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1. Introduction

1.1 Scope and Purpose

This repair shop manual is intended to support familiarised personnel in the repair of water heaters *BBW 46* and *DBW 46* of the fuel and Diesel type.

The heater may only be operated with the specified type of fuel (Diesel or with fuel oil EL) and the appropriate type of electrical installation.

1.2 Meaning of Warnings, Cautions, and Notes

WARNINGS, CAUTIONS, and NOTES in this manual have the following meaning:

WARNING

This heading is used to highlight that non-compliance with instructions or procedures may cause injuries or lethal accidents to personnel.

CAUTION

This heading is used to highlight that non-compliance with instructions or procedures may cause damage to equipment.

NOTE

This heading is used to highlight and draw specific attention to information.

1.3 Additional Documentation to be used

This workshop manual contains all information and procedures necessary for the repair of water heaters *BBW 46* and *DBW 46*. The use of additional documentation is normally not necessary. Operating instructions/installation instructions and the vehicle specific installation proposal may be used as complementary information as necessary.

1.4 Safety Information and Regulations

The general safety regulations for the prevention of accidents and the relevant operating safety instructions have to be observed at all times.

"General Safety Regulations" beyond the scope of these regulations are detailed in the following.

The specific safety regulations applicable to this manual are highlighted in the individual chapters by Warnings, Cautions, and Notes.

1.4.1 General Safety Notes

Within the scope of the StVZO (Road Licensing Regulations of the Federal Republic of Germany) "Design General Approvals" laid down by the Federal Office for Motor Traffic exist for the water heaters *BBW 46* and *DBW 46* with the following official marks of conformity:

- S185 for heater *BBW 46* (fuel)
- S186 for heater *DBW 46* (Diesel)

Installation of the heater is to be performed in accordance with the installation instructions and, in case of a retrofit, must be checked by an officially authorised expert or inspector of the Technical Supervisory Association (TÜV) in accordance with § 19, para. 2 StVZO submitting the "Operating Instructions" and "Installation Instructions". With this expertise a new vehicle operating license must be applied for with the administrative authority (vehicle licensing agency).

Deviations are only permitted after written authorisation of the installation plans by an officially authorised expert or inspector of the Technical Supervisory Association (TÜV).

The year of the initial operation must be durably marked on the heater identification plate by removing the relevant date of the year.

The heaters are cleared for heating the vehicle engine and the passenger compartment. When using the heaters in vehicles not subject to the Road Licensing Regulations (StVZO) (e.g. ships), the applicable partially regional regulations must be observed.

The heater may only be installed in vehicles or in independent heating systems with a minimum coolant capacity of 4.0 litres.

The heater must not be installed in the passenger or driver compartments of vehicles. Should the heater nevertheless be installed in such a compartment, the installation box must be sealed tight against the vehicle interior. There must be sufficient ventilation of the installation box from the exterior in order not to exceed a maximum temperature of 60 °C in the installation box. Excessive temperatures may cause malfunctions.

WARNING

Due to the danger of poisoning and suffocation the heater must not be operated, not even with timer or telestart, in enclosed areas such as garages or workshops not equipped with an exhaust venting facility.

At filling stations and fuel depots the heater must be switched off as there is a potential danger of explosion.

CAUTION

Where flammable fumes or dust may build up (e.g. in the vicinity of fuel, coal, wood, cereal depots, or similar installations) the heater must be switched off to prevent explosions.

In the vicinity of the control unit a temperature of 85 °C (storage temperature) must not be exceeded (e.g. during body paint work). Excessive temperatures may cause permanent damage to the electronics.

When checking the cooling water level proceed in accordance with the vehicle manufacturer's instructions. The water in the heating circuit of the heater must contain at least 10% of a quality brand anti-freeze.

Non-authorized installations will void the heater's marks of conformity and thus the vehicle's permit of operation. The same applies to unskilled repairs or repairs not using original spare parts.

1.5 Legal Provisions for Installation

For testing the heater in accordance with §§ 19, 20, or 21 of the StVZO the following regulations are to be observed in particular (§ 22 a StVZO):

Testing is performed upon presentation of the operating and installation instructions of the manufacturer. The year of the initial operation must be durably marked on the heater identification plate by the installing person.

Extracting combustion air from the vehicle interior is prohibited.

The exhaust line outlet is to be positioned to the top, to the side, or in case of exhaust venting below the vehicle floor, to the nearest possible location of the vehicle's or cockpit side or rear end. Exhaust pipes must be routed so that exhaust fumes are unlikely to penetrate into the vehicle's interior. The function of any part of the vehicle essential for operation must not be impaired.

Accumulations of condensate in the exhaust line must be directly drained, if required a drain hole may be provided.

Installations fitted after March 18, 1993 must have a combustion air inlet and exhaust outlet port, into which a ball of 16 mm in diameter cannot be inserted.

Electrical wiring and heater switching and control gear must be located in the vehicle so that its normal functioning is not impaired under normal operating conditions.

For the routing of fuel lines and the installation of additional fuel tanks §§ 45 and 46 of the StVZO are to be adhered to. The most important regulations are:

- Fuel lines are to be designed in such a way that they remain unaffected by torsional stresses in the vehicle, engine movement, and the like. They must be protected against mechanical damage. Fuel-carrying parts are to be protected against excessive heat and are to be arranged so that any dripping or evaporating fuel can neither accumulate nor be ignited by hot components or electrical equipment.
- In busses fuel lines and fuel tanks may be located neither in the passenger area nor in the driver's compartment. In these type of vehicles the fuel tanks must be located such that they do not pose a direct hazard to the exits in the event of a fire. Fuel supply must not be by means of gravity or pressurisation of the fuel tank.
- Installation instructions for Webasto fuel tanks for fuel supply of heaters in vehicles:
In busses the installation is not permitted in the passengers or driver's compartment.
- The fuel filler neck must not be located in the passenger's or driver's compartment of any type of vehicle.

- Fuel reservoirs for carburettor fuel must not be located immediately behind the vehicle front fairing. They must be away from the engine to prevent fuel fires in case of accidents. This does not apply to towing vehicles with open cockpit.

All fuel reservoirs offered in the Webasto Accessories Catalogue are suitable for a maximum operating pressure of 0.15 bar overpressure.

All fuel reservoirs offered in the Webasto Accessories Catalogue are individually subjected to pressure testing during the manufacturing process with a minimum of 0.15 bar overpressure.

- The fuel reservoirs must be provided either with a vented seal or any other type of venting facility (vent line).

Only sealing caps in accordance with DIN 73400 may be used.

- The heater mode of operation - at least "on" or "off" - must be clearly visible.
- The retrofit of a heater must be checked by an officially authorised expert or inspector of the Technical Supervisory Association (TÜV) in accordance with § 19, para. 2 StVZO. With this expertise a new vehicle operating license must be applied for with the administrative authority (vehicle licensing agency).
- Non-authorised installations will void the heater's marks of conformity (ABG) and thus the vehicle's permit of operation (ABE). The same applies to unskilled repairs or repairs not using original spare parts.

1.6 Corrections and Improvements

Deficiencies, improvements, or proposals for correction of this workshop manual are to be mailed to:

Webasto Thermosysteme GmbH
Abt. Technische Dokumentation
D-82131 Stockdorf
Telephone: 0 89 / 8 57 94 - 5 42
Telefax: 0 89 / 8 57 94 - 7 57

2. General Description

The water heaters DBW 46 and BBW 46 are used in combination with the vehicle's own heating system to

- heat the vehicle's passenger compartment
- defrost the vehicle screens and
- preheat water-cooled engines

The water heater operates independent from the vehicle engine and is connected to the vehicle's cooling system, electrical system, and fuel system.

The heater designed to the evaporator principle operates intermittently controlled by the temperature sensor.

Dependent on the coolant temperature the heater operates in full load with 4.6 kW or in part load with 2.3 kW.

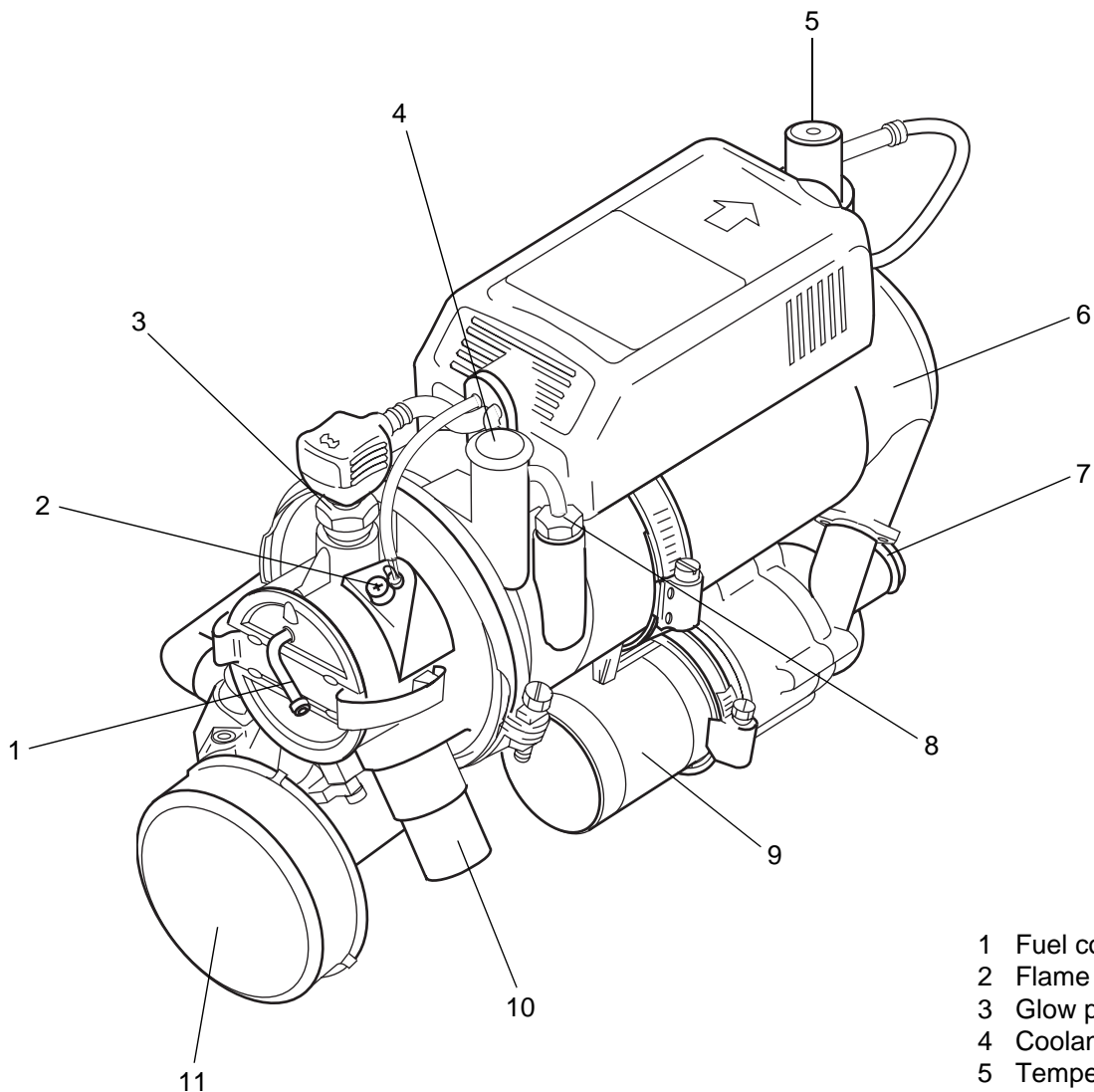
The heaters DBW 46 and BBW 46 basically consist of the

- combustion air fan with intake muffler
- heat exchanger
- burner head with combustion pipe
- circulation pump

For control and monitoring the heater includes a

- control unit (external)
- flame sensor
- glow plug
- temperature sensor
- temperature limiter or temperature fuse

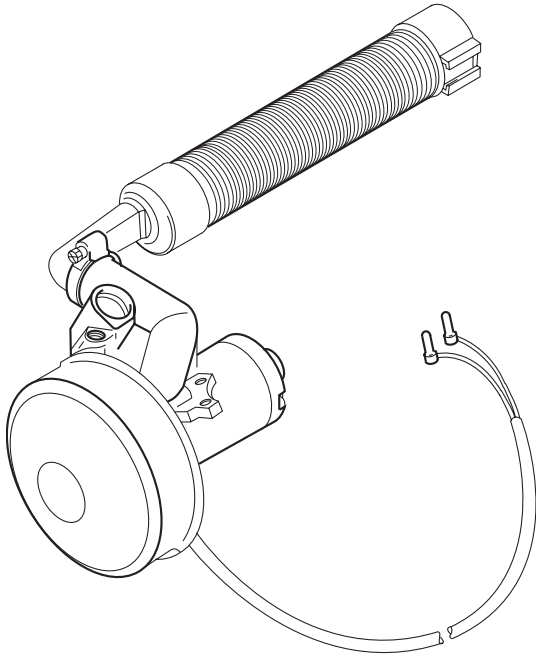
Fuel supply is provided externally by a fuel dosing pump.



- 1 Fuel connection
- 2 Flame sensor
- 3 Glow plug
- 4 Coolant outlet
- 5 Temperature limiter
- 6 Heat exchanger
- 7 Coolant inlet
- 8 Temperature sensor
- 9 Circulation pump
- 10 Exhaust outlet
- 11 Combustion air fan with intake muffler

2.1 Combustion Air Fan with Intake Muffler

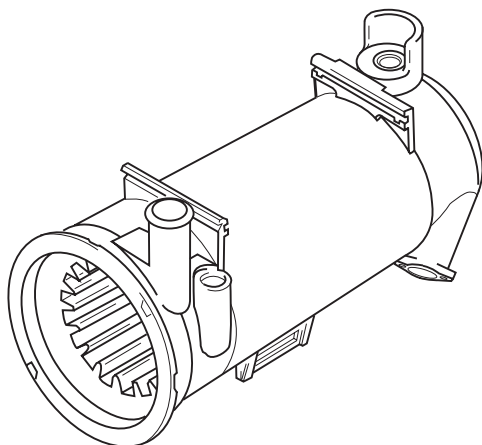
The combustion air fan delivers the air required for combustion through the intake muffler to the burner head. For combustion air control an adjustment screw is provided on the combustion air fan housing.



Combustion Air Fan 12 and 24 V

2.2 Heat Exchanger

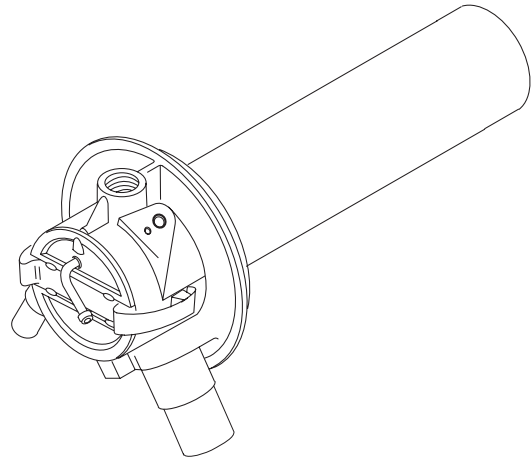
The heat exchanger transfers the heat generated by combustion to the coolant circuit.



Heat Exchanger

2.3 Burner Head with Combustion Pipe

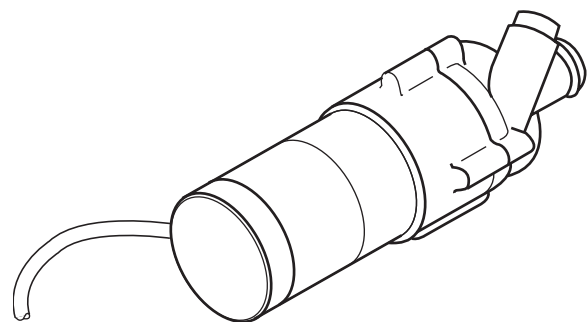
Within the burner head and combustion pipe the fuel is conditioned, ignited and burned. This process heats the coolant via the heat exchanger.



Burner Head with Combustion Pipe

2.4 Circulation Pump

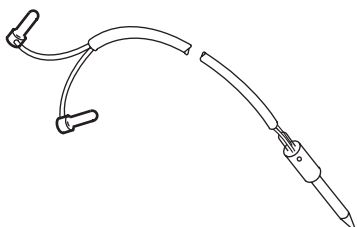
The circulation pump ensures circulation of the coolant within the vehicle and heater coolant circuit. The pump is activated by the control unit and is in continuous operation (also during control idle) together with the heater. The pump may be mounted externally (special type) in the vehicle.



Circulation Pump

2.5 Flame Sensor

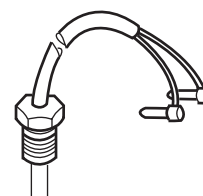
The flame sensor consists of a photo transistor protected by a pipe. After flame-up the pipe starts to glow so that the sensor signals "flame". The flame sensor monitors the flame condition throughout heater operation.



Flame Sensor

2.7 Temperature Sensor

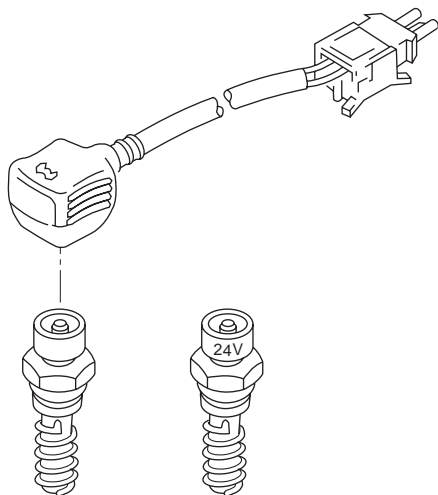
The temperature sensor consists of an aluminium sleeve with an integral silicon PTC sensor. The flame sensor senses the coolant temperature in the heat exchanger of the heater as an electrical resistance. The resistance changes according to temperature and controls via the control unit the heater as well as the vehicle air fan.



Temperature Sensor

2.6 Glow Plug

The glow plug ignites the fuel/air mixture during heater start.



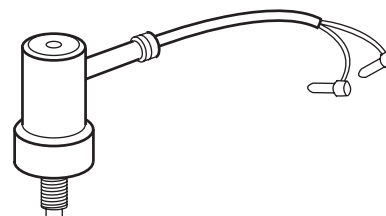
12 Volt

24 Volt

Glow Plugs

2.8 Temperature Limiter

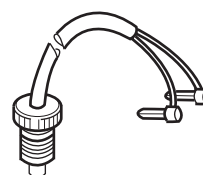
The temperature limiter protects the heater against undue high operating temperatures. The temperature limiter responds when exceeding the maximum temperature and can be reset after cooling down.



Temperature Limiter

2.9 Temperature Fuse

The temperature fuse protects the heater against undue high operating temperatures. The temperature fuse includes a fusible plug which melts when exceeding the maximum temperature. Fuel supply is interrupted and the heater switches off. The temperature fuse must then be replaced.



Temperature Fuse

3. Functional Description

3.1 Sequence of Operation

3.1.1 Switch On

Upon switch on positive control voltage is applied from the battery across F2 and terminal A5 to the electronics of the control unit.

- operating indicator light H1 illuminates.
- glowing is activated via relay K1 and circulation pump via relay K2.
- after pre-glowing (approx. 30 sec) a cycled voltage is applied to connector C2 via transistor V108. From connector C2 dosing pump Y1 is triggered across temperature fuse F3.
- the safety period of approx. 90 sec commences.
- after fuel priming time (approx. 5 sec) the combustion air fan motor M1 is started in full load mode via relay K4.

If there is a "flame" condition during the safety period, flame sensor B1 signals "bright" and relay K1 de-energises. The safety period is reset and the glow plug is switched off. This procedure requires approx. 15 sec for normal ignition.

Repeat start:

If there is a "no flame" condition during the safety period, there will be an automatic restart attempt with a 30 sec run-down involving glowing, pre-glowing (approx. 30 sec) and safety period (approx. 90 sec). This start-up pattern is also applicable for a re-activation during controlled operation.

NOTE

With control units

order no.	105 499	12 Volt
	105 507	24 Volt
	230 04_	12 Volt
	230 05_	24 Volt

after switch-on and after a control idle period there will be a glow plug condition sampling.

Glow plug filament interrupts or fusing defects in the glow plug power circuit will cause a run-down of 60 seconds with a subsequent error lockout.

For control units performing glow plug condition sampling the installation of an external glow cycling relay is not permitted, as the control unit would interpret a glow plug open power circuit when removing the voltage.

During start-up and combustion operation also a voltage sampling is performed. In case of a low voltage which is 9.5 V ± 0.5 V (for 12 V heaters) or 19 V ± 1 V (for 24 V heaters) over a period of 20 seconds there will be an error lockout with a 60 second run-down.

The control units with order no. 230 04_ and 230 05_ have the glow cycling integrated with no influence on the sampling within the control unit.

3.1.2 Combustion Operation

After activation the heater first operates with full load. The temperature sensor increases its resistance with rising temperature dependent on the heating circuit temperature.

When reaching the individual switching thresholds the control unit initiates the following operating conditions (see functional diagram).

Vehicle air fan:

When exceeding a water temperature of 55 °C the vehicle air fan is switched on via relays K5, K6 and connection A6. When the temperature drops below 50 °C the vehicle air fan is deactivated.

Part load operation:

When exceeding a water temperature of 78 °C the part load resistor R1 is connected in series with the combustion air fan motor M1 (relay K4 de-energises, relay K3 energises). At the same time the dosing pump frequency drops by about 50 %.

Full load operation:

When in part load operation the water temperature drops to 70 °C, full load operation is resumed (relay K3 de-energises, relay K4 energises). The dosing pump operates at full load frequency.

Control idle

When in part load operation the water temperature exceeds 86 °C, the dosing pump is switched off. Run-down operation commences.

Run-down

Run-down operation provides for venting and degassing of the combustion chamber as well as for cooling down the heat exchanger to avoid overheat damage. After "flame-out" the flame sensor signals "dark" (for optical run-down refer to Fig. 301).

During run-down (approx. 60 sec) the combustion air fan runs in full load and is deactivated afterwards. The run-down period (for electronic run-down refer to Fig. 301) is always 60 sec and is not abbreviated by switch-off or a rapid drop in temperature.

After run-down only the circulation pump and the vehicle air fan continue their operation.

Start after control idle:

When the temperature drops below 70 °C during the control idle period, an automatic re-start is initiated (see 3.1.1).

As soon as the flame sensor signals "bright", combustion operation has resumed and the heater enters part load operation when the temperature rises above 78 °C (otherwise full load operation).

NOTE

The heater may also remain in part load, full load or control idle operation for longer periods after achieving a balance between generation and use of heat. Also the control sequences for full load/part load and part load/control idle may alternate dependent on the heat required (see functional diagram).

3.1.3 Switch Off**3.1.3.1 Heater is in Combustion Operation**

- After switch off the operation indicator (H1) extinguishes.
- Dosing pump and vehicle air fan are immediately switched off.
- Combustion air fan immediately operates in full load.
- After flame sensor signal "dark" run-down commences (see 3.1.2).
- After run-down also the combustion air fan is deactivated via relay K4 and the circulation pump via relay K2.

3.1.3.2 Heater is in Control Idle

- Circulation pump and vehicle air fan continue operation.

3.1.4 Error Lockout

In case of malfunctions the heater including the circulation pump automatically stop operation. The operation indicator light H1 goes off.

3.1.4.1 Error Lockout - no Flame-up

If there is a no flame-up condition even after restart, the control unit switches the heater off with a run-down.

3.1.4.2 Error Lockout - Flame-out (e.g. lack of fuel)

If the flame extinguishes during combustion operation and the flame sensor B1 signals "dark", the glow plug is activated for a maximum of 90 sec (safety period) by means of relay K1. The heater enters full load operation. Should no combustion be achieved, the heater will go in error lockout with a run-down.

3.1.4.3 Error Lockout - Response of Temperature Fuse or Limiter

An overheat condition in the heating circuit will cause the temperature fuse F3 or the temperature limiter to respond and interrupt dosing pump control. This stops fuel delivery and the flame extinguishes.

For further functional sequence see 3.1.4.2.

3.1.4.4 Error Lockout - after Pre-glowing with Defective Flame Sensor

After pre-glowing the availability of a flame sensor "bright" signal without the combustion air fan having started operation, will cause an error lockout.

3.1.4.5 Error Lockout - Glow Plug Filament or Glow Plug Power Open Circuit

After switch-on and after control idle the control units listed in 3.1.1 will sample the glow plug. A glow plug filament or glow plug power open circuit will cause an error lockout.

3.1.4.6 Error Lockout - Low Voltage

In case of a voltage below $9.5\text{ V} \pm 0.5\text{ V}$ (for 12 V heaters) or $19\text{ V} \pm 1\text{ V}$ (for 24 V heaters) measured over a period of 20 seconds at the control unit input will cause an error lockout with a 60 second run-down.

3.1.4.7 Remedy

- Remove error.
- The error lockout condition is cleared by heater switch-off and subsequent switch-on (switch-off period at least 1 sec).
- In case of overheating replace temperature fuse (see 8.7.3) or reset temperature limiter.

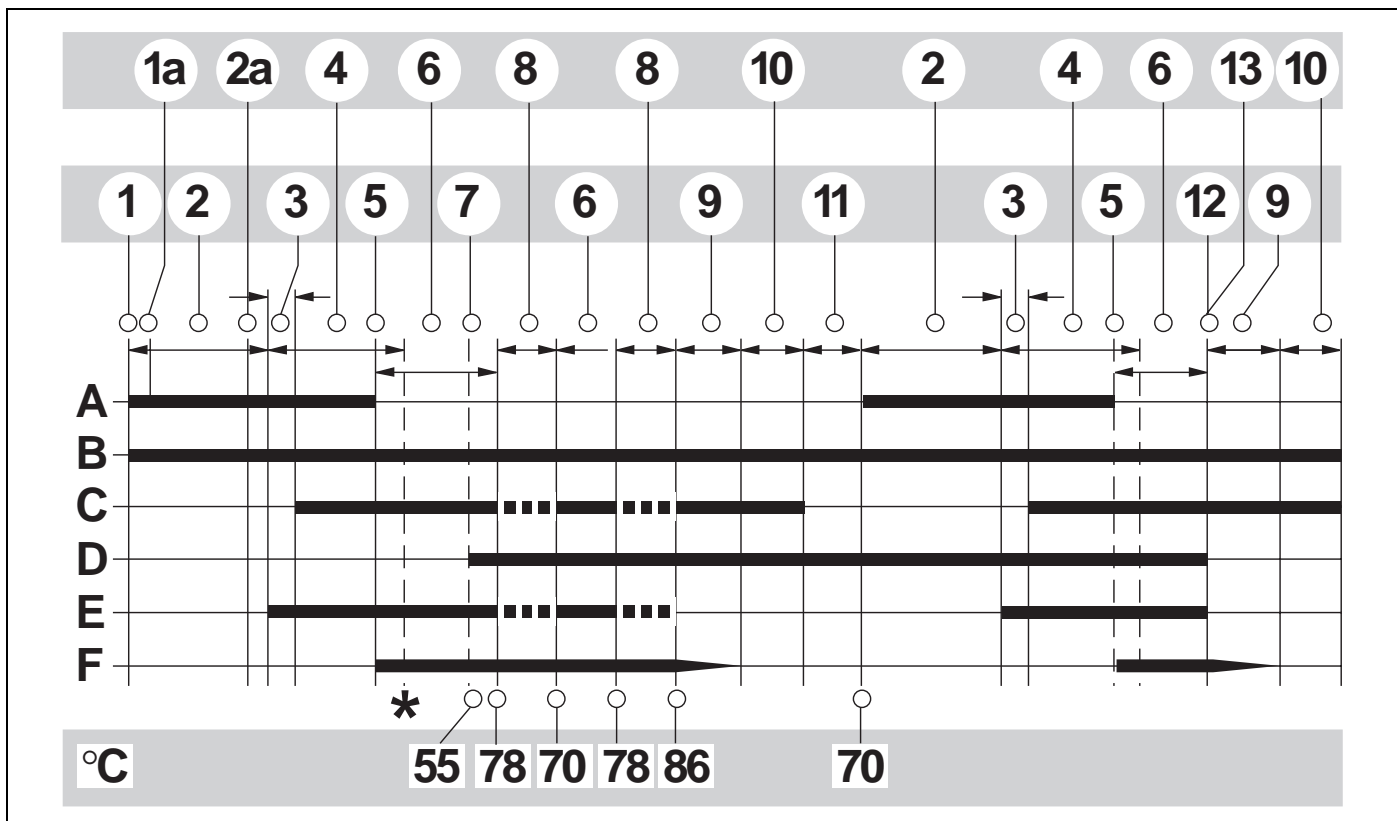


Fig. 301 Functional Diagram

* A no flame-up condition will cause an automatic restart (30 sec run-down with glowing / 30 sec pre-glowing / 90 sec safety period)

- | | |
|---------------------------------|----------------------|
| ① Switch on | A Glow plug |
| ①a Glow plug sampling | B Circulation pump |
| ② Preheating 30 sec | C Combustion air fan |
| ②a Flame sensor sampling | D Vehicle air fan |
| ③ Fuel priming 5 sec | E Dosing pump |
| ④ Safety period 90 sec | F Flame sensor |
| ⑤ Flame | |
| ⑥ Full load | |
| ⑦ Vehicle air fan on | |
| ⑧ Part load | |
| ⑨ Optical run-down, max. 80 sec | |
| ⑩ Electronic run-down 60 sec | |
| ⑪ Control idle | |
| ⑫ Switch off | |
| ⑬ Vehicle air fan off | |

** Glow plug sampling not applicable for control units with Ident. No. 439 789 (12 Volt) and 439 797 (24 Volt)

4. Technical Data

Electrical Components:

Where no threshold values are specified technical data are understood to include standard tolerances for heater units of ± 10 % at an ambient temperature of +20 °C and at nominal voltage.

Control unit, motors for combustion air fan and circulation pump, glow plug, dosing pump, switch and timer are either 12 Volt or 24 Volt components.
Temperature limiter, temperature sensor and flame sensor are identical in 12 V and 24 V heaters.

Heater	Operation	BBW 46	DBW 46
Mark of conformity		~ S185	~ S186
Type		Water heater with evaporator burner	
Heating flow	Full load Part load	4.6 kW 2.3 kW	
Fuel		Fuel	Diesel
Fuel consumption	Full load Part load	0.63 l/h 0.23 l/h	0.58 l/h 0.29 l/h
Nominal voltage		12 or 24 Volt	
Operating voltage range		10 ... 14 or 20 ... 28 Volt	
Nominal power consumption with circulation pump (without vehicle air fan)	Full load Part load	44 W 33 W	
Permissible ambient temperature: Heater: Control unit: Dosing pump	- operation - storage - operation - storage - operation - storage	-40° ... + 80 °C -40° ... + 100 °C -40° ... + 75 °C -40° ... + 85 °C -40° ... + 30 °C -40° ... + 85 °C	
Permissible operating overpressure (heat carrier)		0.4 ... 2.0 bar	
Heat exchanger capacity		0.25 l	
Max. combustion air intake temperature		+40 °C	
Minimum coolout circuit capacity		4.0 l	
Volume flow of circulation pump against 0.1 bar		950 l/h	
CO ₂ in exhaust 500 m above sea level	Full load	10 ... 10.5 Vol.-%	
CO ₂ setting values at room temperature and geograph. height above sea level	Full load		
CO in exhaust with no wind at 100 km/h		0.1 Vol.-% max. 0.2 Vol.-% max.	
HC in exhaust at nominal load and with no wind		100 ppm (0.01 Vol.-%) max.	
NO _x in exhaust at nominal load and with no wind		200 ppm (0,02 Vol.-%) max.	
Smoke spot number according to Bacharach according to Bosch		<6 <0,5	
Dimensions Heater (Tolerance ± 3 mm)	length width height	277 mm 148 mm 197 mm	
Weight incl. circulation pump		3.2 kg	

5. Troubleshooting

5.1 General

This section describes troubleshooting procedures for the heaters BBW 46 and DBW 46.

CAUTION

Troubleshooting requires profound knowledge about components and their theory of operation and may only be performed by trained personnel.

In case of doubt functional interrelations may be derived from Sections 2 and 3.

CAUTION

Troubleshooting is normally limited to the isolation of defective components. The following possible causes for trouble have not been taken into consideration and must always be excluded as a possible cause for malfunction:

- corrosion on connectors**
- loose contacts on connectors**
- wrong crimping on connectors**
- corrosion on wiring and fuses**
- corrosion on battery terminals**

After any fault correction a functional checkout in the vehicle has to be performed.

5.2 General Fault Symptoms

The following diagram (Fig. 501) lists possible fault symptoms of general nature.

* not applicable for control units with Ident. No. 439 789 (12 Volt) and 439 797 (24 Volt)

Symptom	Check, repair or replace as required																	
	Power supply/electrical wiring	Fuses (electrical)	Control unit	Circulation pump	Glow plug*	Temperature fuse/limiter	Dosing pump	Combustion air fan	Fuel supply	Combustion air supply	Exhaust ducting	Flame sensor	Temperature sensor	Vehicle air fan	Water circuit	Part load resistor	Water circuit/temperature > 70 °C	Low voltage protection*
After switch-on - no function	●	●	●															
Error lockout - after approx. 60 sec	●	●			●													
Error lockout - after 80 sec																		●
Error lockout - after approx. 90 sec	●		●									●						
Error lockout - after 270 sec	●		●				●	●	●	●	●	●						
Circulation pump - does not operate	●		●	●														
Glow plug - remains cold	●	●	●		●													
Dosing pump - does not operate	●		●			●	●											
Combustion air fan - does not operate	●		●					●										
Combustion - stops	●						●	●	●	●	●	●						
Vehicle interior - does not warm up	●	●	●									●	●	●				
Heater - does not switch to part load	●		●									●		●	●			
Combustion air fan - operates after switch-on			●									●					●	

Fig. 501 General Failure Symptoms

6. Functional Checkouts

6.1 General

This section describes the tests and adjustments on the heater in installed and removed condition to prove its serviceability.

WARNING

The heater must not be operated in closed areas like garages or workshops not provided with exhaust ventilation facilities.

6.2 Adjustments

6.2.1 Adjustment of CO₂ Contents

Changing the combustion air quantity preset by the manufacturer is permitted and may be achieved by rotating the air set screw.

Adjustment Procedure

Clockwise rotation: CO₂ contents decreases (prior to measurement allow heater to operate for approx. 5 min).
Coarse setting: screw in until flush with surface, then rotate screw back one turn.

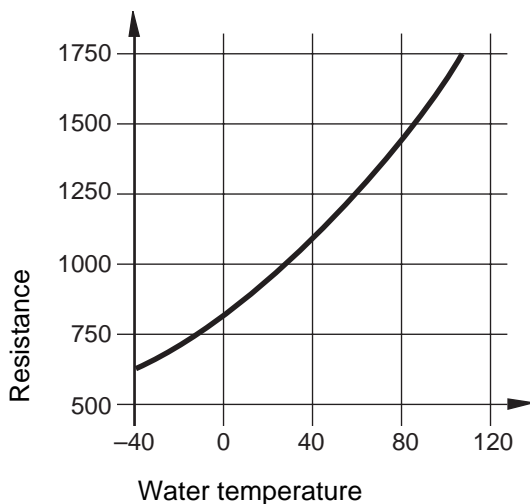
NOTE

Perform adjustment in full load operation only. Set CO₂ adjustment value in combination with a smoke spot number of close to "1".

6.3 Components Testing

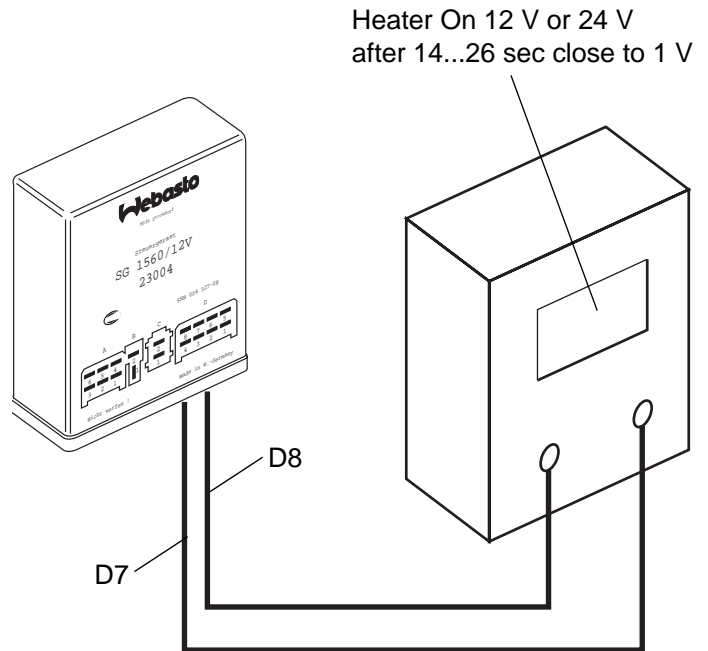
6.3.1 Temperature Sensor Resistance Check

During electrical testing with a digital multimeter the temperature sensor should have the following resistance in accordance with the diagram below.
Test current < 1 mA.



6.3.2 Flame Sensor Check

During electrical testing with a digital multimeter the flame sensor readings should be as follows:
flame sensor "dark" approx. 12 V or 24 V
flame sensor "bright" approx. 1 V.

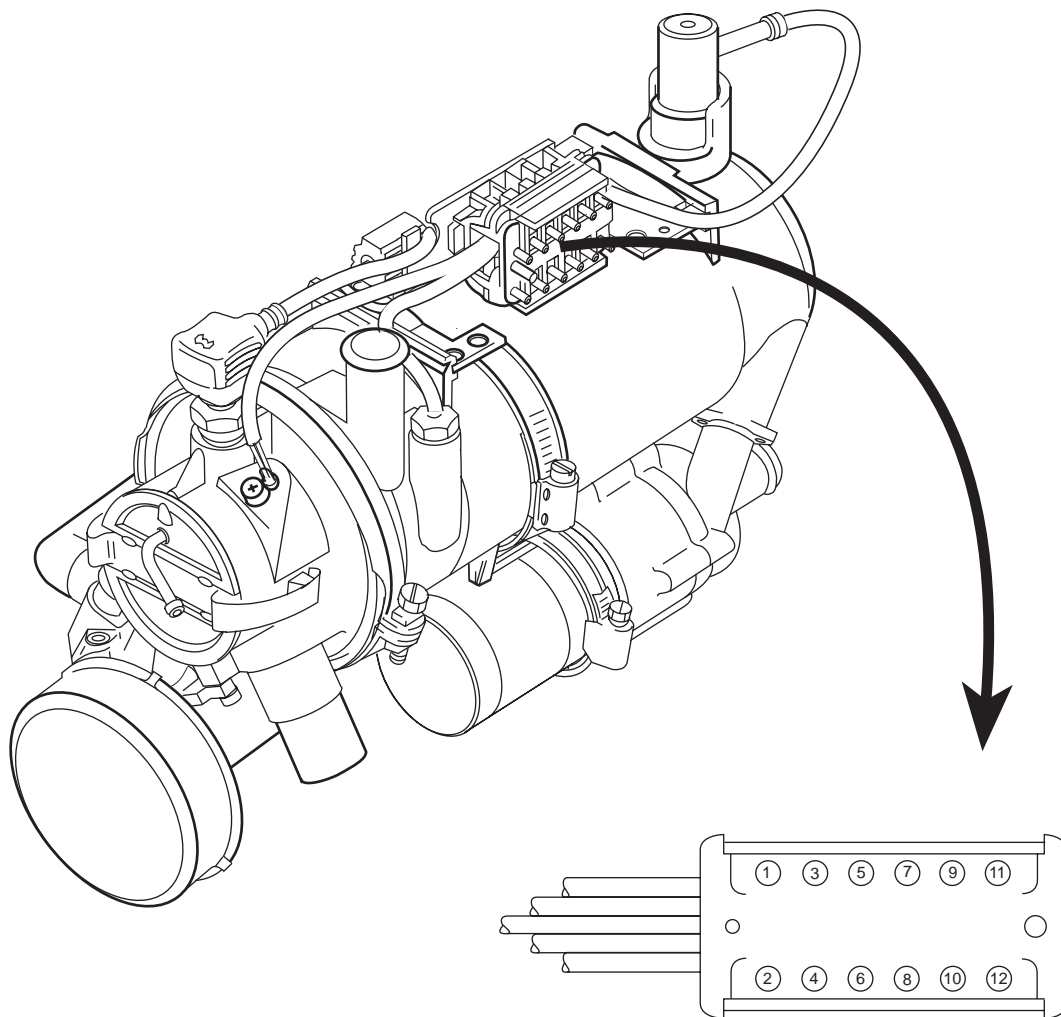


7. Circuit Diagrams

7.1 General

Circuit diagram (Fig. 702) shows possible heater circuits for the heater BBW 46 and DBW 46.

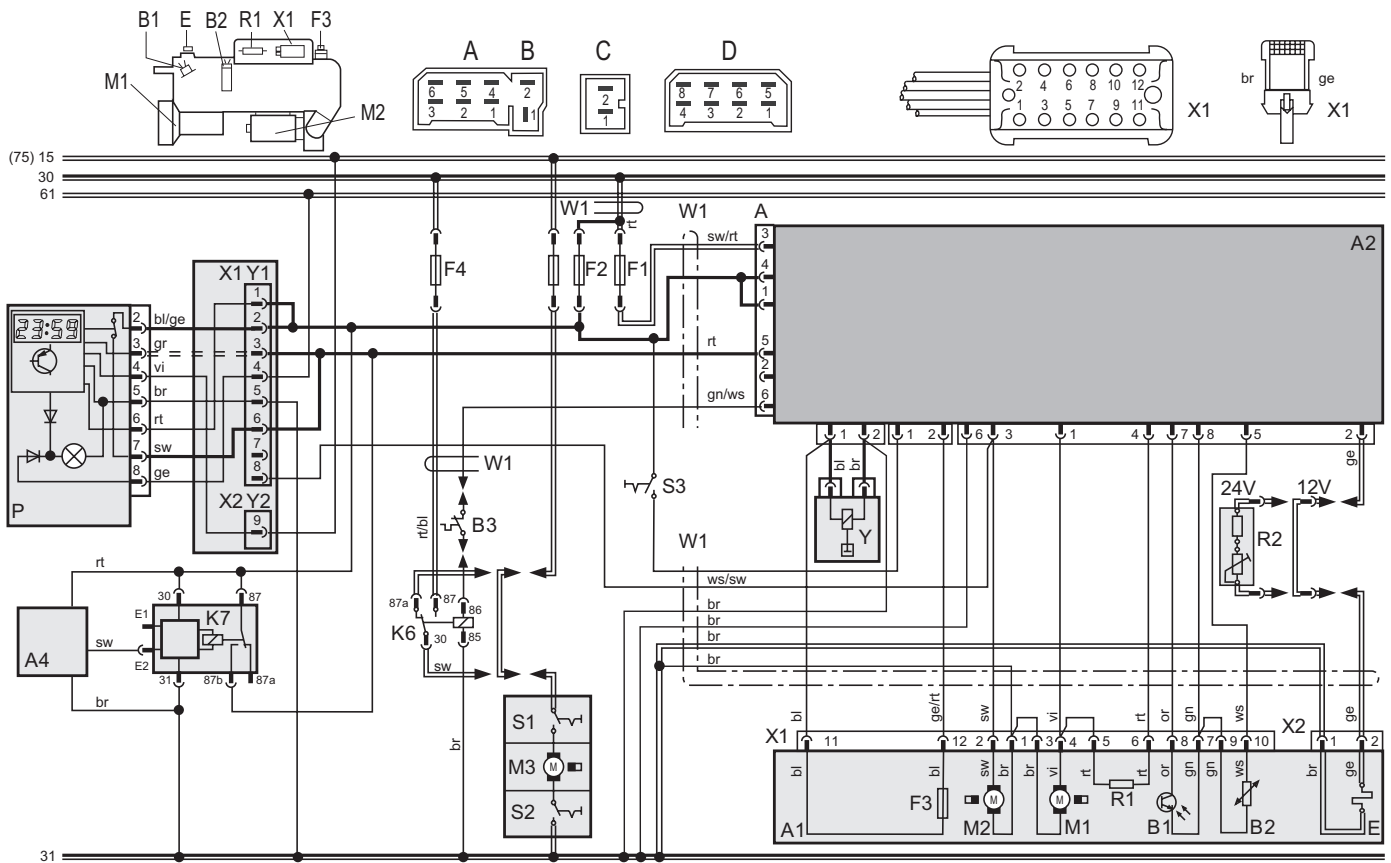
Fig. 701 presents the pin assignment.



Pin assignment:

- 1 = circulation pump (brown)
- 2 = circulation pump (black)
- 3 = combustion air fan (brown)
- 4 = combustion air fan (violet)
- 5 = part load resistor (red)
- 6 = part load resistor (red)
- 7 = flame sensor (green)
- 8 = flame sensor (orange)
- 9 = temperature sensor (green)
- 10 = temperature sensor (white)
- 11 = temperature fuse (blue)
- 12 = temperature fuse (blue)

Fig. 701 Connector Pin Assignment



Wire Colours	
bl	blue
br	brown
ge	yellow
gn	green
gr	grey
or	orange
rt	red
sw	black
vi	violet
ws	white

Wire Gauges		
	< 7.5 m	7.5 - 15 m
—	0.75 mm ²	1.5 mm ²
==	1.0 mm ²	1.5 mm ²
===	1.5 mm ²	2.5 mm ²
====	2.5 mm ²	4.0 mm ²
=====	4.0 mm ²	6.0 mm ²

Item	Nomenclature	Remark
A1	Heater	BBW 46 / DBW 46
A2	Control Unit	SG 1560
A4	Telestart receiver	T6
B1	Flame Sensor	
B2	Temperature Sensor	
B3	Room Thermostat	for vehicle air fan on/off
E	Glow Plug	
F1	Fuse 16A	vehicle fuse DIN 72581
F2	Fuse 8A	vehicle fuse DIN 72581
F3	Temperature Fuse	
F4	Fuse 16A	vehicle fuse DIN 72581
K6	Relay	for vehicle air fan
K7	Relay	for telestart receiver
M1	Motor	combustion air fan
M2	Motor	circulation pump
M3	Motor	vehicle air fan
P	Timer, digital	for timer operation
R1	Resistor	for part load operation
R2	Resistor	only required for 12 V glow plug in 24 V heater

Item	Nomenclature	Remark
S1	Switch for vehicle air fan	depending on vehicle, S1 or S2
S2	Switch for vehicle air fan	depending on vehicle, S1 or S2
S3	Switch for circulation pump	for separate switch-on
V3	Diode (in item A2)	
V108	Transistor (in item A2)	
W1	Wiring harness	
X1	Connection, 12-pole	
X2	Connection, 2-pole	
X4	Connection, 1-pole	
Y	Dosing Pump	

Fig. 702 Automatic Switching Circuit for BBW 46/DBW 46, 12 and 24 Volt Timer and Telestart T6

8. Servicing

8.1 General

This section describes the servicing procedures allowed on the heater when installed.

8.2 Work on the Heater

As long as the heater is in operation or in run-down, the battery main power supply must not be disconnected to prevent the heater from overheating and response of the overheat protection.

For any type of work on the heater the main power supply cable is to be disconnected from the vehicle battery. When performing extensive repairs on the heater its complete removal is considered appropriate.

After work on the heating circuit replenish with a water and anti-freeze mixture according to manufacturer's instructions and bleed water circuit thoroughly.

Repairs requiring a change of location the relevant installation instructions and the vehicle specific heater installation proposal have to be observed.

8.3 Work on the Vehicle

CAUTION

In the vicinity of the heater a temperature of 100 °C and in the vicinity of the control unit 85 °C must never be exceeded (e.g. during paint work on the vehicle).

8.4 Heater Test Run

The heater must not be operated, not even with the timer, in enclosed areas like garages or workshops not provided with exhaust ventilation facilities.

8.5 Servicing

To ensure functional reliability of the heater the following servicing should be performed before each heating season:

- clean air heater exterior (prevent the ingress of water).
- examine electrical connections for corrosion of contacts and for security.
- check combustion air and exhaust ducts for damage and obstructions.
- check fuel line and fuel filter for leakage.
- check coolant circuit and circulation pump for leakage.
- check hoses for cracks.
- replace fuel filter if installed.
- perform heater test run (check exhaust CO₂ contents during test run).

8.6 Visual Inspections and Installation Regulations

8.6.1 Connection to the Vehicle Cooling System

The installation location of the heater should be as low as possible to ensure self-venting of the heater and circulation pump. This applies in particular to the circulation pump, which is not self-sucking.

The heater is to be connected to the vehicle cooling system according to Fig. 801 or 802. The amount of coolant used in the circuit must be at least 4 litres.

The coolant hoses supplied by Webasto must be installed, other hoses must meet at least the DIN 73411 requirement. The hoses are to be routed upwards and without kinks to ensure proper venting. Hose connections must be protected against slippage using hose clamps.

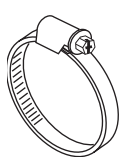
NOTE

The hose clamps are to be torque-tightened with 1.5 Nm (hose clamps previously used) or with 5 Nm (new, wide hose clamps).

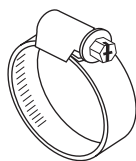
After replacing the coolant ensure that the cooling system is bled thoroughly. The heater and hoses must be installed so that a static venting is guaranteed.

Insufficient venting may cause malfunctions during operation by overheating.

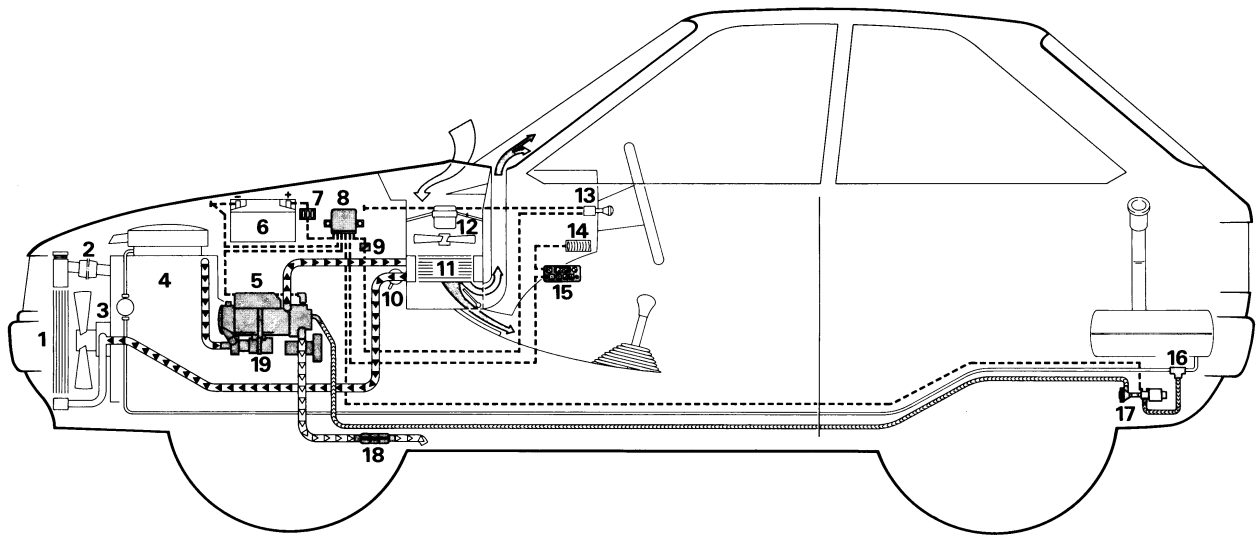
Proper venting may be verified by a circulation pump operating almost noiseless. During operation improper venting may cause a response of the resettable temperature limiter or of the temperature fuse.



Old



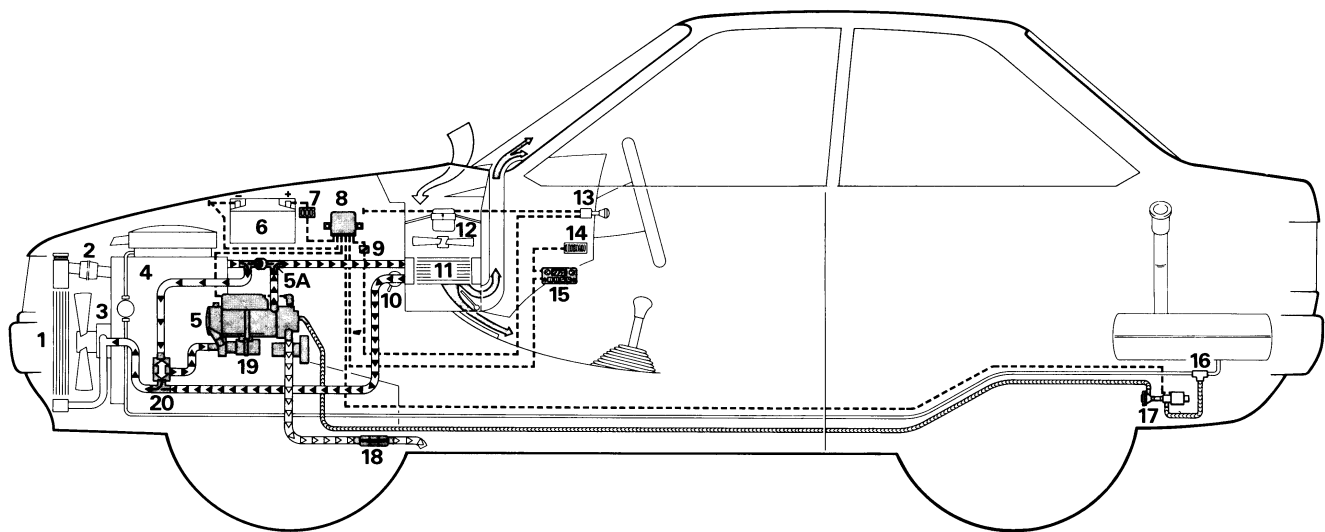
New



- - - - - = Wiring harness
- = Vehicle fuel line
- ~~~~~ = Heater fuel line
- ~~~~~ = Exhaust line
- ~~~~~ = Water circuit

- 1 Radiator
- 2 Coolant thermostat
- 3 Water pump
- 4 Vehicle engine with standard outfit
- 5 Water heater
- 6 Battery
- 7 Fuse holder
- 8 Control unit
- 9 Relay (for vehicle air fan)
- 10 Control valve of vehicle heating system
- 11 Heat exchanger of vehicle heating system
- 12 Air fan of vehicle heating system
- 13 Switch for air fan of vehicle heating system
- 14 Fusebox in vehicle
- 15 Timer
- 16 Fuel tapping
- 17 Dosing pump
- 18 Exhaust muffler
- 19 Circulation pump

Fig. 801 Connection to Cooling System "Inline" Integration



- - - - - = Wiring harness
 ————— = Vehicle fuel line
 ~~~~~~ = Heater fuel line  
 ㄣㄣㄣㄣ = Exhaust line  
 ..... = Water circuit

- 1 Radiator
- 2 Coolant thermostat
- 3 Water pump
- 4 Vehicle engine with standard outfit
- 5 Water heater
- 5A Check valve
- 6 Battery
- 7 Fuse holder
- 8 Control unit
- 9 Relay (for vehicle air fan)
- 10 Control valve of vehicle heating system
- 11 Heat exchanger of vehicle heating system
- 12 Air fan of vehicle heating system
- 13 Switch for air fan of vehicle heating system
- 14 Fusebox in vehicle
- 15 Timer
- 16 Fuel tapping
- 17 Dosing pump
- 18 Exhaust muffler
- 19 Circulation pump
- 20 Thermostat

Fig. 802 Connection to Cooling System "Thermostat" Integration

8.6.2 Connection to Vehicle Fuel System

In vehicles with carburettor or fuel injection including a return line the heater fuel system integration must be in the return line.

Carburettor engines without return line must have the heater integrated in the fuel system's fuel supply line between fuel tank and vehicle fuel pump.

A fuel supply line can normally be identified by its fuel filter.

The following table lists the pressures permitted at the fuel tapping location.

| Permitted fuel feed height (H) m         | at max. permissible over-pressure (bar) in fuel tank     |
|------------------------------------------|----------------------------------------------------------|
| 0.00                                     | 1.5                                                      |
| 1.25                                     | 1.4                                                      |
| 2.50                                     | 1.3                                                      |
| 3.75                                     | 1.2                                                      |
| 5.00                                     | 1.1                                                      |
| 6.25                                     | 1.0                                                      |
| 7.50                                     | 0.9                                                      |
| 8.75                                     | 0.8                                                      |
| 10.00                                    | 0.7                                                      |
| Permitted suction height S (m)           | at max. permissible negative pressure (bar) in fuel tank |
| 0.00 (F; D)                              | -0.15 (F; D)                                             |
| 0.50 (F; D)                              | -0.11 (F; D)                                             |
| 1.00 (D)                                 | -0.07 (D)                                                |
| F = Fuel                      D = Diesel |                                                          |

**NOTE**

If a degassing vessel is included in the vehicle fuel system installation, the fuel tap must be located upstream of the degassing vessel.

Fuel tappings from the supply or return line may only use the special Webasto fuel tap (Fig. 804).

The fuel tap is to be mounted so that air or gas bubbles may escape towards the fuel tank.

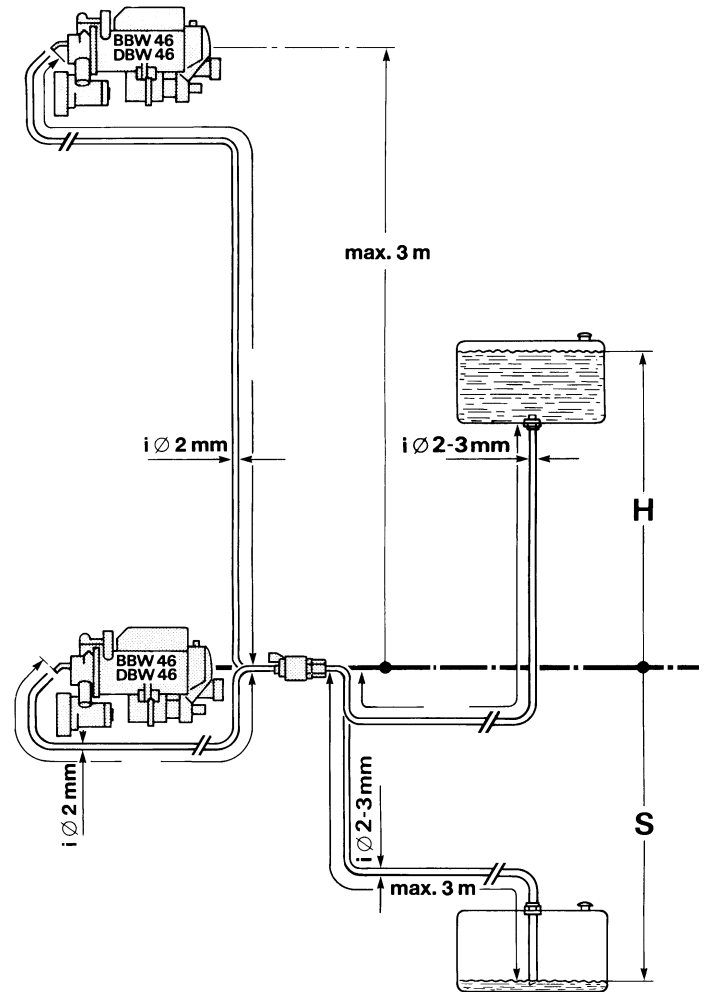


Fig. 803 Fuel Supply

- a = 6 Ø / 470.902
- 8 Ø / 470.910
- 10 Ø / 470.929
- 12 Ø / 470.937

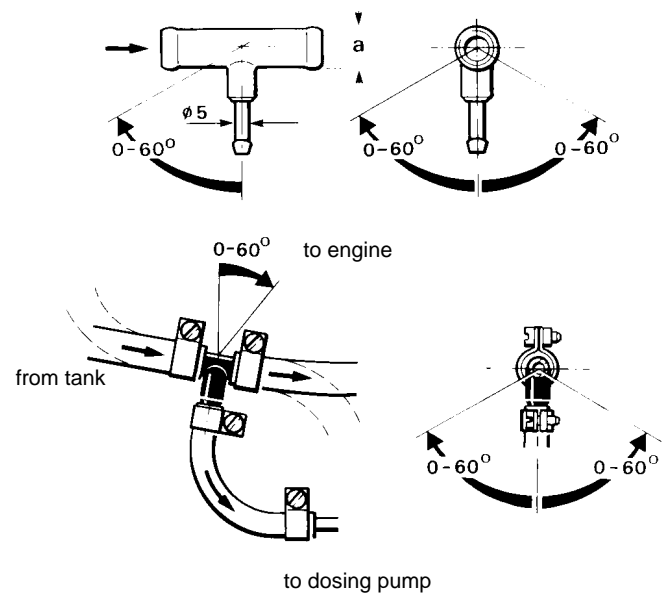


Fig. 804 Webasto Fuel Tap

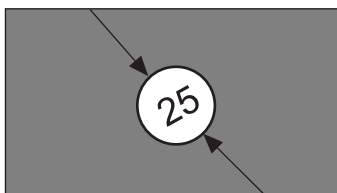
Air or gas bubbles may build up in the vehicle fuel line in case the carburettor or the fuel pump is leaking or if ambient temperatures exceed the fuel evaporation temperature.

The fuel tap should not be located near the engine, as gas bubbles may build up due to the heat radiated by the engine resulting in malfunctions of combustion operation.

When installing the heater in vehicles with fuel injection system, the fuel pump location, internal or external of the fuel tank, must be investigated.

With a fuel pump located inside the fuel tank, fuel may be tapped only from the return line, ensuring that the return line is routed almost all the way down to the fuel tank floor. Otherwise the return line may be lengthened or fuel taps (Fig. 805 and 806) may be used.

With a fuel pump located outside of the fuel tank the fuel tap may be located between tank and fuel pump.



Hole pattern

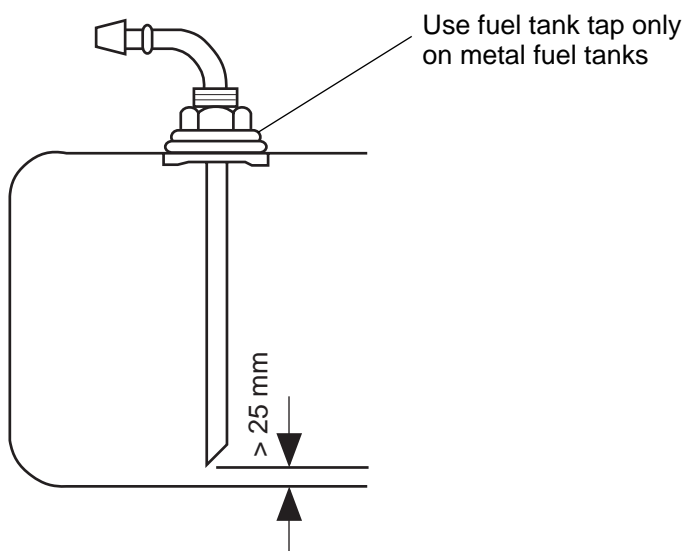


Fig. 805 Webasto Fuel Tank Tap

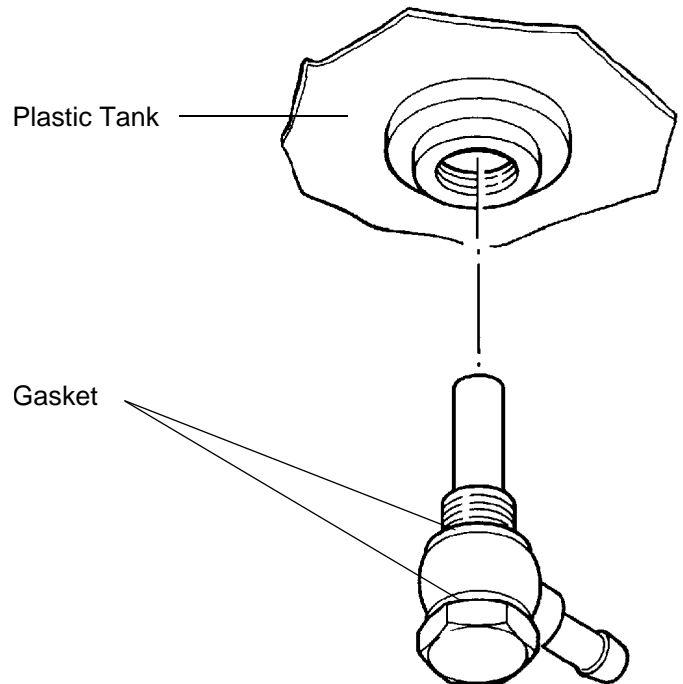


Fig. 806 Fuel Tapping from Plastic Tank (tapping via fuel drain plug)

### 8.6.2.1 Fuel Lines

Fuel lines may only be steel, copper, or plastic lines made of unhardened, light and temperature stabilised PA 11 or PA 12 ( e.g. Mecanyl RWTL) according to DIN 73378. As in most cases a permanently rising fuel line routing cannot be ensured, the inner diameter must not exceed a certain value. Starting from an inside diameter of 4 mm, air or gas bubbles accumulate resulting in malfunctions should the lines be descending or having sags. The diameters specified in Fig. 803 ensure no disturbing formation of bubbles.

A descending line routing from the dosing pump to the heater should be avoided.

Loose fuel lines must be secured in order to avoid sagging. The installation must ensure protection against stone impacts and **undue temperatures** (exhaust line).

The fuel line joints are to be secured against slipping with hose clamps.

### Connection of 2 Pipes with Hose

The proper connection of fuel lines with hose is shown in Fig. 807.

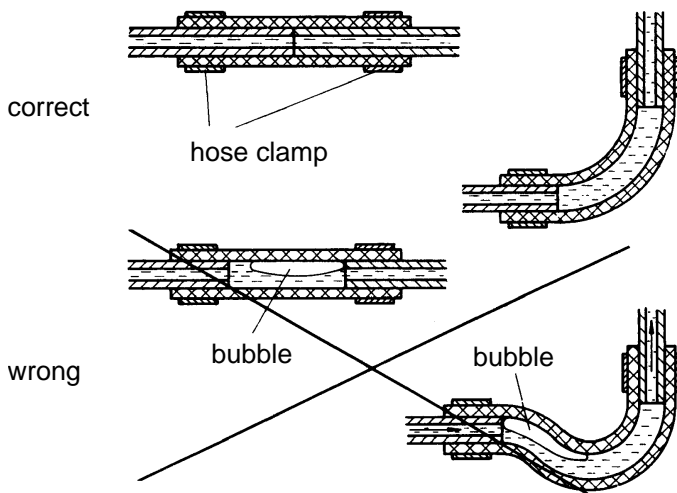


Fig. 807 Pipe/Hose Connection

**8.6.3 Dosing Pump**

The dosing pump is a combined delivery, dosing and shut-off system and is subject to certain installation criteria (Fig. 803 and 808).

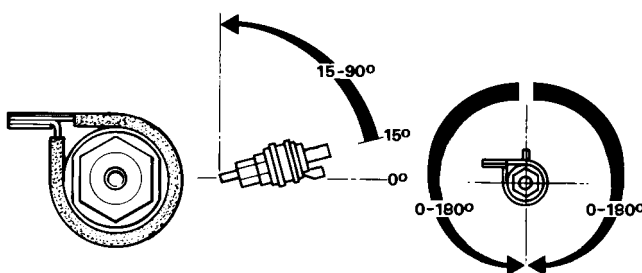
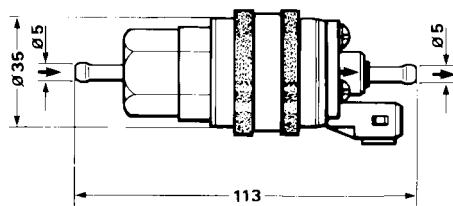


Fig. 808 Installation Position and Attachment of Dosing Pump

**8.6.3.1 Installation Location**

Prior to installation of dosing pump ensure that the pressure at the tapping location is less than 1.5 bar.

It is advantageous to mount the dosing pump in a cool location as close as possible to the tank. The ambient temperature must never exceed + 20 °C during operation.

Dosing pump and fuel lines must not be installed in locations exposed to heat radiated by hot vehicle components. A heat shield is to be provided as necessary. The preferred installation location is near the tank.

**8.6.3.2 Installation and Attachment**

The dosing pump is to be attached with anti-vibration mounts. The installation location is limited according to Fig. 808 to ensure sufficient self-venting capability.

**8.6.4 Fuel Filter**

If there is the probability of contaminated fuel only the Webasto filter, order no. 487 171, may be used. Installation possibly vertical up to horizontal the most (observe direction of flow).

**8.6.5 Combustion Air Supply**

Combustion air must under no circumstances be extracted from rooms with persons. The combustion air inlet must not point towards the forward direction of motion. It must be located so that no clogging by contamination, snow and splash water is to be expected.

The combustion air outlet must not be located above the exhaust outlet.

If the heater is installed in the vicinity of the fuel tank in a common installation compartment, combustion air must be taken in from and the exhaust routed to the exterior. The feedthroughs must be splash water proof.

If the heater is located in a closed installation box, a vent hole of at least 6 cm<sup>2</sup> is required. If the temperature within the installation box exceeds the maximum ambient temperature allowed for the heater (see Technical Data), the vent hole diameter must be increased after consulting Webasto.

**8.6.6 Exhaust Line**

The exhaust line (inner diameter 22 mm) may have an installation length of up to 5 m and several bends (altogether 720°, smallest bending radius 50 mm). An exhaust muffler may be fitted.

In order to ensure an angle of 90° ± 10° an attachment is required not further than 150 mm away measured from the exhaust pipe end (see Fig. 809).

The exhaust pipe outlet must not point in forward direction of motion (see Fig. 809).

The exhaust pipe outlet must be located so that no clogging by snow or mud is to be expected.



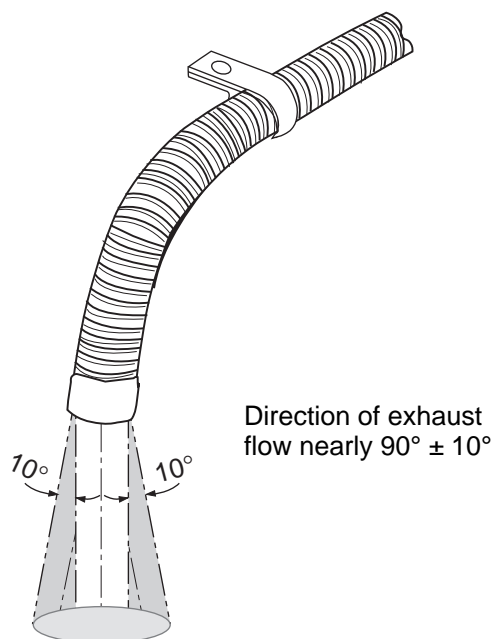


Fig. 809 Installation Arrangement of Exhaust Pipe Outlet

Rigid pipes made of unalloyed or alloyed steel with a minimum wall thickness of 1.0 mm have to be used as exhaust line or flexible pipes made of alloyed steel only. The exhaust pipe is secured to the air heater e.g. with a clamp. For further requirements refer to official regulations.

#### NOTE

Accumulations of condensate in the exhaust line must be directly drained, a condensate drain hole may be provided as required.

## 8.7 Removal and Installation

#### CAUTION

In installed condition only the following disassembly or removal procedures are permitted should the top cover be accessible and enough space for removal allow such action:

- replacement of circulation pump
- replacement of temperature limiter or fuse
- replacement of temperature sensor
- replacement of combustion air fan
- replacement of flame sensor
- replacement of glow plug
- replacement of felt disk in burner head

### 8.7.1 Removal and Installation of Heater

#### 8.7.1.1 Removal

1. Disconnect vehicle battery.
2. Remove top cover (see 9.2.1).

#### WARNING

Allow coolant to cool down sufficiently to prevent skin burns. Also depressurise cooling system and refit cap afterwards.

3. Disconnect electrical connector of wiring harness from heater.

#### WARNING

Take precautionary measures to avoid fires.

4. Disconnect fuel supply inlet on heater and fit protective cap on hose end.
5. Remove hose clamps and disconnect coolant hose from heater.
6. Disconnect combustion air inlet and exhaust outlet on heater.
7. Open tightening strap on heater and remove heater from its support.

#### 8.7.1.2 Installation

1. Locate heater for installation and temporarily secure with tightening strap.
2. Reconnect coolant hoses and secure with hose clamps. Tighten hose clamps with 1.5 Nm.
3. Connect fuel supply line to heater fuel inlet.
4. Secure combustion air inlet and exhaust outlet on heater.
5. Fasten tightening strap with  $3.0 \pm 0.3$  Nm.
6. Connect wiring harness connector to heater.
7. Plug on and arrest top cover.
8. Reconnect vehicle battery.
9. Bleed fuel supply system (see 8.8.1).
10. Bleed coolant circuit.
11. Perform functional test and check CO<sub>2</sub> setting.

### 8.7.2 Replacement of Circulation Pump

#### NOTE

The replacement procedure for the circulation pump is identical with the heater installed or removed. Perform replacement in accordance with 9.2.6.

#### WARNING

When removing from installed condition allow coolant to cool down sufficiently to prevent skin burns. Also depressurise cooling system and refit cap afterwards.

**8.7.3 Replacement of Temperature Limiter or Temperature Fuse****NOTE**

The replacement procedure for the temperature limiter is identical with the heater installed or removed. Perform replacement in accordance with 9.2.2 or 9.2.3 as applicable.

**WARNING**

When removing from installed condition allow coolant to cool down sufficiently to prevent skin burns. Also depressurise cooling system and refit cap afterwards.

**8.7.4 Replacement of Temperature Sensor****NOTE**

The replacement procedure for the temperature sensor is identical with the heater installed or removed. Perform replacement in accordance with 9.2.4.

**WARNING**

When removing from installed condition allow coolant to cool down sufficiently to prevent skin burns. Also depressurise cooling system and refit cap afterwards.

**8.7.5 Replacement of Combustion Air Fan****NOTE**

The replacement procedure for the combustion air fan is identical with the heater installed or removed. Perform replacement in accordance with 9.2.7.

**WARNING**

When removing from installed condition allow coolant to cool down sufficiently to prevent skin burns. Also depressurise cooling system and refit cap afterwards.

**8.7.6 Replacement of Flame Sensor****NOTE**

The replacement procedure for the flame sensor is identical with the heater installed or removed. Perform replacement in accordance with 9.2.5.

**8.7.7 Replacement of Glow Plug****NOTE**

The replacement procedure for the glow plug is identical with the heater installed or removed. Perform replacement in accordance with 9.2.8.

**8.7.8 Replacement of Felt Disk in Burner Head****NOTE**

The replacement procedure for the felt disk in the burner head is identical with the heater installed or removed. Perform replacement in accordance with 9.2.11.

**WARNING**

Before replacement disconnect fuel supply line at cover and close immediately. For removal take precautionary measures to prevent fires.

## 8.8 First Operation

After heater installation the coolant circuit and the fuel supply system must be thoroughly bled observing manufacturer's instructions. During the test run of the air heater all coolant and fuel line connections are to be checked for no leakage and tight fit. The coolant line connections (20 - 27 mm Ø) are to be re-tightened with a torque of 2.0 + 0.5 Nm. Should the heater during operation enter an error lockout condition, perform troubleshooting (see Section 5).

### 8.8.1 Bleeding the Fuel Supply System

After switch-on of the heater the dosing pump must first prime the complete fuel supply system. Should the first start attempt (incl. restart) not yet initiate combustion, the heater must be switched off and on again (possibly several times).

A completely empty fuel system may require - dependent on the length of the fuel lines and the cycle frequency of the dosing pump - in extreme cases up to 12 minutes (approx. 50 sec per meter of fuel line with a line diameter of  $d_i = 2$  mm).

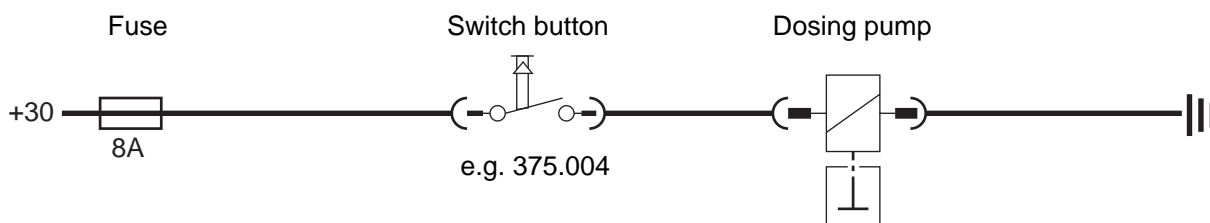
Rapid priming of the fuel line may however be achieved as follows:

- connect the plus connection of the dosing pump to +30 across a switch button (e.g. order no. 375.004) (see Fig.)
- continuously alternate switch-on and switch-off to operate dosing pump until fuel line is primed.

#### CAUTION

Do not flood heater with fuel.

In case of an empty fuel line with a fuel tank completely empty the heater should be started several times only with the vehicle engine running to keep the load on the battery to a minimum.



## 9. Repair

### 9.1 General

This section describes the repairs that may be performed on the heater BBW 46/DBW 46 when removed. Any further disassembly will void the warranty. For re-assembly only components of the original spare part kits are to be used.

#### 9.1.1 Work on Components after Disassembly

##### CAUTION

All sealing elements located between components disassembled must be discarded and renewed.

##### 9.1.1.1 Cleaning

- All components disassembled must be cleaned with cleaning spirit and subsequently blown dry with air.

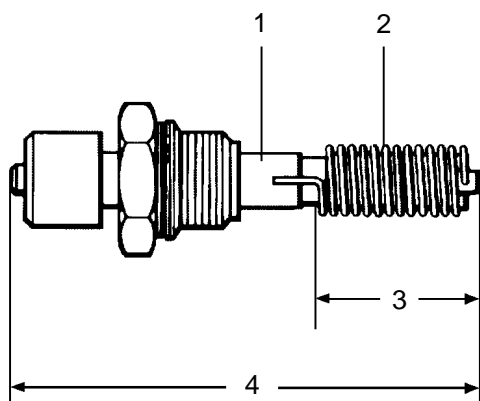
##### 9.1.1.2 Visual Inspection

- Examine all components for damages (cracks, deformation, wear, etc.) and replace as necessary.
- Examine connectors and wiring for corrosion, loose contacts, wrong crimping, etc. and repair as necessary.
- Check terminals for corrosion and contacts for security and repair as necessary.

##### 9.1.1.3 Remarks on the Replacement of Glow Plugs

Due to the manufacturing process the 12 Volt glow plug and the 24 Volt glow plug are nearly identical. In order to avoid the use of the wrong glow plug, the most evident differences between the plugs are illustrated together with a table of Volt/Ampere and torque values.

Ident. No. 479594 12 V  
157915 24 V



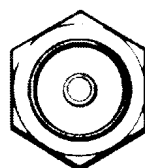
##### NOTE

Prior to glow plug installation apply high temperature grease Copaslip or copper paste to thread.

|                      |               |               |
|----------------------|---------------|---------------|
| Volt max.            | 12            | 24            |
| Ampere               | 20            | 13.3          |
| Torque               | 30 Nm         | 30 Nm         |
| Length of sleeve (1) | approx. 7 mm  | approx. 3 mm  |
| Wire gauge (2)       | 1.1 mm        | 0.8 mm        |
| Length of filament   | approx. 20 mm | approx. 30 mm |
| 30 mm overall length | 64.5 ± 1      | 64 ± 1        |



no voltage identification on 12 V type



24 V

##### CAUTION

Glow plugs are to be handled with care and should be removed from their packaging only immediately prior to installation.

#### 9.1.2 Modification Procedures

##### NOTE

A continuous design improvement of the heaters is intended for their optimisation to prevent failures or malfunctions.

Normally equipment already in operation may be modified by retrofits using the relevant modification kits.

The following details modifications, which may be easily performed at low expenditure during repairs:

- replacement of temperature fuse against temperature limiter with reset (see 9.1.2.1)

### 9.1.2.1 Replacement of Temperature Fuse against Temperature Limiter with Reset

#### General

Several reasons (e.g. unfavourable installation location, wrong manual control during operation) favour the premature response of the temperature fuse. Therefore we recommend the replacement of the temperature fuse (1) against a temperature limiter with a reset facility (2). This component may be ordered with order no. 14865A.

#### CAUTION

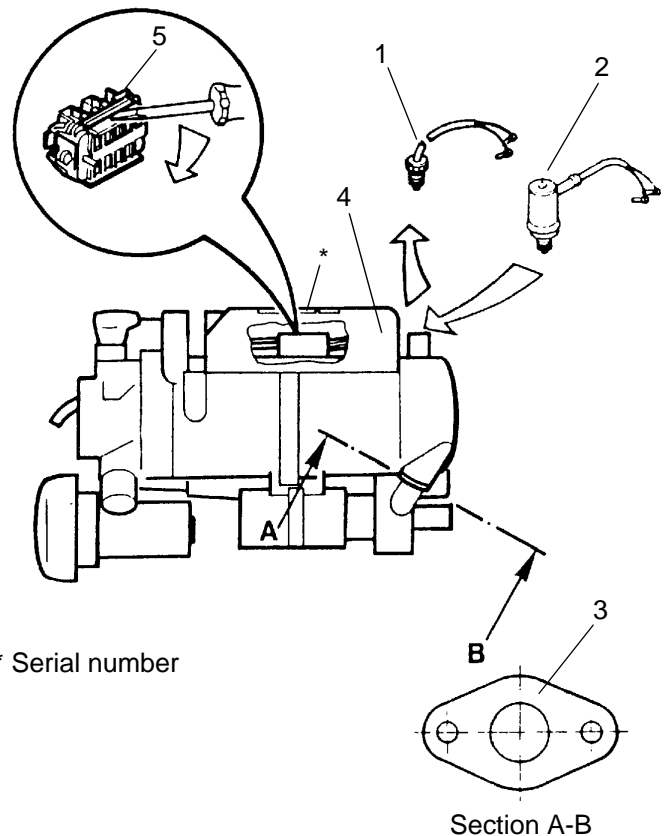
A replacement is only possible on heaters with a flange connection (3) on the heat exchanger (water inlet), or on heaters from June 1988 and up, or on heaters with serial number 71771 (BBW 46) and 38177 (DBW 46) and up. On heaters without flange connection the heat exchanger may suffer damage in case of overheat condition.

#### Procedure

#### WARNING

When performing the replacement with the heater installed allow coolant to cool down sufficiently to avoid skin burns. Also depressurise cooling system and refit cap afterwards.

1. Remove top cover (4).
2. Open locking tab and separate lower portion of connector support (5). With wiring harness connected pins remain fixed in connector. Disconnect wire (blue) from connector base, terminals 11 and 12.
3. Carefully remove temperature fuse (1). There is a probability of water leakage.
4. Apply high temperature grease Copaslip (order no. 105898) to thread of temperature limiter. Manually screw in temperature limiter (2) and using a fork wrench (size 16) tighten with a max. of one third of a turn. Maximum torque 1.5 Nm.
5. Reconnect wires to connector base. The temperature limiter electrical connections cannot be mixed up. The brown and the blue wire may be connected either to terminal 11 or 12.



## 9.2 Disassembly and Assembly

### 9.2.1 Electrical Connections

#### 9.2.1.1 Breaking Electrical Connections

#### NOTE

All electrical connections with exception of the glow plug cable are joined in the electrical connector.

1. Slide top cover in direction of arrow and lift, then slide back and loosen from rear lock wedge.
2. Remove rubber grommet.
3. Disconnection of round connector:  
Using screw driver open locking tab of 12 pin connector and fold down lower part of connector. Remove pins from connector.
4. Disconnection of glow plug connector:  
Using screw driver push locking tabs of glow plug connector (next to 12 pin connector) apart and lift glow plug connector.

**9.2.1.2 Making Electrical Connections**

1. Making electrical connection of round connector:  
Insert connector pins into connector lower part of connector. Connector pins must not be interchanged. Press lower part of connector into upper part until locked.
2. Making electrical connection of glow plug:  
Press glow plug connector into socket until locked.
3. Press electrical cables into grommet as shown in figure. Slide grommet with cables into top cover.
4. Slide top cover into rear locking wedge first, push against direction of arrow and then press into forward locking wedge.

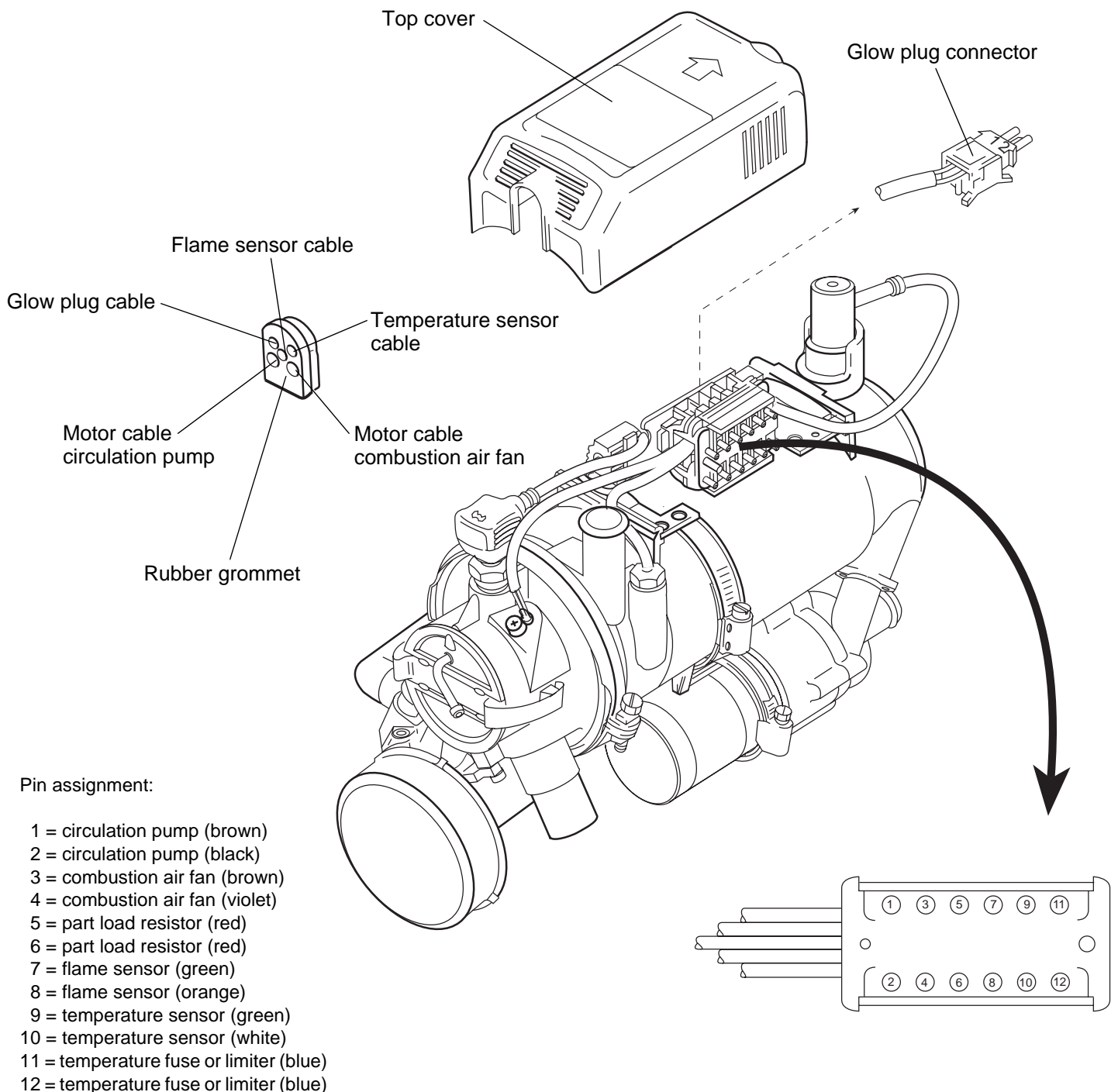


Fig. 901 Electrical Connections

## 9.2.2 Replacement of Temperature Limiter

### NOTE

The temperature limiter is installed only on heaters from June 1988 and up or starting from serial number 71771 (BBW 46) and 38177 (DBW 46) or after performing the modification (see 9.1.2.1).

### 9.2.2.1 Removal

1. Remove heater (see 8.7.1.1)
2. Break electrical connections (see 9.2.1.1).

### WARNING

When removing temperature limiter from installed condition allow coolant to cool down sufficiently to prevent skin burns.

Also depressurise cooling system and refit cap afterwards.

3. Withdraw protective cap (1, Fig. 902).
4. Unscrew temperature limiter (2) from heat exchanger (9) and remove together with O-ring (3).
5. Perform procedures on components after disassembly (refer to 9.1.1).

- 1 Protective cap
- 2 Temperature limiter
- 3 O-ring
- 4 Lock screw
- 5 O-ring
- 6 Flame sensor
- 7 O-ring
- 8 Temperature sensor
- 9 Heat exchanger
- 10 Burner head
- 11 O-ring
- 12 Temperature fuse

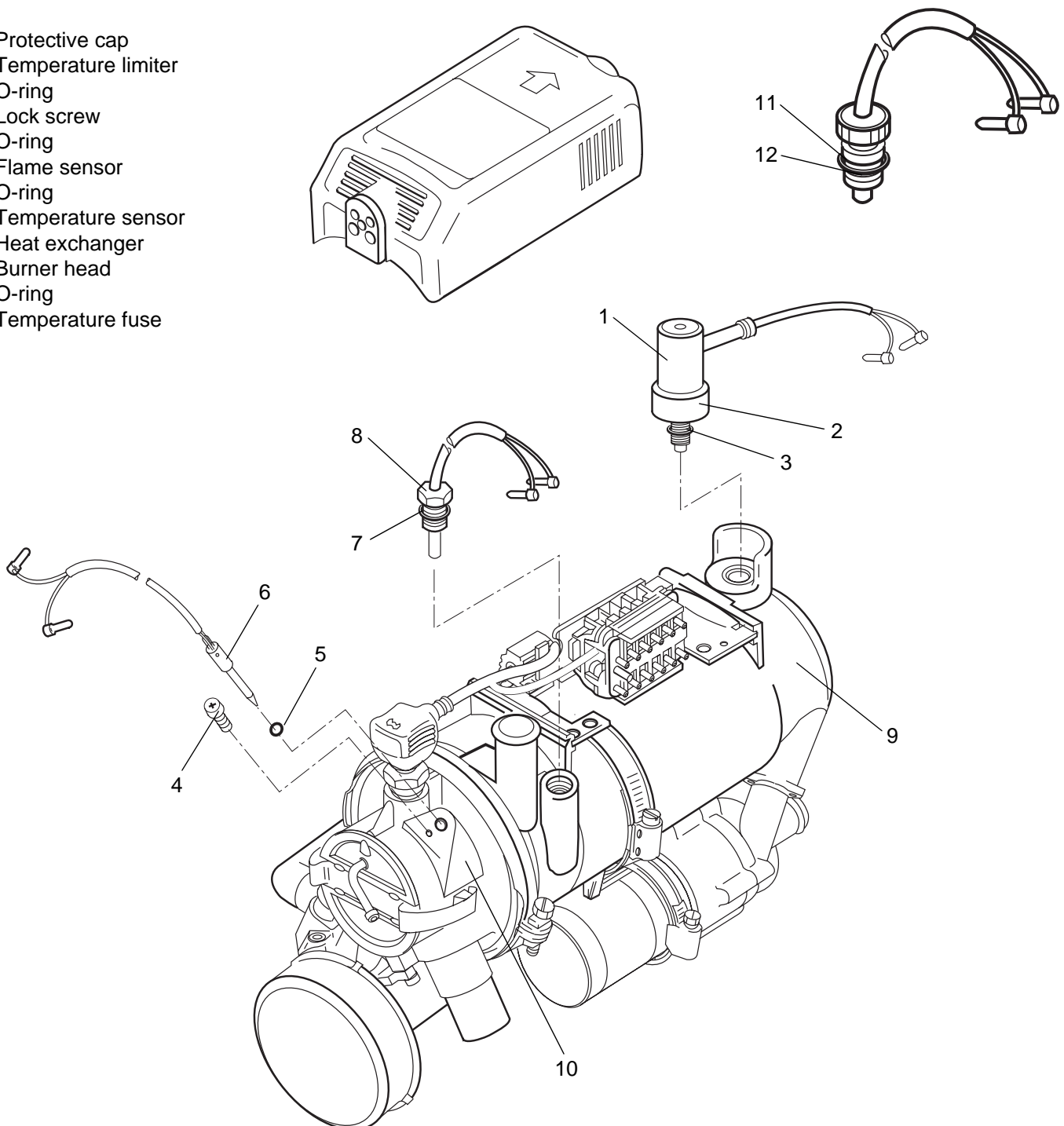


Fig. 902 Replacement of Temperature Limiter, Temperature Fuse, Temperature Sensor and Flame Sensor

**9.2.2.2 Installation**

1. Apply Copaslip (Ident. No. 105898) to thread of temperature limiter (2, Fig. 902) and manually screw into heat exchanger (9).
2. Using a fork wrench tighten temperature limiter (2) with a third of a turn. Maximum torque 1.5 Nm.
3. Fit protective cap (1).
4. Make electrical connections (see 9.2.1.2).
5. Install heater (see 8.7.1.2).

**9.2.3 Replacement of Temperature Fuse**

**9.2.3.1 Removal**

1. Remove heater (see 8.7.1.1).
2. Break electrical connections (see 9.2.1.1).

**WARNING**

When removing temperature fuse from installed condition allow coolant to cool down sufficiently to prevent skin burns.

Also depressurise cooling system and refit cap afterwards.

3. Unscrew temperature fuse (12, Fig. 902) from heat exchanger (9) and remove together with O-ring (11).
4. Perform procedures on components after disassembly (refer to 9.1.1).

**9.2.3.2 Installation**

1. Apply Copaslip (Ident. No. 105898) to thread of temperature fuse (12, Fig. 902).
2. Manually screw temperature fuse (12) with O-ring (11) into heat exchanger (9).
3. Ensure temperature fuse is screwed properly into heat exchanger. Distance between surfaces to be approx. 0.8 mm.
4. Make electrical connections (see 9.2.1.2).
5. Install heater (see 8.7.1.2).

**9.2.4 Replacement of Temperature Sensor**

**9.2.4.1 Removal**

1. Remove heater (see 8.7.1.1).
2. Break electrical connections (see 9.2.1.1).

**WARNING**

When removing temperature sensor from installed condition allow coolant to cool down sufficiently to prevent skin burns.

Also depressurise cooling system and refit cap afterwards.

3. Unscrew temperature sensor (8, Fig. 902) and remove together with O-ring (7).
4. Perform procedures on components after disassembly (refer to 9.1.1).

**9.2.4.2 Installation**

1. Apply Copaslip (Ident. No. 105898) to temperature sensor (8, Fig. 902), manually screw with O-ring (7) in place into heat exchanger (9) and tighten with 0.5 Nm.
2. Make electrical connections (see 9.2.1.2).
3. Install heater (see 8.7.1.2).

**9.2.5 Replacement of Flame Sensor**

**9.2.5.1 Removal**

1. Remove heater (see 8.7.1.1).
2. Break electrical connections (see 9.2.1.1).
3. Loosen lock screw (4, Fig. 902).
4. Withdraw flame sensor (6) on clamp together with O-ring (5).
5. Perform procedures on components after disassembly (refer to 9.1.1).

**9.2.5.2 Installation**

1. Apply non-acid grease to O-ring (5, Fig. 902) and locate on flame sensor (vent port must remain open).
2. Slide flame sensor (6) into burner head (10).
3. Apply copper paste to lock screw (4) and screw into burner head (10).
4. Make electrical connections (see 9.2.1.2).
5. Install heater (see 8.7.1.2).

**9.2.6 Replacement of Circulation Pump**

**NOTE**

For a circulation pump mounted externally in vehicle the following procedure is similar.

**WARNING**

When removing circulation pump from installed condition allow coolant to cool down sufficiently to prevent skin burns.

Also depressurise cooling system and refit cap afterwards.



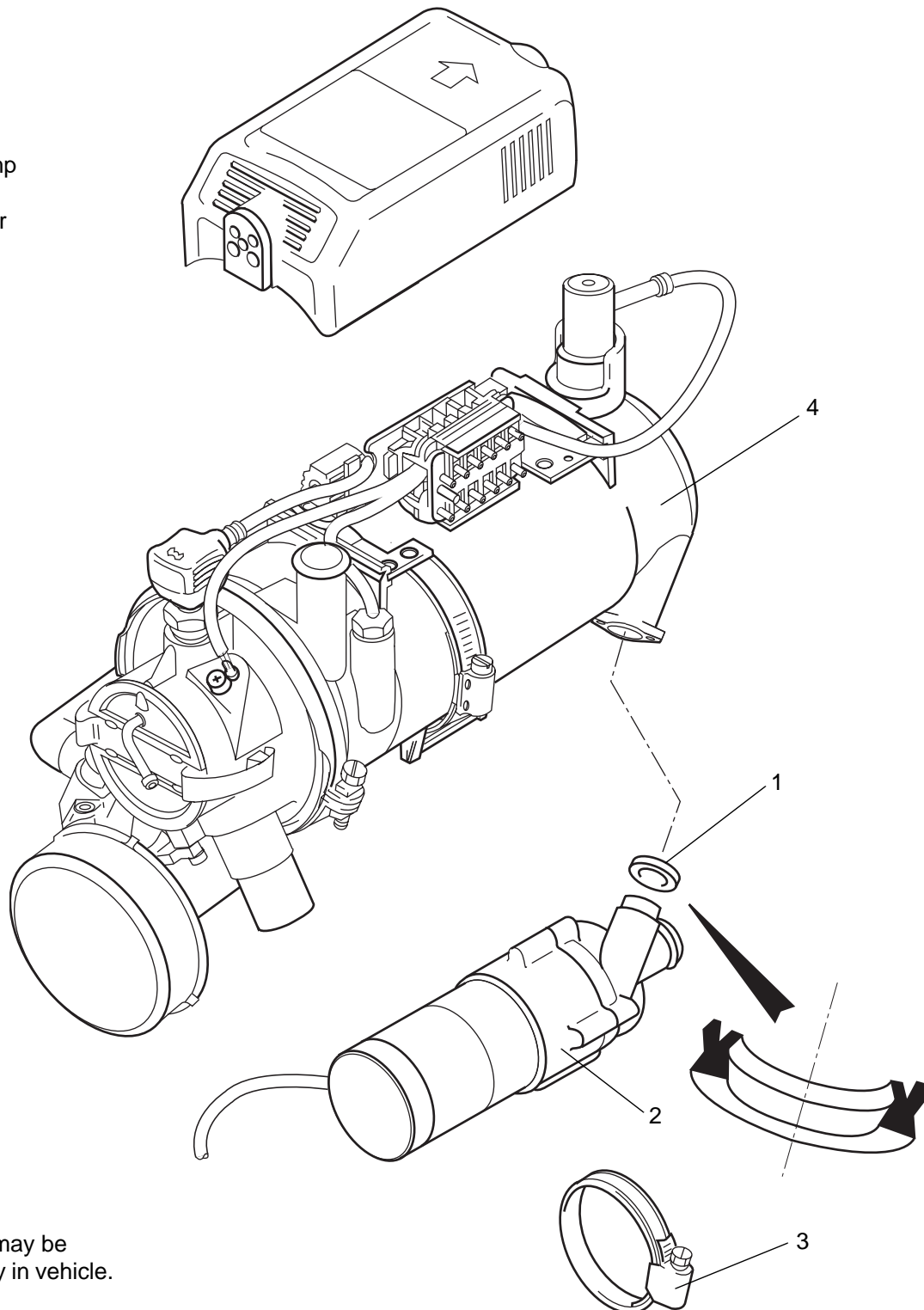
## 9.2.6.1 Removal

1. Remove heater (see 8.7.1.1).
2. Break electrical connections (see 9.2.1.1).
3. Open clamping ring (3, Fig. 903).
4. Remove circulation pump (2) and gasket (1).
5. Perform procedures on components after disassembly (refer to 9.1.1).

## 9.2.6.2 Installation

1. Remove deposits form water inlet of heat exchanger.
2. Apply Copaslip (Ident. No. 105898) to new gasket (1) and locate on connector pipe.
3. Position circulation pump (2) for assembly and secure with clamping ring (3).
4. Make electrical connections (see 9.2.1.2).
5. Install heater (see 8.7.1.2).

- 1 Gasket
- 2 Circulation pump
- 3 Clamping ring
- 4 Heat exchanger



**NOTE**

Circulation pump may be mounted externally in vehicle.

Fig. 903 Replacement of Circulation Pump

**9.2.7 Replacement of Combustion Air Fan**

**9.2.7.1 Removal**

1. Remove heater (see 8.7.1.1).
2. Break electrical connections (see 9.2.1.1).
3. Loosen hose clamp (4, Fig. 904) on air intake muffler (5).
4. Loosen hexagon socket head cap screws (6).
5. Withdraw combustion air fan (1) from air intake muffler (5) and burner head (7) and remove.
6. Perform procedures on components after disassembly (refer to 9.1.1).

**9.2.7.2 Installation**

1. Locate combustion air fan (1, Fig. 904) for assembly and slide onto air intake muffler (5) and burner head (7).
2. Screw hexagon socket head cap screws (6) into burner head and torque to 4.5 Nm.
3. Tighten hose clamp (4) on air intake muffler (5).
4. Make electrical connections (see 9.2.1.2).
5. Secure cable with cable tie (2).
6. Install heater (see 8.7.1.2).
7. Perform CO<sub>2</sub> adjustment procedure (see 6.2.1).

- 1 Combustion air fan
- 2 Cable tie
- 3 O-ring
- 4 Hose clamp
- 5 Air intake muffler
- 6 Hexagon socket head cap screw (2)
- 7 Burner head

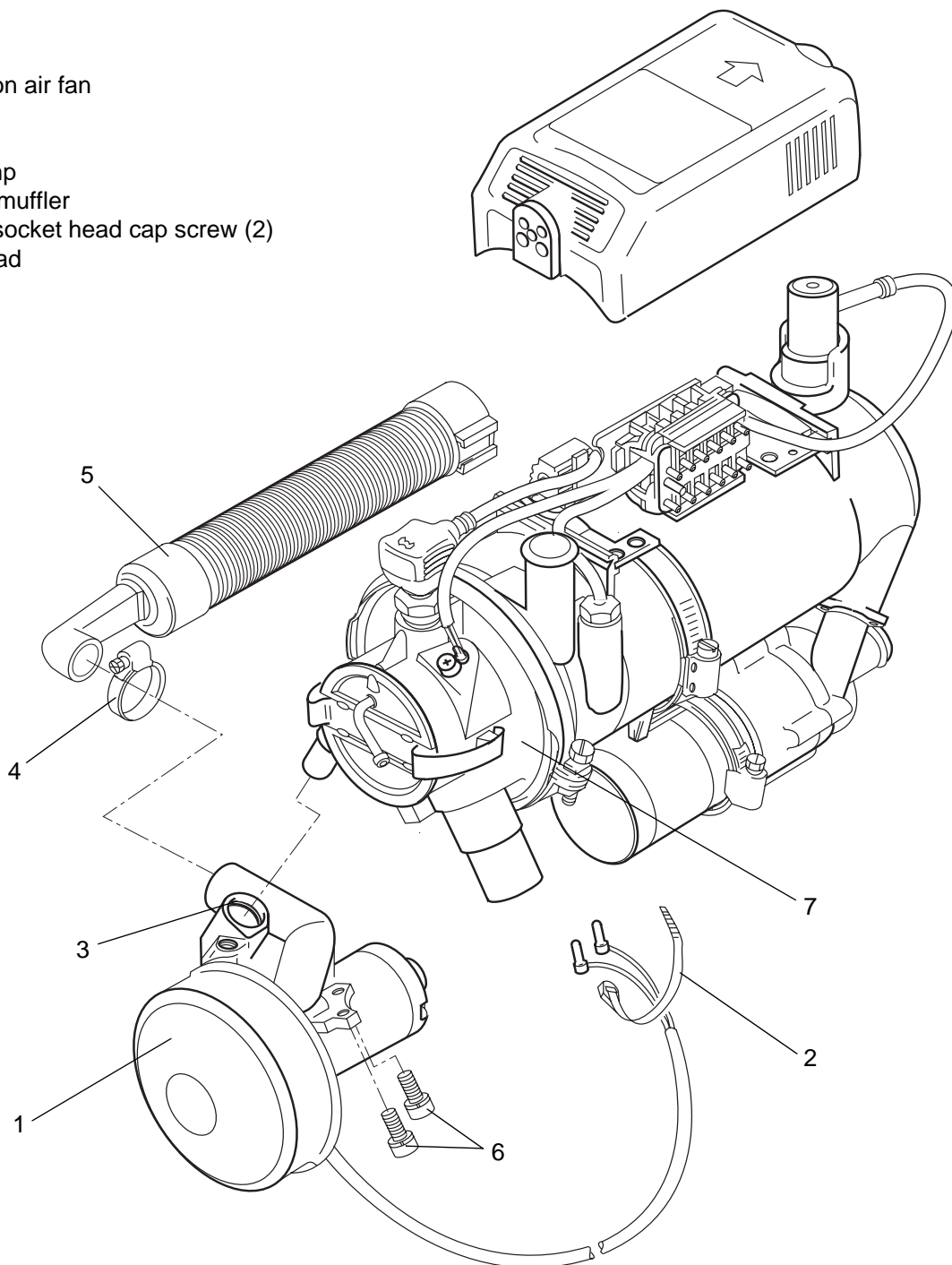


Fig. 904 Replacement of Combustion Air Fan

## 9.2.8 Replacement of Glow Plug

## 9.2.8.1 Removal

1. Remove heater (see 8.7.1.1).
2. Break electrical connections (see 9.2.1.1).
3. Pull wiring harness (2, Fig. 905) from glow plug (1).
4. Unscrew glow plug (1) from burner head (3).
5. Perform procedures on components after disassembly (refer to 9.1.1).

## 9.2.8.2 Installation

**NOTE**

Observe remarks on glow plug replacement (see 9.1.1.3).

1. Apply Copaslip (Ident. No. 105898) or copper paste to thread of glow plug.
2. Screw glow plug (1, Fig. 905) into burner head (3) and torque with 30 Nm.
3. Plug wiring harness (2) onto glow plug (1).
4. Make electrical connections (see 9.2.1.2).
5. Install heater (see 8.7.1.2).

- 1 Glow plug
- 2 Wiring harness
- 3 Burner head

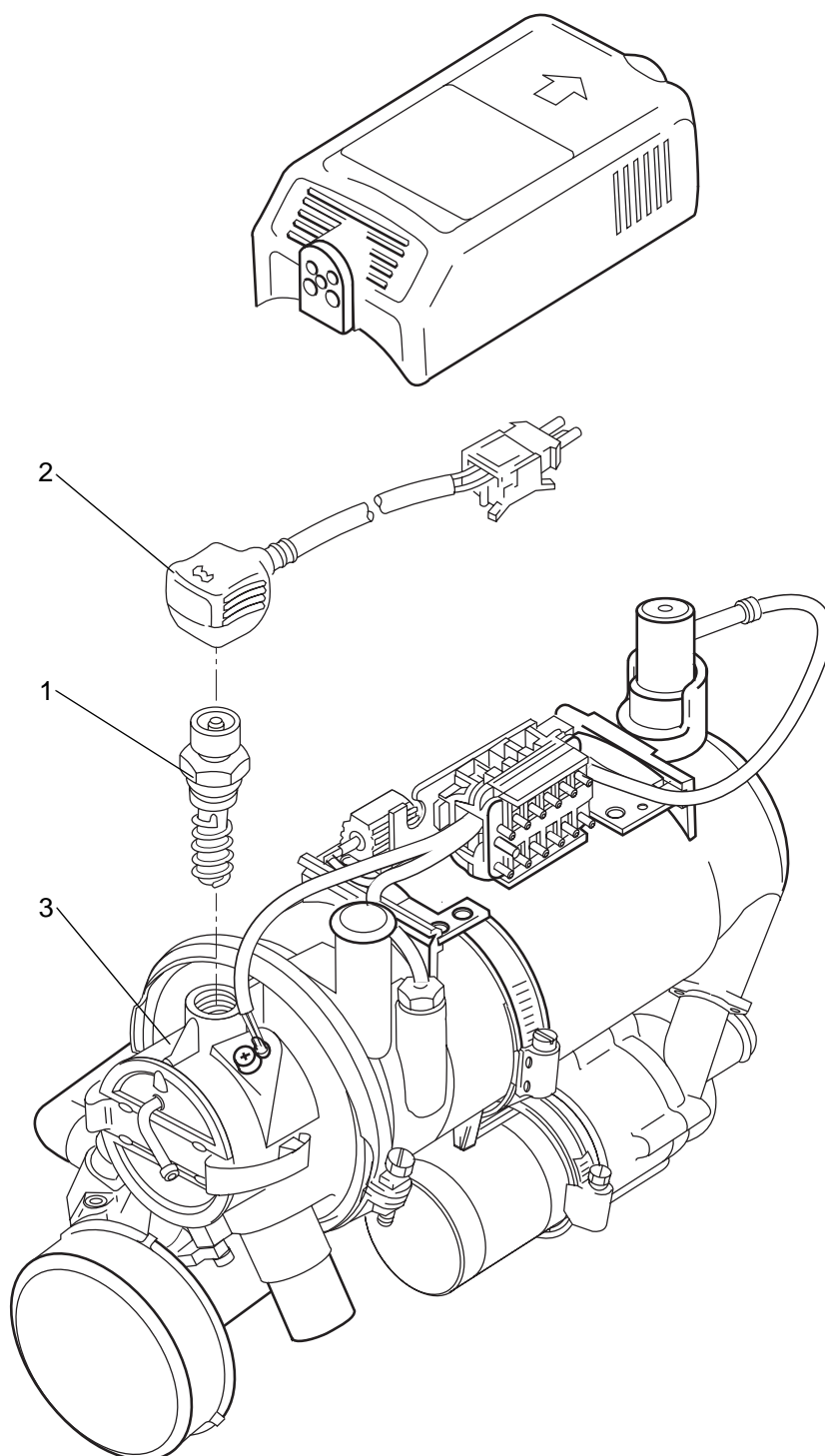


Fig. 905 Replacement of Glow Plug

**9.2.9 Replacement of Burner Head with Combustion Pipe**

**9.2.9.1 Removal**

1. Remove heater (see 8.7.1.1).
2. Break electrical connections (see 9.2.1.1).
3. Remove combustion air fan (see 9.2.7.1).
4. Remove glow plug (see 9.2.8.1).
5. Remove flame sensor (see 9.2.5.1).
6. Remove V-clamp (2, Fig. 906).
7. Engage two screw drivers in recess (4) and lever off burner head (1) and remove.
8. Perform procedures on components after disassembly (refer to 9.1.1).

**9.2.9.2 Installation**

1. Locate burner head (1, Fig. 906) with combustion pipe for assembly. Apply Copaslip (Ident. No. 105898) between burner head and heat exchanger (3).
2. Slide burner head (1) with combustion pipe into heat exchanger (3) and align as required.
3. Secure V-clamp and torque with 4.5 Nm.
4. Install flame sensor (see 9.2.5.2).
5. Install glow plug (see 9.2.8.2).
6. Install combustion air fan (see 9.2.7.2).
7. Install heater (see 8.7.1.2).

- 1 Burner head with combustion pipe
- 2 V-clamp
- 3 Heat exchanger
- 4 Recess

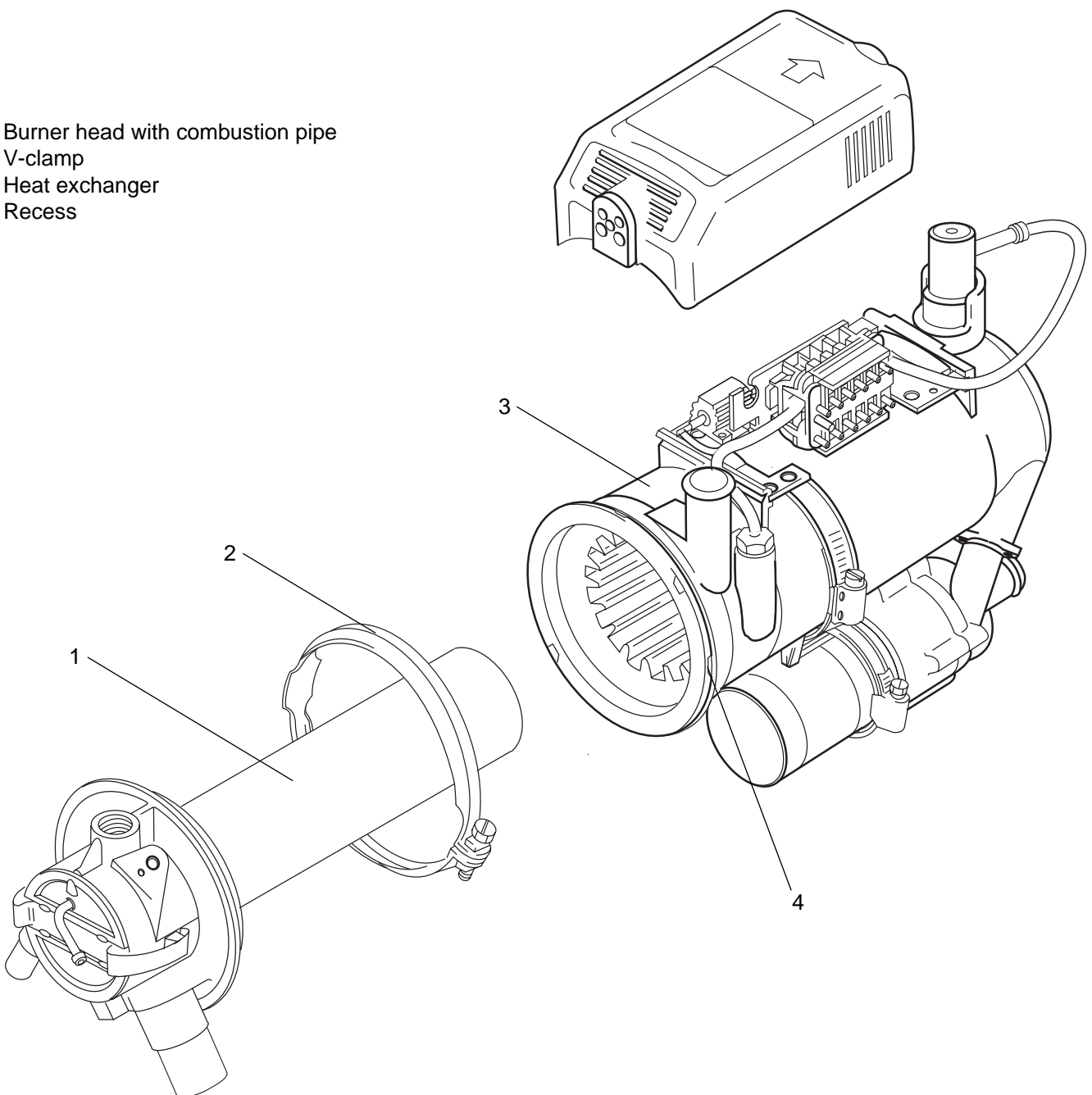


Fig. 906 Replacement of Burner Head with Combustion Pipe

## 9.2.10 Disassembly of Heat Exchanger

## 9.2.10.1 Removal

1. Remove heater (see 8.7.1.1).
2. Break electrical connections (see 9.2.1.1).
3. Remove combustion air fan (see 9.2.7.1).
4. Remove glow plug (see 9.2.8.1).
5. Remove flame sensor (see 9.2.5.1).
6. Remove temperature limiter or temperature fuse as applicable (see 9.2.2.1 or 9.2.3.1).
7. Remove temperature sensor (see 9.2.4.1).
8. Remove burner head with combustion pipe (see 9.2.9.1).
9. Engage two screw drivers in recess (3, Fig. 907) and lever heating pipe (1) out of heat exchanger.
10. Remove O-ring (2).
11. Perform procedures on components after disassembly (refer to 9.1.1).

## 9.2.10.2 Assembly

1. Apply Copaslip (Ident. No. 105898) to mating surfaces between heating pipe (1, Fig. 907) and heat exchanger (4).
2. Fit new O-ring (2), slide heating pipe (1) into heat exchanger (4) and locate for assembly.
3. Install burner head with combustion pipe (see 9.2.9.2).
4. Install temperature sensor (see 9.2.4.2).
5. Install temperature limiter or temperature fuse as applicable (see 9.2.2.2 or 9.2.3.2).
6. Install flame sensor (see 9.2.5.2).
7. Install glow plug (see 9.2.8.2).
8. Install combustion air fan (see 9.2.7.2).
9. Make electrical connections (see 9.2.1.2).
10. Install heater (see 8.7.1.2).

- 1 Heating pipe
- 2 O-ring
- 3 Recess
- 4 Heat exchanger

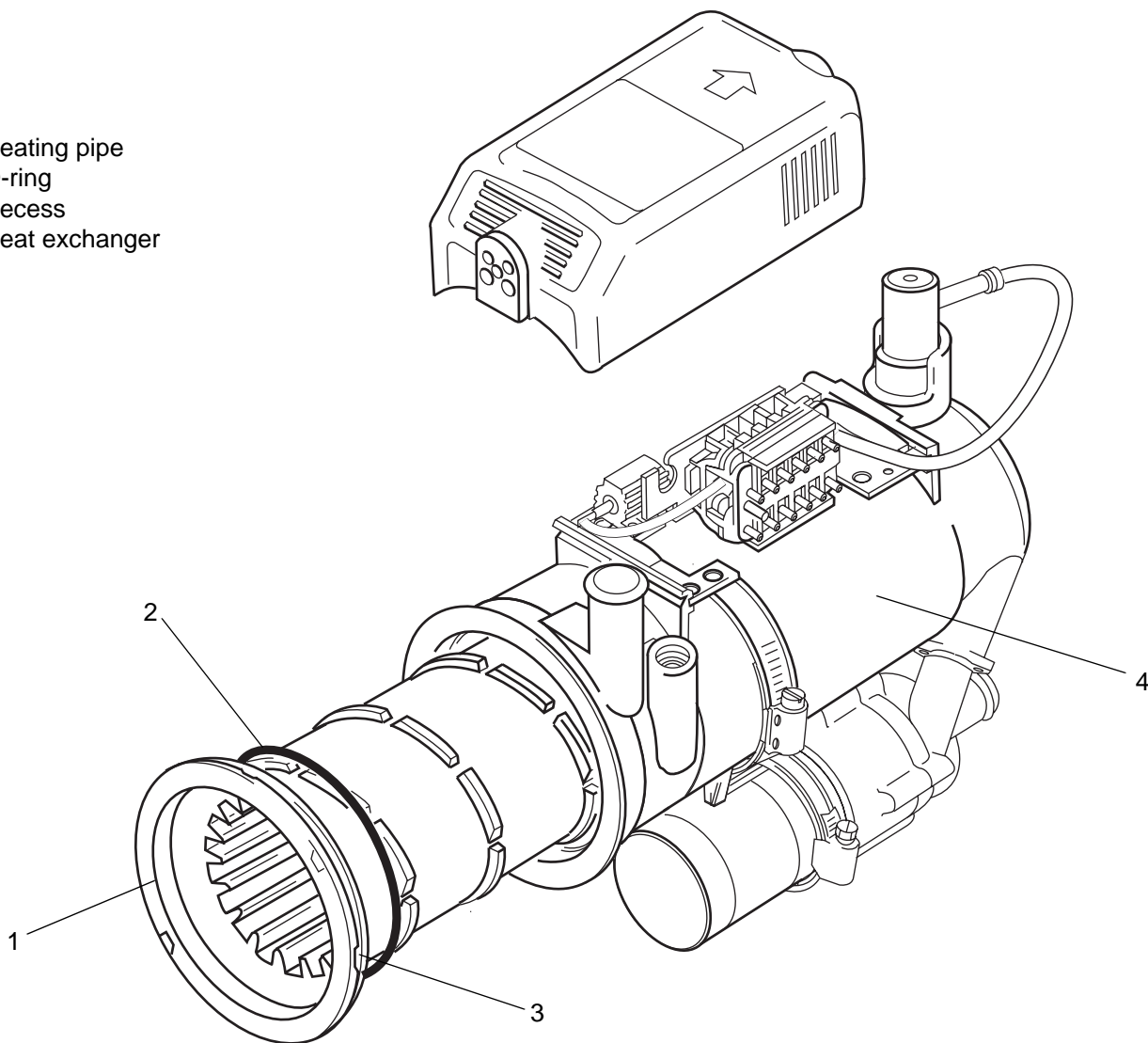


Fig. 907 Replacement of Heat Exchanger

9.2.11 Replacement of Felt Disk in Burner Head

For equipment delivered and in use we recommend the replacement of the ring and felt disk in combination with the glow plug.

9.2.11.1 Removal

1. Remove heater (see 8.7.1.1).
2. Press clamping spring (6, Fig. 908) from locking pegs (9) using screw driver.
3. Engage two screw drivers in recesses (7) and lever off cover (1).
4. Discard O-ring (2) and gasket (8).
5. Remove felt disk (3) and ring (4) from burner head (5) and discard.
6. Check burner head for felt deposits and contamination and remove as required.
7. Clean glow plug orifice (10), diameter 2.5 mm.
8. Perform procedures on components after disassembly (refer to 9.1.1).

9.2.11.2 Installation

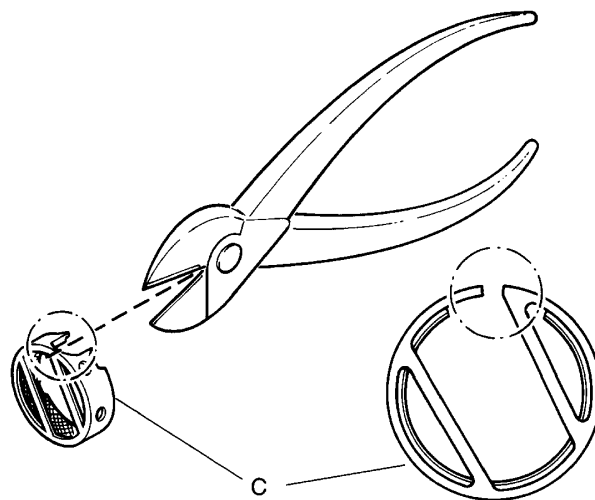
NOTE

The felt disk is different for the fuel and Diesel versions (see Fig. 909 and Fig. 910). During assembly all components, except for the cover, must be renewed (O-ring, felt disk, ring and gasket).

To increase the life of the glow plug, the ring **must** be cut open as shown in the figure. This also happens during manufacture of new equipment.

CAUTION

Prior to assembly cut ring open as shown. During assembly ensure that ring is not compressed beyond spring tension or bent.



1. Install felt ring observing assembly procedure according to Fig. 909 (BBW 46) or Fig. 910 (DBW 46).
2. Install heater (see 8.7.1.2).

- 1 Cover
- 2 O-ring
- 3 Felt disk
- 4 Ring
- 5 Burner head
- 6 Clamping spring
- 7 Recesses
- 8 Gasket
- 9 Locking pegs
- 10 Glow plug orifice

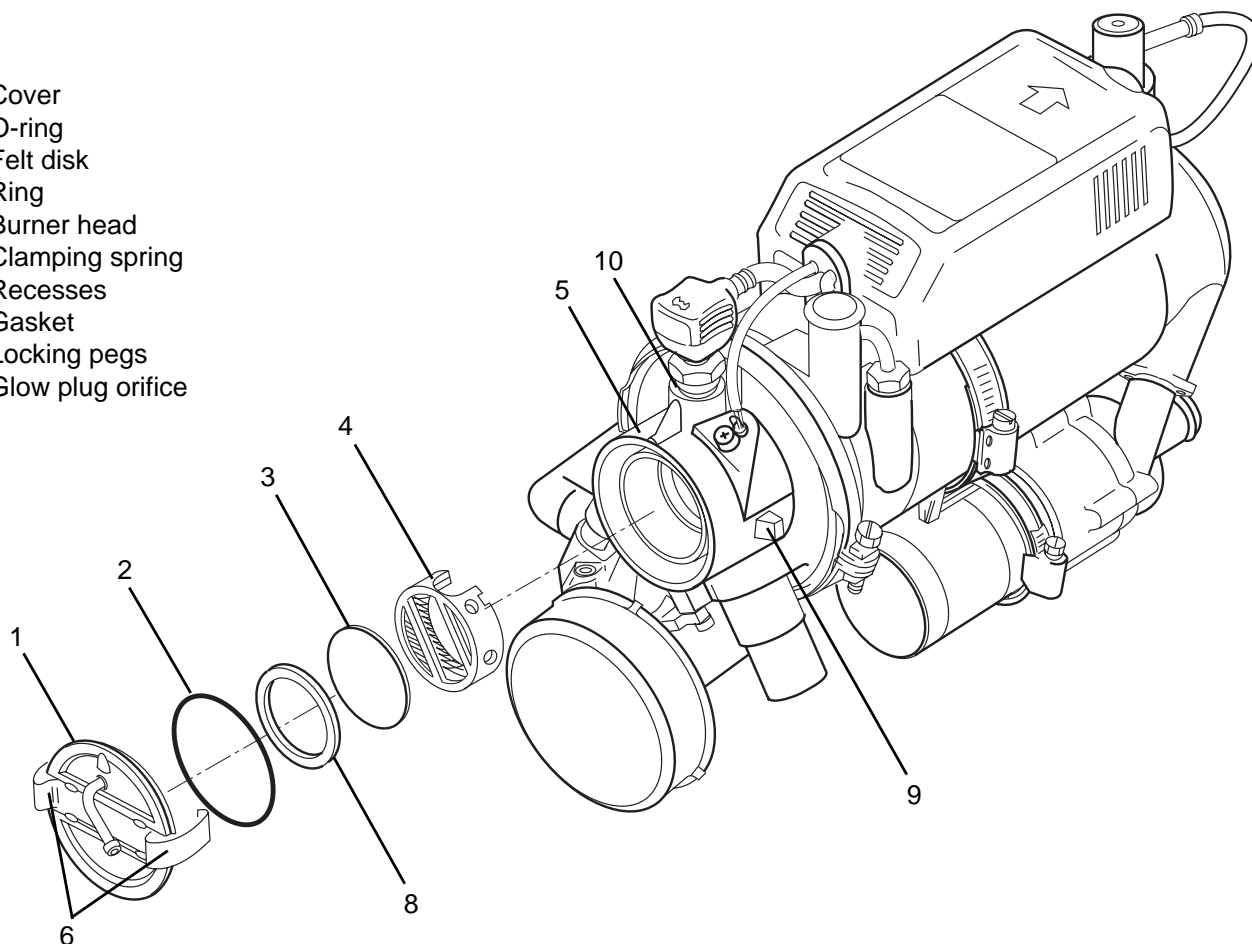


Fig. 908 Removal of Felt Disk in Burner Head

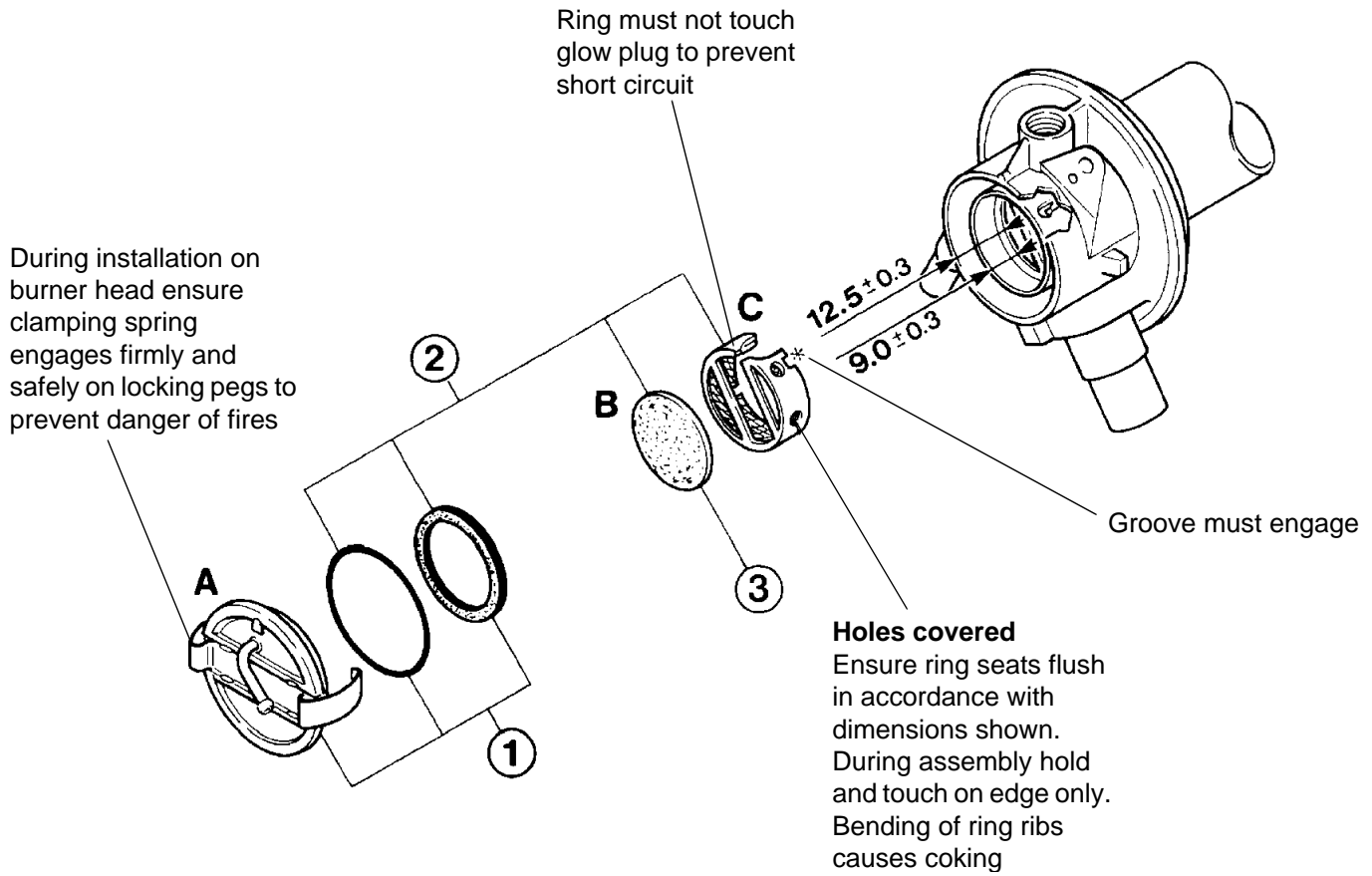


Fig. 909 Assembly Procedure for Burner Head, Fuel Version

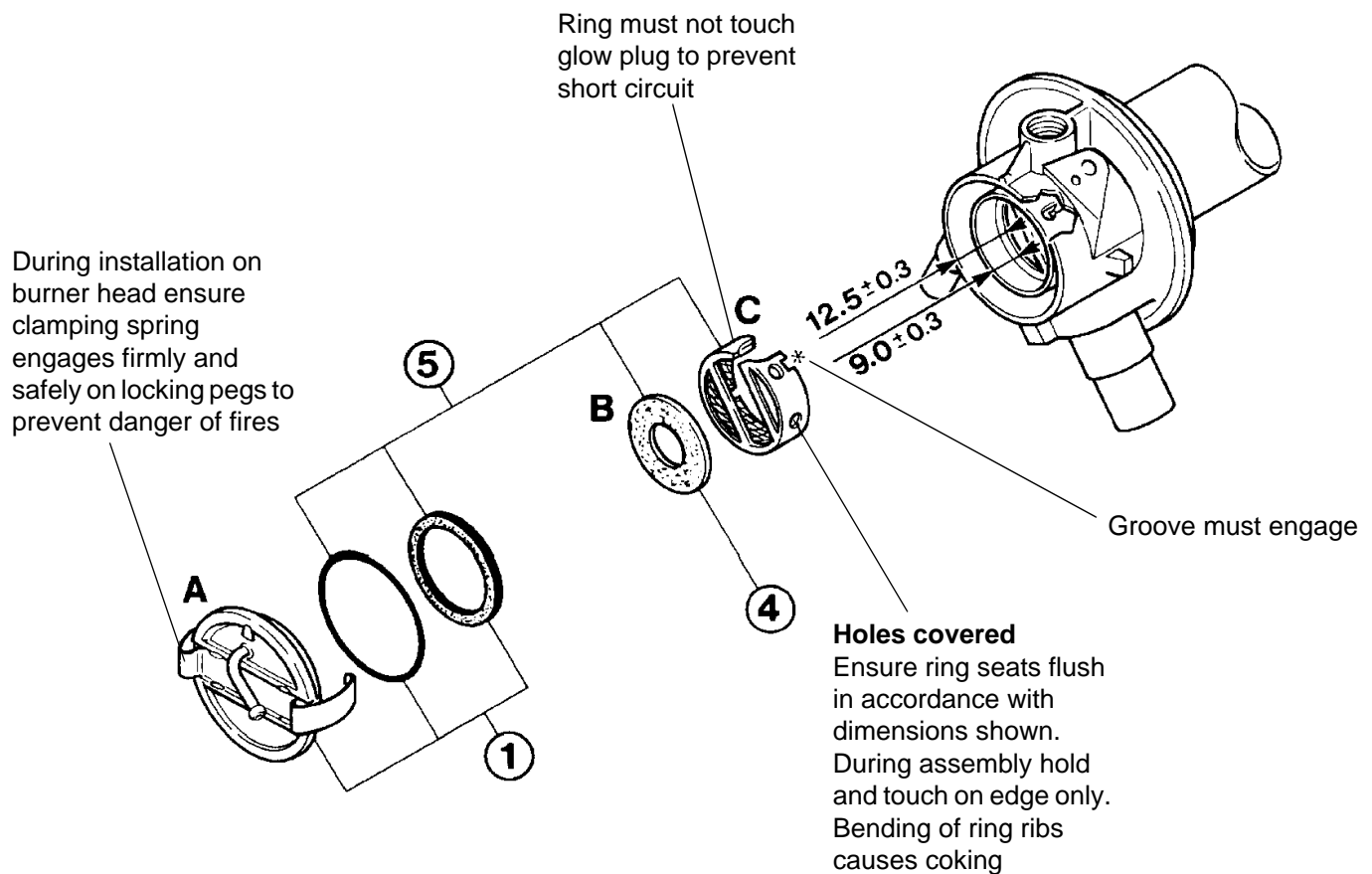


Fig. 910 Assembly Procedure for Burner Head, Diesel Version



## **10. Packaging, Storage and Shipping**

### **10.1 General**

The heater or its components shipped to Webasto Thermosysteme GmbH for testing or repair must be cleaned and packaged so that they are protected against damage during handling, shipping and storage.

#### **CAUTION**

When shipping a complete heater assembly it must be drained completely. No fuel or coolant is allowed to escape during packaging or shipping.

Dummy plugs must be fitted to the coolant line connections.

In storage the ambient temperatures specified in Section 4 must not be exceeded.