Water heaters

Workshop Manual

Thermo 50

Type Thermo 50 (Diesel/PME)

09/1999

Improper installation or repair of Webasto heating and cooling systems can cause fire or the leakage of deadly carbon monoxide leading to serious injury or death.

To install and repair Webasto heating and cooling systems you need to have completed a Webasto training course and have the appropriate technical documentation, special tools and special equipment.
Only genuine Webasto parts may be used. See also Webasto air and water heaters accessories catalogue.

NEVER try to install or repair Webasto heating or cooling systems if you have not completed a Webasto training course, you do not have the necessary technical skills and you do not have the technical documentation, tools and equipment available to ensure that you can complete the installation and repair work properly.

ALWAYS carefully follow Webasto installation and repair instructions and heed all WARNINGS.

Webasto rejects any liability for problems and damage caused by the system being installed by untrained personnel.

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1 Introduction

1.1 Contents and purpose

This workshop manual is intended to support instructed personnel in repairing the diesel version of Thermo 50 water heaters.

The heaters are marked on the type label with the text "Diesel". The heaters may only be operated with the specified fuel (for diesel units also with EL heating oil) and only in the respectively specified type of electrical connection.

1.2 Meaning of signal words

In this manual, the signal words
WARNING, IMPORTANT AND NOTE have the following meaning:

WARNING
This heading is used to highlight operating instructions or procedures which, if not or not correctly followed, may result in personal injury or fatal accidents.

IMPORTANT
This heading is used to highlight operating instructions or procedures which, if not or not correctly followed, may result in damage to the equipment or its components.

NOTE
This heading is used to direct your attention to a special feature deemed essential to highlight.

1.3 Additional documentation to be used

This workshop manual contains all necessary information and instructions for the repair of
Thermo 50 water heaters.
Normally, there is no need to use additional documentation. If necessary the operating/installation instructions and the installation suggestion for the specific vehicle may also be used.

1.4 Safety precautions and regulations

In principle, the general accident prevention regulations and current works safety instructions are applicable. "General safety precautions" which go beyond the scope of these regulations are listed in the following.

Any special safety regulations relevant to this instruction manual will be highlighted in the relevant sections or text passages of the procedures.

1.4.1 General safety regulations

Within the scope of the German Motor Vehicle Construction and Use Regulations (StVZO), the "General Type Approval" with the following official mark of conformity of the German Federal Motor Vehicle Registration Agency apply for the Thermo 50 water heater:

~ S 320 for Thermo 50 (diesel).

The units must be installed in accordance with the installation instructions. It must be inspected
a) during the vehicle type approval according to Section 20 of the German StVZO
b) during the individual inspection according to Section 21 of the German StVZO or
c) during the evaluation according to Section 19 of the German StVZO by an officially recognised expert or inspector for motor vehicle traffic, a motor vehicle expert or an employee in accordance with Paragraph 7.4 a of Appendix VII to the German StVZO

and in case c) it must be certified with specification of
– the vehicle manufacturer
– the vehicle model and
– the vehicle identification number

on the approval certificate contained in the copy of the General Certification (ABG). The effectiveness of the type approval is dependent on this.
The approval certificate must be carried in the vehicle at all times.

The heaters are approved for heating the motor vehicle engine and the vehicle cab. If the heater is used in special vehicles not subject to the German StVZO (e.g. ships), the regionally applicable regulations must be complied with. Use in "Vehicles for transporting dangerous goods (TRS/ADR)" is permissible.

The heater may only be installed in motor vehicles or in independent heating systems with a minimum coolant quantity of 4 litres.
When checking the coolant level, proceed according to the vehicle manufacturer's instructions. The water in the heating circuit of the heater must contain at least 10 % of a brand-name antifreeze.

The heater may not be installed in the driver's cab or passenger compartment of vehicles.

The heater must be switched off at filling stations and tank farms as a result of the risk of explosion.

The heater must not be operated in enclosed areas such as garages and workshops without an emissions extraction system, even if you use the timer, because of the risk of asphyxiation and poisoning.

A temperature of 120 °C (storage temperature) must not be exceeded in the vicinity of the heater under any circumstances (for example, when competing painting work on the vehicle). Otherwise, the electronics may suffer permanent damage.

1.5 Statutory regulations governing installation

The following regulations must primarily be observed (Section 22 a of German StVZO) for the testing of the heater in accordance with Sections 19, 20 or 21 of the German StVZO):

Testing is carried out with presentation of the manufacturer's operating / installation instructions.
The year of initial commissioning must be permanently marked on the type label by removing the corresponding year.

Removal of the combustion air from the vehicle passenger compartment is not permitted.

The mouth of the exhaust pipe should be installed downward, to the side or, if the exhaust pipe passes under the floor of the vehicle, to the side or rear limit of the driver's cab or the vehicle.

Exhaust pipes must be routed so that no penetration of the exhaust gases into the vehicle interior is to be expected. The function of important parts of the vehicle must not be adversely affected. Accumulated condensation in the exhaust line must be discharged immediately. A condensate drain hole may be drilled if necessary.

The openings of the combustion air inlet and exhaust air outlet must be designed so that a ball with a 16 mm diameter cannot be inserted.

The electric cables and controls of the heater must be arranged in the vehicle so that their proper functioning cannot be adversely affected under normal operating conditions.

Compliance with §§ 45 and 46 of the Road Vehicle Licensing Act must be ensured for the installation of fuel lines and the installation of additional fuel tanks. The main points from this law:

- Fuel pipes must be designed in such a way that torsion in the vehicle, movements by the engine and the like do not have a negative effect on their durability. They must be protected from mechanical damage. Parts that carry fuel must be protected from heat that will adversely affect their function and positioned so that dripping or evaporating fuel cannot collect or ignite on hot parts or on electrical equipment.

- The heater may not be installed in rooms used by persons.

- The respective operating mode of the heater, at least switched on or off, must be easily recognisable.

The vehicle owner is only relieved of the obligation to apply for a new operating permit (with certificate) after installation of the heater if the installation complies with all requirements of installation specifications for which a special supplement to the General Type Approval (GTA) exists. The GTA and the operating instructions must be carried in the vehicle at all times.

- Installations which are not recognised will result in the General Type Approval (GTA) of the heater, and with it the General Operating Permit (GOP) of the vehicle being voided. The same applies if repairs are carried out incorrectly or with the use of parts other than genuine spare parts.

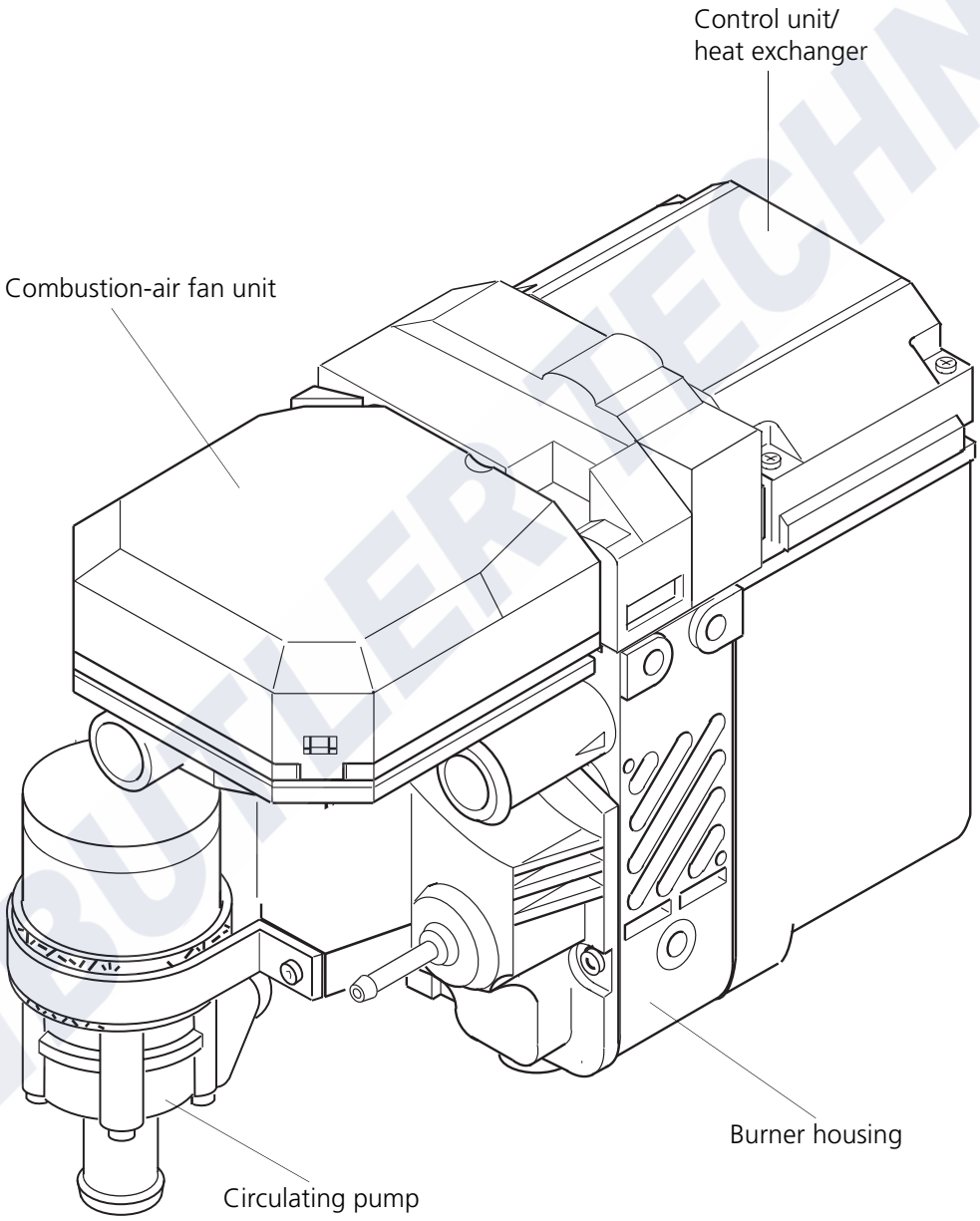
2 General description

The Thermo 50 water heater is used:
- to heat the vehicle interior,
- to defrost the vehicle windows,
- to preheat water-cooled vehicle engines.

The heater is designed with the evaporator principle and is controlled by a temperature sensor.

To protect the battery, the heater switches from full load to partial load after reaching a coolant temperature of 68 °C. In this operating mode the heater runs especially quietly and more efficiently with regards to electrical and fuel consumption.

The heater consists of the combustion-air fan unit, the control unit/heat exchanger, the burner insert, the burner housing and the circulating pump.



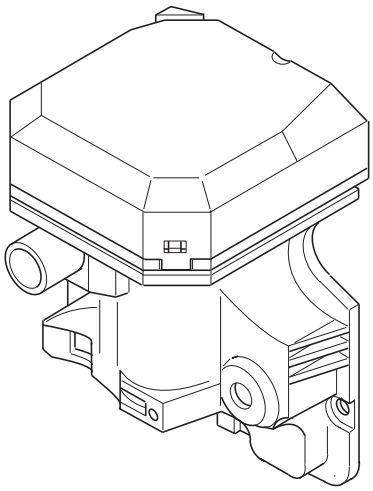
2.1 Combustion-air fan unit

The combustion-air fan unit contains
the combustion air fan,
the opening for the combustion air pipe,
the opening for the fuel transfer connection.

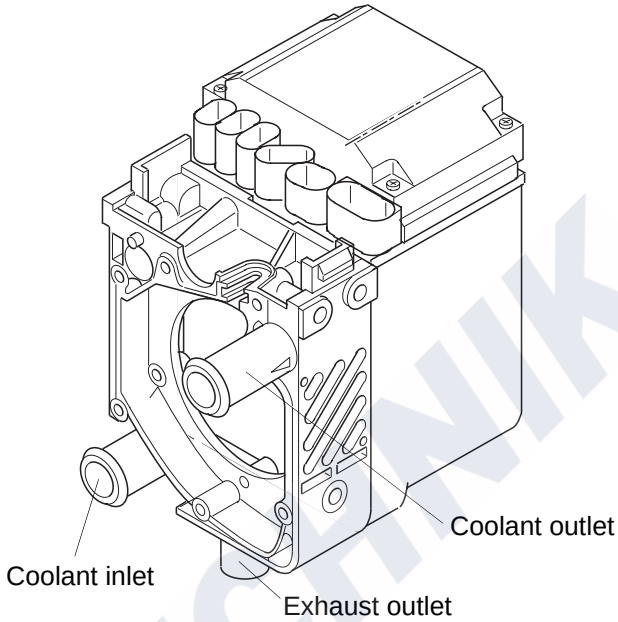
The circulating pump is fastened to the combustion-air fan unit.

2.1.1 Combustion air fan

The combustion air blower supplies the air required for the combustion process from the combustion air inlet to the burner insert.



Combustion-air fan unit



Burner housing

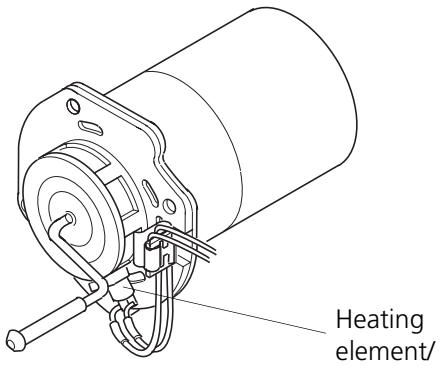
2.2 Burner housing

The burner housing contains
the coolant inlet connection,
the coolant outlet connection,
the exhaust outlet connection.

The burner housing holds the burner and is one unit together with the control unit/heat exchanger.

2.3 Burner

The fuel is distributed over the burner cross-section in the combustion pipe in the burner. The fuel-air mixture burns in the combustion pipe, causing the heat exchanger to become hot.



Burner

2.3.1 Glow plug / Flame monitor

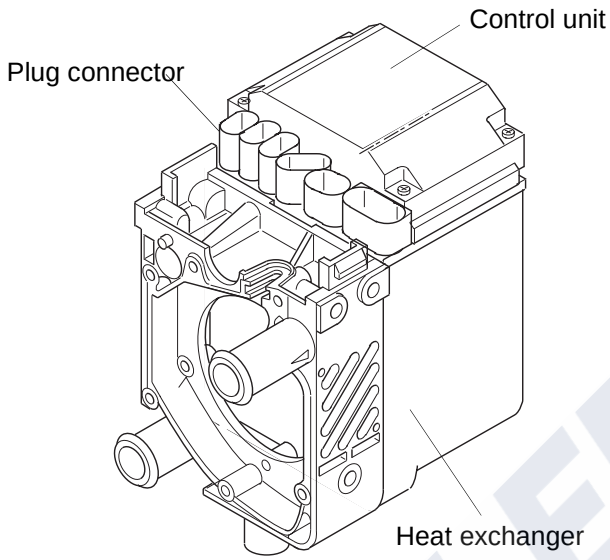
The fuel-air mixture is ignited when the heater is started with the heating element/flame monitor located in the burner. After starting, the heating element/flame monitor assumes the task of the flame monitor. The heating element/flame monitor designed as an electrical resistor is positioned in the burner on the side facing away from the flame.

2.4 Control unit/heat exchanger

The control unit/heat exchanger contains

the control unit,
the temperature sensor,
the overheating protection,
the heat exchanger,
the plug connector.

IMPORTANT
The control unit/heat exchanger forms one unit together with the burner housing and may not be dismantled.



2.4.1 Control unit

The control unit is the central component and ensures the operating sequence and the monitoring of combustion.

The control unit is ventilated via a ventilation hose.

2.4.2 Temperature sensor

The temperature sensor detects the coolant temperature in the heat exchanger of the heater as an electrical resistance. This signal is fed to the control unit, where it is processed.

2.4.3 Overheating protection

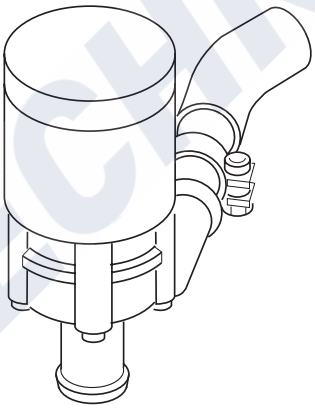
The overheating protection, controlled via a thermal resistor, protects the heater from impermissibly high operating temperatures. The overheating protection is actuated at a coolant temperature above 105 °C and switches off the heater.

2.4.4 Heat exchanger

The heat generated in the heat exchanger by combustion is transferred to the coolant circuit.

2.5 Circulating pump

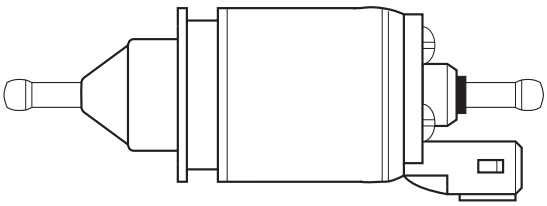
The circulating pump ensures a feed rate of the coolant in the vehicle or heater circuit.
The pump is switched on with the control unit and runs during the entire operation of the heater.



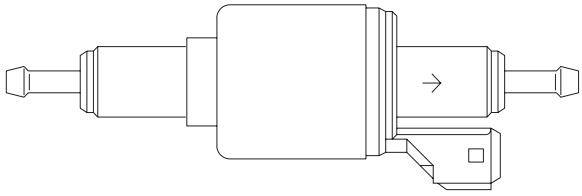
Circulating pump

2.6 Metering pump

The metering pump is a combined transport, metering and shut-off system for supplying fuel from the vehicle's tank.



Metering pump DP 2



Metering pump DP 30

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3 Function description

3.1 Switch on

When the "Immediate heating" button is pressed, the digital timer displays the following symbol . This makes the heater ready for operation.
The heating element, the combustion air fan and the circulatingpump are put into operation. After 30 seconds the fuel metering pump is connected and the combustion air fan is switched off for 3 seconds.
Then the combustion air fan is run up in a ramp and within 56 seconds to a partial load level. Following a stabilisation phase (constant speed) of 15 seconds, the combustion air fan is run up approximately to full load in the course of a 50 second ramp. In the last 20 seconds of this ramp, the heating element voltage moves to 0 in a ramp. After the full-load fuel feed is reached, the combustion air fan is run up to full load.
During the next 40 seconds and in normal combustion operation, the heating element applies the task of the flame monitor and checks the flame stability.
Then the automatically controlled heating mode begins automatically.
If no flame is formed or a flame tear-off results, the fuel supply is ended and a shut-down on faults with run-on of the combustion air fan takes place.
If a flame out occurs during normal combustion operation, a restart is automatically initiated.

3.2 Heating mode

Following an increase in the temperature to 68 °C, the heater switches over to the energy-saving partial load mode. If the temperature of the cooling liquid rises further to 77 °C, the heater switches into the control break. This also takes place if the duration of the entire combustion operation exceeds approx. 76 minutes.
The circulating pump, the original vehicle heater fan and the operation indicator remain in operation during the control break.
After the cooling liquid cools down to 68 °C, the heater restarts in partial load. If the temperature rises over 77 or 81 °C in the process, the heater switches into the control break again. If the temperature of the cooling liquid continues to drop due to an increased heat requirement during partial load operation, then the heater switches over to full load operation again at 60 °C.

However, if the temperature of the cooling liquid does not drop below 68 °C within 15 minutes during the control break, the heater starts in the full load mode with the regular starting procedure during the subsequent dropping below of the coolant temperature of 68 °C.

If the vehicle engine is operating (terminal D^+), the control temperature of the cooling liquid for changing over from partial load in the control break is 77 °C (instead of 81 °C).

3.3 Switch off

Switch-off by pressing the immediate heating button switches off the vehicle fan. The combustion is ended and the run-on begins. However, the circulating pump and the combustion air fan continue to run to cool down the heater (run-on) and are automatically switched off.

NOTE

The run-on time and the combustion-air fan speed are dependent on the operating mode from which the heater is switched off.

The run-on time is:

- 175 seconds during switch-off from the full load mode and
- 110 seconds during switch-off from the partial load mode

The run-on time may vary, depending on the software version in the control unit.

3.4 Functions of heater in TRS/ADR vehicles

The heater is put into operation with the switch. A TRS/ADR case (forced switch-off) is triggered if

– the vehicle engine is switched off,
– a transport is started.

after 40 seconds the short run-on is ended.

Then the control unit is then in the "fault lock-out mode" position. The On/Off switch must be set to the "Off" position before restarting.

The separating switch (Emergency-Stop switch) may only be actuated in case of danger, as the heater is switched off without run-on (overheating possible).

3.5 Faults

3.5.1 Fault switch-off

In case of a fault, the combustion air fan is interrupted for 5 seconds and the fuel pump is switched off. Then a cooling run-on takes place for 120 seconds on the full load level of the fan. After the run-on, the heater is in fault lock-out. If the operating voltage limits are exceeded/dropped below, the regular switch-off procedure is carried out.

3.5.2 Diagnosis in Case of Fault Switch-Off

If the heater is fitted with a standard timer, an error message will appear on the display of the timer after a fault occurs:

NOTE

The type of fault is output during operation with the switch by a flashing code via the operating indicator lamp during the run-on time of the heater. After five short signals, the long flashing pulses are counted. The flashing pulses are equivalent to the number in the following table.

F 01	No start (after 2 attempts to start)
F 02	Flame abort (repeated > 5)
F 03	Undervoltage or overvoltage
F 04	Premature flame detection
F 05	Flame monitor interruption or flame monitor short circuit
F 06	Temperature interruption or temperature sensor short circuit
F 07	Metering pump interruption or Metering pump short circuit
F 08	Fan motor interruption or fan motor short circuit or fan motor faulty speed
F 09	Heating element interruption or heating element short circuit
F 10	Overheating
F 11	Circulating pump interruption or Circulating pump short circuit

4 Technical data

The technical data listed in the table refer to the usual heater tolerances of ± 10 % at an ambient temperature of +20 °C. All electrical components are designed for a nominal voltage of 24 volts.

Fuel
Diesel fuel or PME fuel approved by the vehicle manufacturer is suitable as fuel. If you change to low-temperature fuel, the heater must be operated for approx. 15 minutes so that fuel line and fuel pump are also filled with the new fuel.
We know of no negative influences due to additives.

Heater	**Operation**	**Thermo 50 Diesel/PME**
Mark of conformity		~ S 320
Model		Water heater with evaporator-type burner
Heat output	Full load Partial load	5.0 kW 2.2 kW
Fuel		Diesel/PME
Fuel consumption	Full load Partial load	0.63 l/h 0.27 l/h
Rated voltage		24 V
Operating voltage range		20 to 32 V
Nominal power consumption with circulating pump (without vehicle fan)	Full load Partial load	50 W 34 W
Max. ambient temperature: Heater: - Operation - Storage Metering pump: - Operation		 -40 °C to +60 °C -40 °C to +120 °C -40 °C to +20 °C
Perm. operating pressure (heat carrier)		0.4 ... 2.5 bar
Capacity of the heat exchanger		0.15 l
Minimum capacity of the circuit		4.00 l
Minimum flow rate for the heater		250 l/h
CO_2 in exhaust gas (perm. function range)		7.0 to 12.0 vol. %
Heater dimensions		Length 237 mm Width 106 mm Height 193 mm
Weight		2.9 kg

Circulating pump		**4847**
Volume flow at differential pressure		900 l/h 0.1
Rated voltage		24 V
Operating voltage range		18 to 32 V
Rated power consumption		15 W
Dimensions, circulating pump		Length 95 mm Width 61 mm Height 61 mm
Weight		0.3 kg

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5 Troubleshooting

5.1 General error symptoms

The following table (Fig. 501) lists the general error symptoms with the heater installed.

IMPORTANT

Troubleshooting work demands precise knowledge of the structure and theory of operation of the various components and must be carried out by trained personnel only.

If in doubt, refer to sections 2 and 3 for a description of how the functions interact.

IMPORTANT

The error remedy is generally limited to the localisation of the faulty components and provides information on defective line connections.
The following potential sources of malfunctions are not taken into account and should always be checked so that they can then be excluded as the cause of the particular fault:

Corrosion on connectors
Loose contact on connectors
Crimping error on connectors
Corroded cables and fuses
Corroded battery terminals

Conduct a function test in the vehicle after rectifying each fault (see 6.2).

Error symptom	Troubleshooting
Fuel odour	Check integration in vehicle fuel system. Inspect the fuel line for leaks, kinking or clogging. If the line is OK, there is a leak within the heater. Remove the heater and carry out troubleshooting in the workshop.
Heater does not reach the full load mode	Remove the heater and carry out troubleshooting in the workshop.
Continuous white smoke in combustion operation	Remove the heater and carry out troubleshooting in the workshop.
Heater cannot be switched off	Conduct an operating check of the digital timer or the switch. Replace or repair the defective component.
Coolant escapes (drips); heater smokes during combustion; exhaust odour is extremely sweet	Inspect coolant hoses for leaks, kinking, loosened clamps, etc. If the line is OK, there is a leak within the heater. Remove the heater and carry out troubleshooting in the workshop.
Fuel escapes (drips)	Check integration in vehicle fuel system. Inspect fuel connection for leaks. If the line is OK, there is a leak within the heater. Remove the heater and carry out troubleshooting in the workshop.

Fig. 501 Error symptoms

5.2 Faults

5.2.1 Fault lock-out due to faults in heater

Fuel is supplied for max. 180 seconds if the flame does not start to burn.

The fuel supply is shut off immediately if the system overheats (temperature limiter is tripped).

In all cases (except a fault in the combustion air fan), the heater continues to run for 120 seconds after a fault lock-out. The run-on time may vary, depending on the software version in the control unit.

NOTE

The type of fault is output during operation with the switch by a flashing code via the operating indicator lamp during the run-on time of the heater.

After five short signals, the long flashing pulses are counted (see 3.5.2).

5.2.2 Fault lock-out due to undervoltage or overvoltage

At an undervoltage of < 21 -1 volts (measured at the wiring harness input) for a duration of 20 ± 1 seconds, a fault lock-out is carried out with the regular switchoff procedure.

At an overvoltage of > 32 volts (measured on the heater) for a duration of more than 6 ± 0.5 seconds, a fault lock-out is also carried out with the regular switch-off procedure.

After the fault cause is eliminated, the fault release is carried out by switching the heater off and then on again. In case of overheating, the fault release is carried out by removing the F1 fuse, 15 A, for at least 10 seconds.

The fuse in not destroyed by overheating.

6 Operating Check

6.1 General

This section describes the tests conducted on the heater and its components when it is installed and not installed to verify that it is in working order.

WARNING

The heater must not be operated in enclosed areas such as garages and workshops without an emissions extraction system.

6.2 Operating checks in vehicle

6.2.1 Checking heating operation

1. Make sure that the fan switch is set to the slowest or to the speed recommended in the operating instructions.

2. Make sure that the air inlet is free of foreign bodies (snow, leaves, etc.) and any pollen and dust filters are clear.

3. Make sure that the coolant circuit and the fuel system are carefully bled in accordance with the vehicle manufacturer's specifications.

   NOTE

   The following functions must be checked with regard to time with a stopwatch or another suitable aid. The exact times are described in Section 3.

4. Switch on the heater with the digital timer or switch.

- When the heater is switched on, the circulating pump and the combustion air fan run. This is audible. The vehicle fan runs when the coolant temperature has reached 30 °C.

- The heater starts up after approx. 130 seconds. This can be detected from exhaust exiting at the exhaust silencer or connection piece.

5. Allow the heater to run. Check the heating effect at the air outlet of the vehicle fan.

   NOTE

   The heating effect is dependent on several factors: To evaluate it, the outside temperature, the vehicle model, the engine temperature and the type of integration in the vehicle cooling system, the quantity of coolant to be heated up and the time since the start must be used for the evaluation.

   NOTE

   The following functions must be checked with regard to time with a stopwatch or another suitable aid.

6. Switch off the heater again with the digital timer or switch.

- When the heater is switched off, a run-on of approx. 110 seconds from partial-load operation or 175 seconds from full-load operation takes place. This is apparent from the fact that the circulating pump is heard to continue running.

- Then the complete heater is switched off completely, (with the ignition switched off).

6.3 Operating checks in workshop

6.3.1 Testing individual components

6.3.1.1 Resistance test of heating element/flame monitor

During an electrical test with a digital multimeter, the heating element/flame monitor is to have the following values:

Resistance at 25 °C:	0.670 to 0.870Ω
Test current:	< 5 mA

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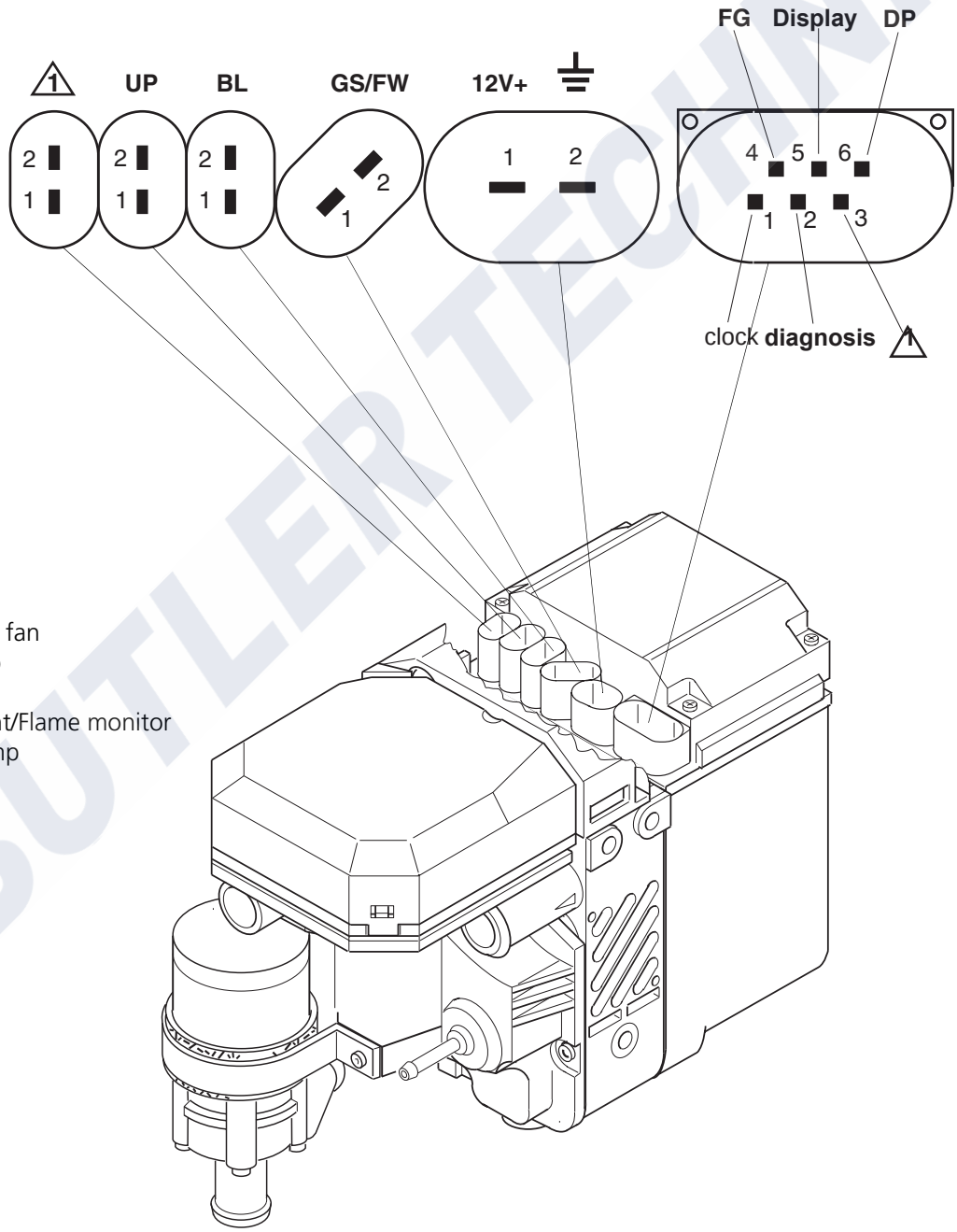
7 Wiring diagram

7.1 General

The connector assignment of the control unit is shown in Fig. 701.

The wiring diagrams (Fig. 702 to Fig. 707) show the circuits of the heater with the digital timer, switch, auxiliary drives and TRS/ADR.

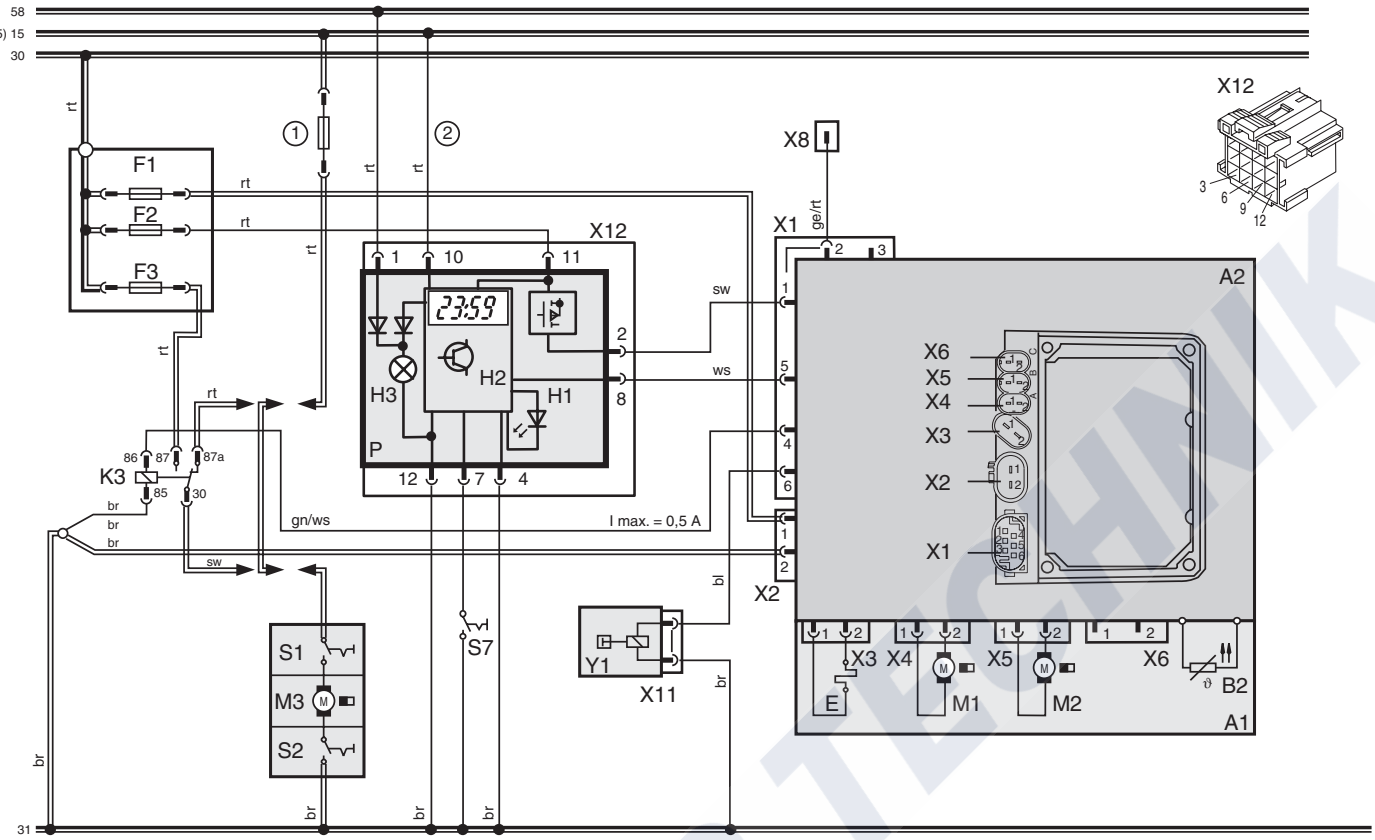


1 not in use

BL Combustion air fan
DP Metering pump
FG Vehicle fan
GS/FW Heating element/Flame monitor
UP Circulating pump

Fig. 701 Connector assignment of control unit

7 Wiring diagram



Item	Description	Comment
A1	Heater	Thermo 50
A2	Control unit	
B2	Temperature sensor	
E	Glow plug / Flame monitor	
F1	Fuse 15 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse	max. 20 A
H1	LED (in Pos. P)	Switch-on indicator
H2	LED (in Pos. P)	Indicator
H3	Lamp (in Pos. P)	Display lighting
K3	Relay (in Pos. A3)	Vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
P	Timer, digital	for programmed operation
S1	Switch for vehicle fan	S1 or S2 depending on vehicle
S2	Switch for vehicle fan	S1 or S2 depending on vehicle
S7	Momentary-contact switch	Immediate heat button/remote control
X1	Plug connector, 6-pin	
X2	Plug connector, 2-pin	
X3	Plug connector, 2-pin	
X4	Plug connector, 2-pin	
X5	Plug connector, 2-pin	
X6	Plug connector, 2-pin	
X8	Plug connector, 2-pin	Diagnosis
X11	Plug connector, 2-pin	
X12	12-pin plug connection	Digital timer
Y1	Metering pump	

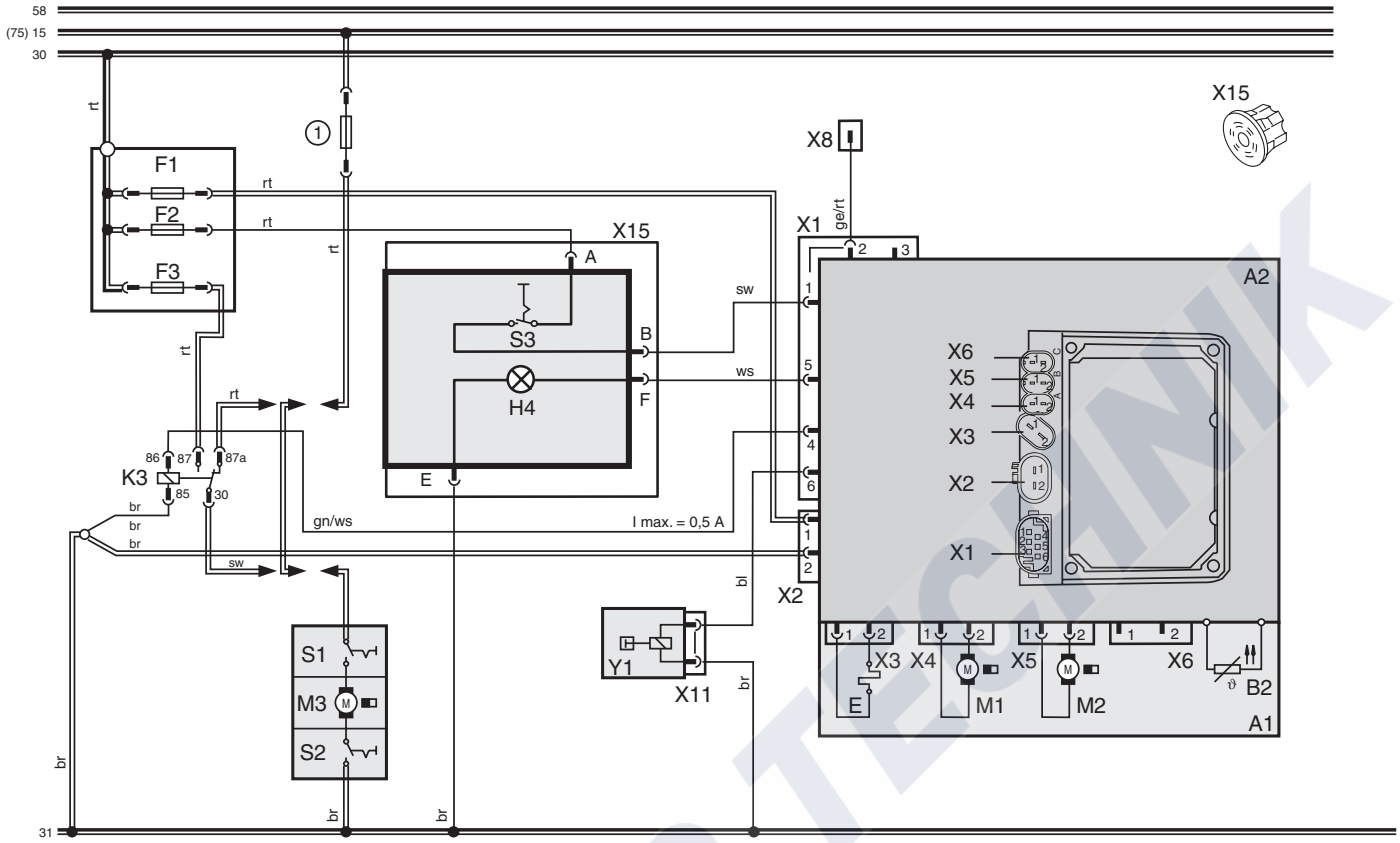
Cable cross sections		
	< 7,5 m	7,5 - 15 m
	0,5 mm²	0,75 mm²
	0,75 mm²	1,5 mm²
	1,5 mm²	2,5 mm²
	2,5 mm²	4,0 mm²
	4,0 mm²	6,0 mm²

Cable colours	
bl	**blue**
br	**brown**
ge	**yellow**
gn	**green**
gr	**gray**
or	**orange**
rt	**red**
sw	**black**
vi	**purple**
ws	**white**

① Vehicle fan fuse present in vehicle

② With positive on Connection 10: Continuous operation with immediate heating possible, program operation
Without positive on Connection 10: Heating time is variably programmable (10 min to 120 min), basic setting 120 min; heating duration limited to 120 min

Fig. 702 Wiring diagram with digital timer



Item	Description	Comment
A1	Heater	Thermo 50
A2	Control unit	
B2	Temperature sensor	
E	Glow plug / Flame monitor	
F1	Fuse 15 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse	max. 20 A
H4	Lamp	Indicator
K3	Relay (in Pos. A3)	Vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
S1	Switch for vehicle fan	S1 or S2 depending on vehicle
S2	Switch for vehicle fan	S1 or S2 depending on vehicle
S3	Switch	Immediate heat button
X1	Plug connector, 6-pin	
X2	Plug connector, 2-pin	
X3	Plug connector, 2-pin	
X4	Plug connector, 2-pin	
X5	Plug connector, 2-pin	
X6	Plug connector, 2-pin	
X8	Plug connector, 2-pin	Diagnosis
X11	Plug connector, 2-pin	
X15	Plug connector, 4-pin	Switch On/Off
Y1	Metering pump	

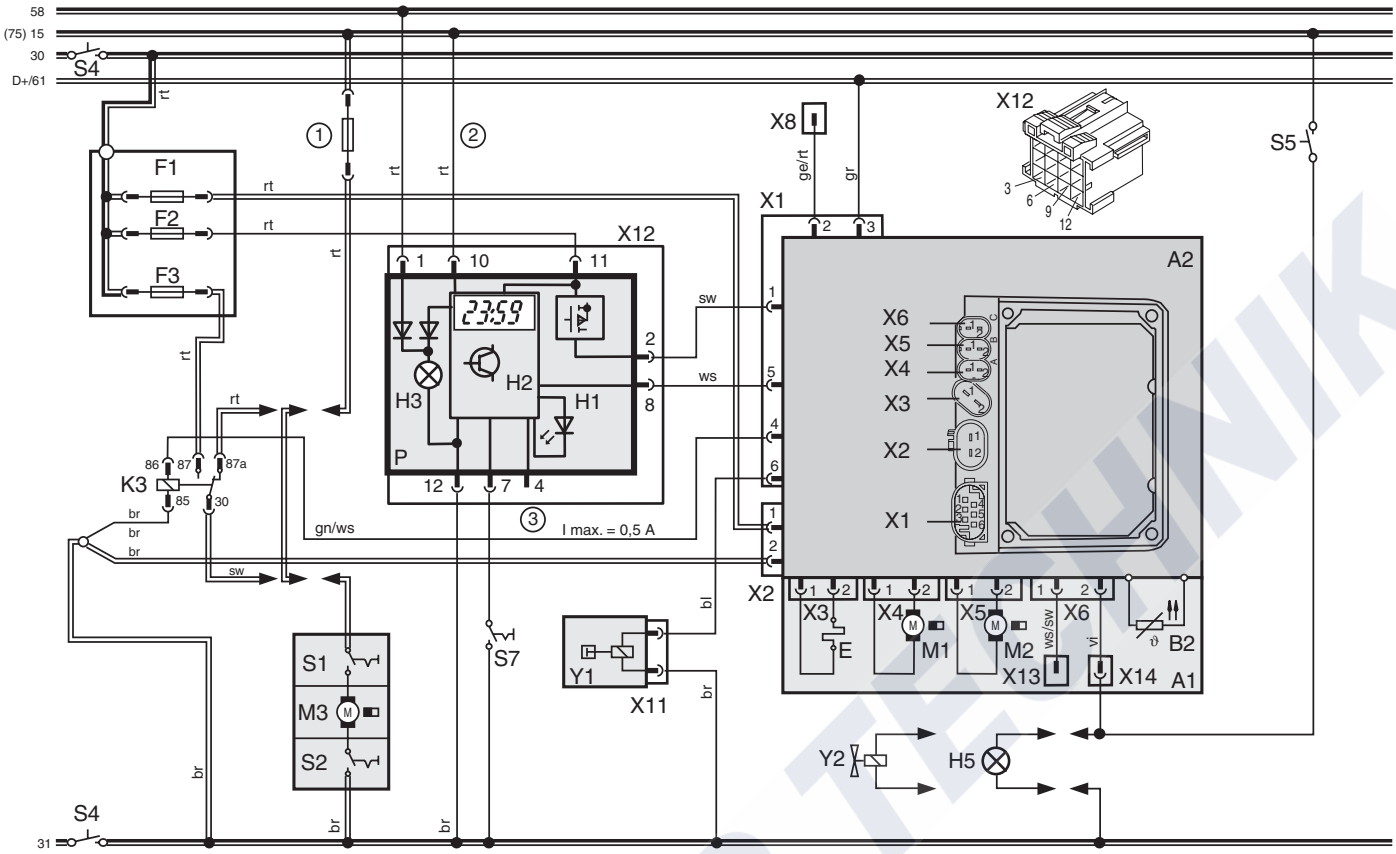
Cable cross sections

	< 7,5 m	7,5 - 15 m
------	0,5 mm²	0,75 mm²
——	0,75 mm²	1,5 mm²
——	1,5 mm²	2,5 mm²
——	2,5 mm²	4,0 mm²
——	4,0 mm²	6,0 mm²

Cable colours	
bl	**blue**
br	**brown**
ge	**yellow**
gn	**green**
gr	**gray**
or	**orange**
rt	**red**
sw	**black**
vi	**purple**
ws	**white**

① Vehicle fan fuse present in vehicle

Fig. 703 Wiring diagram with switch



Item	Description	Comment
A1	Heater	Thermo 50
A2	Control unit	
B2	Temperature sensor	
E	Glow plug / Flame monitor	
F1	Fuse 15 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse	max. 20 A
H1	LED (in Pos. P)	Switch-on indicator
H2	LED (in Pos. P)	Indicator
H3	Lamp (in Pos. P)	Display lighting
H5	Lamp (min 1.2 W)	Switch-on indicator pumping device
K3	Relay (in Pos. A3)	Vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
P	Timer, digital	for programmed operation
S1	Switch for vehicle fan	S1 or S2 depending on vehicle
S2	Switch for vehicle fan	S1 or S2 depending on vehicle
S4	1 or 2-pin disconnecting switch	Emergency-Stop switch, electr. or pneumatic
S5	Switch	on pumping device 1
S7	Momentary-contact switch	Immediate heat button/remote control
X1	Plug connector, 6-pin	
X2	Plug connector, 2-pin	
X3	Plug connector, 2-pin	
X4	Plug connector, 2-pin	
X5	Plug connector, 2-pin	
X6	Plug connector, 2-pin	
X8	Plug connector, 2-pin	Diagnosis
X11	Plug connector, 2-pin	
X12	12-pin plug connection	Digital timer
X13	Plug connector, 1-pin	Battery isolation switch
X14	Plug connector, 1-pin	Auxiliary drive
Y1	Metering pump	
Y2	Solenoid valve	for pumping device 1

Cable cross sections

	< 7,5 m	7,5 - 15 m
-------	0,5 mm²	0,75 mm²
———	0,75 mm²	1,5 mm²
———	1,5 mm²	2,5 mm²
———	2,5 mm²	4,0 mm²
———	4,0 mm²	6,0 mm²

Cable colours

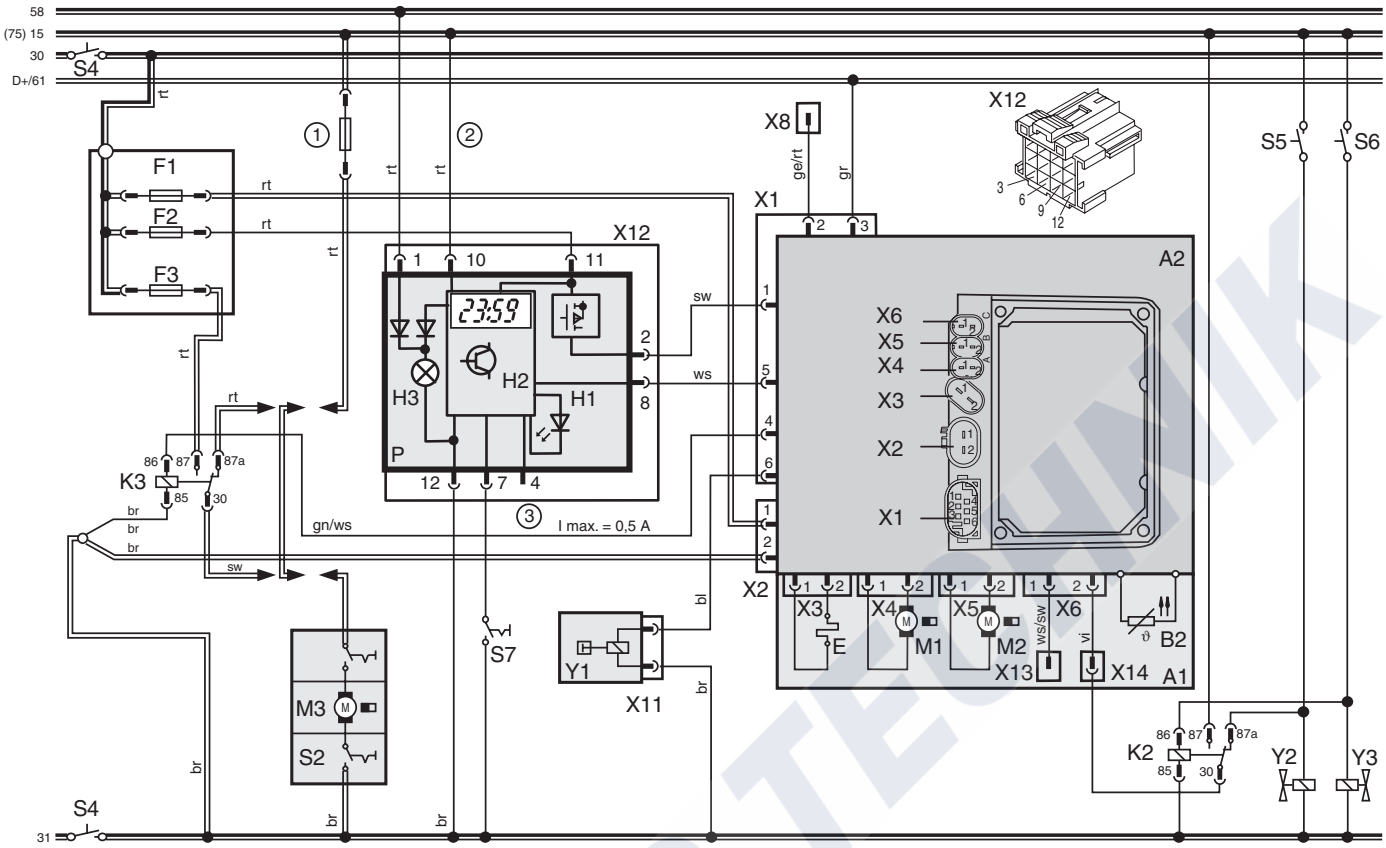
bl	**blue**
br	**brown**
ge	**yellow**
gn	**green**
gr	**gray**
or	**orange**
rt	**red**
sw	**black**
vi	**purple**
ws	**white**

① Vehicle fan fuse present in vehicle

② With positive on Connection 10: Continuous operation with immediate heating possible, program operation
Without positive on Connection 10: Heating time is variably programmable (10 min to 120 min), basic setting 120 min; heating duration limited to 120 min

③ This connection must remain open on ADR vehicles! (not preselection function)

Fig. 704 Wiring diagram, TRS/ADR, with digital timer and one auxiliary drive



Item	Description	Comment
A1	Heater	Thermo 50
A2	Control unit	
B2	Temperature sensor	
E	Glow plug / Flame monitor	
F1	Fuse 15 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse	max. 20 A
H1	LED (in Pos. P)	Switch-on indicator
H2	LED (in Pos. P)	Indicator
H3	Lamp (in Pos. P)	Display lighting
K2	Relay	for pumping device
K3	Relay (in Pos. A3)	Vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
P	Timer, digital	for programmed operation
S2	Switch for vehicle fan	S1 or S2 depending on vehicle
S4	1 or 2-pin disconnecting switch	Emergency-Stop switch, electr. or pneumatic
S5	Switch	on pumping device 1
S6	Switch	on pumping device 2
S7	Momentary-contact switch	Immediate heat button/remote control
X1	Plug connector, 6-pin	
X2	Plug connector, 2-pin	
X3	Plug connector, 2-pin	
X4	Plug connector, 2-pin	
X5	Plug connector, 2-pin	
X6	Plug connector, 2-pin	
X8	Plug connector, 2-pin	Diagnosis
X11	Plug connector, 2-pin	
X12	12-pin plug connection	Digital timer
X13	Plug connector, 1-pin	Battery isolation switch
X14	Plug connector, 1-pin	Auxiliary drive
Y1	Metering pump	
Y2	Solenoid valve	for pumping device 1
Y3	Solenoid valve	for pumping device 2

Cable cross sections

	< 7,5 m	7,5 - 15 m
	0,5 mm²	0,75 mm²
	0,75 mm²	1,5 mm²
	1,5 mm²	2,5 mm²
	2,5 mm²	4,0 mm²
	4,0 mm²	6,0 mm²

Cable colours

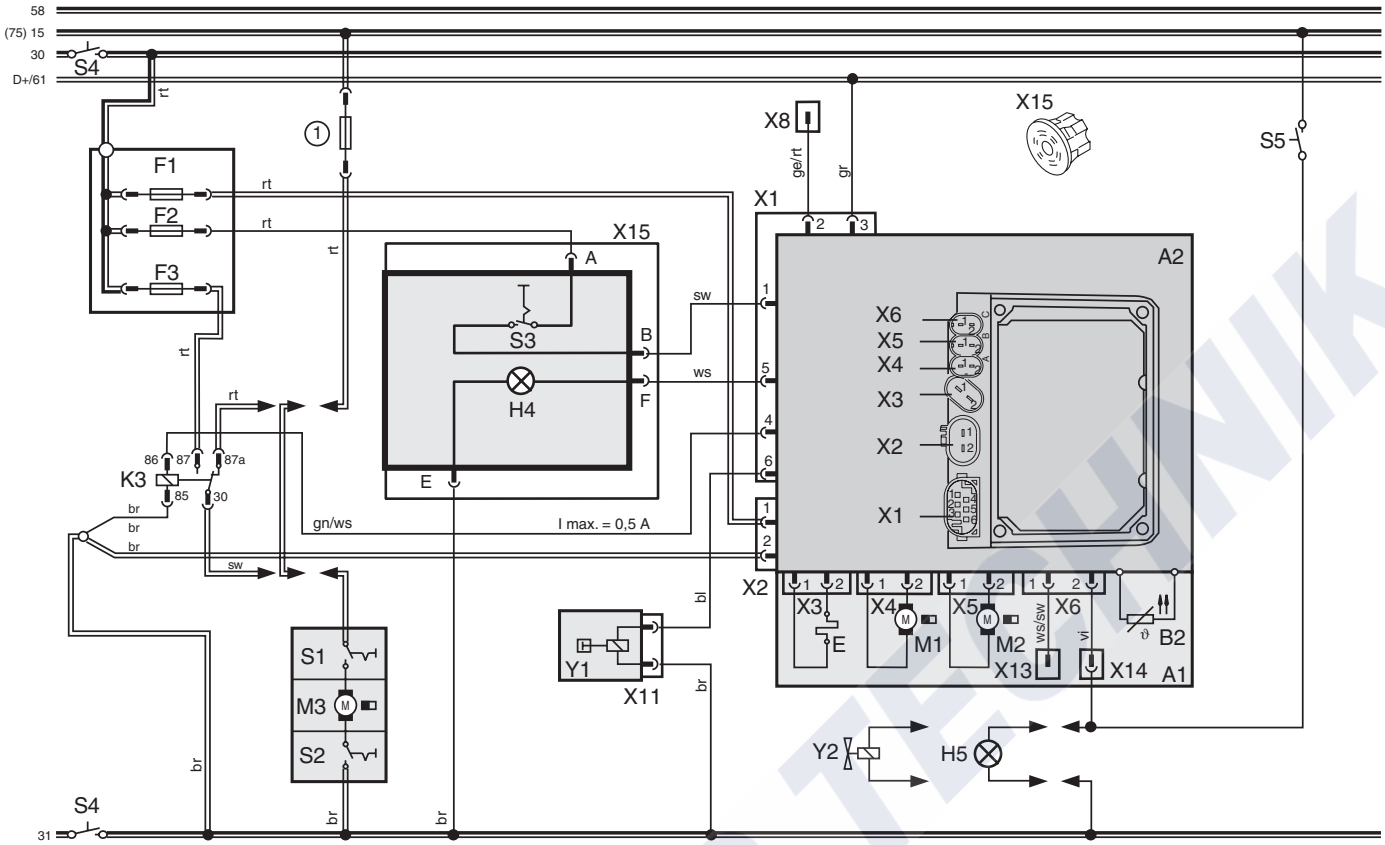
bl	blau
br	braun
ge	gelb
gn	grün
gr	grau
or	orange
rt	rot
sw	schwarz
vi	violett
ws	weiß

① Vehicle fan fuse present in vehicle

② With positive on Connection 10: Continuous operation with immediate heating possible, program operation
Without positive on Connection 10: Heating time is variably programmable (10 min to 120 min), basic setting 120 min; heating duration limited to 120 min

③ This connection must remain open on ADR vehicles! (not preselection function)

Fig. 705 Wiring diagram, TRS/ADR, with digital timer and two auxiliary drives



Item	Description	Comment
A1	Heater	Thermo 50
A2	Control unit	
B2	Temperature sensor	
E	Glow plug / Flame monitor	
F1	Fuse 15 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse	max. 20 A
H4	Lamp	Indicator
H5	Lamp (min 1.2 W)	Switch-on indicator pumping device
K3	Relay (in Pos. A3)	Vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
S1	Switch for vehicle fan	S1 or S2 depending on vehicle
S2	Switch for vehicle fan	S1 or S2 depending on vehicle
S3	Switch	Immediate heat button
S4	1 or 2-pin disconnecting switch	Emergency-Stop switch, electr. or pneumatic
S5	Switch	on pumping device 1
X1	Plug connector, 6-pin	
X2	Plug connector, 2-pin	
X3	Plug connector, 2-pin	
X4	Plug connector, 2-pin	
X5	Plug connector, 2-pin	
X6	Plug connector, 2-pin	
X8	Plug connector, 2-pin	Diagnosis
X11	Plug connector, 2-pin	
X13	Plug connector, 1-pin	Battery isolation switch
X14	Plug connector, 1-pin	Auxiliary drive
X15	Plug connector, 4-pin	Switch On/Off
Y1	Metering pump	
Y2	Solenoid valve	for pumping device 1

Cable cross sections

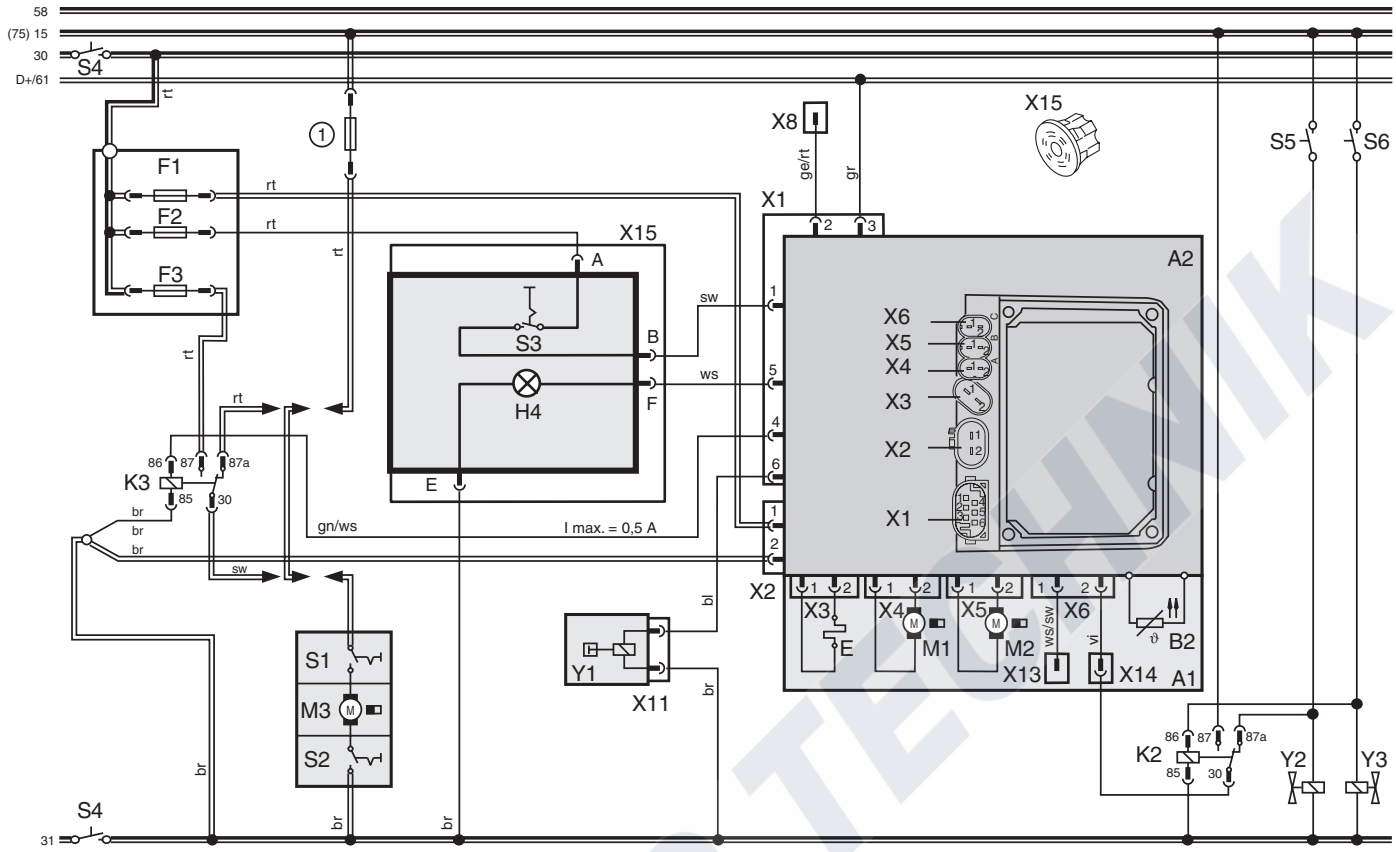
	< 7,5 m	7,5 - 15 m
	0,5 mm²	0,75 mm²
	0,75 mm²	1,5 mm²
	1,5 mm²	2,5 mm²
	2,5 mm²	4,0 mm²
	4,0 mm²	6,0 mm²

Cable colours

bl	blue
br	brown
ge	yellow
gn	green
gr	gray
or	orange
rt	red
sw	black
vi	purple
ws	white

① Vehicle fan fuse present in vehicle

Fig. 706 Wiring diagram, TRS/ADR, with switch and one auxiliary drive



Item	Description	Comment
A1	Heater	Thermo 50
A2	Control unit	
B2	Temperature sensor	
E	Glow plug / Flame monitor	
F1	Fuse 15 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse	max. 20 A
H4	Lamp	Indicator
K2	Relay	for pumping device
K3	Relay (in Pos. A3)	Vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
S1	Switch for vehicle fan	S1 or S2 depending on vehicle
S2	Switch for vehicle fan	S1 or S2 depending on vehicle
S3	Switch	Immediate heat button
S4	1 or 2-pin disconnecting switch	Emergency-Stop switch, electr. or pneumatic
S5	Switch	on pumping device 1
S6	Switch	on pumping device 2
X1	Plug connector, 6-pin	
X2	Plug connector, 2-pin	
X3	Plug connector, 2-pin	
X4	Plug connector, 2-pin	
X5	Plug connector, 2-pin	
X6	Plug connector, 2-pin	
X8	Plug connector, 2-pin	Diagnosis
X11	Plug connector, 2-pin	
X13	Plug connector, 1-pin	Battery isolation switch
X14	Plug connector, 1-pin	Auxiliary drive
X15	Plug connector, 4-pin	Switch On/Off
Y1	Metering pump	
Y2	Solenoid valve	for pumping device 1
Y3	Solenoid valve	for pumping device 2

Cable cross sections

	< 7,5 m	7,5 - 15 m
:::::::	0,5 mm²	0,75 mm²
———	0,75 mm²	1,5 mm²
———	1,5 mm²	2,5 mm²
———	2,5 mm²	4,0 mm²
———	4,0 mm²	6,0 mm²

Cable colours

bl	**blue**
br	**brown**
ge	**yellow**
gn	**green**
gr	**gray**
or	**orange**
rt	**red**
sw	**black**
vi	**purple**
ws	**white**

① Vehicle fan fuse present in vehicle

Fig. 707 Wiring diagram, TRS/ADR, with switch and two auxiliary drives

Page for notes

8 Service Work

8.1 General

This section describes the servicing work that can be carried out on the heater when it is installed.

WARNING

There is a danger of burns, as the heater and the attached parts may be extremely hot.

8.2 Working on heater

Disconnect the main power cable from the vehicle's battery before carrying out any work on the heater. The main battery power must not be disconnected whilst the heater is operating or slowing down as a result of the risk of the heater overheating and the overheating protection thus being tripped. If extensive repair work is carried out on the heater, it must be completely removed. After work is performed on the heating circuit, a coolant mixture of water and antifreeze must be added in accordance with the vehicle manufacturer's specifications and the heating circuit must be carefully bled. Refer to the relevant installation instructions and the installation proposal for the heater for the specific vehicle for repairs that necessitate the installation position being changed.

8.3 Working on vehicle

WARNING

A temperature of 120 °C must not be exceeded in the vicinity of the heater under any circumstances (for example, during painting work on the vehicle).

8.4 Test operation of heater

The heater must not be operated in enclosed areas such as garages and workshops without an emissions extraction system, even if you use the timer.

8.5 Service work

The following servicing work is to be carried out periodically to maintain the functional reliability of the heater:

- Clean the exterior of the heater (avoid the ingress of water).
- Inspect electrical connections for contact corrosion and firm seating.
- Inspect exhaust and combustion air lines for damage and to ensure that they are clear.
- Check the fuel line and filter for leaks.
- Check the coolant circuit and circulating pump for leaks.
- Check hoses for cracks.
- Replace the fuel filter if there is one.

8.6 Visual inspections and installation instructions

8.6.1 Connection to vehicle cooling system

The heater should be installed as low as possible to permit automatic bleeding of the heater and circulating pump. This is particularly important as the circulating pump is not self-priming.

The circulating pump can be installed either in its intended position on the heater or separately from the heater, in the coolant circuit.
It is important to ensure that coolant water flows through the heater in the right direction (coolant outlet at the top/ coolant inlet at the bottom). Failure to observe this will result in malfunctions.

The heater must be connected to the vehicle cooling system as shown in Fig. 801 or 802. The system must contain at least 4 litres of coolant.

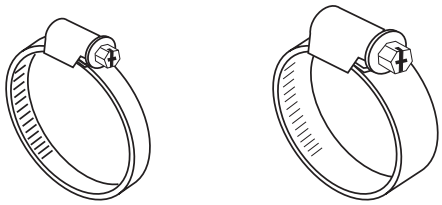
The heater must be integrated into the cooling circuit in the feed line to the on-board heat exchanger.

The coolant hoses supplied by Webasto must always be used. If other hoses are used, they must at least comply with DIN 73411. The hoses must be routed without kinking and, if possible, uphill to ensure proper bleeding. Hose connections must be supported by hose clips so they cannot slip off.

NOTE

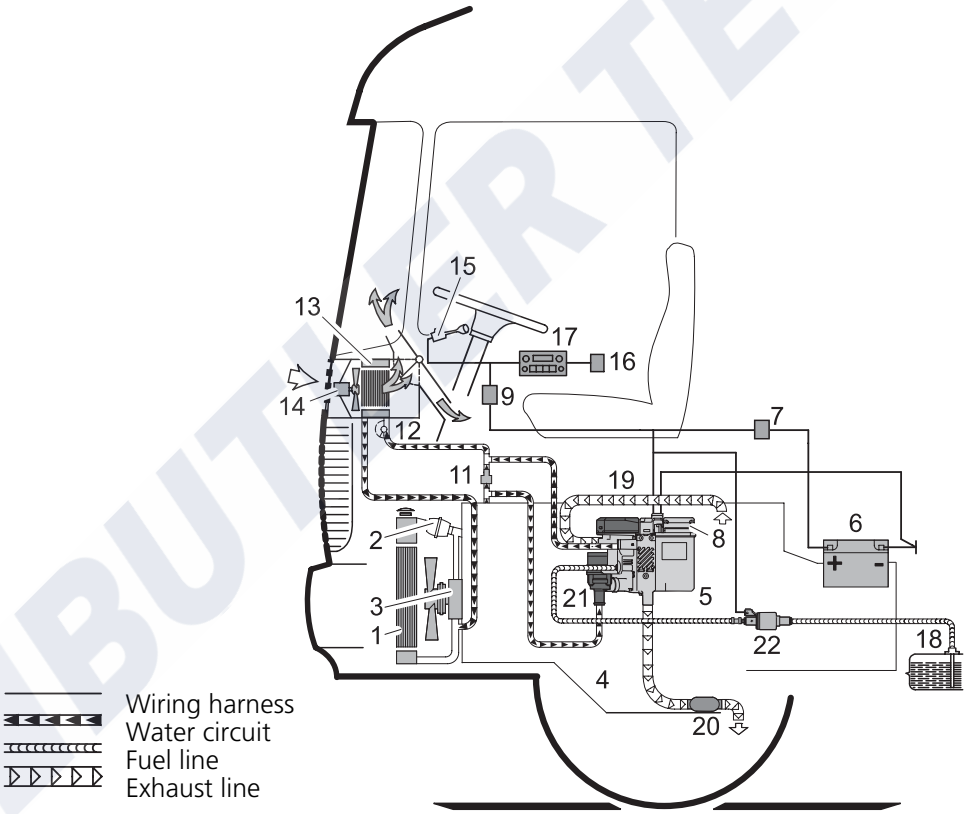
The hose clips on the heater must be fitted between the flared neck and the heater.

The hose clamps must be tightened with a torque of 1.5 Nm (previous clamps) or 5 Nm (new, wide clamps).



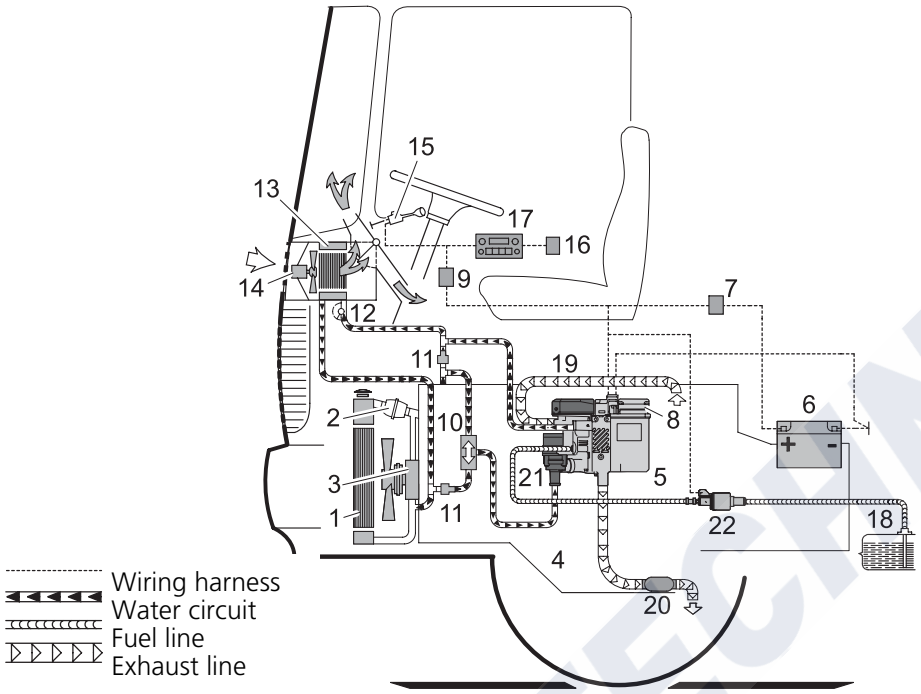
previous new

Care must be taken to bleed the cooling system before the heater is taken into service for the first time or after refilling with fresh cooling water. heater and lines must be installed in such a way as to ensure static bleeding.
Malfunctions due to overheating may occur during heating operation if the heater and lines have not been bled correctly.



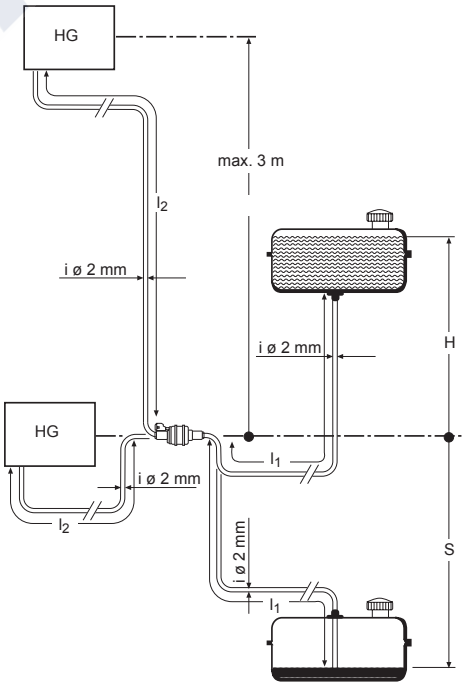
1 Radiator
2 Coolant thermostat
3 Water pump (of vehicle engine)
4 Vehicle engine with standard equipment
5 Water heater
6 Battery
7 Fuse holder
8 Control unit (in heater)
9 Relay (for vehicle fan)
10 Thermostat
11 Check valve with leak hole
12 Control valve of vehicle heater
13 Heat exchanger of vehicle heater
14 Fan of vehicle heater
15 Switch for fan of vehicle heater
16 Fuse block in vehicle
17 Digital timer
18 Fuel removal
19 Intake muffler, combustion-air intake pipe
20 Exhaust silencer
21 Circulating pump
22 Fuel metering pump

Fig. 801 Installation example, bypass integration with check valve



1 Radiator
2 Coolant thermostat
3 Water pump (of vehicle engine)
4 Vehicle engine with standard equipment
5 Water heater
6 Battery
7 Fuse holder
8 Control unit (in heater)
9 Relay (for vehicle fan)
10 Thermostat
11 Check valve with leak hole
12 Control valve of vehicle heater
13 Heat exchanger of vehicle heater
14 Fan of vehicle heater
15 Switch for fan of vehicle heater
16 Fuse block in vehicle
17 Digital timer
18 Fuel removal
19 Intake muffler, combustion-air intake pipe
20 Exhaust silencer
21 Circulating pump
22 Fuel metering pump

Fig. 802 Installation example, thermal circuit



$l_1 + l_2 \leq 10$ m
$l_1 \leq 1.2$ m
$l_2 \leq 8.8$ m

Fig. 803 Fuel supply

8.6.2 Connection to vehicle fuel system

The fuel is taken from the vehicle fuel tank or from a separate fuel tank.

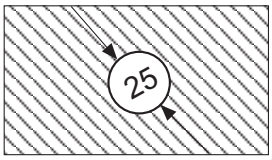
The information on permissible pressure at the fuel removal point is contained in the following table.

Permissible fuel inflow height (H) m	At max. perm. pressure (bar) in fuel line
0,00	0,20
1,00	0,11
2,00	0,03
Permissible fuel intake height S (m)	At max. perm. overpressure (bar) in fuel tank
0,00	-0,10
0,50	-0,06
1,00	-0,02

8.6.2.1 Fuel removal

The fuel must be taken from the vehicle fuel tank or from a separate tank (Fig. 804, 805 and 806). This separate fuel pickup precludes any effect of pressure.

Hole pattern



Only use a tank extractor with metal fuel tanks

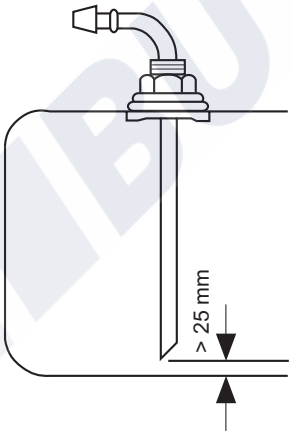


Fig. 804 Webasto fuel extractor

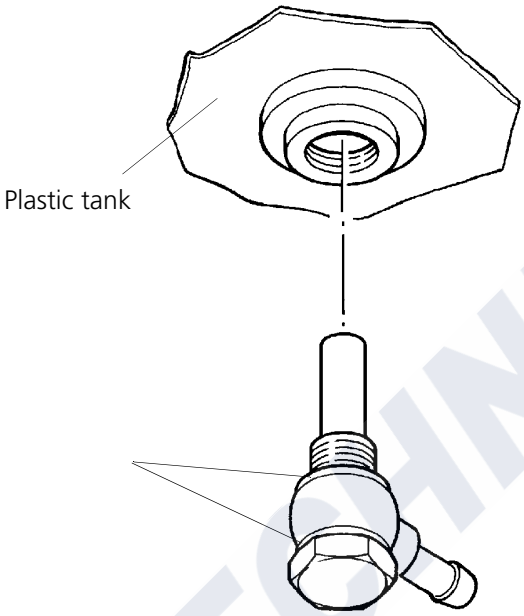


Abb. 805 Fuel removal from the plastic tank (removal via tank drain screw)

NOTE
The fitting must be made from metal!

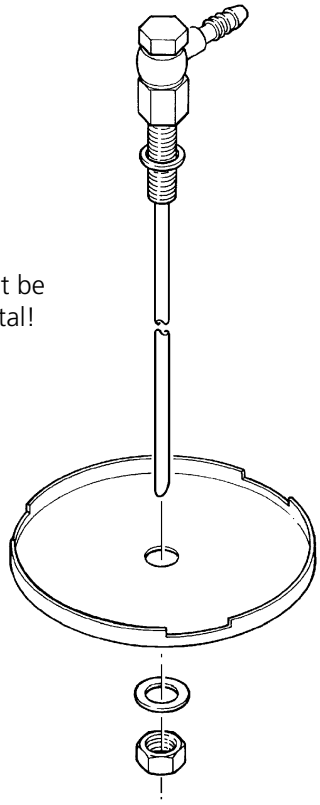


Fig. 806 Fuel removal from plastic tank (removal via fuel-tank sending unit)

8.6.2.2 Fuel lines

Only steel, copper and plastic lines of plasticised, light and temperature-stabilised PA 11 or PA 12 (e.g. Mecanyl RWTL) pursuant to DIN 73378 may be used for the fuel lines. Since the lines normally cannot be routed with a constant rising gradient, the internal diameter must not be allowed to exceed a certain size. Air or gas bubbles will accumulate in lines with an internal diameter of more than 4 mm and these will cause malfunctions if the lines sag or are routed downwards. The diameters specified in Fig. 803 will ensure that bubbles do not form.

The lines should not be routed downwards from the metering pump to the heater.

Unsupported fuel lines must be secured to prevent them sagging. They must be installed in such a way that they cannot be damaged by flying road chippings and **high temperatures** (exhaust line).

The fuel lines must be secure at the connections using hose clips to prevent their slipping.

Connecting two pipes with a hose

The correct procedure for connecting fuel lines with hoses is shown in Fig. 807.

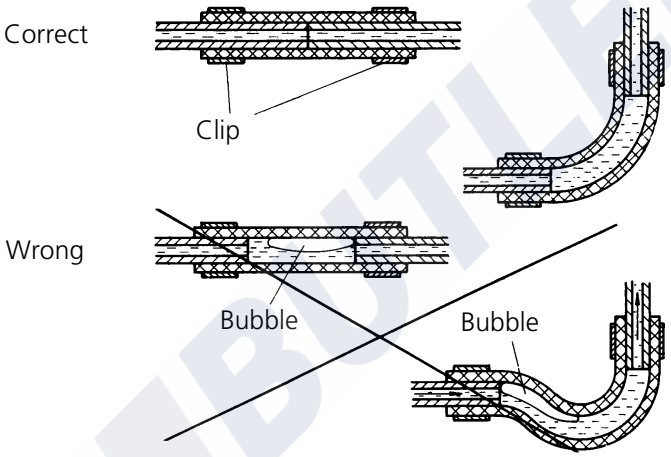


Fig. 807 Pipe/hose connection

8.6.2.3 Metering pump

The metering pump is a combined delivery, metering and shutoff system and is subject to specific installation criteria (see Fig. 803 and 808).

It is advantageous to mount the metering pump at a cool location as close to the fuel tank as possible. The maximum ambient temperature must not exceed +40 °C at any time during operation. The maximum pressure which occurs at the removal point must be below 1.5 bar.

The metering pump and fuel lines must not be installed within range of the radiated heat from hot vehicle parts. A heat shield must be used if necessary.

The metering pump must be secured with a vibration-damping mounting. Its installation position is limited as shown in fig. 808 in order to ensure effective auto-bleeding. As a result of the risk of corrosion, only genuine Webasto parts may be used for the plug connections between the metering pump and the metering pump wiring harness.

IMPORTANT

If PME (vegetable oil methyl ester) is used as fuel, care must be taken to ensure that the fuel lines and fuel filter are resistant to PME.

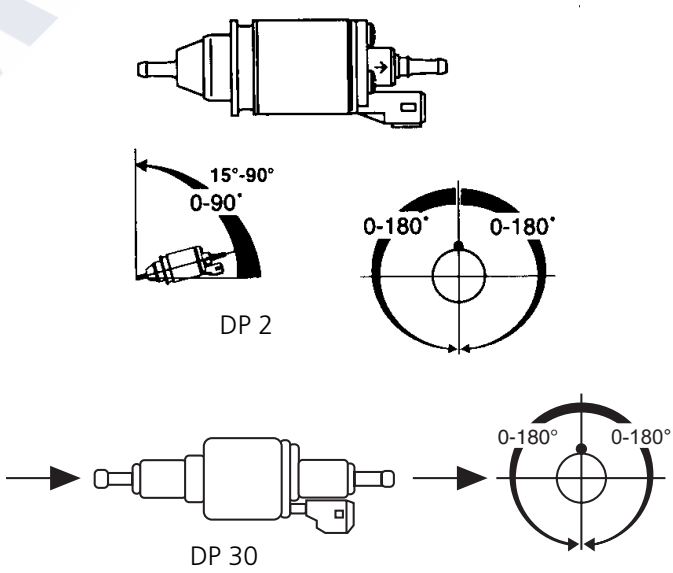


Fig. 808 Metering pump, installation position

8.6.2.4 Fuel filter

Only a Webasto filter, order no. 487 171, is allowed to be used if the fuel is expected to be contaminated. Install vertically if possible, however at least horizontally (check flow direction).

8.6.2.5 Combustion air supply

An intake line is required for combustion air.

The removal point for the combustion air must be in a splash-water-protected location.

The combustion air pipe can be routed with several bends (a total of 270°, and a smallest bending radius of 50 mm). The maximum length equals 1000 mm.

Under no circumstances may the combustion air be taken from areas occupied by people. A ventilation opening measuring at least 3 cm^2 is required if the heater is installed in an enclosed box.
If the temperature in the installation box exceeds the permissible ambient temperature of the heater, then the ventilation opening must be enlarged after consulting Webasto.

The intake opening for combustion air must be located so that it cannot become clogged with dirt.
It must **not** point in the direction of travel.

If the heater is installed in a common installation space near the vehicle tank, the combustion air must be taken in from the outside and the exhaust gas discharged into the atmosphere. The openings must be splash-proof.

8.6.3 Exhaust pipe

The exhaust pipe (inside diameter 22 mm) can be routed with several bends (270° altogether, minimum bending radius 50 mm). The total length of the exhaust line must be not less than 500 mm. The maximum length equals 1000 mm.

The exhaust silencer should be installed near the heater, however at least 200 mm from the heater.
The exhaust silencer must not be installed near the intake opening for the combustion air.
The heater may not be operated without a silencer.

NOTE

Accumulated condensation in the exhaust line must be discharged immediately. A condensate drain hole (3 mm dia.) may be drilled if necessary.

The opening of the exhaust pipe must not point in the direction of travel (see Fig. 809).

Rigid pipes of unalloyed steel with a minimum wall thickness of 1.0 mm or flexible piping of alloyed steel only must be used as exhaust line.

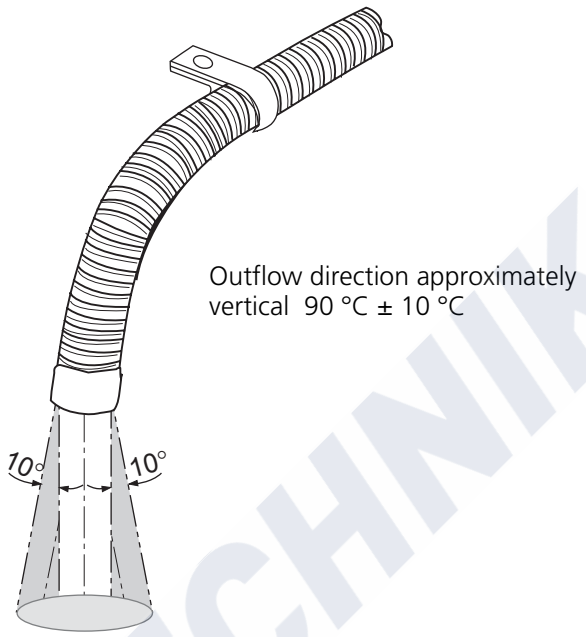


Fig. 809 Exhaust pipe mouth, installation position

8.7 Removal and installation

IMPORTANT

When installed, only the removal and installation procedure for the circulating pump is permissible, provided it is accessible (see 9.2.1).

8.7.1 Heater, removal and installation

8.7.1.1 Removal

1. Interrupt power supply of heater by removing 15 A blade fuse from Webasto fuse holder.
2. Remove central cover.
3. Separate connectors on heater.
4 Open coolant cap, release pressure and close cap again.

NOTE

The coolant must be prevented from escaping with hose clamping pliers or caught with appropriate containers.

5. Loosen hose clamp and pull coolant hoses off heater.
6. Remove heater from bracket.
7. Loosen hose clamps, pull off fuel line and seal off with suitable sealing plugs etc.

8.7.1.2 Installation

1. Bring heater into installation position.
2. Connect fuel line and secure with hose clamp.
3. Connect coolant hoses and secure with hose clamps.
4. Restore all electrical connections on plug connector.
5. Fit central cover.
6. Mount 15 A blade fuse.
7. Bleed coolant circuit.
8. Bleed fuel system if necessary.

8.8 Initial start-up

After installing the heater, the coolant circuit and fuel supply system must be carefully bled. Observe the vehicle manufacturer's specifications when doing so.

All coolant and fuel connections must be checked for leaks and secure attachment during a trial run of the heater. Should the heater malfunction during operation, troubleshooting (see Section 5) must be carried out.

Page for notes

9 Repairs

9.1 General information

These repair instructions describe the permissible repair work with the heater removed.
Any further dismantling will invalidate the warranty.
An operating check must be carried out following any repair work.

9.1.1 Measures on dismantled components

IMPORTANT
All sealing elements between the dismantled components must always be removed and replaced.

9.1.1.1 Cleaning

- All dismantled component must be cleaned.
- Completely and carefully remove any sealing compound from the components using a suitable tool.

9.1.1.2 Visual inspection

- Check all components for damage (cracks, deformation, wear, etc.) and fit new ones if necessary.
- Inspect the plugs and cables for corrosion, loose contacts, crimping faults, etc. and repair them if necessary.
- Check connectors for signs of corrosion and contacts to ensure they are secure.

9.2 Dismantling and assembling

9.2.1 Replacing circulating pump

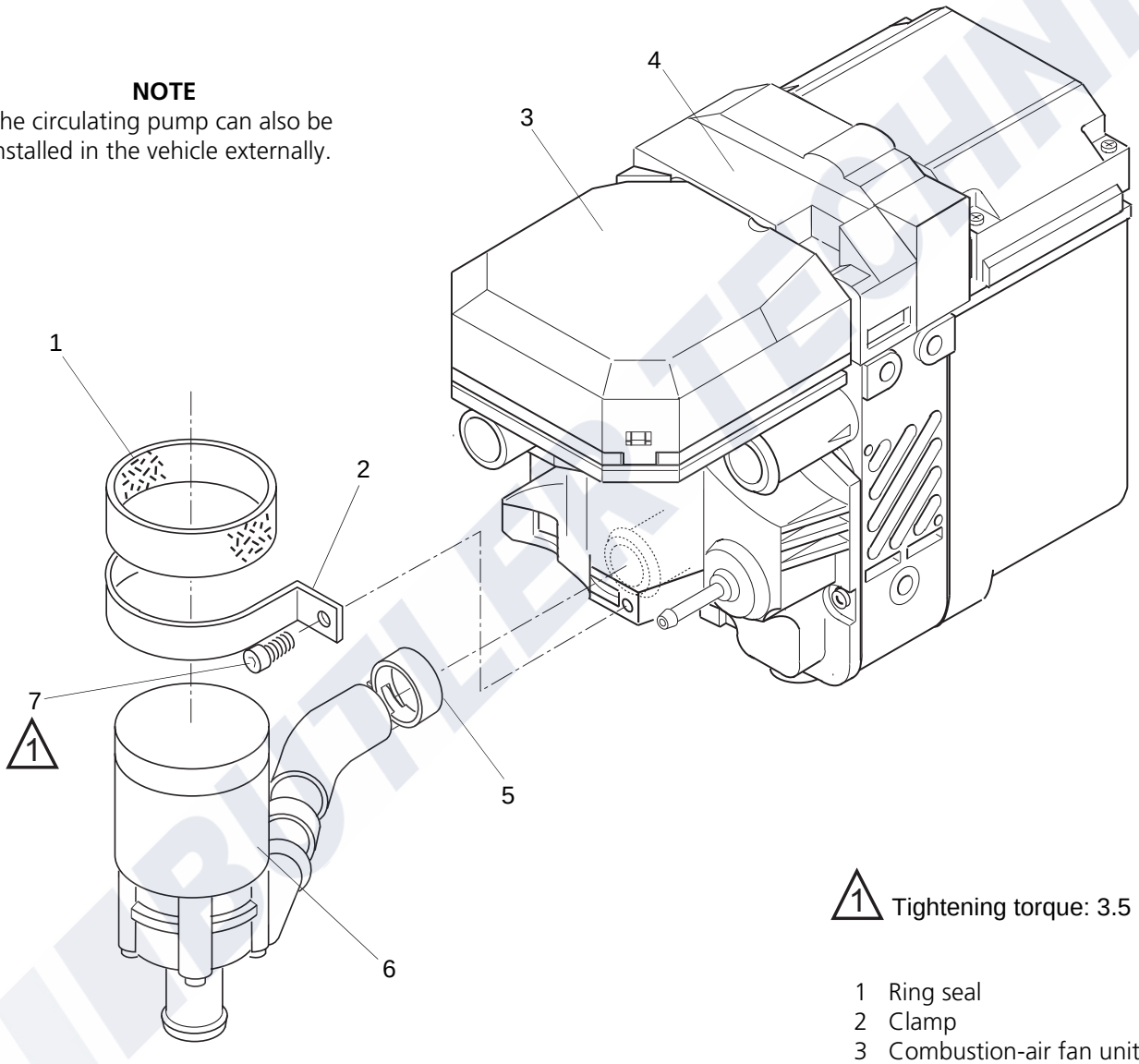
9.2.1.1 Removing

1. Remove central cover (4, Fig. 901) and separate electrical connection of circulating pump.
2. Loosen spring clip (5, Fig. 901).
3. Remove bolt (7) and clamp (2).
4. Pull off circulating pump (6) and spring clip (5).
5. Pull off ring seal (1) if necessary.
6. Carry out measures on dismantled components (see 9.1.1).

9.2.1.2 Installing

1. Slide spring clip (5, Fig. 901) onto hose end.
2. Slide ring seal (1) onto circulating pump (6) if necessary.
3. Move circulating pump (6) into attachment position and secure with clamp (2) and bolt (7) on combustion-air fan unit (3).
4. Mount spring clip (5).
5. Tighten screw (7) to 3.5 ± 0.3 Nm.
6. Connect electrical connector of circulating pump and fit central cover (4).

NOTE
The circulating pump can also be installed in the vehicle externally.



1 Tightening torque: 3.5 Nm

1 Ring seal
2 Clamp
3 Combustion-air fan unit
4 Central cover
5 Spring clip
6 Circulating pump
7 Bolt

Fig. 901 Replacing circulating pump

9.2.2 Replacing combustion-air fan unit

9.2.2.1 Removing

1. Remove circulating pump (see 9.2.1.1).
2. Separate electrical connector of combustion air fan.
3. Remove bolts (7, Fig. 902).
4. Pull combustion-air fan unit (1) off burner housing (10) or fuel connection piece (5).
5. Remove and discard gasket (2).
6. Carry out measures on dismantled components (see 9.1.1).

9.2.2.2 Installing

1. Position new gasket (2, Fig. 902) on burner housing (10).
2. Slide combustion-air fan unit (1) onto fuel connection piece (5) up to assembly position.
3. Secure combustion-air fan unit (1) with screws (7). Tighten bolts to 4 ± 0.4 Nm.
4. Mount electrical connectors of combustion-air fan.
5. Mount circulating pump (see 9.2.1.2).

9.2.3 Replacing burner

9.2.3.1 Removal

1. Remove circulating pump (see 9.2.1.1).
2. Remove combustion-air fan unit (see 9.2.2.1).
3. Press grommet of cable duct of heating element/flame monitor (4, Fig. 902) out of burner housing (10).
4. Remove screws (6).
5. Pull burner (3) with heating element/flame monitor (4) out of burner housing (10).
6. Remove and discard gasket (11).
7. Remove heating element/flame monitor (see 9.2.5.1) if necessary.
8. Carry out measures on dismantled components (see 9.1.1).

9.2.3.2 Installation

1. Install heating element/flame monitor (see 9.2.5.2) if necessary.
2. Position new gasket (11, Fig. 902) on burner housing (10).
3. Place burner (3) in its assembly position and secure it with screws (6). Tighten bolts to 4 ± 0.4 Nm.
4. Press grommet of cable duct of heating element/flame monitor into burner housing (10).
5. Mount combustion-air fan unit (see 9.2.2.2).
6. Mount circulating pump (see 9.2.1.2).

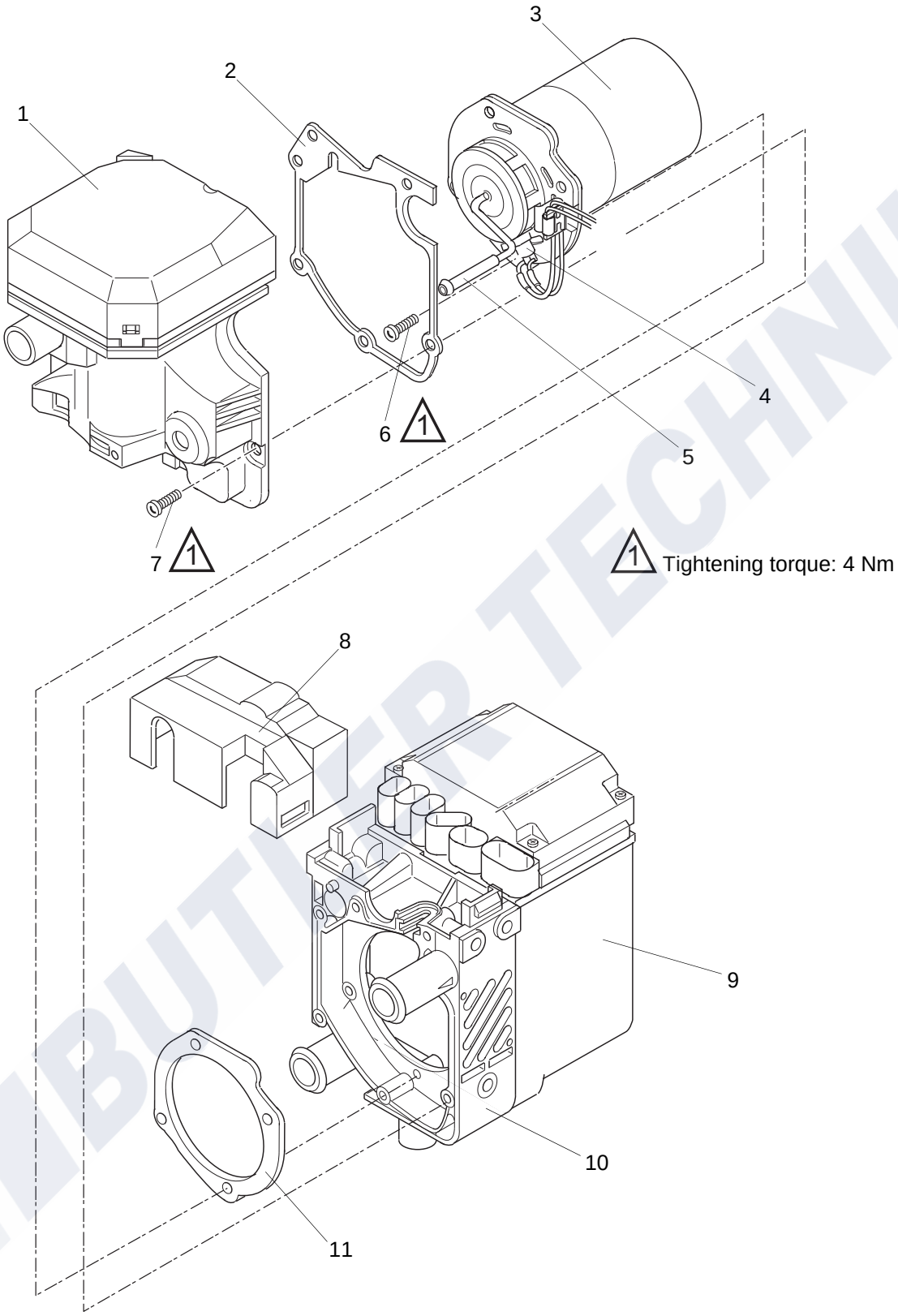
9.2.4 Replacing control unit/heat exchanger with burner housing

9.2.4.1 Removal

1. Remove circulating pump (see 9.2.1.1).
2. Remove combustion-air fan unit (see 9.2.2.1).
3. Press grommet of cable duct of heating element/flame monitor (4, Fig. 902) out of burner housing (10).
4. Remove screws (6).
5. Pull burner (3) with heating element/flame monitor (4) out of burner housing (10) and remove.
6. Remove and discard gasket (11).
7. Carry out measures on dismantled components (see 9.1.1).

9.2.4.2 Installation

1. Position new gasket (11, Fig. 902) on burner housing (10).
2. Place burner (3) in its assembly position and secure it with screws (6). Tighten bolts to 4 ± 0.4 Nm.
3. Press grommet of cable duct of heating element/flame monitor into burner housing (10).
4. Mount combustion-air fan unit (see 9.2.2.2).
5. Mount circulating pump (see 9.2.1.2).



1 Combustion-air fan unit
2 Gasket
3 Burner
4 Glow plug/Flame monitor
5 Fuel connection piece
6 Screw (4)
7 Screw (4)
8 Central cover
9 Control unit/heat exchanger
10 Burner housing
11 Gasket

Fig. 902 Dismantling heater

9.2.5 Replacing heating element/flame monitor

9.2.5.1 Removal

1. Remove circulating pump (see 9.2.1.1).
2. Remove combustion-air fan unit (see 9.2.2.1).
3. Press grommet of cable duct of heating element/flame monitor (5, Fig. 903) out of burner housing (11).
4. Pull heating element/flame monitor cable out of clip (4).

IMPORTANT

The heating element/flame monitor (5) can break easily and must be handled with the corresponding care.

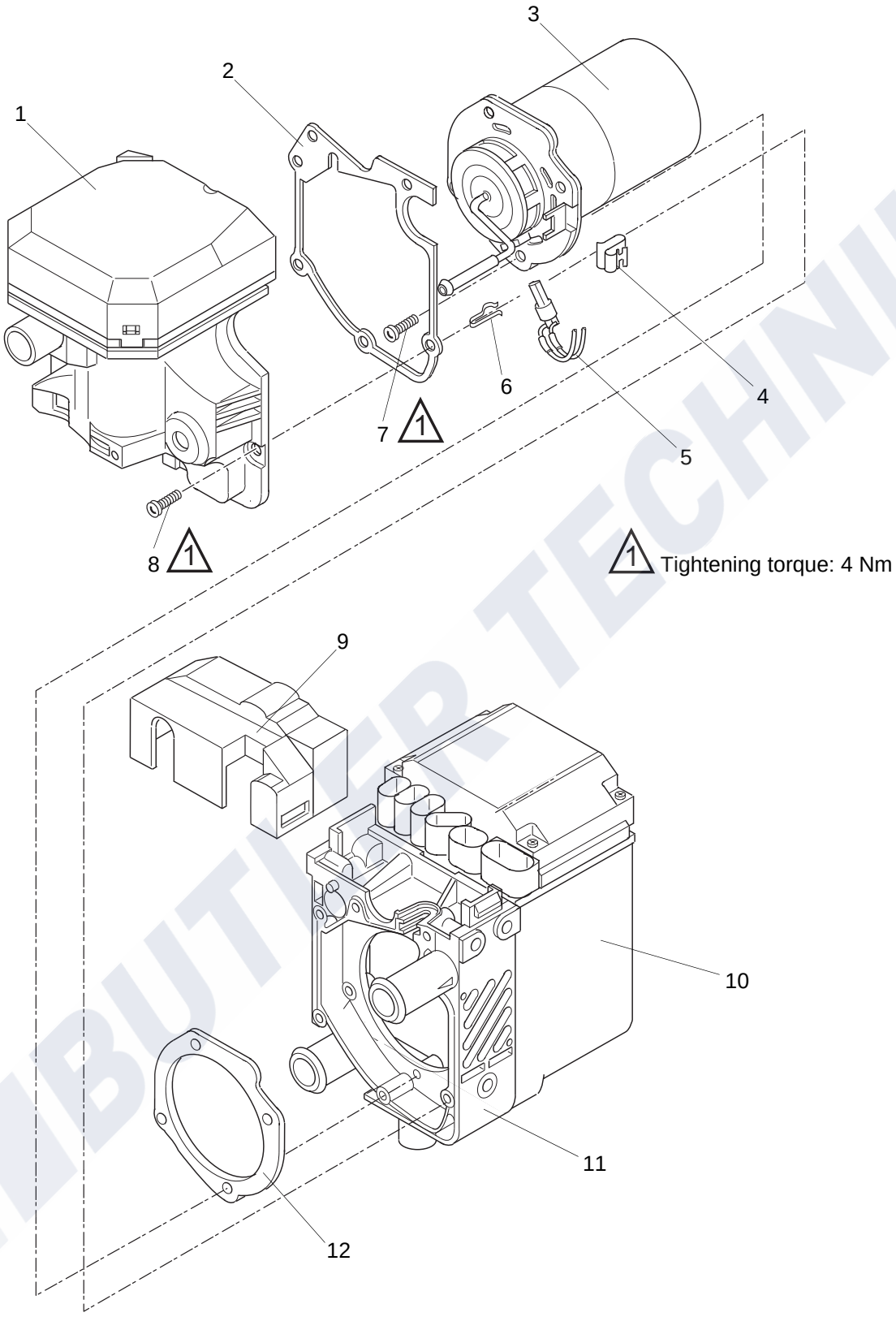
5. Remove clip (6) and pull heating element/flame monitor (5) out of burner and remove.
6. Carry out measures on dismantled components (see 9.1.1).

9.2.5.2 Installation

IMPORTANT

The heating element/flame monitor (5, Fig. 903) can break easily and must be handled with the corresponding care.

1. Carefully guide heating element/flame monitor (5) as far as possible into hole of burner (3).
2. Mount clip (6).
3. Mount clip (4) on bar if necessary.
4. Press heating element/flame monitor cable into clip (4).
5. Press grommet of cable duct of heating element/flame monitor into burner housing (11).
6. Mount combustion-air fan unit (see 9.2.2.2).
7. Mount circulating pump (see 9.2.1.2).



1 Combustion-air fan unit
2 Gasket
3 Burner
4 Clip
5 Glow plug/Flame monitor
6 Clip
7 Screw (4)
8 Screw (4)
9 Central cover
10 Control unit/heat exchanger
11 Burner housing
12 Gasket

Fig. 903 Replacing heating element/flame monitor

Page for notes

10 Packing, Storage and Shipping

10.1 General information

If the heater or its components are sent to Webasto AG for testing or repair, it must be cleaned and packed in such a way that it is protected against damage during handling, transport and storage.

IMPORTANT

If an entire heater is returned, then it must be completely drained.
It must be ensured that no fuel or coolant can escape during packing and/or shipping.
The coolant connection piece and the fuel connection must be sealed off with blind plugs.

Webasto AG
Postfach 80
D - 82131 Stockdorf
Germany

National:
Hotline: 01805 93 22 78
(€ 0,14 aus dem deutschen Festnetz)
Hotfax: 0395 5592 353
Hotmail: hotline@webasto.de
www.webasto.de

International:
www.webasto.com

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