.

7.40 Burner operation since initial startup

	Display	Explanation	Remark
112°C		Total operation duration burner	

7.41 Operating hours of the pump since pump service

	Display	Explanation	Remark
125°C		Operation duration pump since the last maintenance	Maintenance after 600 pump hours.

7.42 Pump services

	Display	Explanation	Remark
140°C		Number of pump maintenances	Delete service. Turn off the appliance. Hold SET (2-3 seconds). Turn on the appliance. **Note** The fault memory is also deleted.

7.43 Pump operation since initial startup

	Display	Explanation	Remark
155°C		Total operation duration of the pump	

7.44 Quick overview for reading the service functions

- Turn off the appliance.
- Make a note of the position of the service switch.
- Set the service switch to Service.
- Turn on the appliance.
- Set temperature regulator to the relevant temperature.
- 30 (30/20)°C - Behaviour after 30 minutes of continuous operation.
- 35 (34/32)°C - Behaviour after 30 minutes of stand-by.
- 40 (37/34)°C - Behaviour in case of leakage.
- 45 (40/35)°C - Brightness flame sensor.
- 45 (40/35)°C and Set upon switch-on - device with/without RFID
- 50 (43/36)°C - Temperature at the temperature sensor.
- 55 (46/38)°C - Function check programme switch and temperature controller.
- 60 (48/40)°C - Function check service switch.
- 65 (50/42)°C - Input test (level oil pump, pressure switch ON, winding protection motor, level fuel, level chem1, water shortage safeguard, pressure switch OFF, exhaust gas thermostat, level system care, level chem2).
- 70 (52/44)°C - Display fault memory and software function (overvoltage, low voltage, excess current, phases asymmetric, winding protection motor, dry running, water shortage safeguard is stuck, oil shortage pump, leakage, exhaust gas thermostat, temperature sensor, flame sensor without light, flame sensor with light, RFID defective, software version).
- 75 (55/45)°C - Bottle consumption system care RM 110/111.
- 80 (58/46)°C - Gun switching operations since the last gun service (maintenance every 80000 switching operations).
- 85 (60/48)°C - Number of gun services.
- 85 (60/48)°C and Set upon switch-on - delete gun service and fault memory.
- 90 (63/50)°C - Total gun switching operations.
- 95 (66/52)°C - Operating hours since last burner service (maintenance every 400 h).
- 100 (68/54)°C - Number of burner services.
- 100 (68/54)°C and Set upon switch-on - delete burner service and fault memory.
- 112 (70/55)°C - Total operating hours burner.
- 125 (74/56)°C - Operating hours since last pump service (maintenance every 600 h).
- 140 (77/58)°C - Number of pump services.
- 140 (77/58)°C and Set upon switch-on - delete pump service and fault memory.
- 155 (80/60)°C - Total operating hours pump.
- Turn off the appliance.
- Bring the service switch back into the position taken down before.
- Turn on the appliance.

Note
- 1. Value without brackets concerns all standard devices.
- 1. Value in brackets for devices up to max. 80 ?.
- 2. Value in brackets for devices up to max. 60 ?.

7.45 Reset of the maintenances

Display "Service" is on and the device functions completely normal.
- Description applies to HDS devices with indicator lights on the control panel.
- When resetting the maintenances, the fault memory is also deleted. (Delete faults only: Temperature controller to 70 (52/44)°C and SET upon switch-on).

Maintenance due as one or several of the following conditions has been reached:
- 80000 gun switching operations,
- 400 burner hours or
- 600 pump hours.

- Print and cut out template (page 13).
- Hold the template against the indicator lights on the control panel.

- Select the service mode.
  (Switch off the device, put the service switch to "Service", switch on device).

Query gun switching operations: Temperature controller to 80 (58/46)°C.
- Maintenance is due after 80000 switching operations.
- Perform maintenance when necessary.
- Reset gun maintenance: 85 (60/48)°C and hold SET upon switch-on.

Query burner hours: Temperature controller to 95 (66/52)°C.
- Maintenance is due at 400h.
- Perform maintenance when necessary.
- Reset burner maintenance: 100 (68/54)°C and hold SET upon switch-on.

Query pump hours: Temperature controller to 125 (74/56)°C.
- Maintenance is due at 600h.
- Perform maintenance when necessary.
- Reset pump maintenance: 140 (77/58)°C and hold SET upon switch-on.

Note
- 1. Value without brackets concerns all standard devices.
- 1. Value in brackets for devices up to max. 80 ?.
- 2. Value in brackets for devices up to max. 60 ?.

7.46 Overview of a quick check of the device status

Read the fault memory in service mode at 70 (52/44)°C. Advance with "SET".
Every fault type is saved only once, together with the passed hours since it has last occurred.

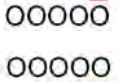

Overvoltage detected hours ago:

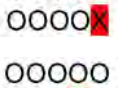

Low voltage range detected hours ago:

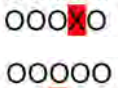

Excess current detected hours ago:


Current asymmetry detected hours ago:


Tripped winding protection motor detected hours ago:


2 minutes dry running detected hours ago:

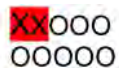

Stuck water shortage safeguard detected hours ago:


Oil shortage in pump detected hours ago:


Leakage (10 short startups) detected hours ago:


Triggered exhaust gas thermostat detected hours ago:


Faulty temperature sensor for water detected in hours:

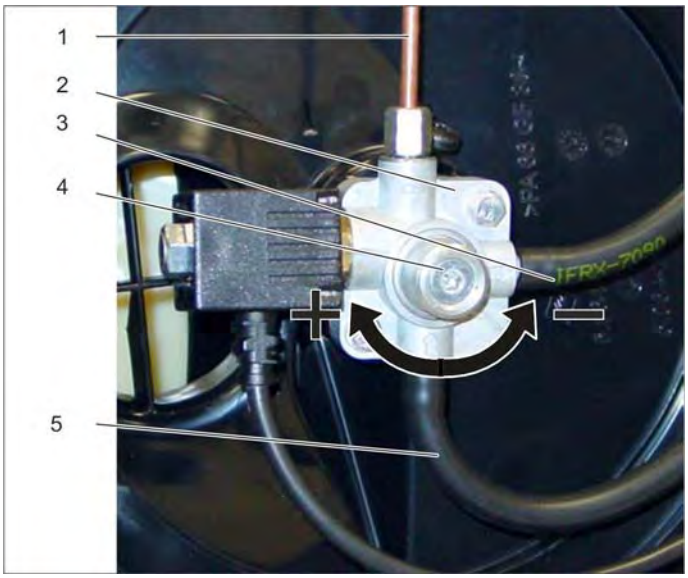

Flame sensor detects too little light hours ago:


Flame sensor detects light hours ago:


Reading error RFID electronics detected hours ago:

OOOO end of the fault memory reached.
OOOO display of the software version.

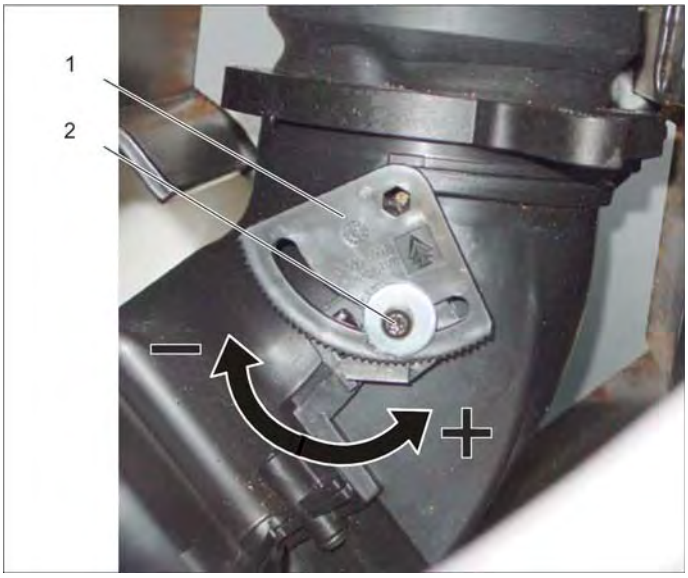
7.47 Settings, burner



1 Pressure line to the burner
2 Fuel pump
3 Suction hose, fuel
4 Adjustment screw, fuel pressure
5 Return hose to the fuel tank

Measure water temperature

➔ Install the shut-off valve with thermometer (special tool) on the appliance outlet.
➔ Switch on the burner and bring the appliance to working pressure with full water volume via the shut-off valve.
➔ Let the device run in burner operation for approx. 5 minutes until the maximum water temperature is reached.
➔ Measure the increase in water temperature (water outlet temperature minus water supply flow temperature).
➔ For target values refer to technical specifications.
➔ Measure the soot value, CO2 content and the exhaust temperature (special tools, measuring gauges).



1 Air door, air volume adjustment
2 Stop screw

Adjusting the fuel pressure

➔ Set the fuel pressure (and water temperature) via the set screw.
➔ For target values refer to technical specifications.

Adjusting the soot value

➔ If the soot value is too high, then the air flap needs to be opened further or the fuel pressure needs to be reduced.

Adjust the CO_2 value

➔ Adjust the CO_2 value by moving the air flap. Open the air flap, the CO_2 content is decreasing.

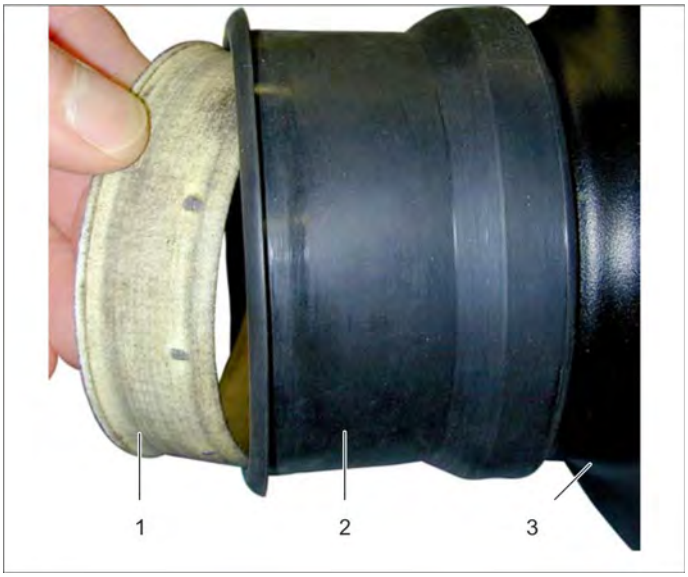
Note

An accurate basic adjustment of the burner is only possible if the heating coil was previously thoroughly desooted and the deposits were removed.Eine exakte Grundeinstellung des Brenners ist nur möglich, wenn die Heizschlange vorher gründlich entrußt und die inneren Ablagerungen entfernt wurden.

Note

After finishing the basic adjustment, the fuel pump and the air flap must be sealed.

7.48 Installation air duct on the outer jacket



1 Clamp ring
2 Air guidance
3 Exterior coat

➔ Clean the air duct and the outer jacket in the installation area.
➔ Install the air duct on the outer jacket.
➔ Grease clamping ring.
➔ Insert the clamping ring up into the air duct up to the noticeable stop.

Note
When installing the outer jacket (booster heater) in the device, the air duct can fall off the outer jacket. This leads to an aggravated installation. An additional clamping ring serves as installation aid.

Note
Ensure correct seating of the air duct.

1 Lock handles
2 Exterior coat
3 Clamp ring
4 Air guidance

7.49 Adjusting the working pressure with the rotary regulator on the gun

7.49.1 Setting the maximum working pressure

1 Adjustment screw, high pressure
2 Lock nut, adjustment screw, high pressure
3 Spindle, pressure and quantity regulation
4 Adjustment screw, low pressure
5 Lock nut, adjustment screw, low pressure
6 Housing, overflow valve

➔ Install the test manometer (special tool) to the high-pressure connection.
➔ Connect the high-pressure hose with gun and rotary regulator to the test manometer.
➔ Screw in the twist grip of the pressure and volume regulation on the pump all the way to the stop (towards "+").
➔ Turn the rotary regulator to the position with the lowest pressure at the nozzle (towards "-"), open gun and let the device run.
➔ Pull off the rotary handle.
➔ Loosen the locknut of the adjustment screw for high pressure.
➔ Turn the adjustment screw high pressure in a way that the opening pressure of the overflow valve is reached on the test manometer.

Note
If this screw is turned clockwise, the pressure is increased; and if it is turned counter-clockwise, the pressure is decreased.

➔ After adjustment, secure the adjustment screw high pressure by means of a lock nut.
➔ Check the working pressure, feed volume and switch points of the pressure switches.
➔ Seal the adjustment screw for high pressure and the lock nut with safety lacquer.

Note
The rotary regulator is used to adjust the opening pressure of the overflow valve.

7.49.2 Setting the minimum working pressure

1 Adjustment screw, high pressure
2 Lock nut, adjustment screw, high pressure
3 Spindle, pressure and quantity regulation
4 Adjustment screw, low pressure
5 Lock nut, adjustment screw, low pressure
6 Housing, overflow valve

➔ Fasten the test manometer to the high-pressure connection.
➔ Connect the high-pressure hose and gun to the test manometer.
➔ Install the **new** high pressure nozzle.
➔ Completely open the control knob on the gun (turn towards "+").
➔ Actuate the trigger on the gun and switch on the appliance.
➔ Rotate the rotating handle of the pressure regulator on the pump anti-clockwise (direction "-") all the way to the stop.
➔ Pull off the rotary handle on the pressure regulator.
➔ Loosen the locknut of the adjustment screw for low pressure.
➔ Turn the adjustment screw low pressure together with the spindle until the minimum working pressure of the overflow valve is reached on the test manometer (see technical data, partial load).

Note
If this screw is turned clockwise, the pressure is increased; and if it is turned counter-clockwise, the pressure is decreased.

➔ Secure the adjustment screw for low pressure by tightening the locknut.
➔ Check the working pressure, feed volume and switch points of the pressure switches.
➔ Then seal this setting.

Note
With minimum pressure and volume adjustments and when using the supplied steam nozzle, the pressure must not exceed 32 bar.

7.50 Setting the working pressure with standard gun without rotary knob

7.50.1 Setting the maximum working pressure

1 Adjustment screw, high pressure
2 Lock nut, adjustment screw, high pressure
3 Spindle, pressure and quantity regulation
4 Adjustment screw, low pressure
5 Lock nut, adjustment screw, low pressure
6 Housing, overflow valve

➔ Fasten the test manometer to the high-pressure connection.
➔ Connect high-pressure hose with standard gun to the test pressure gauge.
➔ Install the **new** high pressure nozzle.
➔ Open standard gun.
➔ Turning on the appliance.
➔ Screw in the twist grip of the pressure and volume regulation on the pump all the way to the stop (towards "+").
➔ Pull off the rotary handle.
➔ Loosen the locknut of the adjustment screw for high pressure.
➔ Turn the adjustment screw high pressure in a way that the opening pressure of the overflow valve is reached on the test manometer.

Note
If this screw is turned clockwise, the pressure is increased; and if it is turned counter-clockwise, the pressure is decreased.

➔ Secure the adjustment screw for high pressure by tightening the locknut.
➔ Check the working pressure, feed volume and switch points of the pressure switches.
➔ Then seal this setting.

Note
The maximum working pressure is set with the standard gun without control knob.

7.50.2 Setting the minimum working pressure

1 Adjustment screw, high pressure
2 Lock nut, adjustment screw, high pressure
3 Spindle, pressure and quantity regulation
4 Adjustment screw, low pressure
5 Lock nut, adjustment screw, low pressure
6 Housing, overflow valve

➔ Fasten the test manometer to the high-pressure connection.
➔ Connect high-pressure hose with standard gun to the test pressure gauge.
➔ Install the **new** high pressure nozzle.
➔ Open standard gun.
➔ Turning on the appliance.
➔ Rotate the rotating handle of the pressure regulator on the pump anti-clockwise (direction "-") all the way to the stop.
➔ Pull off the rotary handle.
➔ Loosen the locknut of the adjustment screw for low pressure.
➔ Turn the adjustment screw low pressure and the spindle until the minimum working pressure is reached.

Note
If this screw is turned clockwise, the pressure is increased; and if it is turned counter-clockwise, the pressure is decreased.

➔ Secure the adjustment screw for low pressure by tightening the locknut.
➔ Check the working pressure, feed volume and switch points of the pressure switches.
➔ Then seal this setting.

Note
With minimum pressure and volume adjustments and when using the supplied steam nozzle, the pressure must not exceed 32 bar.

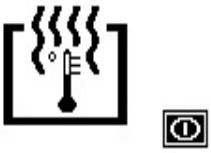
8 Care and maintenance

Service group does not contain any maintenance and inspection points.

9 Troubleshooting

Failure	Measure
Device is not running (no LED/display indication)	– Check/replace mains voltage, connecting cable and mains fuse. – Check the fuse (F1). – Check/replace the power switch. – Check/replace the pressure switch – Check/adjust/replace control transformer. – Check/replace the temperature fuse. – Check/replace the PCB. – Unplug the RFID cable from the PCB and switch RFID in the software.
Device is not running, LED standby is on or the display shows three filling levels	– Check pressure switch electrically and mechanically.
Winding protection contact was triggered	– Switch off appliance and let it cool down. Remove the cause of the problem. Turn on the appliance again.
Water pressure too low	– Check/raise the water input amount. – Check/clean/replace water fine filter. – Vent appliance. – Check/replace high-pressure nozzle. – Check/replace the pressure and suction valves – Check / adjust/ replace overflow valve. – Check/adjust/replace safety valve.
Water is not being heated	– Check/correct temperature setting. – If the water shortage safeguard is switched off, ensure sufficient water supply/repair water shortage safeguard. – Check/refill fuel level in the tank. – Check/replace the solenoid valve fuel pump. – Check/replace fuel filter. – Check/correct the setting of the fuel pump. – Check/correct fuel nozzle. – Check/replace ignition cables. – Check/correct distances of the ignition electrodes. – Check/repair burner blower. – Check/correct setting of the air flap.
Control LED is on	– *5.4.1Control panel with LED indicator*
During operation, all 10 LEDs are blinking at the same time, device switches off	– Check service switch and ribbon cable.
Inadequate or no detergent function	– Check/correct dosing valve setting. – Check/clean detergent tank. – Check/clean/replace detergent filter. – Check/replace detergent hose, dosing valve and detergent inlet at the cylinder head.
Pressure reduction in the HP system	– Check the trigger gun and the O-rings on the high-pressure hose for leaks / replace. – Check the pressure holding valve for leaks/replace the O-rings. – Check / adjust/ replace overflow valve. – Check/replace the pressure switch and control piston.
Water leak between the cylinder head and the piston casing	– Leakiness of 1 drop per minute and piston is acceptable. – Check/replace high pressure and low pressure seals.
Oil leaks between the cylinder head and the piston casing	– Replace the oil seals.
Pump is vibrating	– Check pump for leaks/eliminate leaks. – Vent appliance.

9.1 Error messages

Display	Explanation	Remark
	Rotating field of the motor incorrect.	Perform a phase inversion in the commutating pole plug.
	Thermal motor protection switch (WSK) in the motor has tripped.	Switch off the device and allow the motor to cool down.
	Mains voltage too low or too high or phase failed or the motor current is too high.	Check power supply. Check the pump for sluggishness.
	Water shortage (dry running after 2 minutes).	Open tap. Ensure water supply.
	Exhaust temperature is too high	Perform maintenance on the burner.
	Time monitoring active for 30 minutes, continuous break/continuous operation	Switch the device off and back on.

9.2 Error message with service demand

Note

One display for multiple faults is used here. By reading the fault memory, the fault can possibly be localized. (Service mode 70°C)

Display	Explanation	Remark
	Water shortage safeguard (reed switch or magnetic piston is sticky).	Check water shortage safe guard.
	10 short startups/leakage.	Rectify leaks in the HP system.
	Contactor does not switch.	Check contactor. Check installation of the current transformer. This fault is not saved.
	Water temperature sensor (NTC) defective.	Check NTC. Cable NTC scraped blank or interrupted.
	Flame sensor detects condition that is not permitted.	Possible causes: – Fuel solenoid valve – Fuel line/filter – Stray light – Sight glass sooted – Combustion chamber scaled – Fuel empty and fuel empty message defective
	RFID write-read electronics defective.	Check connection to the RFID write-read electronics.

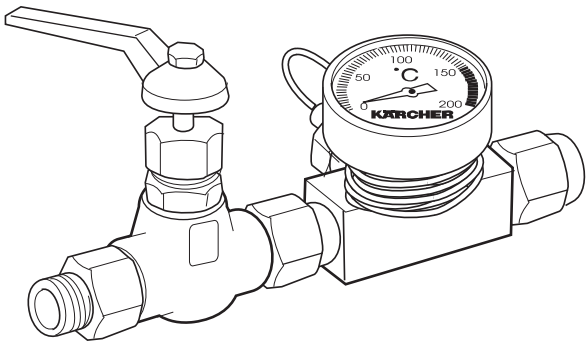
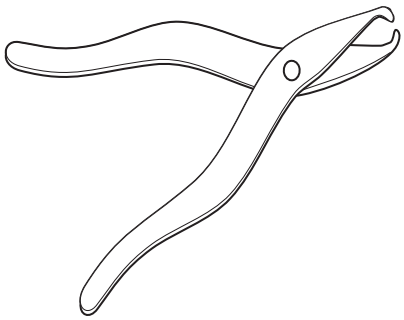
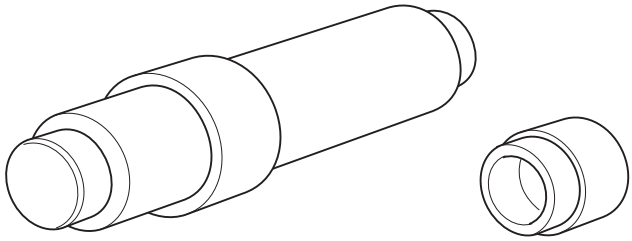
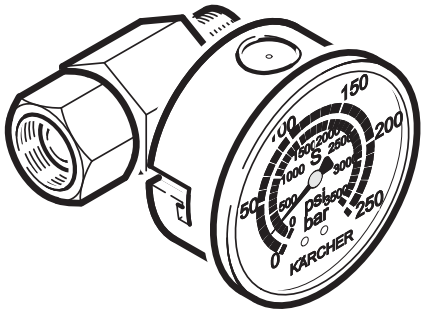
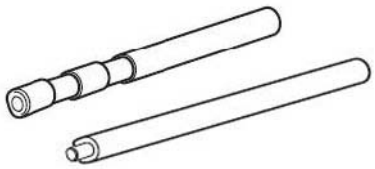
10 Technical specifications

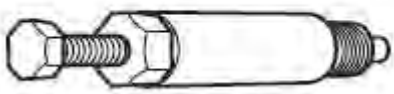
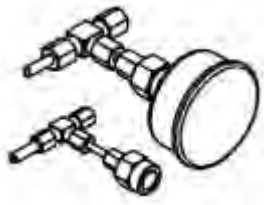
Appliance type	Appliance no.	Circuit diagram	Operating instructions	Spare parts list
HDS 7/12-4 M	1.077-410.0	0.089-021	5.964-883.0	5.972-064.0
HDS 7/12-4 MX	1.077-450.0	0.089-021	5.964-883.0	5.972-064.0
HDS 8/18-4 M	1.077-609.0	0.089-025	5.964-883.0	5.972-275.0
HDS 8/18-4 MX	1.077-650.0	0.089-025	5.964-883.0	5.972-275.0
HDS 9/18-4 M	1.077-810.0	0.089-025	5.964-883.0	5.965-902.0
HDS 9/18-4 MX	1.077-850.0	0.089-025	5.964-883.0	5.965-902.0
HDS 10/20-4 M	1.071-420.0	0.088-952	5.964-883.0	5.971-982.0
HDS 10/20-4 MX	1.071-456.0	0.088-952	5.964-883.0	5.971-982.0
HDS 12/18-4 S	1.071-620.0	0.088-952	5.964-883.0	5.972-173.0
HDS 12/18-4 SX	1.071-650.0	0.088-952	5.964-883.0	5.972-173.0
HDS 13/20-4 S	1.071-800.0	0.089-026	5.965-833.0	5.972-204.0
HDS 13/20-4 SX	1.071-850.0	0.089-026	5.965-833.0	5.972-204.0

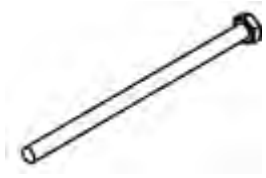
10.1 Tightening torques

Cylinder head screws	50 - 60 Nm
Piston casing	5 - 7 Nm
Gun, pressure regulator	40 Nm
High pressure outlet	6 - 8 Nm
Pressure valve screw connection	40 - 45 Nm
Pressure valve screw connection	30 - 35 Nm
Suction valve screw connection	15 - 17 Nm
Overflow valve seat	8 - 10 Nm
Swash plate	12 +/- 3 Nm
Oil drain screw	20 - 25 Nm
Motor cover, rear	9 - 10 Nm
Blower wheel	7 - 8 Nm

11 Special tools

			
Electric measuring appliance	6.803-022.0	Shut-off valve with thermometer	2.901-030.0
			
Removal pliers, pressure/suction valves and water sieves	4.901-062.0	Installation mandrel oil seal, high-pressure seal Piston diameter 18mm	5.901-062.0
		Installation sleeve, high pressure seal Piston diameter 18mm	5.901-118.0
		Installation mandrel oil seal, high-pressure seal Piston diameter 20mm	5.901-055.0
		Installation sleeve, high pressure seal Piston diameter 20mm	5.901-194.0
		Installation mandrel oil seal Piston diameter 22mm	5.901-064.0
		Installation mandrel high pressure gasket Piston diameter 22mm	5.901-018.0
		Installation sleeve, high pressure seal Piston diameter 22mm	5.901-136.0
			
Test manometer for working pressure	4.742-025.0	Disassembly overflow valve seat Assembly overflow valve seat	5.901-161.0 5.901-162.0

			
Soot pump Soot filter paper Soot pattern scale Thermometer Hardness indicator A Indicator paper Obtain recommended measuring devices, Testo 320 or Testo 320-2-LL - measuring device CO2, directly from the supplier. **Note** Additionally required for both measuring devices: – Power Supply – Device case – Flue gas probe	6.775-001.0 6.775-002.0 6.775-003.0 6.432-029.0 6.768-004.0 6.768-006.0	Puller for swashing plate	4.901-038.0
			
Pressure gauge for fuel pressure	4.901-060.0	Installation mandrel for O-ring/support ring, overflow piston	5.901-163.0

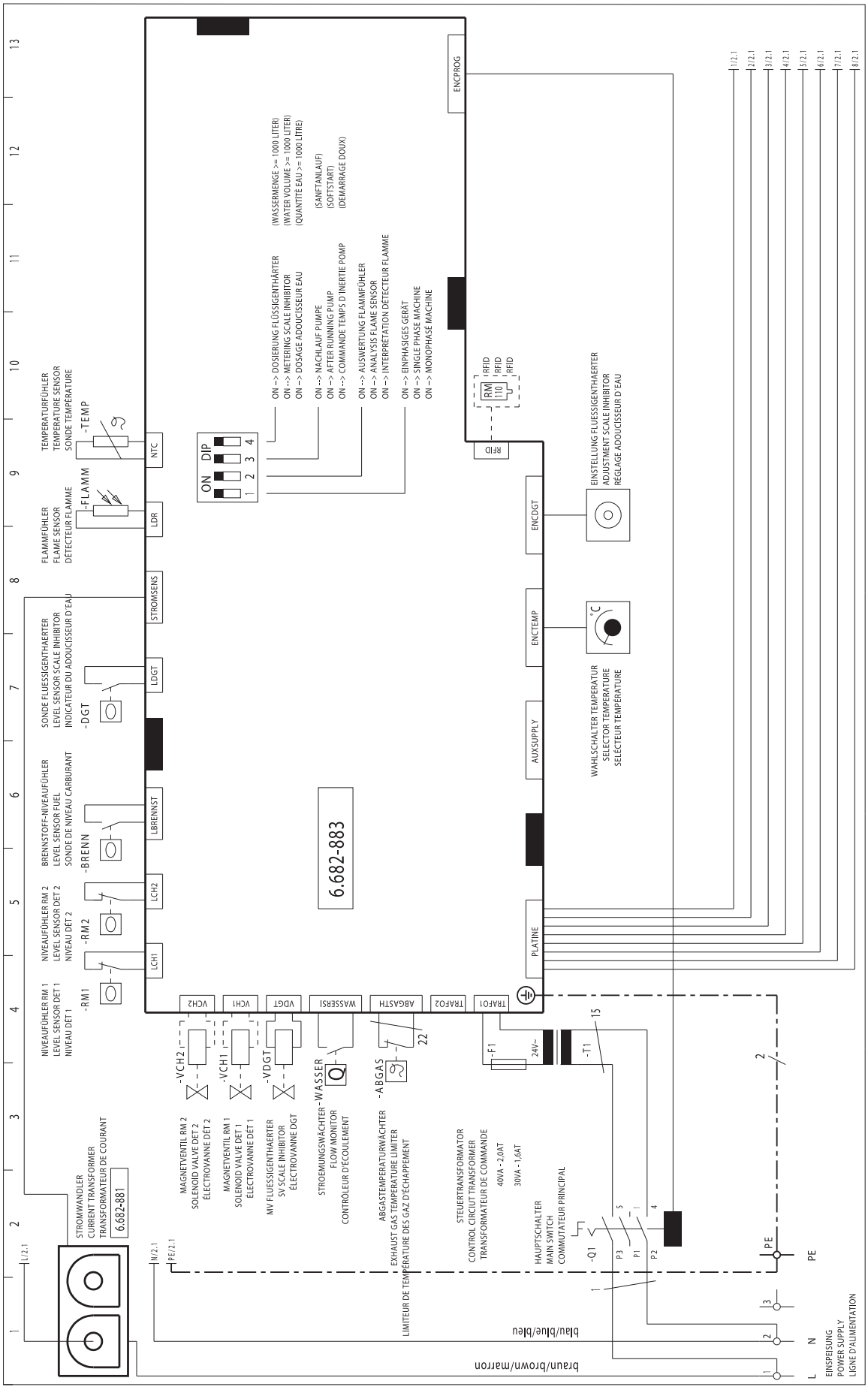
			
Mounting screws for piston guide (M8 x 75)	7.304-403.0		
Mounting screws for piston guide (M6 x 110)	7.304-467.0		

12 Circuit diagram

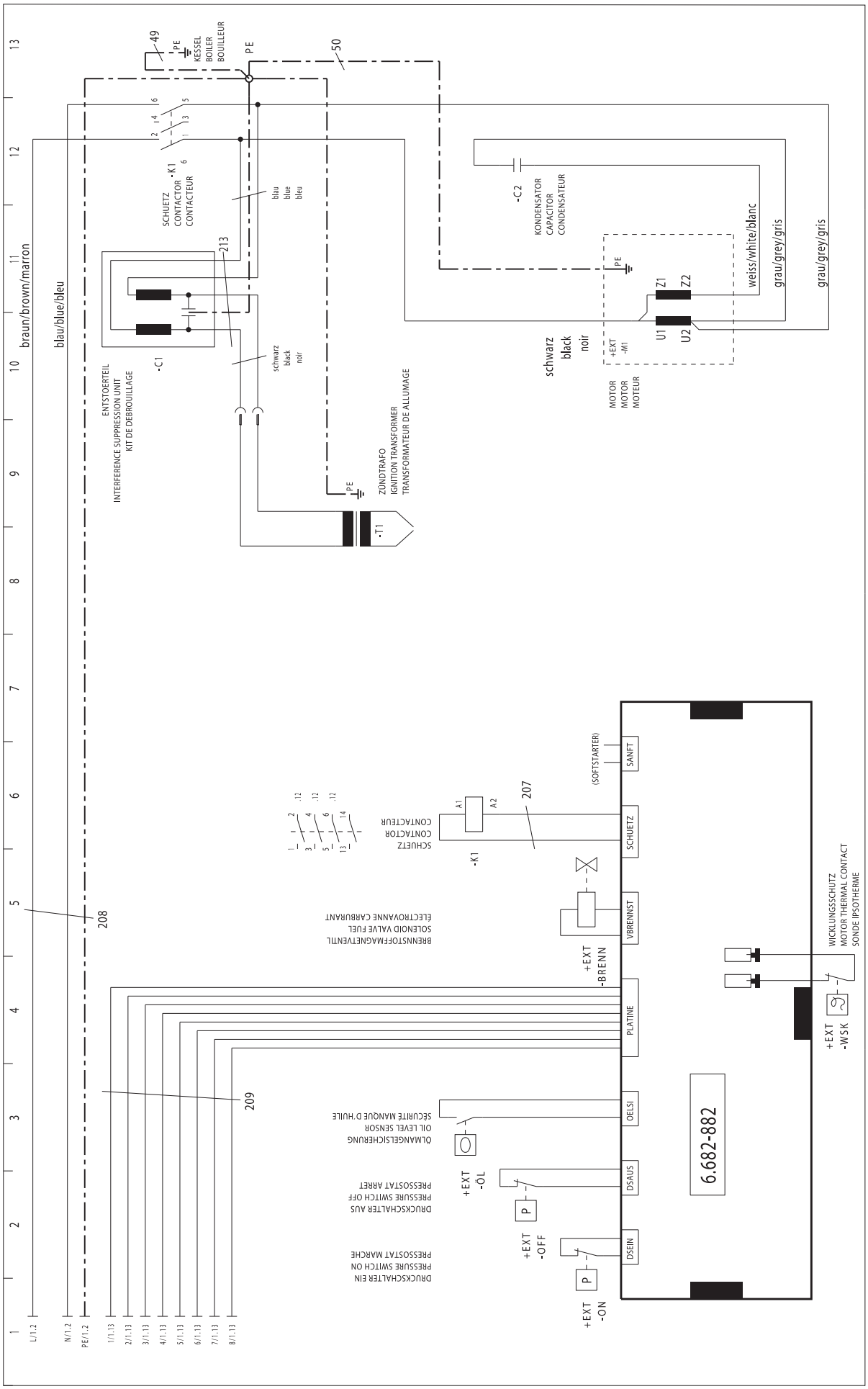
Note

Please observe the most current circuit diagrams in DISIS.

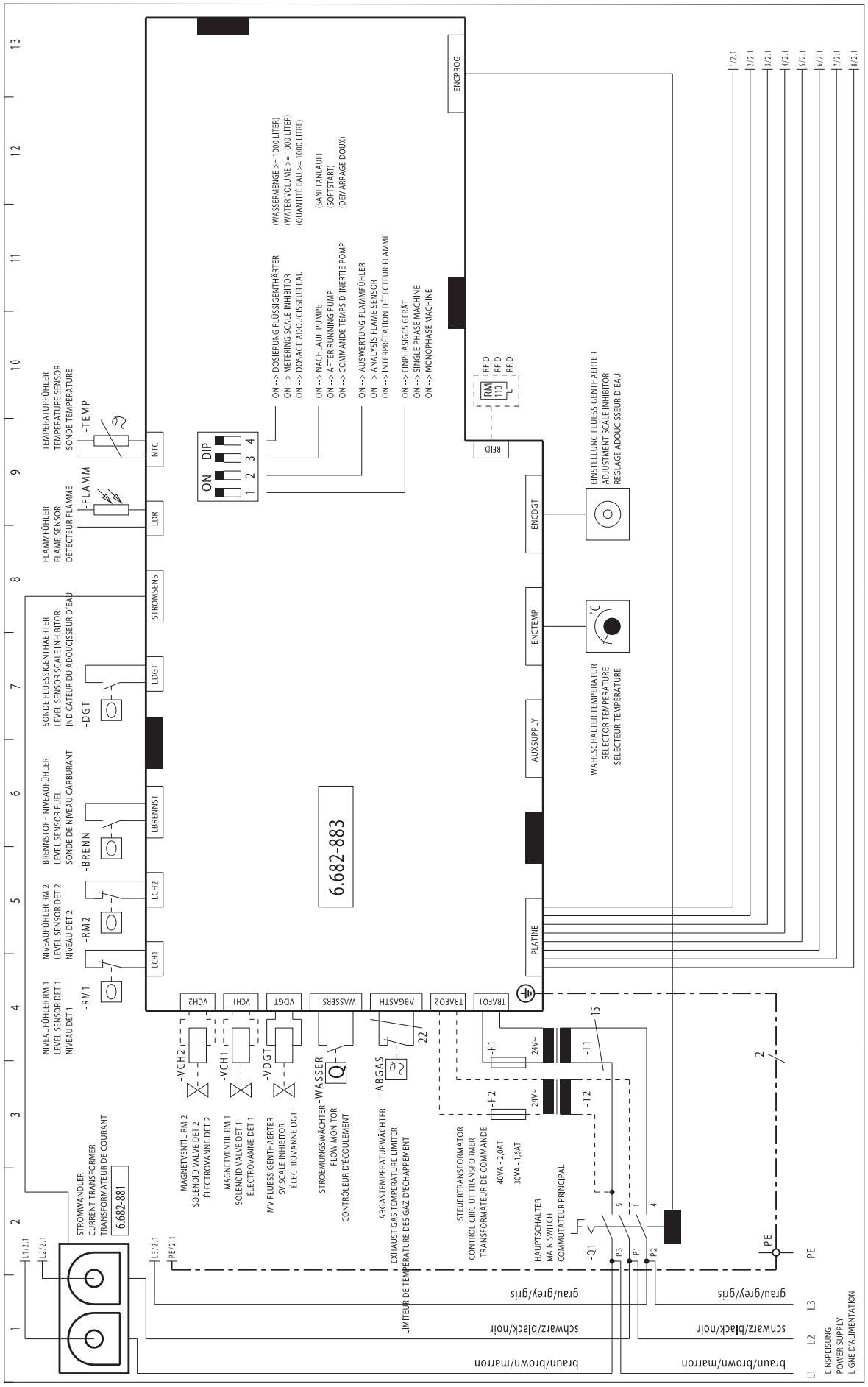
Circuit diagram 0.089-021.0 HDS 7/12



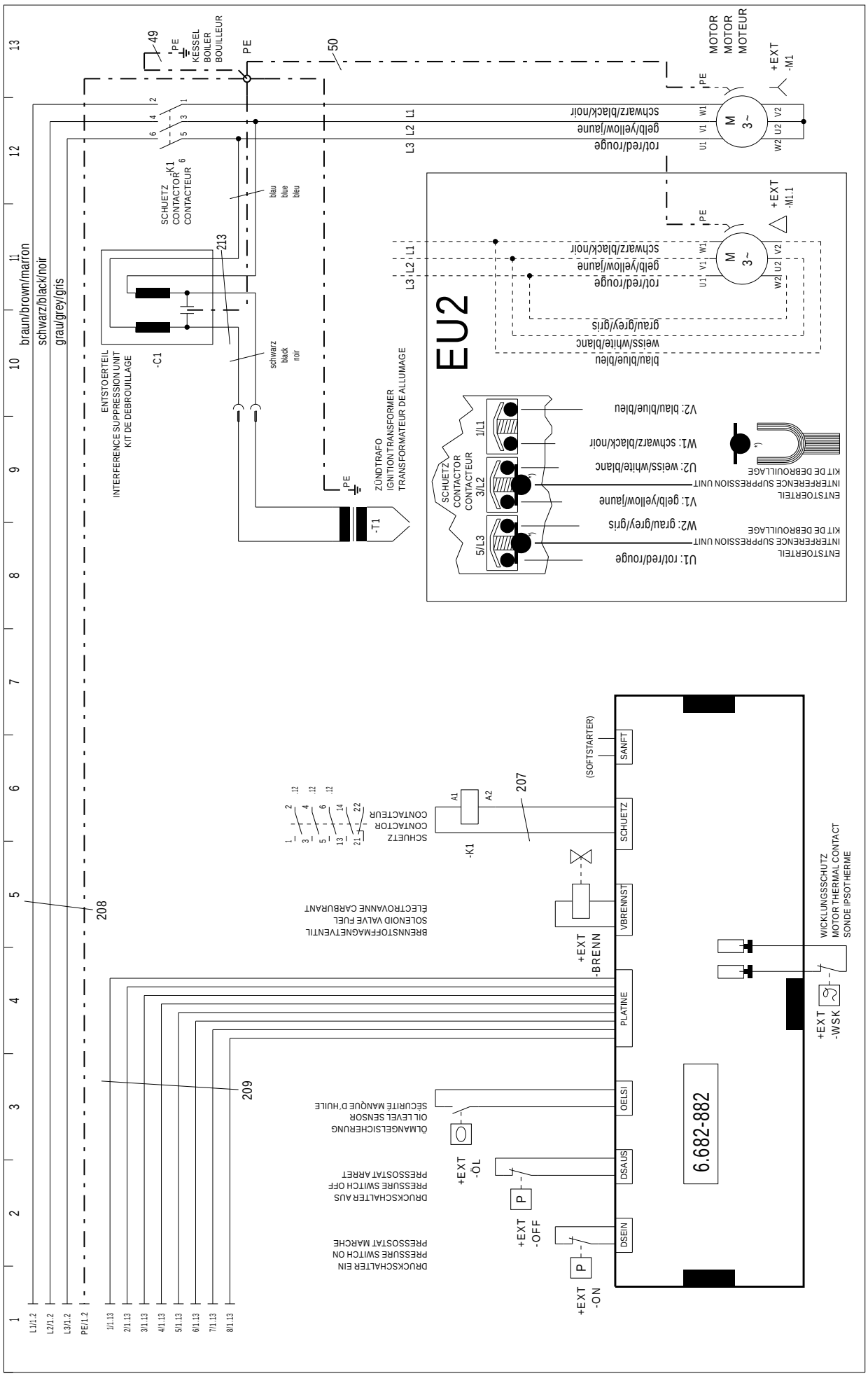
Circuit diagram 0.089-021.0 HDS 7/12



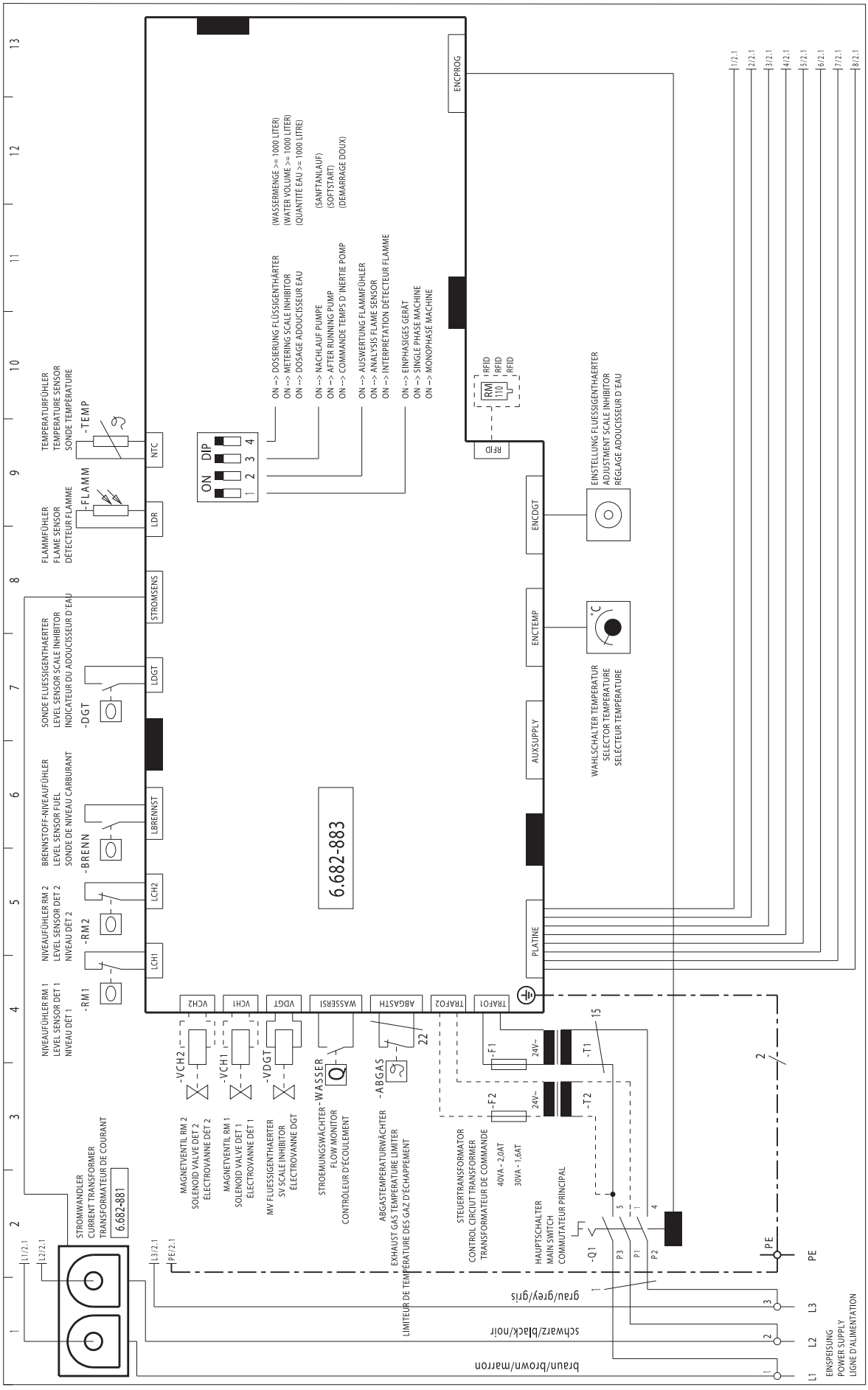
Circuit diagram 0.089-025.0 HDS 8/18, HDS 9/18



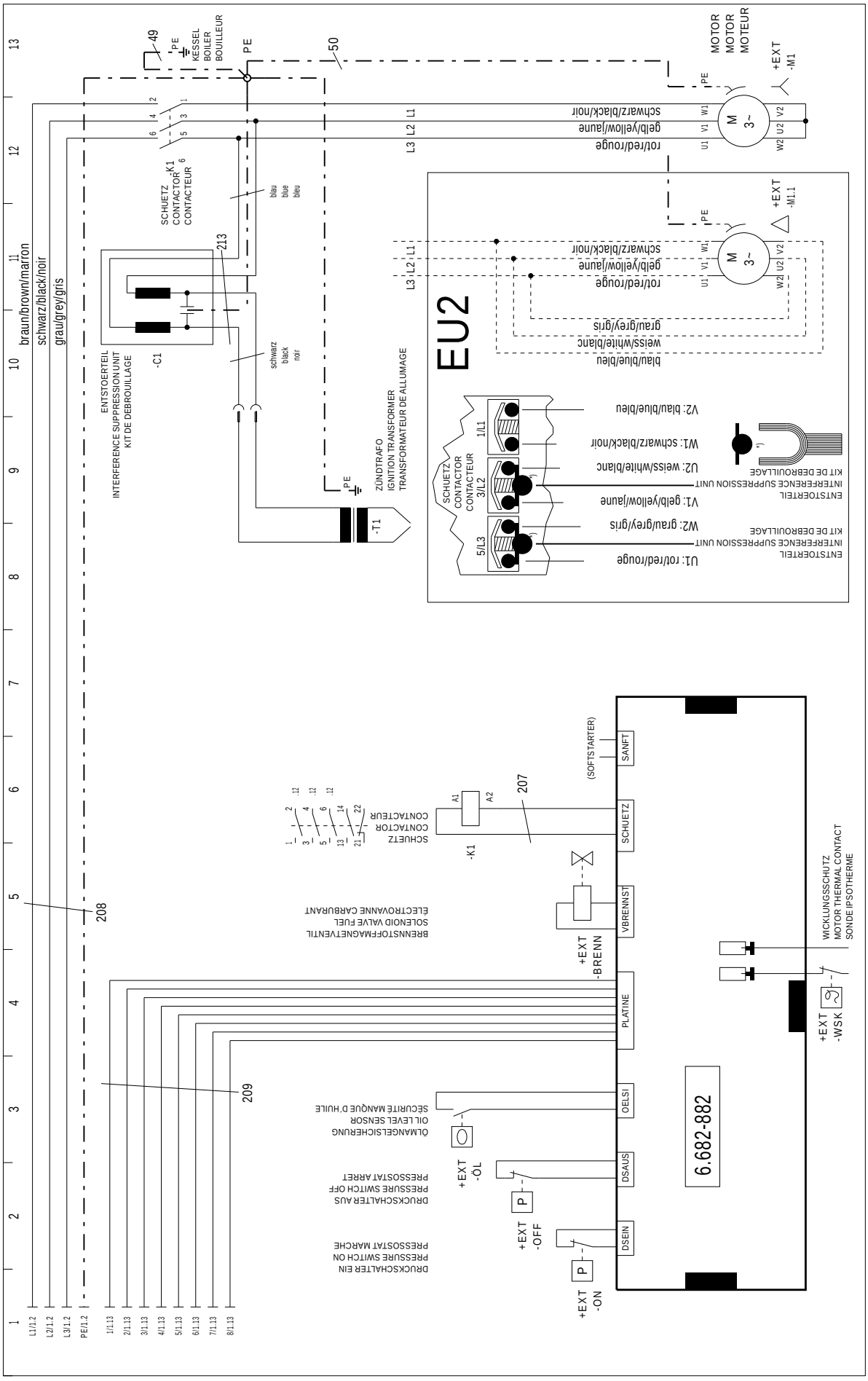
Circuit diagram 0.089-025.0 HDS 8/18, HDS 9/18



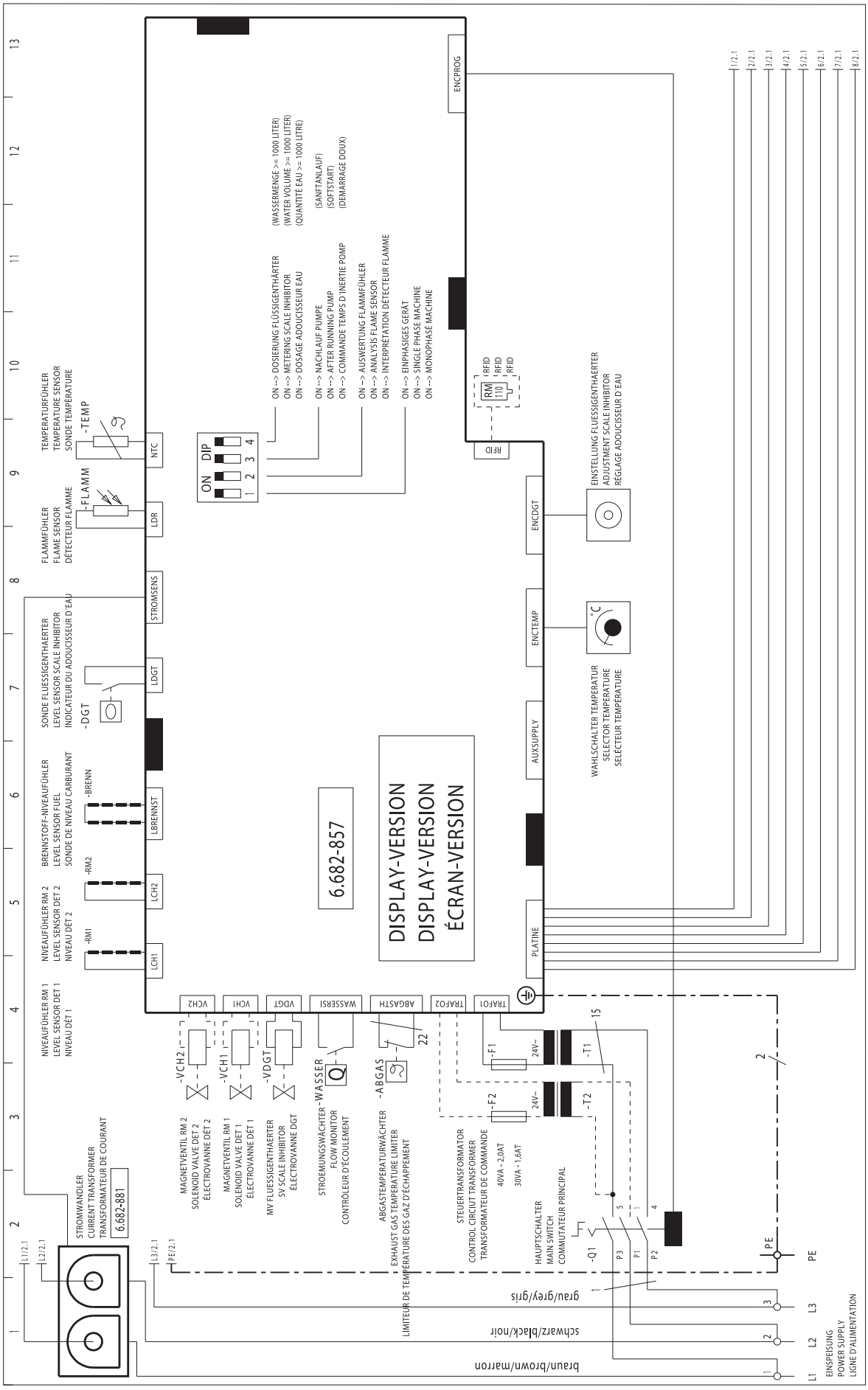
Circuit diagram 0.088-952.0 HDS 10/20, HDS 12/18



Circuit diagram 0.088-952.0 HDS 10/20, HDS 12/18



Circuit diagram 0.089-9026.0 HDS 13/20



Circuit diagram 0.089-9026.0 HDS 13/20