

Water Heaters

Workshop Manual

Thermo Pro 90

Thermo Pro 90 12 V Diesel - ADR

Thermo Pro 90 24 V Diesel - ADR





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.

/// BUTLER TECHNIK

Table of Contents

1	Introduction	101
1.1	Contents and purpose	101
1.2	Meaning of signal words	101
1.3	Additional documentation to be used	101
1.4	General safety precautions	101
1.4.1	Statutory regulations governing installation	101
1.4.2	General safety precautions	101
1.5	Spare parts	102
2	General description	201
2.1	Combustion air fan	202
2.2	Heat exchanger	202
2.2.1	Coolant temperature sensor	202
2.2.2	Overheating protection	202
2.3	Burner unit	202
2.3.1	Glow plug	202
2.4	Combustion pipe	203
2.5	Exhaust temperature sensor	203
2.6	Circulation pump	203
2.7	Control unit	203
2.8	Metering pump	203
3	Description of Operation	301
3.1	Switching on and residual-heat utilisation phase	301
3.2	Starting and control mode	302
3.3	Switch off	302
3.4	Functions of heater in ADR vehicles	302
4	Technical Data	401
5	Faults, Troubleshooting	501
5.1	Troubleshooting without error code output	503
5.2	Troubleshooting with error code output	507
5.2.1	Error code output with Webasto Thermo Test PC Diagnosis	507
5.2.2	Error code output without Webasto Thermo Test PC Diagnosis	507
5.3	Visual inspection for evaluation of burner unit	510
5.3.1	Metal fibre evaporator	510
5.3.2	Combustion chamber	510
5.3.3	Entire burner unit	511

Table of Contents

Thermo Pro 90

6	Operating tests	601
6.1	General	601
6.2	Operating checks in vehicle	601
6.3	Adjusting CO2 content	601
6.4	Checking individual components	602
6.4.1	Resistance test of coolant temperature sensor	602
6.4.2	Resistance test of glow plug	602
6.4.3	Resistance test of exhaust temperature sensor	602
6.4.4	Testing combustion air fan	602
6.4.5	Testing DP42 metering pump	603
6.4.6	Testing overheating protection	603
6.4.7	Testing circulation pump	603
7	Circuit diagrams	701
8	Servicing work	801
8.1	Work on heater	801
8.2	Work on vehicle	801
8.3	Test run of heater	801
8.4	Checking work	801
8.5	Heater, removal and installation	801
8.5.1	Removal	801
8.5.2	Installation	802
8.6	Recommissioning	802
9	Maintaining and Replacing Components	901
9.1	General	901
9.2	Measures on components when dismantled	901
9.3	Disconnecting electrical connections	901
9.4	Replacing circulation pump	902
9.5	Replacing overheating protection	903
9.6	Replacing coolant temperature sensor	903
9.7	Replacing combustion air fan	905
9.8	Replacing burner unit and glow plug	906
9.9	Replacing burner head	907
9.10	Replacing heat exchanger	908
9.11	Replacing control unit	908
9.12	Replacing exhaust temperature sensor	908
10	Packing, Storage and Shipping	1001
10.1	General	1001
10.2	Storage	1001
10.3	Transport	1001

Table of Illustrations

Fig. 201	Thermo Pro 90	201
Fig. 202	Combustion air fan	202
Fig. 203	Heat exchanger	202
Fig. 204	Burner unit	202
Fig. 205	Burner head with combustion pipe	203
Fig. 206	Exhaust temperature sensor	203
Fig. 207	Circulation pump	203
Fig. 301	Operating sequence of Thermo Pro 90	301
Fig. 501	Overview of possible faults	503
Fig. 502	Overview of functional test of heater and its components	503
Fig. 503	Error code output by standard timer/switch.	507
Fig. 504	Visual inspection, rear wall of burner.	510
Fig. 505	Visual inspection, entire burner unit	511
Fig. 601	CO ₂ adjustment value (permissible from 10.5 to 14.1 vol. %).	602
Fig. 701	Connector assignment on control unit	701
Fig. 702	Positioning of electrical components on heater	701
Fig. 703	Wiring diagram for Thermo Pro 90, parking heater with standard timer without ADR.	703
Fig. 704	Circuit diagram for Thermo Pro 90, parking heater with On/Off switch without ADR.	704
Fig. 705	Circuit diagram for Thermo Pro 90, parking heater with On/Off switch with ADR with auxiliary drive.	705
Fig. 706	Circuit diagram for Thermo Pro 90, parking heater with On/Off switch with ADR without auxiliary drive.	706
Fig. 901	Replacing circulation pump	902
Fig. 902	Replacing overheating protection and coolant temperature sensor	904
Fig. 903	Replacing combustion air fan	905
Fig. 904	Replacing burner unit, glow plug, burner head and exhaust temperature sensor.	907
Fig. 905	permissible bending angle and permissible load	909
Fig. 906	Testing mica disc (insulation) on sensor.	909
Fig. 1001	Preferred position of Thermo Pro 90 heater for storage and transport	1001

1 Introduction

Thermo Pro 90

1 Introduction

1.1 Contents and purpose

This workshop manual serves to support instructed personnel, which repairs the Thermo Pro 90 water heater.

1.2 Meaning of signal words

Throughout this manual, the signal words WARNING, IMPORTANT and NOTE have the following meanings:

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 Pro 90 water heaters.

Information of the general installation and operating instructions is not contained in this workshop manual. If repairs are necessary, these documents must also be used.

1.4 General safety precautions

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 Statutory regulations governing installation

Homologation approvals according to the EC Directives 72/245/EEC (EMC), ECE-R 10 (EMC), 2001/56/EC (Heating) and ECE R-122 (Heating) and ECE R-10 03 (EMC) exist for the Thermo Pro 90 heater.

For the installation, primarily the regulations of Appendix VII of the Directive 2001/56/EC and the regulations contained in the installation instructions must be observed.

NOTE:

The regulations of these guidelines are binding in the scope of the EU Directive 70/156/EEC and/or EC/2007/46 (for new vehicle models from 29/04/2009) and should also be observed in countries in which there are no special regulations!

The Thermo Pro 90 water heater was designed for use in commercial vehicles. The applicable regulations must be taken into account when installing in special vehicles. Other uses must be clarified with Webasto in advance.

1.4.2 General safety precautions

The repair and commissioning of the unit may only be carried out by personnel trained by Webasto. The repair and installation of the unit may only be carried by trained experts in accordance with the workshop manual and the installation instructions.

The year of initial start-up must be permanently marked on the type label by removing the inapplicable years.

The heaters are approved for heating the motor vehicle engine and the vehicle cab, however not for heating the hazardous-material cargo area.

The heater may only be installed in motor vehicles or in independent heating systems with a minimum coolant quantity of 6 litres.

The heater may not be installed in the cab or the passenger compartment of vehicles. If the heater is nevertheless installed in an area of this type, then the installation box must be sealed off tight to the vehicle interior. The installation box must be sufficiently ventilated from the outside so that a maximum temperature of 60 °C is not exceeded in the installation box. Malfunctions can occur if this temperature is exceeded.

When checking the coolant level, the procedure described by the vehicle manufacturer must be followed.

Non-compliance with the installation instructions and the warnings contained therein will lead to the exclusion of all liability by Webasto. The same applies if repairs are carried out incorrectly or with the use of parts other than genuine spare parts. This will result in the invalidation of the General Type Approval for the heater and therefore of the General Homologation of the vehicle.

WARNING

The heater must not be operated:

- In filling stations and tank farms.
- At locations at which highly flammable gases or dusts can form, and at which highly flammable liquids or solid materials are stored (e.g. near fuel, coal and wood dust, grain warehouses, dry grass and leaves, cardboard, paper, etc.).
- In enclosed rooms (e.g. garages), not even via the timer or Teletart.
- Without at least 33 % brand name anti-freeze in the water of the heating circuit.

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

The heater including the control unit:

- may not be exposed to storage temperatures of more than +125 °C. The operating voltage may be connected at the time. Otherwise the electronics may suffer permanent damage.
- may only be operated with the fuel specified on the type label and at the nominal voltage specified on the type label.
- must be shut down by immediately switching off the heater and removing the fuse in case of heavy smoke, unusual combustion noises or fuel odours. The heater must not be restarted until the unit has been checked exclusively by personnel duly trained by Webasto.
- must be switched off during work in the engine compartment and **may not be cleaned with high-pressure cleaning units or compressed air.**
- Must be put into operation at least once a year for 10 minutes with the engine cold and the lowest fan speed selected.
- Must be checked by a professional every 2 years, at the commencement of the heating period.

Liability:

- Non-compliance with the installation/operating instructions and the warnings contained therein will lead to the exclusion of all liability by Webasto. The same applies if repairs are carried out incorrectly or with the use of parts other than genuine spare parts. This will result in the invalidation of the type approval for the heater and therefore of its homologation/EC type licence.

Be sure to read the operating instructions of the heater before commissioning.

1.5 Spare parts

The ID numbers of available spare parts can be found in the Webasto spare parts catalogue or online in the dealer portal at <http://dealers.webasto.com>.

2 General description

Thermo Pro 90

2 General description

The Thermo Pro 90 water heater is used in conjunction with the original vehicle heating system in the parking heating mode for

- cab and engine preheating,
- utilisation of residual vehicle engine heat.

The auxiliary heating mode can also be operated with the vehicle engine running.

Depending on the equipment, the ADR function is intended for the 12 V and 24 V variant.

The water heater operates independently of the vehicle engine and is connected to the cooling system, the fuel system and the electrical system of the vehicle.

The heater runs in controlled intermittent operation according to the coolant temperature.

Depending on the deviation of the current coolant temperature from the set-point temperature at the coolant temperature sensor, the burner output is controlled within a range of 1.8 to 7.6 kW. In case of a particularly high heating capacity requirement (preheating), the maximum output of 9.1 kW is available for 2 hours when the unit is switched on.

The Thermo Pro 90 heater mainly consists of the following components:

- Combustion air fan
- Heat exchanger
- Burner unit
- Circulation pump

The following components are arranged in the heater for control and monitoring:

- Control unit
- Exhaust temperature sensor
- Glow plug
- Coolant temperature sensor
- Overheating protection.

The burner motor speed is monitored with a sensor located in the control unit. Operation with a separate control unit is therefore not possible.

The fuel supply is provided from an external source via a metering pump, which is connected to the fuel system of the vehicle.

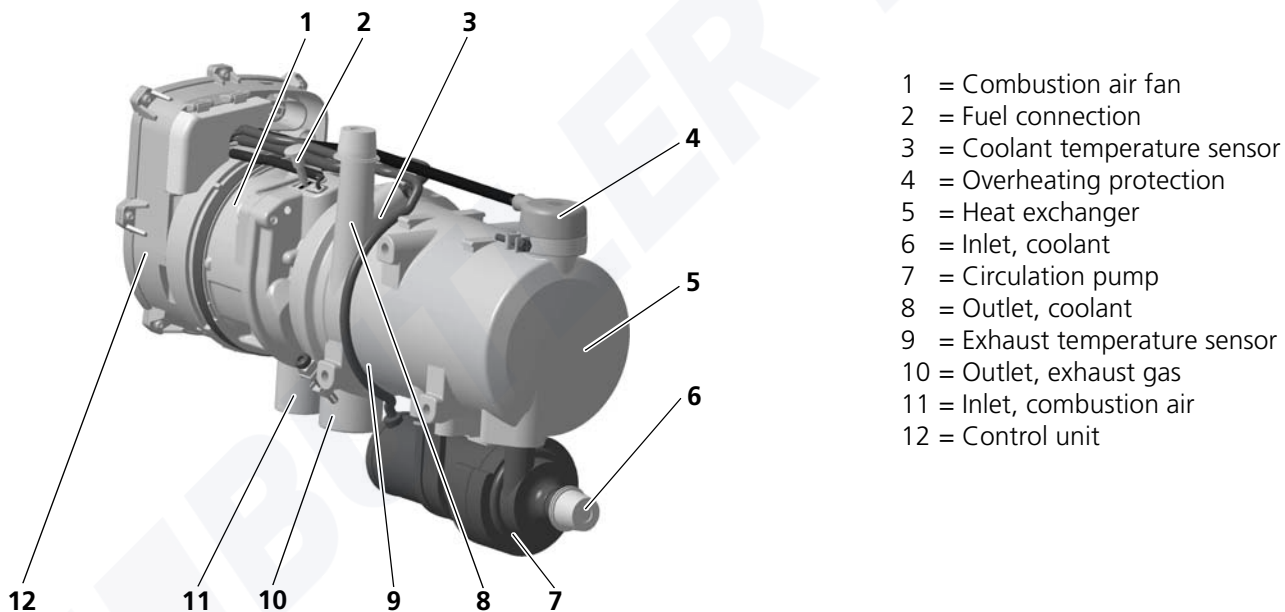


Fig. 201 Thermo Pro 90

2.1 Combustion air fan

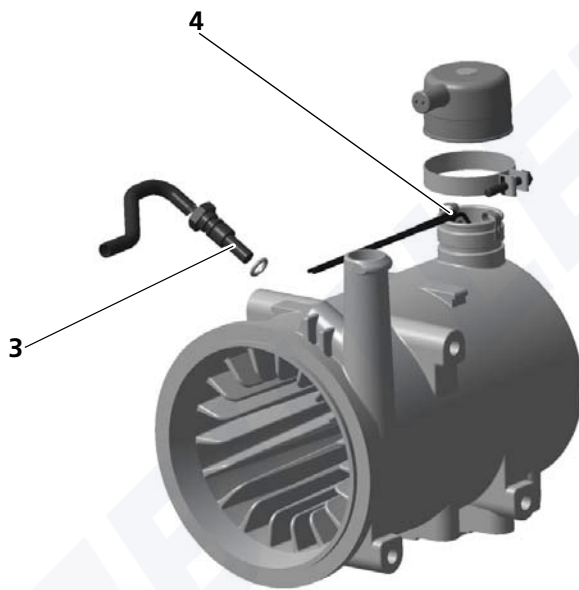
The combustion air fan feeds the air required for combustion to the burner unit.



Fig. 202 Combustion air fan

2.2 Heat exchanger

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



- 3 = Coolant temperature sensor
- 4 = Overheating protection

Fig. 203 Heat exchanger

2.2.2 Overheating protection

The overheating protection (bi-metal) protects the heater against impermissibly high operating temperatures. The overheating protection reacts at a heat transfer temperature above $127 \pm 7 \text{ }^{\circ}\text{C}$ and switches off the heater. The overheating protection is reset automatically at temperatures below $65 \pm 5 \text{ }^{\circ}\text{C}$.

2.3 Burner unit

The evaporation and pre-combustion of the fuel take place in the burner unit.

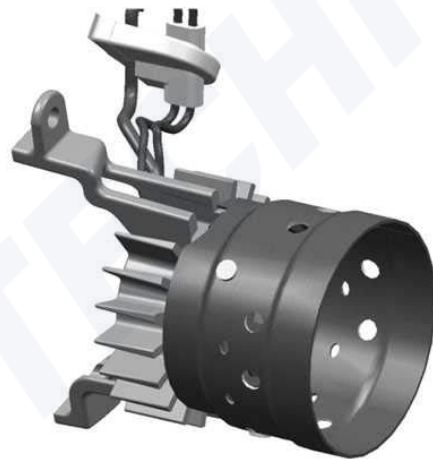


Fig. 204 Burner unit

2.3.1 Glow plug

The fuel-air mixture is ignited with the glow plug when the heater is started. The glow plug is positioned axially in the centre of the burner unit.

2.2.1 Coolant temperature sensor

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

2 General description

Thermo Pro 90

2.4 Combustion pipe

The combustion pipe supports the combustion of the fuel-air mixture, and as a result partially also the heating of the heat exchanger.

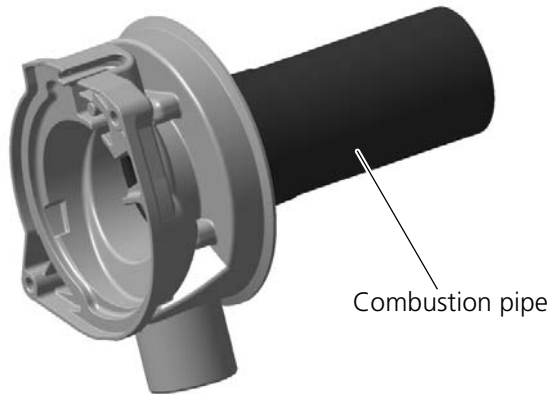


Fig. 205 Burner head with combustion pipe

2.5 Exhaust temperature sensor

The exhaust temperature sensor (ATS) is used to detect the flame and impermissible exhaust temperatures.



Fig. 206 Exhaust temperature sensor

2.6 Circulation pump

The circulation pump ensures the pumping of the coolant in the vehicle and/or heater circuit. The pump is switched on via the control unit and runs during the entire operating phase (even in the control break, during run-on and during the residual heat utilisation phase) of the heater.

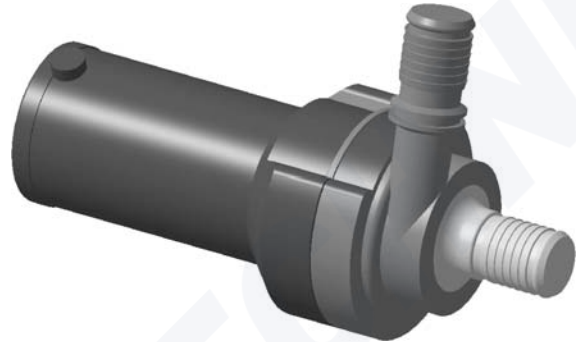


Fig. 207 Circulation pump

2.7 Control unit

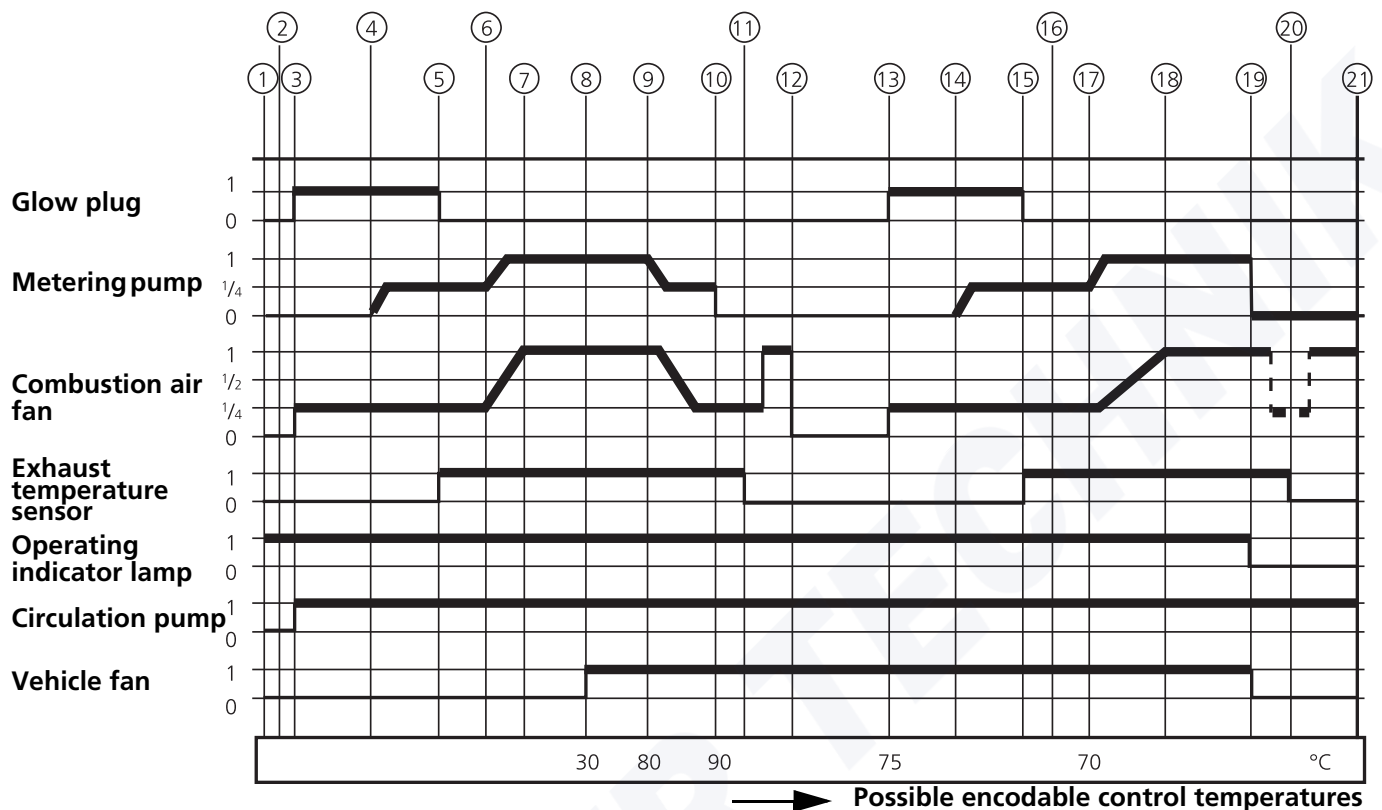
The control unit ensures the operating sequence and the monitoring of combustion operation.

2.8 Metering pump

The metering pump is used for the heater fuel supply. In addition, it also serves as a shut-off system with the heater switched off.

The magnetic coil of the metering pump receives the pulses from the microprocessor of the control unit.

3 Description of Operation



- | | |
|-------------------------------------|--------------------------------------|
| 1) Switching on | 12) Run-on ended |
| 2) Component check | 13) Preheating 15 to 20 sec. |
| 3) Preheating 40 s. | 14) Metering pump/partial load (1/4) |
| 4) Metering pump/partial load (1/4) | 15) "Flame ON" detection |
| 5) "Flame ON" detection | 16) Stabilisation time |
| 6) Stabilisation time | 17) Coolant temperature dropped |
| 7) Full load | 18) Full load |
| 8) Vehicle fan "On" | 19) Switching off (run-on) |
| 9) Control range | 20) "Flame OFF" detection |
| 10) Control break | 21) Run-on ended |
| 11) "Flame OFF" detection | |

Fig. 301 Operating sequence of Thermo Pro 90

3.1 Switching on and residual-heat utilisation phase

The heater is switched on depending on the equipment variant by means of a switch or standard timer.

Activating residual-heat utilisation phase

The coolant temperature is checked by the heater each time the heater is switched on, before the heating process. If the coolant temperature is above 60 °C, the residual-heat utilisation phase is activated automatically. When the residual-heat utilisation phase is active, the circulation pump of the heater and the vehicle fan are controlled automatically.

The activation of the residual-heat utilisation phase can only take place from the "OFF" state, i.e. in the "residual-heat utilisation phase" state, there is no transition from the states "Fault lock-out", "ADR lock-out" and "Heater lock-out".

Deactivating residual-heat utilisation phase

The residual-heat utilisation phase is deactivated:

- when the lower limit of the operating voltage is reached
- when the coolant outlet temperature is below 40 °C
- when the heater is switched off.

If the criteria a) or c) are met when activating the residual-heat utilisation phase or during the residual-heat utilisation phase, then there is a transition to the "OFF" state.

3 Description of Operation

Thermo Pro 90

If the criterion b) is met during the activation of the residual-heat utilisation phase or during the residual-heat utilisation phase, then the heater is automatically started.

3.2 Starting and control mode

After combustion begins (start), controlled heating automatically begins.

At a low coolant temperature, the boost heating capacity of 9.1 kW can be run for a maximum of 2 hours.

At a higher coolant temperature, the heating capacity is modulated between 1.8 kW and 7.6 kW. The objective is to achieve and maintain the control temperature.

The original vehicle heater fan does not switch until the coolant is sufficiently heated (from approx. 30 °C).

If the coolant temperature increases above the set-point value of the control temperature, and further to the control break threshold, the heater switches into the control break. The circulation pump, the original vehicle heater fan and the operation indicator continue to operate during the control break.

The heater starts again automatically after the coolant has cooled to the pre-encoded restart temperature.

3.3 Switch off

When the heater is switched off, the operation indicator on the standard timer/switch goes out. Combustion is ended and the run-on begins. However, the circulation pump, the glow plug and the combustion air fan continue to run during the run-on time to cool the heater. It is permissible to switch on the heater again during the run-on. However, restarting does not take place until after the run-on is complete.

3.4 Functions of heater in ADR vehicles

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

- the vehicle engine is shut down (generator signal (D+) is eliminated),
- a pumping device is put into operation (auxiliary drive signal (NA) is active).

In this case, combustion is ended and a reduced run-on, i.e. the ADR run-on, is initiated. 40 seconds after the ADR case occurs, the ADR run-on is ended.

Then the heater is in the "ADR lock-out" state. Before restarting, the On/Off switch must be set to "Off" and the auxiliary drive signal may no longer be active.

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

4 Technical Data

Heater	Operation	Thermo Pro 90	
		12 V	24 V
Approval symbol		E1 122R 00 0320 (Heater) E1 10R 03 6196 (EMC)	
Model		Water heater with evaporator-type burner	
Heat output	Max. Control range	9.1 kW 1.8 to 7.6 kW	
Fuel		Diesel DIN EN 590 PME DIN EN 14214	
Fuel consumption ± 10 %	Max. Control range	1.14 l/h 0.21 to 0.92 l/h	
Rated voltage		12 V	24 V
Operating voltage range		10.5 to 14.7 V	20 to 29 V
Nominal power consumption with circulation pump ± 10 % (without vehicle fan)	Max. Control range	≤ 90 W 37 to 83 W	
Perm. ambient temp.: Heater incl. control unit: - Operation - Storage Metering pump: - Operation - Storage		-40 to +80 °C -40 to +125 °C (heater off, operating voltage may be connected) -40 to +30 °C -40 to +85 °C	
Perm. operating gauge pressure (coolant)		2.5 bar	
Capacity of the heat exchanger		0.15 l	
Max. combustion-air intake temperature		+40 °C	
Max. fuel temperature		+30 °C	
Minimum quantity of coolant circuit		6.00 l	
Delivery rate of the circulation pump against 0.15 bar		1,650 l/h	
CO ₂ in exhaust gas (perm. function range)		8 to 13 vol. %	
CO ₂ adjustment values at approx. +20 °C and geodetic altitude of 0 m above sea level		10.5 vol. %	
Heater dimensions * From control unit to inlet connection piece of circulation pump Also see Fig. 2. (Tolerance ± 3 mm)		L = Length: 355 (381*) mm W = Width: 131 mm H = Height: 232 mm	
Weight		5.25 kg	

5 Faults, Troubleshooting

General

This section describes troubleshooting on the Thermo Pro 90 heater.

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.

In case of questions, the functional relationships are described in Section 2 or 3.

IMPORTANT

Error detection is generally limited to the localisation of the defective components. The following fault causes are not taken into account and should always be checked or a fault should be excluded for the following reasons:

- **Corrosion on connector**
- **Loose contact on connector**
- **Crimping error on connector**
- **Corrosion on lines and fuses**
- **Corrosion on battery terminals**
- **Impermissible high ambient temperature**

Each time an error is eliminated, a functional check must be carried out in the vehicle; switch the heater off and on again beforehand.

Procedure in case of errors or faults and lock-outs

IMPORTANT

Always determine the error cause for the lock-out first, then eliminate the lock-out.

If errors occur in the heater, they will be detected by the control unit as a fault. Depending on the type and weighting of the fault, a fault run-on can be initiated. When a fault run-on is initiated, the heater remains in the fault lock-out. In addition, a error code is output after a fault is detected during the fault switch-off.

The error code is displayed via:

- the operation indicator or
- the "ON/OFF" switch or
- Reading out of the error memory with Webasto Thermo Test PC Diagnosis.

The error code is used by the workshop or the authorised Webasto dealer for troubleshooting.

NOTE

In the Webasto Thermo Test PC Diagnosis, W bus must be selected under "Diagnosis" => "Device selection". It is recommended that the operating and fault data and the extended fault environment conditions be printed out.

Fault causes

A fault occurs when one or more error have occurred. Possible errors are, e.g.

- Overvoltage/undervoltage
- Malfunctions of all components, e.g. due to a short circuit or open circuit
- Overheating of the heater
- Impermissible exhaust temperature
- False starts
- Flame failures

Elimination of faults without Webasto Thermo Test PC Diagnosis

Switch on heater (switch/standard timer)



An error has occurred and is detected by the control unit as a relevant **fault**



Heater switches off due to the error, i.e. fault switch-off with subsequent **fault lock-out**.

The error code is output with the switch/standard timer.



Determine error cause (e.g. with or without **error code output**, visual inspection of fuses and connectors, etc.)



Eliminate error



Switch off heater



Switch on heater



Fault lock-out unlocked

Elimination of faults with Webasto Thermo Test PC Diagnosis

Switch on heater (switch/standard timer or with "Parking Heating" button)



An error has occurred and is detected by the control unit as a relevant **fault**



Heater switches off due to the error, i.e. fault switch-off with subsequent **fault lock-out**.



Determine cause of error by reading out **error memory**! The error memory is read out by clicking the "Error list" button.

Always **print error memory** first or note!

Then clear error memory with the "Clear fault memory and heater interlock" command in the "Error memory" menu.



Eliminate error



Switch off heater



Switch on heater



Fault lock-out unlocked

Certain errors result in the errors being added up in the error memory. If the number of errors in the error memory has exceeded a limit, the heater changes over to the heater lock-out. The maximum number of errors in the error memory or the error memory limit is defined by Webasto.

Heater lock-out

With Webasto Thermo Test PC Diagnosis

Is unlocked as follows:

1. **Switch on heater** (switch/standard timer or with "Parking Heating" button)
2. Clear the error memory with the "Clear fault memory and heater interlock" command in the "Error memory" menu.
3. Delete the heater lock-out by clicking the "Delete heater lock-out" button in the "Error memory" menu
4. **Switch off heater** (switch/standard timer) or with "Parking Heating" button of heater

Without Webasto Thermo Test PC Diagnosis

Is unlocked as follows:

1. **Switch on heater** (switch/standard timer)
2. At the latest 10 s after switching on, remove the fuse **F3** for at least 10 s.
3. Reinstall fuse **F3**
4. **Switch off heater**

5 Faults, Troubleshooting

Thermo Pro 90

5.1 Troubleshooting without error code output

Possible faults

The overview only shows some of the possible faults. The Webasto Service Hotline must be contacted in individual cases.

IMPORTANT

The error points specified from Tables Fig. 501 and Fig. 502 DO NOT match the error code numbers for error code output!

Heater Mode	Fault Description	Possible error point (see Table Fig. 502)
Start	Heater does not react, no component starts up, no display by operation indicator	6, 8
	Heater does not start, short start-up, then changes into run-on immediately, operation indicator flashes (error code output)	1, 2, 3, 4, 5, 10
	Heater smokes in start-up phase	2, 9, 10, 12, 15, 19
Combustion operation	Heater runs through start, however switches off prematurely	7, 9, 10, 12, 13, 15, 19, 20
	Heater has rough combustion	9, 12, 19
	Heater smokes in heating phase	9, 12, 15, 19, 21
	Heater runs, vehicle interior cold	17
Run-on	Heater smokes in run-on phase	15, 19
Other	Fuel odour	1, 2, 12
	Exhaust odour in vehicle interior	16
	Coolant loss	11, 14

Fig. 501 Overview of possible faults

Functional test of heater and its components

Error point	Component	Recommended workshop action	Parameter
1	DP42 metering pump	Check continuity and seating of flat spring contacts of metering pump line	
		Measure cold resistance of DP42 metering pump at 25 °C, also see Section 6.4.5	4.95 to 5.45 ohms, Test current: < 1 mA
2	Glow plug	Measure glow-plug resistance value on glow plug connector X2 , also see Section 6.4.2	Cold resistance at 25 °C: – 0.235 to 0.305 ohms for the 12 V variant – 0.670 to 0.870 ohms for the 24 V variant ("green" marking on glow plug)
3	Coolant temperature sensor	For information on checking the cold resistance of the coolant temperature sensor, also see Section 6.4.1	At 25 °C: 990 to 1,010 ohms, Test current: < 1 mA

Fig. 502 Overview of functional test of heater and its components

Error point	Component	Recommended workshop action	Parameter
4	Combustion air fan	Combustion air fan short circuit/open circuit Check fan wiring and replace component if necessary	
5	U4840 circulation pump	Check wiring	
		Conduct component test to check function of circulation pump with Webasto Thermo Test PC Diagnosis.	Touch pump with hand; pump functions if slight vibration or running can be felt
		Check self-bleeding installation position, also see Section 8.5.2	
6	Power supply	With Webasto Thermo Test PC Diagnosis Measure operating voltage from Webasto Thermo Test PC Diagnosis	Check fuse F1 Check power supply
		Without Webasto Thermo Test PC Diagnosis Measure power supply on heater unit connector X8 , Pin 12 (also see Fig. 703, Fig. 704 and Fig. 705)	
7	Undervoltage detection	With Webasto Thermo Test PC Diagnosis Measure operating voltage from Webasto Thermo Test PC Diagnosis	<ul style="list-style-type: none"> 12 V variant: The voltage may not drop below 10.5 V for more than 10 consecutive seconds 24 V variant: The voltage may not drop below 20.0 V for more than 10 consecutive seconds Check fuse F1
		Without Webasto Thermo Test PC Diagnosis Measure power supply on heater unit connector X8 , Pin 12 (also see Fig. 703, Fig. 704 and Fig. 705)	
8	Operation indicator (standard timer or ON/OFF switch)	When the immediate heat button/switch is operated, the light in the display/switch is activated	Operation indicator of standard timer: <ul style="list-style-type: none"> Measure power supply on connector X9, Pin 11 Check continuity on connector X9, Pin 12 to earth Check fuse F2
			Operation indicator of switch: <ul style="list-style-type: none"> Measure power supply on switch S4, Pin A Check continuity on switch S4, Pin F to earth Check fuse F2
9	DP42 metering pump	Measure fuel feed rate (use Webasto Thermo Test PC Diagnosis for controlling the metering pump), also see Section 6.4.5	Diesel feed rate at metering pump frequency of 9 Hz and feed time of 180 s: 49.5 to 54.7 ml
		Check fuel line connection to DP42 metering pump	

Fig. 502 Overview of functional test of heater and its components

5 Faults, Troubleshooting

Thermo Pro 90

Error point	Component	Recommended workshop action	Parameter
10	Combustion air fan	Combustion air fan sluggish. Conduct component test on function of fan motor with Webasto Thermo Test PC Diagnosis.	<ul style="list-style-type: none"> Specify a set-point speed of 6,000 rpm Listen for rubbing and friction noises. In addition, start-up must be audible up to the specified speed No "Sluggish fan start" fault message may be output
11	U4846 circulation pump	Check pump for leaks	
12	Fuel connection	Observe fuel fill level and fuel removal from tank	
		Check integration in vehicle fuel system	
		Check fuel lines for leaks, kinking and clogging, especially in the area of the intake-side line connectors	
		Disconnect the fuel line from the heater, hold the hose in a catch container and operate the metering pump with the Webasto Thermo Test PC Diagnosis for 180 s at 9 Hz. When doing so, watch whether the fuel is pumped bubble-free	
		If fuel sprays out of the line when the line is separated from the heater, the fuel pipe of the burner unit is probably clogged. If this is the case, the burner unit must be replaced.	
13	Coolant circuit	Check the integration in the vehicle coolant circuit in accordance with the general installation instructions	
		Check whether coolant circuit is correctly bled	
		Check circulation in coolant circuit	
14	Coolant circuit	Eliminate kinks and rubbing spots	
		Check leaks on heater, water connection piece, circulation pump and hoses and eliminate	
15	Exhaust system and air intake system	Check whether intake pipe and exhaust pipe are routed in accordance with general installation instructions	
		Check to make sure lines are not clogged	
		Eliminate existing leaks on intake pipe and exhaust pipe (no CO ₂ in intake air)	
		The exhaust pipe outlet may not be routed under the intake pipe inlet	
16	Exhaust system and air intake system	Check whether sufficient distance is present to passenger compartment fresh-air intake of vehicle	No exhaust gas may be sucked in through the combustion air pipe

Fig. 502 Overview of functional test of heater and its components

Error point	Component	Recommended workshop action	Parameter
17	Vehicle fan	Check fuse F1	
		Observe coolant temperature (K5 switches at approx. 25 °C)	
		Check switching signal on the relay K5 , ground on Pin 85 and positive on Pin 86 (audible, also see wiring diagram in general installation instructions)	
		Check coolant temperature signal wire (green/white, gn/wh), Pin 86 on K5	
18	Control unit/ heater locked	<p>Determine error cause for lock-out, then eliminate lock-out.</p> <p>A distinction is made between 3 types of lock-out:</p> <ul style="list-style-type: none"> – Fault lock-out Unlocking by pressing ON/OFF switch – ADR lock-out See Fault lock-out When ADR is triggered by the auxiliary drive, it must be deactivated before switching on the heater again – Heater lock-out Unlock: <ol style="list-style-type: none"> 1) Switch on heater (with switch or standard timer) 2) Remove fuse F3 for at least 10 s. 3) Switch off heater (only with switch). 4) Reinstall fuse F3. 	
19	Burner unit	Dismantling and visual inspection	
20	Sooting: Exhaust gas temperature has increased to maximum permissible value.	Dismantling and visual inspection of burner unit, exhaust temperature sensor, combustion pipe and heat exchanger	Clean or completely replace depending on condition
21	Optional room thermostat	Room thermostat B4 does not switch	Clean or replace components
		Check connection	

Fig. 502 Overview of functional test of heater and its components

5 Faults, Troubleshooting

Thermo Pro 90

5.2 Troubleshooting with error code output

The error code is displayed via:

- the operation indicator or
- the "ON/OFF" switch or
- Reading out of the error memory with Webasto Thermo Test PC Diagnosis.

NOTE

In the Webasto Thermo Test PC Diagnosis, W bus must be selected under "Diagnosis" => "Device selection". It is recommended that the operating and fault data and the extended fault environment conditions be printed out.

5.2.1 Error code output with Webasto Thermo Test PC Diagnosis

The fault memory of the heater can be read out with the Webasto Thermo Test PC Diagnosis by clicking the "Error list" button.

The fault memory displays up to 8 different faults. The older an fault is, the higher its number.

The current operating duration and the current start-up number are entered in the control unit summary.

If a fault is entered as "current" then the control unit has discovered this fault since the last switch-on.

The fault message "Initial starting attempt failed" remains current until either full-load combustion operation is achieved in the restart or the second start-up also fails. In this case, the fault message "Initial starting attempt failed" is deleted and replaced with "No start".

The fault message "Flame failure" remains current until the heater is switched off or several flame failures lead to the heating mode being aborted. In this case, the fault message "Flame failure" is deleted and replaced with "Flame failure (FAZ)".

5.2.2 Error code output without Webasto Thermo Test PC Diagnosis

Equipment with On/Off switch

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

Equipment with standard timer

If the system is fitted with a standard timer, the fault is indicated on the timer's display after an error has occurred.

Error code number/ Number of flashing pulses	Fault message	Possible causes	Recommended workshop action
0	No function (only five short flashing pulse)	Fuses	Check fuses F1, F2 and F3
		Electrical wiring	Check battery connections: + on 12/- on 9/+ on 3 (switch-on signal), connector X8
		Heater lock-out	Delete heater lock-out
		Control unit defect	Replace control unit
1	No start	Fuel system	Check fuel level
			Check fuel filter
			Check fuel standpipe and fuel line for leaks
			Bleed fuel system
2	Flame failure in combustion mode	Combustion air/exhaust pipe	Check combustion air/exhaust pipe for foreign bodies and clean if necessary
		Burner unit	Clean burner unit and replace if necessary
			Check fuel level
			Check fuel filter
		Fuel system	Check fuel standpipe and fuel line for leaks
			Bleed fuel system
			Clean burner unit and replace if necessary

Fig. 503 Error code output by standard timer/switch

Error code number/ Number of flashing pulses	Fault message	Possible causes	Recommended workshop action
3	Supply voltage too high/Operating voltage too low	Power supply	Check battery
			Check electrical connections
4	Flame was detected prior to combustion	Exhaust temperature sensor defective	Functional check of exhaust temperature sensor; replace exhaust temperature sensor if necessary
5	Not available	Not available	Not available
6	Coolant temperature sensor defective	Wiring	Check wiring for damage, open circuit and short circuit
		Coolant temperature sensor defective	Functional check of coolant temperature sensor; replace if necessary
7	Metering pump defective	Wiring	Check wiring for damage, open circuit and short circuit
		Metering pump defective	Functional check of metering pump; replace metering pump if necessary
8	Combustion air fan defective	Wiring	Check wiring for damage, open circuit and short circuit
		Combustion air fan is blocked	Functional check of combustion air fan; replace combustion air fan if necessary
		Combustion air fan defective	Replace combustion air fan
9	Glow plug defective	Wiring	Check wiring for damage, open circuit and short circuit
		Glow plug defective	Functional check of glow plug; replace glow plug if necessary
10	Overheating	Heater overheated	Check coolant level, bleed coolant circuit
			Check circulation pump for operation
		Coolant temperature sensor defective	Check wiring for damage, open circuit and short circuit
			Functional check of coolant temperature sensor; replace if necessary
11	Circulation pump defective	Wiring	Check wiring for damage, open circuit and short circuit
		Circulation pump defective	Replace circulation pump
12	Battery main switch short circuit	Wiring	Check wiring for damage, open circuit and short circuit
		Electronic battery switch defective	Replace electronic battery switch (S10, see Chap. 7)
13	Output vehicle fan short circuit	Wiring	Check wiring for damage, open circuit and short circuit
		Vehicle fan relay	Check wiring for damage, open circuit and short circuit
14	Overheating protection defective	Wiring	Check wiring for damage, open circuit and short circuit
		Overheating protection sensor defective	Functional check of overheating protection sensor; replace if necessary
15	Reference resistance not reached during start	Wiring	Check glow plug wiring for damage, open circuit and short circuit
		Glow plug defective	Functional check of glow plug; replace glow plug if necessary

Fig. 503 Error code output by standard timer/switch

5 Faults, Troubleshooting

Thermo Pro 90

Error code number/ Number of flashing pulses	Fault message	Possible causes	Recommended workshop action
16	Exhaust gas temperature too high	Exhaust temperature sensor defective	Check wiring for damage, open circuit and short circuit Functional check of exhaust temperature sensor; replace exhaust temperature sensor if necessary
		Heater sooted	Visual inspection with cleaning or replacement of burner unit, burner head and inner surface of heat exchanger
17	Exhaust temperature sensor defective	Wiring	Check wiring for damage, open circuit and short circuit
		Exhaust temperature sensor defective	Functional check of exhaust temperature sensor; replace exhaust temperature sensor if necessary

Fig. 503 Error code output by standard timer/switch

5.3 Visual inspection for evaluation of burner unit

Observe the specific features of the burner unit if it needs to be replaced or no source of error is apparent. The criteria for proper checking are listed in the following.

First, the burner unit is checked for completeness and proper condition according to Fig. 504.

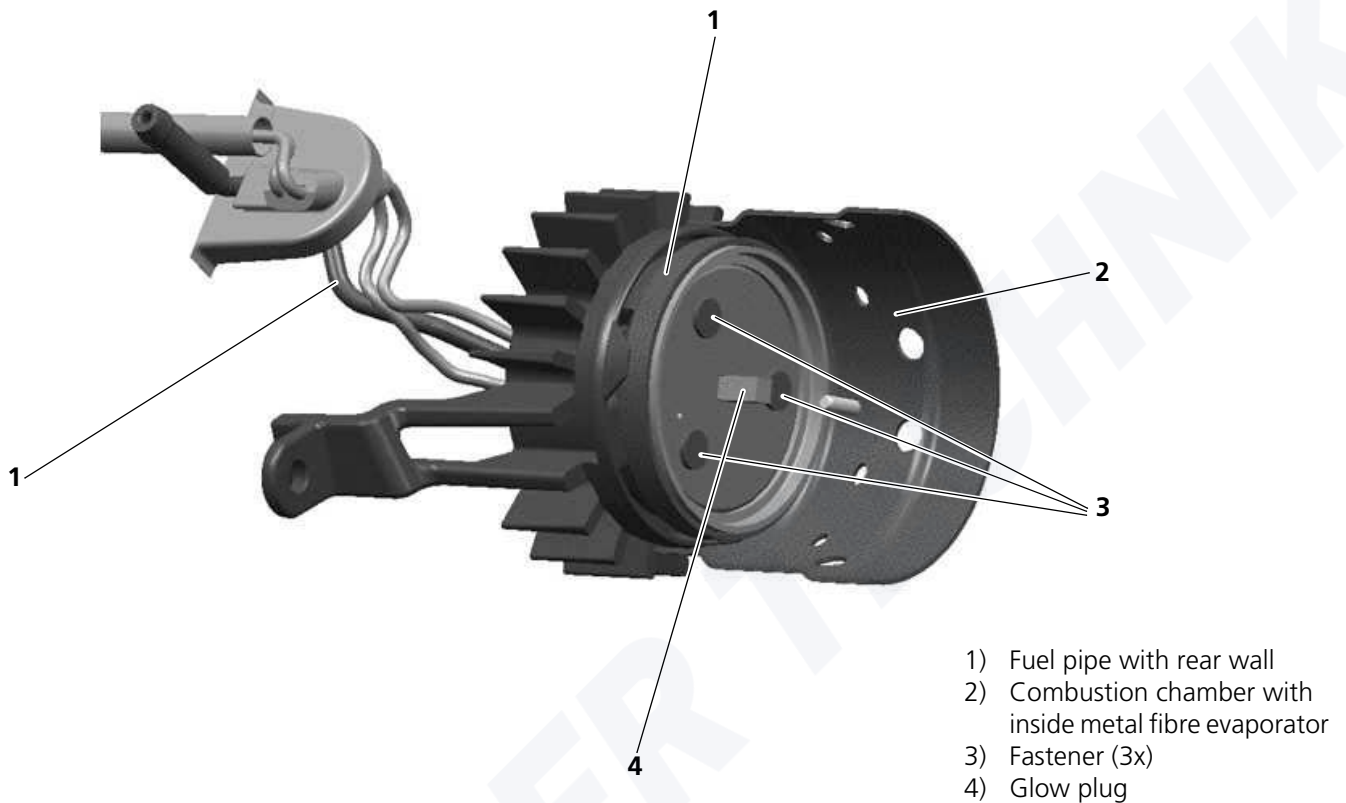


Fig. 504 Visual inspection, rear wall of burner

5.3.1 Metal fibre evaporator

- Cracks, chipping and black or other discolourations of the metal fibre evaporator do not result in burner failure and have no negative effect on operation.
- Coke deposits on the evaporator surface are common; the burner unit generally cleans itself thanks to the load change from full load/partial load and partial load/full load.
- If the metal fibre evaporator is partially burned away the burner unit must be replaced.
- The retaining ring is deformed. As a result, the metal fibre evaporator is not pressed on correctly and the burner unit must be replaced.

5.3.2 Combustion chamber

- The combustion chamber (Fig. 505) should not be damaged (e.g. dented). A dented combustion chamber can result in poor combustion or carbonising of the heater.

Remedy

Replace burner unit

- The air holes (Fig. 505) in the combustion chamber may not be clogged with coke. Air holes clogged with coke can result in a failure to start or poor combustion.

Remedy

Carefully clear air holes by scraping

5 Faults, Troubleshooting

Thermo Pro 90

- Fasteners (3x) of metal fibre evaporator are deformed or missing. Therefore, metal fibre evaporator is not pressed on correctly.

Remedy

Replace burner unit.

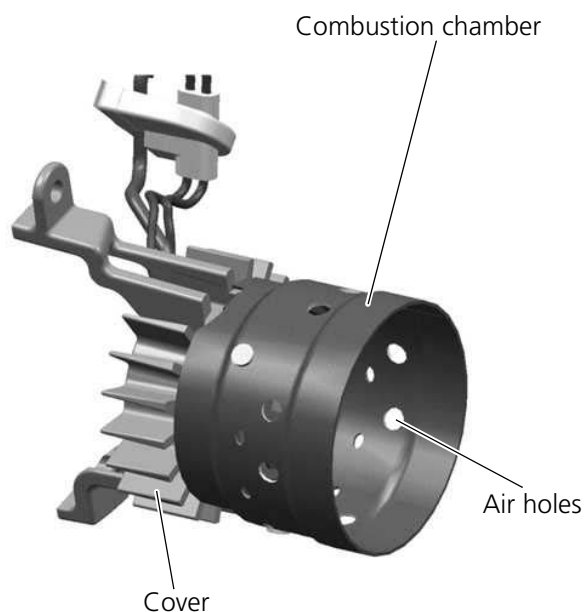


Fig. 505 Visual inspection, entire burner unit

5.3.3 Entire burner unit

- The cover and the combustion chamber (Fig. 505) must be permanently connected and may not have any clearance (check by moving slightly).

Remedy

Replace burner unit.

- If there is a radial air gap between the combustion chamber and the cover, the burner unit must be replaced.
- The fuel pipe is permanently connected to the rear wall and may not have any clearance (check by moving the fuel pipe slightly).
Remedy in case of clearance between fuel pipe and rear wall: Replace burner unit.

6 Operating tests

6.1 General

This section describes the tests and adjustments of the heater and its components in the installed and the removed state.

WARNING

The heater may not be operated in closed rooms, such as garages or workshops, without exhaust extraction, not even with time preselection.

6.2 Operating checks in vehicle

1. Set the vehicle fan to fan speed 1 - 2 or to the speed recommended in the vehicle-specific operating instructions.
2. Make sure that the fresh-air inlet is clear 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.
4. Switch on the heater with the heater control.

When the heater is switched on, the circulation pump and the combustion air fan run. This is audible. The vehicle fan is switched on by the heater when the coolant temperature has reached 30 to 50 °C (vehicle-specific). After a maximum of 240 sec, exhaust can be seen exiting at the exhaust silencer or connection piece.

5. Allow the heater to run in the combustion mode. Check the heating effect at the outlet nozzles of the vehicle fan.

NOTE

The heating function is dependent on several factors: To evaluate it, the outside temperature, the vehicle model, the engine temperature, 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. The coolant temperature determined by the heater and the coolant or engine temperature indicated by the vehicle may differ considerably, as the respective sensors are installed at different locations and may measure different temperatures.

6. Switch off the heater again after approx. 15 minutes with the heater control.

6.3 Adjusting CO₂ content

NOTE

After repairing the heater and/or replacing the metering pump, the adjustment of the CO₂ value **should** be checked.

IMPORTANT

After replacing the burner unit, the combustion air fan or the control unit, the CO₂ value **must** be checked and reset if necessary.

The Thermo Pro 90 is equipped with an automatic altitude compensation function. As a result, the permissible operating altitude for the heater is 0 to 3500 m above sea level.

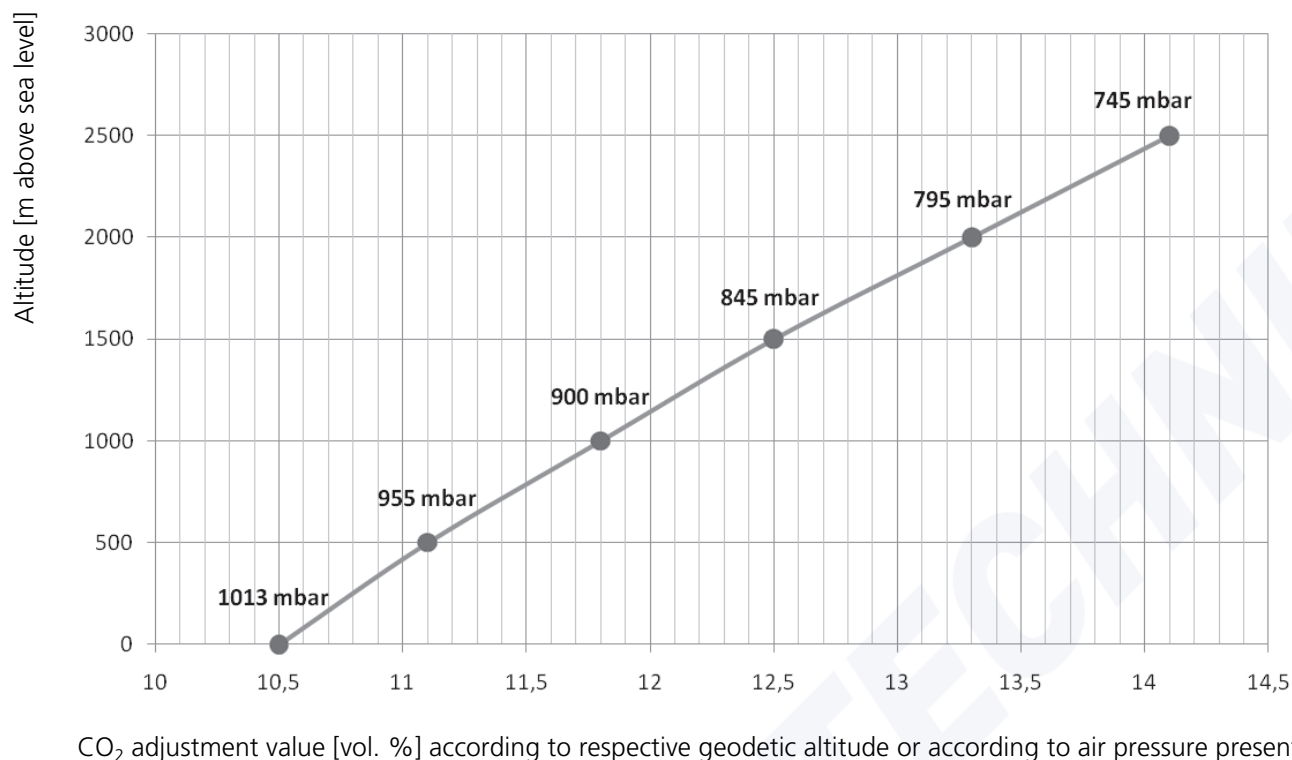
A change in the factory-defined combustion air quantity is permissible and can be achieved by changing the CO₂ adjustment value with Webasto Thermo Test PC Diagnosis.

Checking and adjusting CO₂ content

- Switch the heater into the "CO₂ adjustment" state with the Webasto Thermo Test PC Diagnosis. The heater starts automatically and switches into the "combustion process - combustion process" state. In the process, it operates the heating capacity level of 9.1 kW, which is used exclusively for CO₂ adjustment. This means the heating capacity must remain at 9.1 kW for several minutes (approx. 10 min.) according to Webasto Thermo Test PC Diagnosis. During this the coolant temperature is to be kept as low as possible. To do this, the greatest heat dissipation must be ensured with the vehicle fan (fan speed and passenger compartment temperature at Maximum).
- Now the CO₂ content must be adjusted as shown in Fig. 601. When adjusting, the following applies:
 - CO₂ adjustment value is increased => combustion air fan transports more air => CO₂ measured value must drop.
 - CO₂ adjustment value is decreased => combustion air fan transports less air => CO₂ measured value must rise.

IMPORTANT

Due to the automatic altitude compensation function of the heater, the CO₂ adjustment must be carried out exclusively with the Webasto Thermo Test PC Diagnosis in the "CO₂ adjustment" state.

Fig. 601 CO₂ adjustment value (permissible from 10.5 to 14.1 vol. %)

6.4 Checking individual components

6.4.1 Resistance test of coolant temperature sensor

During an electrical test with a digital multimeter, the temperature sensor is to have the following values:

Resistance at 25 °C: 990 to 1,010 ohms
Test current: < 1 mA

6.4.2 Resistance test of glow plug

During an electrical test with a digital multimeter, the glow plug is to have the following values:

Glow plug:	12 V (red)	24 V (green)
Resistance at 25 °C:	270 ± 35 mohms	770 ± 100 mohms

Measuring accuracy better than ± 5 mohms according to 4-conductor measuring principle

6.4.3 Resistance test of exhaust temperature sensor

During an electrical test with a digital multimeter, the exhaust temperature sensor is to have the following values:

Resistance at 25 °C: 2,195 ± 4 ohms
Test current: < 5 mA

6.4.4 Testing combustion air fan

The test of the combustion air fan speed must be carried out in the permissible operating voltage range. Check that the fan is not rubbing during operation.

NOTE

The test of the combustion air fan is only carried out when installed. This means the control unit must be mounted on the fan housing. The reason for this is sensors in the control unit which are required for speed control.

The test is carried out with the related Webasto Thermo Test PC Diagnosis.

Speed specification is 6,100 rpm

Rubbing and friction noises must be listened for. In addition, start-up must be audible up to the specified speed. In the event of the fan rubbing the fault message would be "Sluggish fan start".

6.4.5 Testing DP42 metering pump

During an electrical test with a digital multimeter, the DP42 is to have the following values:

Resistance at 25 °C:	4,95 to 5,45 ohms
Test current:	< 1 mA

Diesel feed rate at metering pump frequency of 9 Hz and feed time of 180 s: 49.5 to 54.7 ml

6.4.6 Testing overheating protection

NOTE

The overheating protection (ÜHS) may only be removed if it is replaced with a new one. The operating test must be carried out while installed.

Check continuity of overheating protection at room temperature; the electrical resistance must be approximately 0 ohms in this case.

6.4.7 Testing circulation pump

The operation of the circulation pump (UP) must be tested with the component test function in the Webasto Thermo Test PC Diagnosis. In addition, operation can also be felt by touching the circulation pump with the hand. When doing so, a constant vibration of the circulation pump must be felt.

7 Circuit diagrams

Thermo Pro 90

7 Circuit diagrams

Fig. 703 shows the circuit of the Thermo Pro 90 heater, parking heater with standard timer without ADR.

Fig. 704 shows the circuit of the Thermo Pro 90 heater, parking heater with On/Off switch without ADR.

Fig. 705 shows the circuit of the Thermo Pro 90 heater, parking heater with On/Off switch with ADR with auxiliary drive.

Fig. 706 shows the circuit of the Thermo Pro 90 heater, parking heater with On/Off switch with ADR without auxiliary drive.

For connector assignment on control unit, see Fig. 701.

For positioning of electrical components on heater, see Fig. 702.

For the legend for wiring diagrams, see Table 1, Table 2 and Table 3.

Table 1 Cable cross-sections




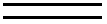

	Length < 7.5 m	Length 7.5 to 15 m
	0.75 mm ²	1.0 mm ²
	1.0 mm ²	1.5 mm ²
	1.5 mm ²	2.5 mm ²
	2.5 mm ²	4.0 mm ²
	4.0 mm ²	6.0 mm ²

Table 2 Cable colours

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

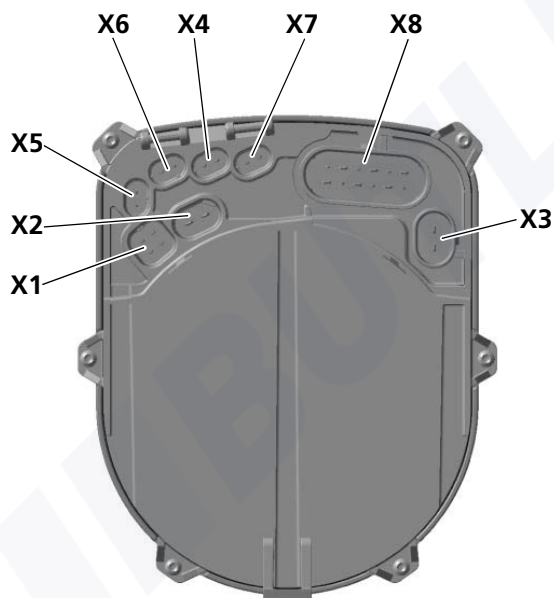


Fig. 701 Connector assignment on control unit

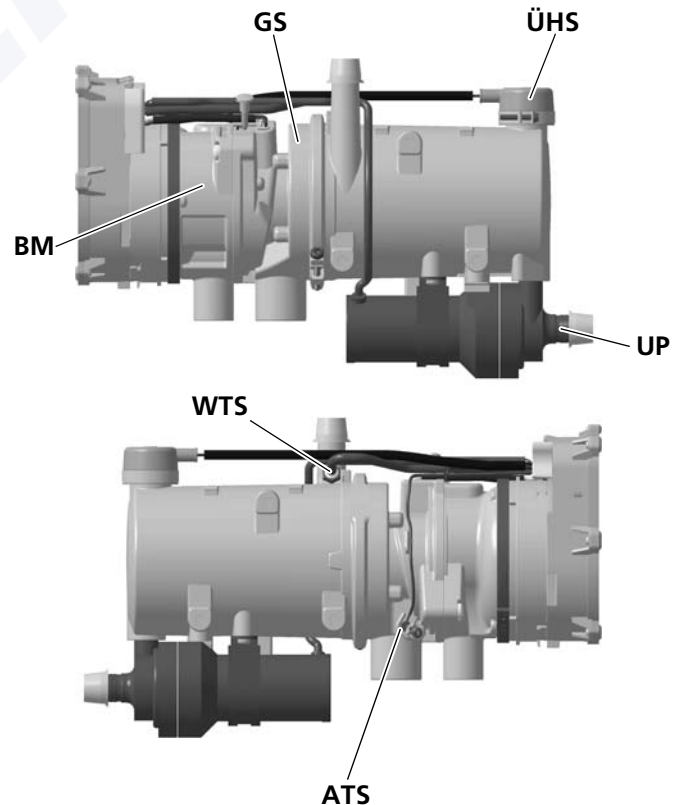
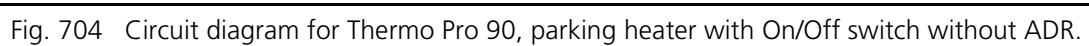


Fig. 702 Positioning of electrical components on heater

Table 3 Legend for wiring diagrams

Item	Description	Comment
①	Temperature coding	D+ signal (vehicle engine ON/OFF) for determination of the control temperature
②	Standard clock P2	<ul style="list-style-type: none"> – with ignition (Terminal 15) on connection 10: Continuous operation with immediate heating and ignition on – Connection 10 open: Heating duration is programmable (10 to 120 min.), basic setting 120 min.
③	Vehicle fuse	for vehicle fan
④	Vehicle fan switch	
A1	Heater	Thermo Pro 90
A2	Control unit	
ATS	Exhaust temperature sensor	PT2000
B4	Room thermostat	optional
BA	Operation indicator	Bulb max. 2 W
BM	Burner motor	Combustion air fan
DP	Metering pump	Fuel pump for heater
F1	20 A fuse	Flat fuse SAE J 1284
F2	5 A fuse	Flat fuse SAE J 1284
F3	20 A fuse	Flat fuse SAE J 1284
FZG	Vehicle fan	
GS	Glow plug	
H1	"Heating" symbol in the display	Operating indicator (in item P2)
H3	Symbol light	Bulb (in item P2)
H5	Switch-on indicator pumping device	Bulb max. 1.2 W
H6	Illumination of immediate heat button, BA, switch-on check (in Pos. P2)	Red LED (in Pos. P2)
K3	Relay	Circulation pump remote control
K5	Vehicle fan relay	
P2	Standard timer	For programmed operation
S4	On/Off switch	with BA, in place of standard clock
S6	Emergency-Off switch, mechanical or pneumatic	Isolating switch
S7	Pumping device switch	ADR
S8	Immediate heating signal	Momentary-contact switch (optional via remote control)
S10	Electronic battery switch	
ÜHS	Overheating protection	Sensor on heat exchanger
UP	Circulation pump	
WTS	Coolant temperature sensor	Coolant temperature in coolant circuit
X1	Plug connector, 4-pin	Pos. BM to Pos. A2
X2	Plug connector, 2-pin	Pos. GS to Pos. A2
X3	Plug connector, 2-pin	Pos. DP to Pos. A2
X4	Plug connector, 2-pin	Pos. UP to Pos. A2
X5	Plug connector, 2-pin	Pos. WTS to Pos. A2
X6	Plug connector, 2-pin	Pos. ATS to Pos. A2
X7	Plug connector, 2-pin	Pos. ÜHS to Pos. A2
X8	Plug connector, 12-pin	Wiring harness, vehicle-specific
X9	Plug connector, 12-pin	Pos. P2
X10	Plug connector, 2-pin	W bus PC diagnosis
X11	Plug connector, 2-pin	to Pos. DP
X12	Plug connector, 2-pin	to Pos. UP
Y2	Solenoid valve for pumping device	





7 Circuit diagrams

Thermo Pro 90

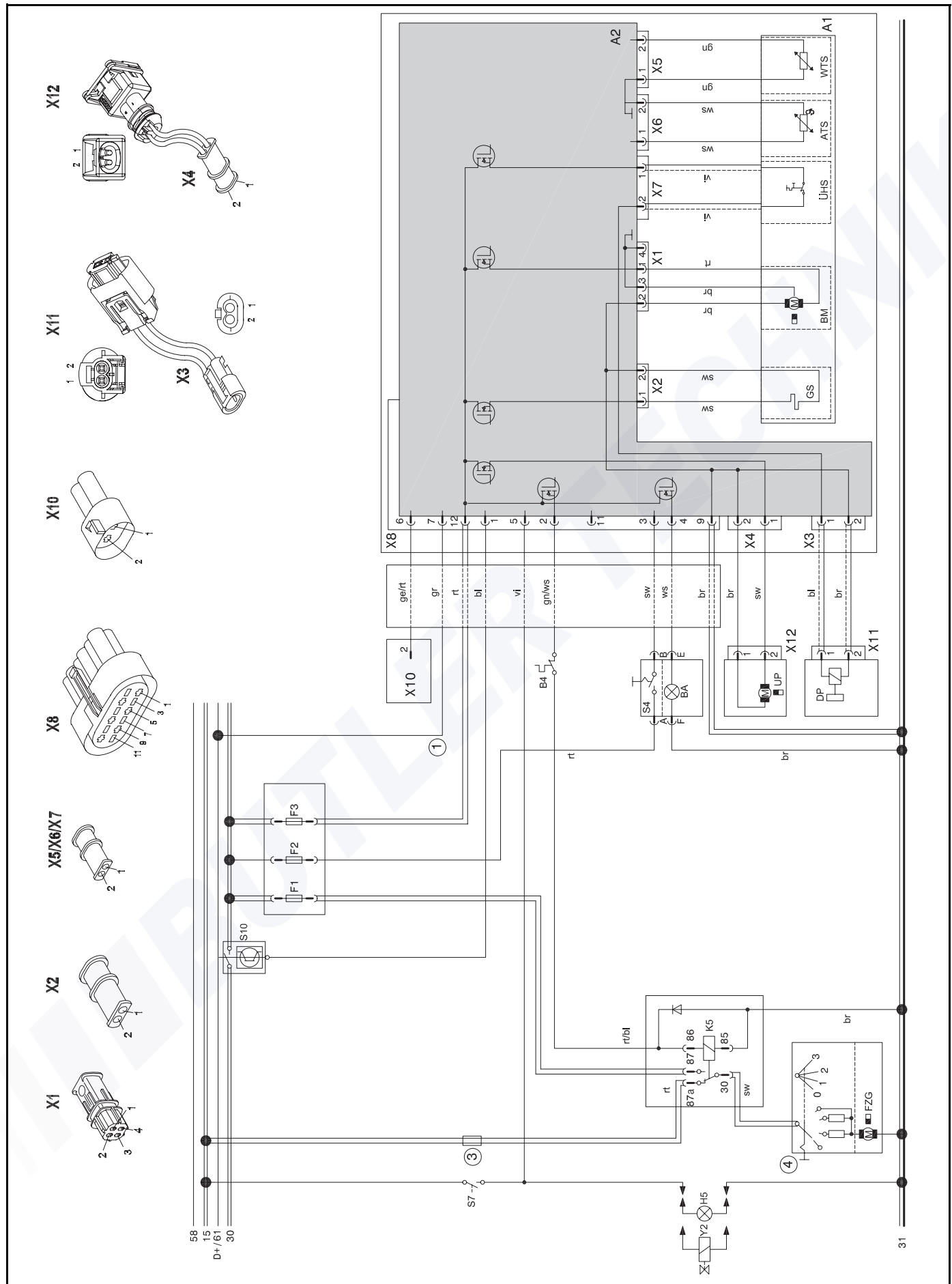


Fig. 705 Circuit diagram for Thermo Pro 90, parking heater with On/Off switch with ADR with auxiliary drive.

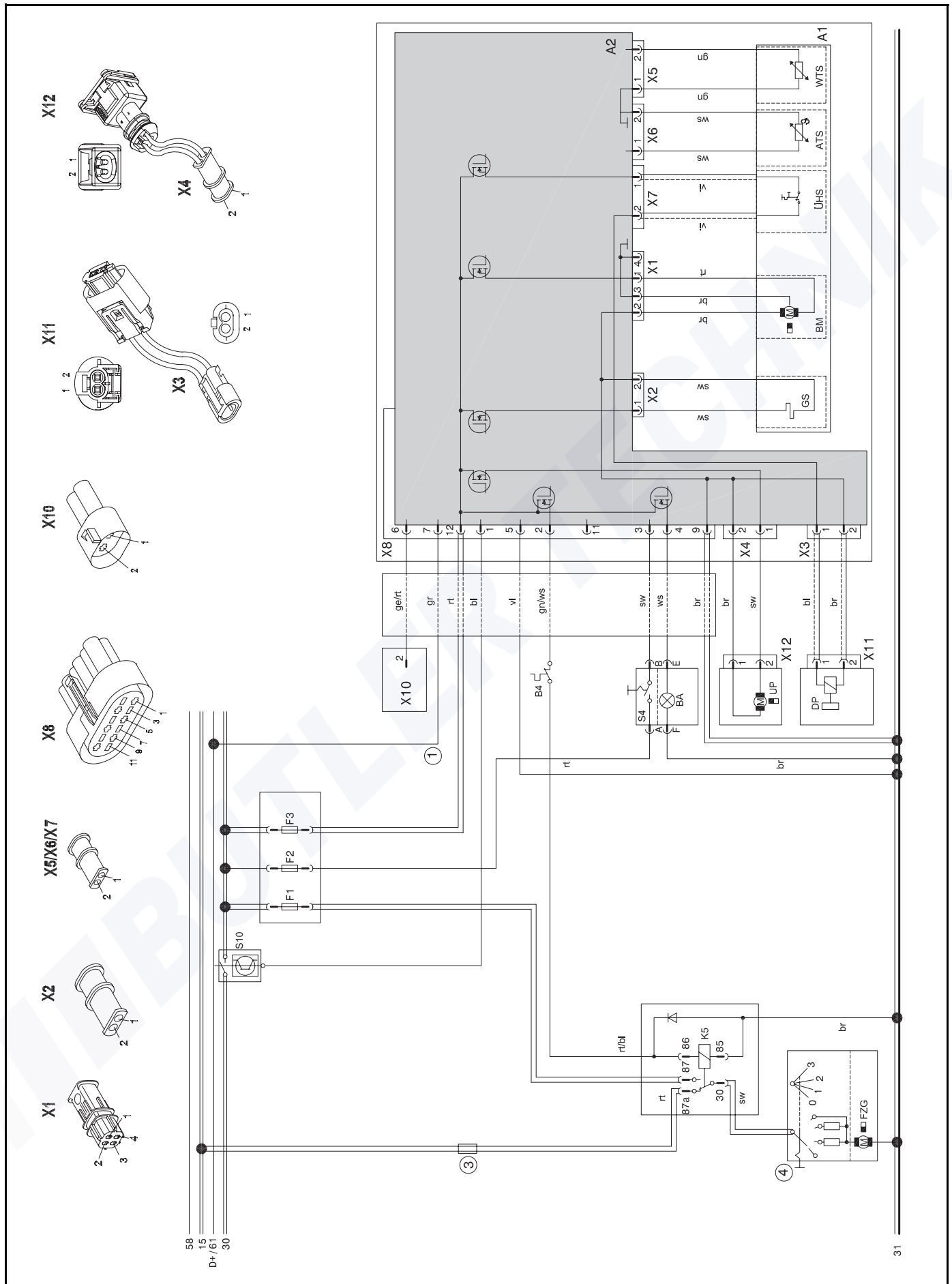


Fig. 706 Circuit diagram for Thermo Pro 90, parking heater with On/Off switch with ADR without auxiliary drive.

8 Servicing work

Thermo Pro 90

8 Servicing work

This section describes the servicing work that can be carried out on the heater and its components while installed.

8.1 Work on heater

The power supply must always be disconnected at the vehicle battery before carrying out any work on the heater, or pull fuses F2 and F3. The power supply 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. In case of repair work on the heater, it must be completely removed. After the heater and all coolant-carrying components have been installed, the entire coolant system must be filled, bled and checked for leaks with the specified system pressure (see technical data) in accordance with the vehicle manufacturer's instructions. The general installation instructions and the vehicle-specific installation instructions for the heater must be observed when carrying out repairs which make it necessary to change the installation location.

NOTE

Any coolant running off should be collected using an appropriate container.

8.2 Work on vehicle

IMPORTANT

A temperature of 125 °C with the operating voltage connected and the heater switched off must never be exceeded in the area of the heater (e.g. during painting work on the vehicle) (see technical data).

8.3 Test run of heater

WARNING

The heater may not be operated in closed rooms, such as garages or workshops, without exhaust extraction, not even with time preselection.

8.4 Checking work

In the interest of the operating safety of the heater, the following service work must be carried out after or before each heating season:

- Read out fault memory.
- Clean outside of heater (avoid penetration of water).
- Check electrical connections for contact corrosion and firm seating.
- Check exhaust and combustion air lines for damage and to ensure that they are clear.
- Check fuel line and filter for leaks.
- Check coolant circuit and circulation pump for leaks.
- Check hoses for cracks.
- Replace fuel filter if installed.
- Conduct operating test of heater as described in section 6.2.

8.5 Heater, removal and installation

8.5.1 Removal

- 1 Disconnect vehicle battery.
- 2 The control unit door need not be unlocked to remove the vehicle specific wiring harness.
- 3 Pull off the wiring harness connector at the heater (not by the cables)
- 4 De-pressurise coolant system.

NOTE

All open plugs and connectors must be protected against moisture and soiling.

- 5 Loosen hose clamps and pull coolant hoses off water connection pieces of heater. The coolant hoses must be secured against draining.
- 6 Loose combustion air pipe and exhaust pipe on heater and pull off.
- 7 Loosen hose clamps and pull off fuel line. Seal off fuel connection piece on heater and fuel line with suitable sealing plugs etc.
- 8 Remove three screws and washers from the heater bracket.
- 9 Remove heater.

8.5.2 Installation

- 1 Position heater in installation position and fasten with 3 screws and washers.
- 2 Mount fuel line and secure with hose clamp.
- 3 Mount coolant hoses and tighten hose clamps with 8 Nm.
- 4 Restore all electrical connections.
The 12-pin vehicle specific wiring harness connector and the 2-pin metering pump connector must audibly engage.
- 5 Connect combustion air pipe and exhaust pipe.
- 6 Connect vehicle battery.
- 7 Bleed coolant circuit.
- 8 Bleed vehicle fuel system if necessary.

IMPORTANT

A polarity reversal of the power supply can result in damage to the control unit. The correct polarity of the connection wires must be ensured. A direct connection to a power supply without an intermediate fuse is not permissible.

8.6 Recommissioning

After the heater has been installed, the coolant circuit and the fuel supply system must be carefully bled. The specifications of the vehicle manufacturer must be observed when doing so. All coolant and fuel connections must be checked for leaks and secure attachment during the test run. Should a fault occur in the heater during operation, then troubleshooting must be carried out (see Section 5).

To support bleeding of the coolant circuit, the circulation pump must be put into operation via the Component test function of the Webasto Thermo Test PC Diagnosis.

IMPORTANT

Before the heater is commissioned, the coolant temperature must be $< 40^{\circ}\text{C}$, as otherwise the heater may not go into combustion operation. The heater must be put into operation with the Webasto Thermo Test PC Diagnosis. With the fuel line completely drained, the line must be filled with the Webasto Thermo Test PC Diagnosis: Press the "Fuel prime" button and prime line with fuel until fuel is present at the heater.

All coolant and fuel connections must be checked for leaks and secure attachment during a test run of the heater.

9 Maintaining and Replacing Components

Thermo Pro 90

9 Maintaining and Replacing Components

9.1 General

This section describes the permissible repair work on the heater when removed. Any and all warranty claims shall be voided if the heater is dismantled further. During assembly only the spare parts from the corresponding spare parts kit may be used.

9.2 Measures on components when dismantled

NOTE

The seals must always be replaced before assembling the heater.

Cleaning

All dismantled components must be cleaned.

Visual inspection

- Check all components for damage (cracks, deformation, wear, etc.) and replace if necessary.
- Check connectors and wiring for corrosion, loose contacts, crimping errors, etc. and repair if necessary.
- Check connector contacts for corrosion and contacts for firm seating and repair if necessary.

9.3 Disconnecting electrical connections

All electrical connections are routed together separately with individual connectors in the control unit. Before removing a component, first the corresponding electrical connection must be disconnected.

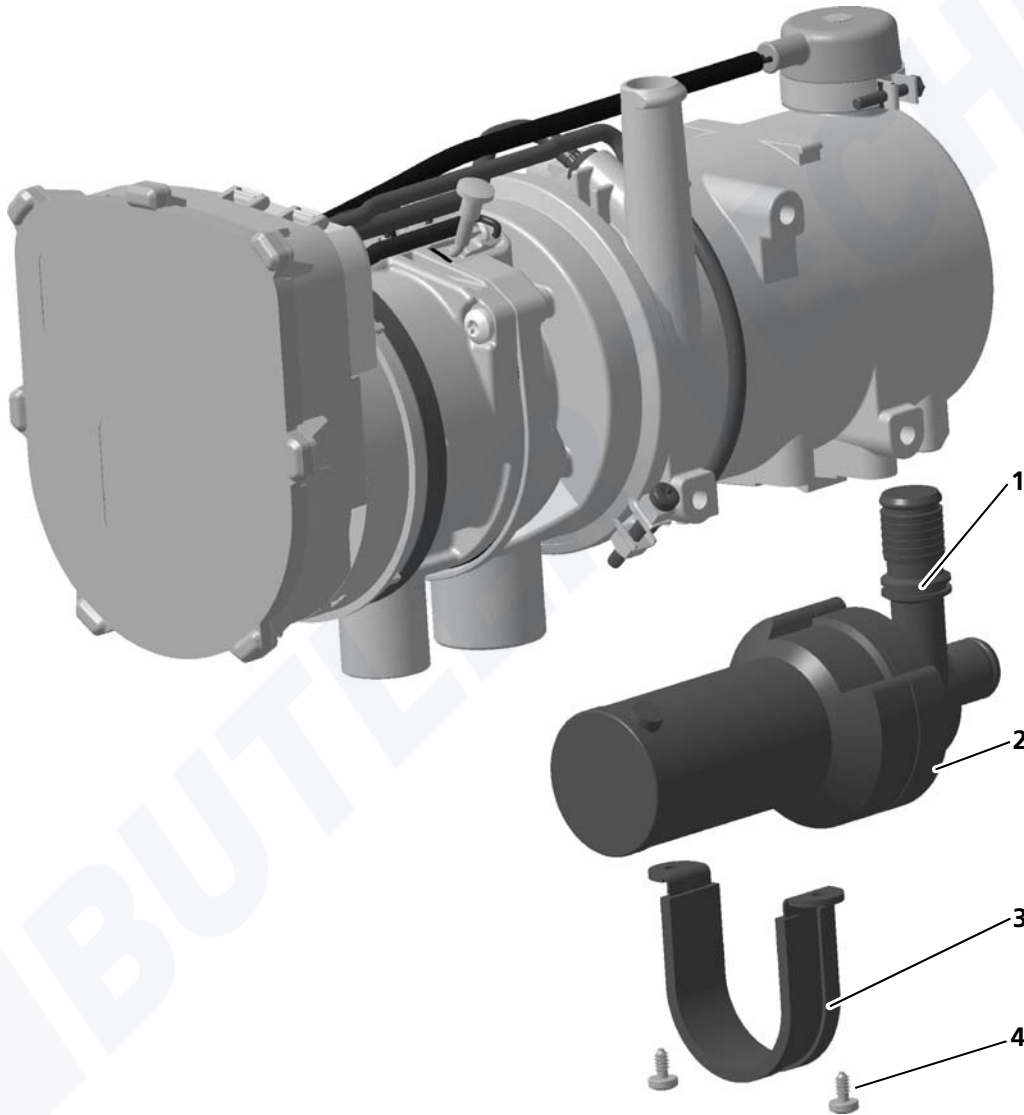
9.4 Replacing circulation pump

Removal

1. Remove heater (see Section 8.5.1).
2. Disconnect electrical connections (see Section 9.3).
3. Remove screws (4, Fig. 901).
4. Remove clamp (3) and circulation pump (2).
5. Carry out measures on components when dismantled (see Section 9.2).

Installation

1. Coat sealing ring (1, Fig. 901) with acid-free grease (Vaseline).
2. Position circulation pump (2, Fig. 901) in assembly position and fasten with clamp (3) and screws (4).
3. Tighten screws (4) to $3 \text{ Nm} \pm 10\%$.
4. Connect electrical connections (see Section 9.3).
5. Install heater (see Section 8.5.2).



- 1 = Sealing ring
- 2 = Circulation pump
- 3 = Clamp
- 4 = Screw (2x)

Fig. 901 Replacing circulation pump

9 Maintaining and Replacing Components

Thermo Pro 90

9.5 Replacing overheating protection

Removal

NOTE

The overheating protection may only be removed if it is replaced with a new one.

The operating test must be carried out while installed.

1. Remove heater (see Section 8.5.1), depending on space required.
2. Disconnect electrical connections (see Section 9.3).
3. Remove clamp (2, Fig. 902) and pull off protective cap (1).
4. Lever off retaining spring with screwdriver and remove overheating protection (3).
5. Carry out measures on components when dismantled (see Section 9.2).

Installation

IMPORTANT

Incorrect installation will result in the heat exchanger melting.

1. Insert new overheating protection (3, Fig. 902) in heat exchanger (4) and press in retaining spring.

NOTE

The spring must be heard and felt to engage in the groove.

Only then is the overheating protection in its proper installation position.

If the spring is not heard and felt to engage:

- Clean contact surface of overheating protection on heat exchanger
- Clean groove on heat exchanger
- Make sure that locking lugs are present on both sides of spring. Replace overheating protection if necessary. Position circulation pump (2, Fig. 901) in assembly position and fasten with clamp (3) and screws (4).

2. Lay on protective cap (1) and secure with clamp (2).
3. Tighten clamp to $0.5 \text{ Nm} \pm 20\%$.
4. Connect electrical connections (see Section 9.3).
5. Install heater (see Section 8.5.2) if previously removed.

9.6 Replacing coolant temperature sensor

Removal

1. Remove heater (see Section 8.5.1).
2. Disconnect electrical connections (see Section 9.3).

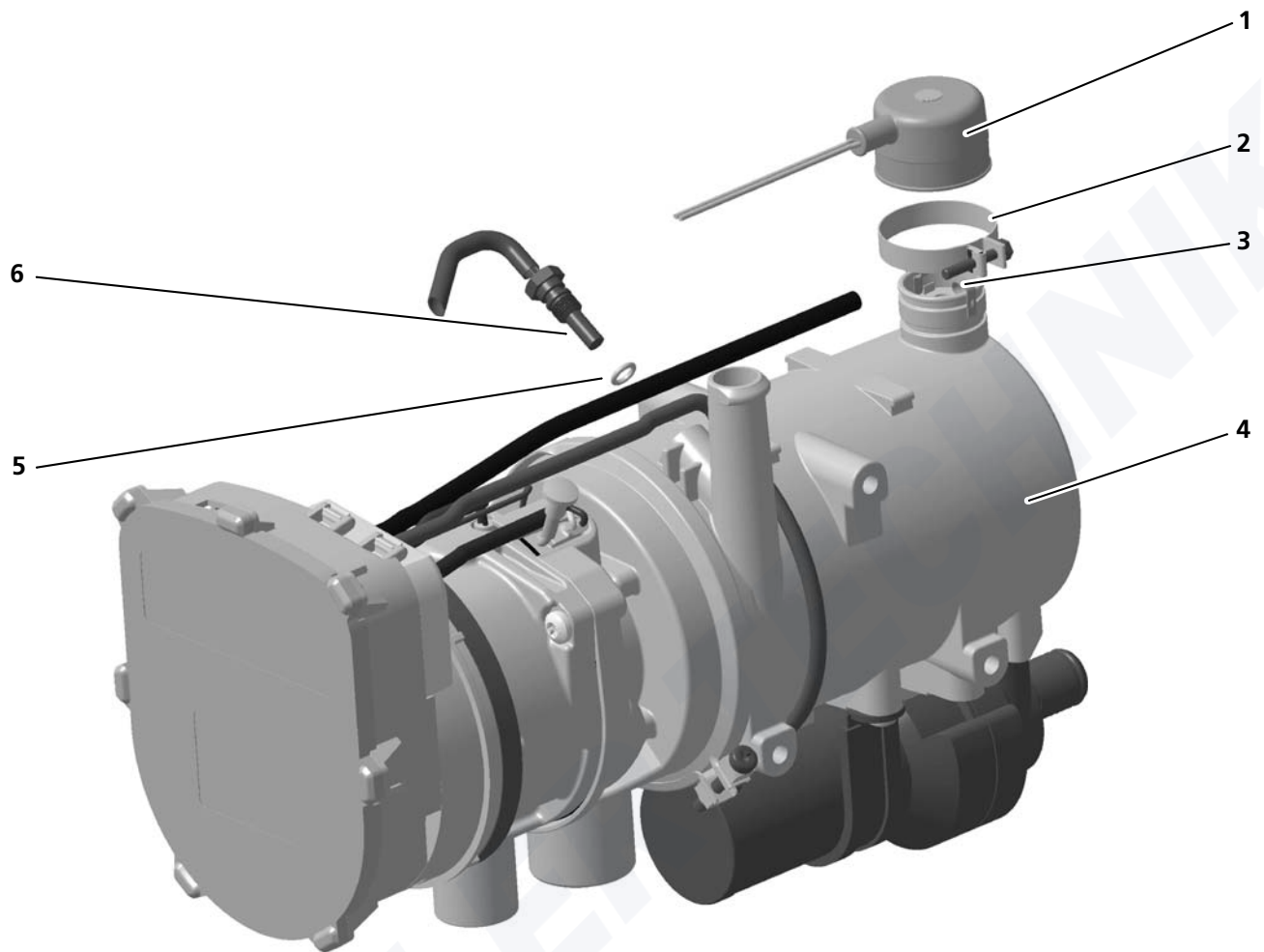
WARNING

Escaping hot coolant can cause burns.

3. Screw out coolant temperature sensor (6, Fig. 902) (13 mm hexagon) and remove with round sealing ring (5).
4. Carry out measures on components when dismantled (see Section 9.2).

Installation

1. Grease round sealing ring (5, Fig. 904) with acid-free grease (Vaseline).
2. Screw coolant temperature sensor (6) with round sealing ring (5) into heat exchanger (4) and tighten to $1.5 \text{ Nm} \pm 10\%$.
3. Connect electrical connections (see Section 9.3).
4. Install heater (see Section 8.5.2) if previously removed.



- 1 = Protective cap
- 2 = Clamp
- 3 = Overheating protection
- 4 = Heat exchanger
- 5 = Round sealing ring
- 6 = Coolant temperature sensor

Fig. 902 Replacing overheating protection and coolant temperature sensor

9 Maintaining and Replacing Components

Thermo Pro 90

9.7 Replacing combustion air fan

Removal

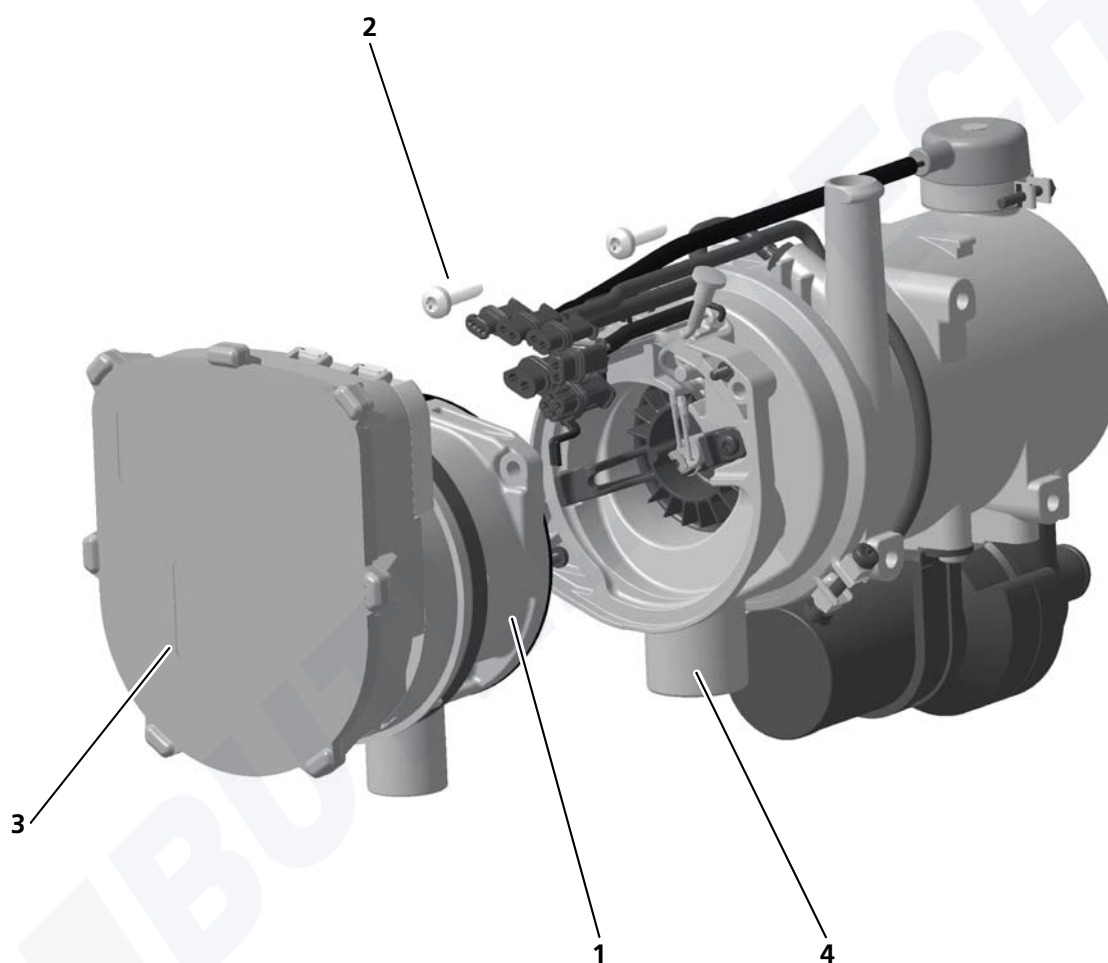
1. Remove heater (see Section 8.5.1), depending on space required.
2. Disconnect electrical connections (see Section 9.3).
3. Remove screws (2, Fig. 903). Pull off control unit if necessary.
4. Pull combustion air fan (1) off burner head (4) and remove.
5. Carry out measures on components when dismantled (see Section 9.2).

Installation

NOTE

Ensure intact, moulded-on sealing bead.

1. Position combustion air fan (1) in assembly position and fasten with screws (2).
2. Tighten screws (2) to $3 \text{ Nm} \pm 10\%$.
3. Mount control unit and connect electrical connections (see Section 9.3).
4. Install heater (see Section 8.5.2) if previously removed.



- 1 = Combustion air fan
- 2 = Screw (2x)
- 3 = Control unit
- 4 = Burner head

Fig. 903 Replacing combustion air fan

9.8 Replacing burner unit and glow plug

Removal

1. Remove heater (see Section 8.5.1), depending on space required.
2. Remove combustion air fan (see Section 9.7).
3. Remove screw (3, Fig. 904).
4. Pull grommet (7) and burner unit (1) out of burner head (2).
5. Loosen screw (6) with hold-down device (5) for glow plug (4) and remove.
6. Pull glow plug (4) out of burner unit (1).
7. Carry out visual inspection for evaluation of burner unit (see Section 5.3).
8. Carry out measures on components when dismantled (see Section 9.2).

Alternative:

1. Disconnect electrical connections (see Section 9.3).
2. Unlock control unit and pull off of combustion air fan cap.
3. Remove fastening screw of V-clamp (9, Fig. 904) and pull off V-clamp.
4. Pull combustion air fan (4, Fig. 903) with burner head (2, Fig. 904) out of heat exchanger (8, Fig. 904) and remove.
5. Remove combustion air fan (see Section 9.7).
Continue as described above from Point 3.

Installation

1. Carefully insert glow plug (4) in burner unit (1) as far as possible and fasten hold-down device for glow plug with screw. Tighten screw to $2.5 \text{ Nm} \pm 10\%$.
2. Insert burner unit (1) and grommet (7) in burner head (2).
3. Secure burner unit (1) with screw (3). Tighten screw to $3 \text{ Nm} \pm 10\%$.
4. Mount combustion air fan (see Section 9.7).
5. Connect electrical connections (see Section 9.3).
6. Install heater (see Section 8.5.2) if previously removed.

Alternative:

1. Continue as described above up to Point 4.
2. Mount combustion air fan (see Section 9.7).
3. Guide combustion air fan (4, Fig. 903) with burner head (2, Fig. 904) into heat exchanger (8, Fig. 904), align if necessary and fasten with V-clamp (9, Fig. 904).
4. Mount control unit and connect electrical connections (see Section 9.3).

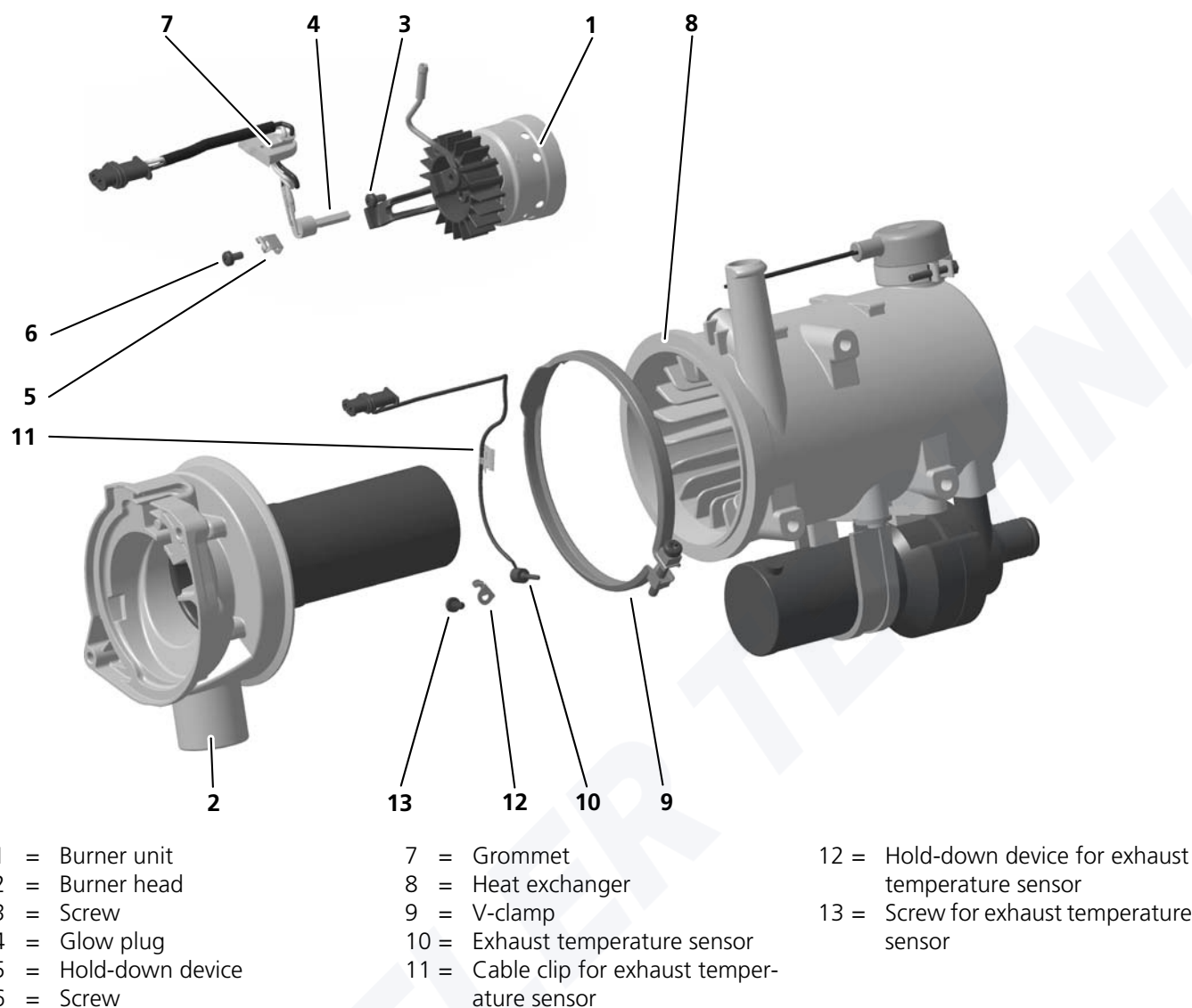


Fig. 904 Replacing burner unit, glow plug, burner head and exhaust temperature sensor

9.9 Replacing burner head

Removal

1. Remove heater (see Section 8.5.1).
2. Remove combustion air fan (see Section 9.7).
3. Remove burner unit with glow plug (see Section 9.8).
4. Remove fastening screw of V-clamp (9, Fig. 904) and pull off V-clamp.
5. Pull burner head (2) out of heat exchanger (8) and remove.
6. Carry out measures on components when dismantled (see Section 9.2).

NOTE

When replacing the burner head, the exhaust temperature sensor must be removed from the old burner head and installed in the new burner head. See Section 9.12.

Installation

NOTE

The burner head or the exhaust outlet connection can still be aligned when installing it in the vehicle.

1. Guide burner head (2, Fig. 904) into heat exchanger (8), align if necessary and fasten with V-clamp (9).
2. Tighten fastening screw of V-clamp to $3 \text{ Nm} \pm 10\%$ if necessary.
3. Install burner unit with glow plug (see Section 9.8).
4. Mount combustion air fan (see Section 9.7).
5. Install heater (see Section 8.5.2).

9.10 Replacing heat exchanger

Removal

1. Remove heater (see Section 8.5.1).
2. Remove circulation pump (see Section 9.4).
3. Remove overheating protection (see Section 9.5).
4. Remove coolant temperature sensor (see Section 9.6).
5. Remove burner head with combustion air fan (see Section 9.9).
6. Carry out measures on components when dismantled (see Section 9.2), check for damage (cracks, deformation, etc.) and replace if necessary.
Clean soot off inner jacket of heat exchanger.

Installation

1. Install burner head with combustion air fan (see Section 9.9).
2. Install coolant temperature sensor (see Section 9.6).
3. Install overheating protection (see Section 9.5).
4. Mount circulation pump (see Section 9.4).
5. Install heater (see Section 8.5.2).

9.11 Replacing control unit

Removal

1. Disconnect electrical connections (see Section 9.3).
2. Unlock control unit and pull off of combustion air fan cap.

Installation

1. Slide control unit onto combustion-air fan cap until locking bar engages.
2. Insert electrical connection, see cautionary note!
3. Close control unit door until it engages.

IMPORTANT

Always ensure proper handling when producing the electrical connection of the individual connectors on the control unit.

This means all connectors are manually pushed as far as possible into the respective position provided for them in the control unit. Only then is the control unit door locked. The control unit door is not an aid for pushing in connectors!

It only locks the connectors against slipping out.

9.12 Replacing exhaust temperature sensor

Removal

1. Disconnect electrical connections (see Section 9.3).
2. Lever cable clip off burner head rib. (sketch position of clip if necessary).
3. Unscrew screw fitting of hold-down device and pull out exhaust temperature sensor.

Installation

1. Slide exhaust temperature sensor into burner head.
2. Fix exhaust temperature sensor in place on burner head with hold-down device and screw. The tightening torque of the screw fitting of the hold-down device is $2.5 \text{ Nm} \pm 10\%$.
3. Fix exhaust temperature sensor cable in place on burner head rib by pressing on clip. When doing so, ensure torque-free routing of cable between exhaust temperature sensor and clip.

NOTE

In case of a mechanical defect of the exhaust temperature sensor due to an external cause, this component can be replaced without additional work.

However, if an apparent thermal defect has occurred or if no mechanical defect can be recognised in spite of a fault message, then additional work is required. This means visual inspection of the burner unit, exhaust pipes, combustion pipe and the heat exchanger ribs (inner surface). In the process, check for unusual amounts of soot, combustion residues and carbonisation. Should this be the case, then all affected parts must be cleaned. Here the burner unit must also be checked for thermal damage by an expert and replaced if necessary.

IMPORTANT

The exhaust temperature sensor must be handled carefully - it is a sensitive electronic ceramic component!

Tensile loading of the exhaust temperature sensor cable on the sensor head must always be avoided during installation and heater operation.

Sharp bends in the cable at the sensor head are not permitted in order to prevent damage to the Teflon insulation of the cable.

Do not pull on the cable after the exhaust temperature sensor is installed!

Should a sensor be dropped during maintenance work, then a new sensor must be installed.

The proper condition of the mica disc (insulation) on the sensor, the force-free seating of the cable clips of the exhaust temperature sensor and the loose routing of the exhaust temperature sensor cable to the control unit must be ensured during installation.

9 Maintaining and Replacing Components

Thermo Pro 90

IMPORTANT

The exhaust-temperature sensor cable is designed as a high-temperature-resistant line.

The material is resistant to continuous effects of temperatures of up to 185 °C, however it is sensitive to external mechanical influences.

Before the final decision about specification of the heater installation location, we recommend conducting an analysis for the possible risk of damage to the cable due to stone impact. If stone impact is possible at the heater installation location, then precautionary measures must be taken for direct protection of the exhaust temperature sensor cable, e.g. with suitable covers.

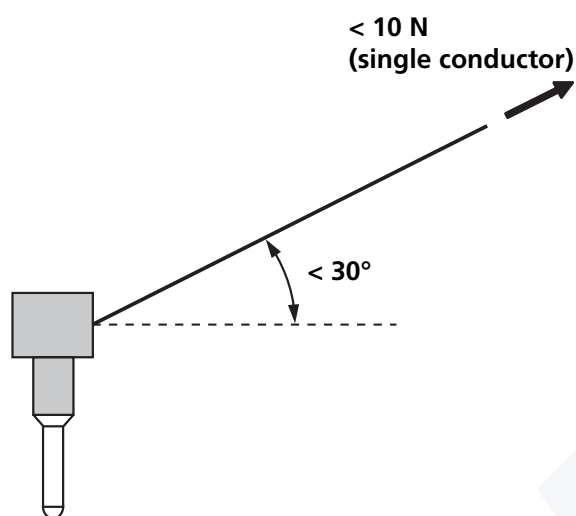


Fig. 905 permissible bending angle and permissible load

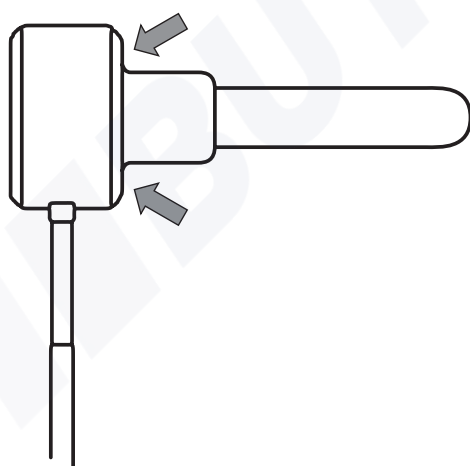


Fig. 906 Testing mica disc (insulation) on sensor

10 Packing, Storage and Shipping

10.1 General

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

The temperatures during transport and storage must not drop below or exceed the ambient temperatures specified in the technical data of the installation instructions.

10.2 Storage

Heater position

The heater can be stored in any position. There are no restrictions here.

Heaters must always be stored in the delivery packaging or in similarly suitable packaging in closed rooms!

After being removed from the delivery packaging, the heaters should only make contact on the aluminium parts. The type label and the surface of the heater must be protected against damage with a suitable surface (e.g. cardboard).

During storage the heater should be covered and must be protected from dust, dirt and moisture.

The heater may not come into contact with chemicals or their vapours, e.g. fuel, battery fluids or brake fluids.

No dirt, water or chemicals may enter into the openings of the heater during storage, see above.

The fuel pipe must be protected from side impact loads which lead to pipe deformation.

10.3 Transport

The heater can be transported in any position and must be packed in suitable packing.

The electrical contacts and the fuel pipe must be protected against mechanical damage.

NOTE

If an entire heater is returned, then it must be completely drained of operating fluids. It must be ensured that no fuel or coolant residues can escape during packing and/or shipping.

The coolant connection piece and the fuel connection must be sealed off with blind plugs.

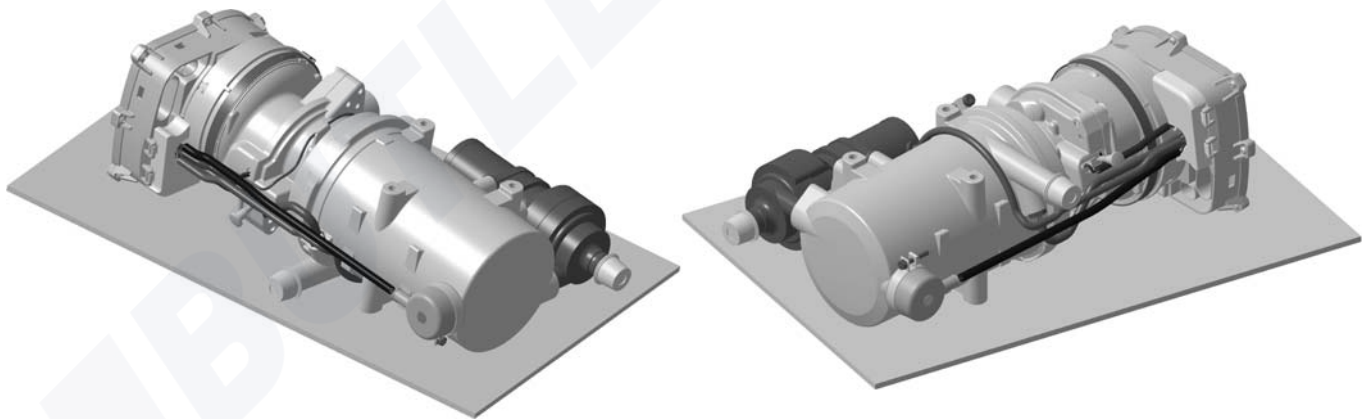


Fig. 1001 Preferred position of Thermo Pro 90 heater for storage and transport

Webasto Thermo & Comfort SE
Postfach 1410
82199 Gilching
Germany

Visitors' address:
Friedrichshafener Str. 9
82205 Gilching
Germany

Internet: www.webasto.com

Technical Extranet: <http://dealers.webasto.com>

The telephone number of each country can be found
in the Webasto service center leaflet or the website of
the respective Webasto representative of your country.