Webasto

## 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.

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# 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 AG 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 Telestart.
- 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

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.

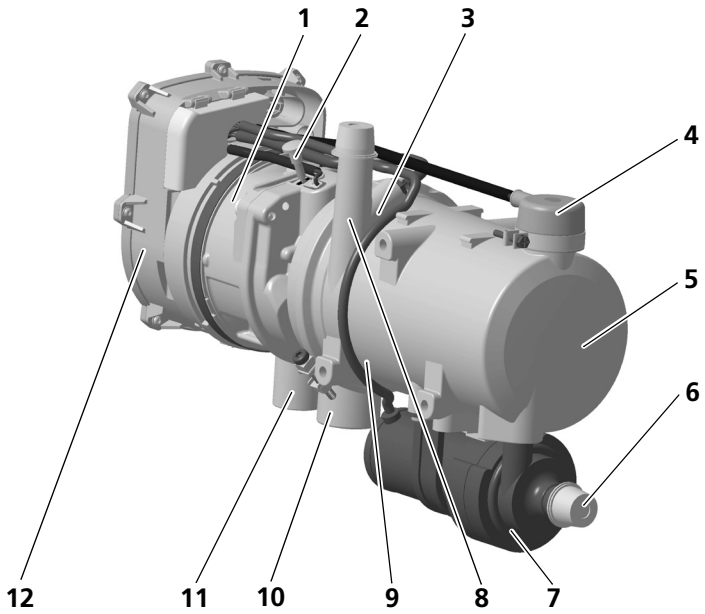
The heater runs in controlled intermittent operation according to the coolant temperature.

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.




1 = Combustion air fan
2 = Fuel connection
3 = Coolant temperature sensor
4 = Overheating protection
5 = Heat exchanger
6 = Inlet, coolant
7 = Circulation pump
8 = Outlet, coolant
9 = Exhaust temperature sensor
10 = Outlet, exhaust gas
11 = Inlet, combustion air
12 = Control unit

Fig. 201 Thermo Pro 90

## 2.1 Combustion air fan

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

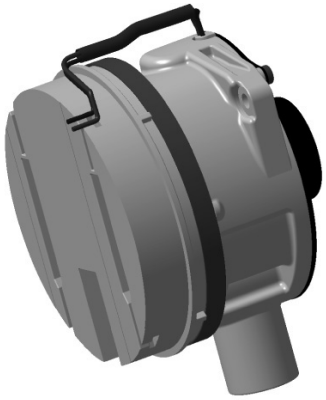
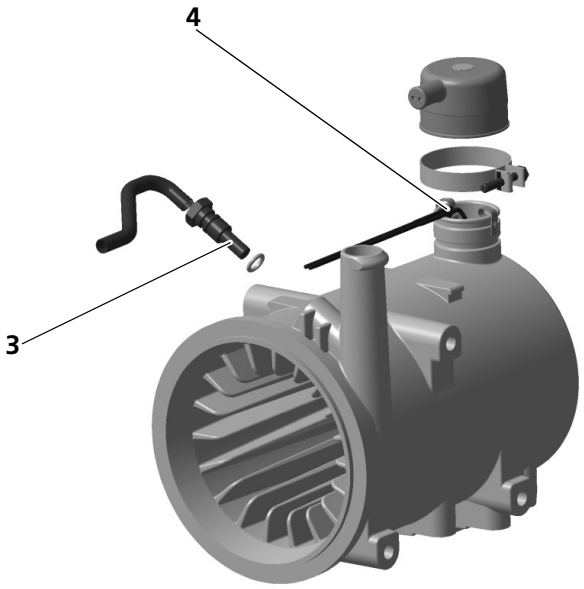


Fig. 202 Combustion air fan

## 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

### 2.2.1 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.

### 2.2.2 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 ± 7 °C and switches off the heater.
The overheating protection is reset automatically at temperatures below 65 ± 5 °C.

## 2.3 Burner unit

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

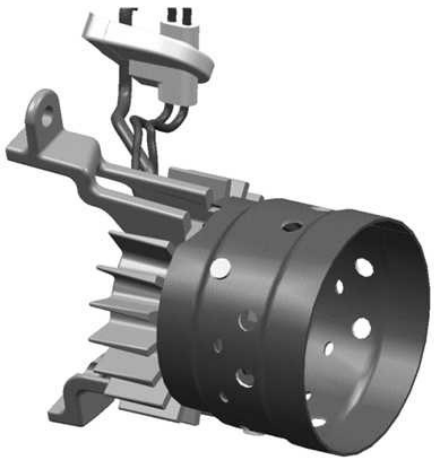


Fig. 204 Burner unit

### 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.

## 2.4 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.

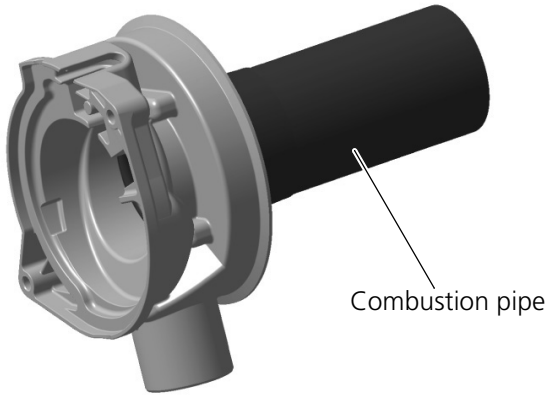



Fig. 205 Burner head with combustion pipe

## 2.5 Exhaust temperature sensor

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

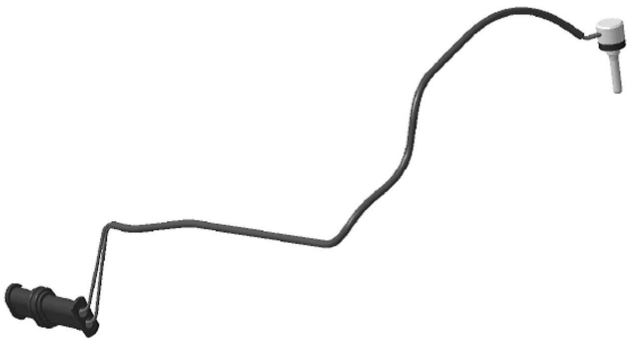


Fig. 206 Exhaust temperature sensor

## 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.

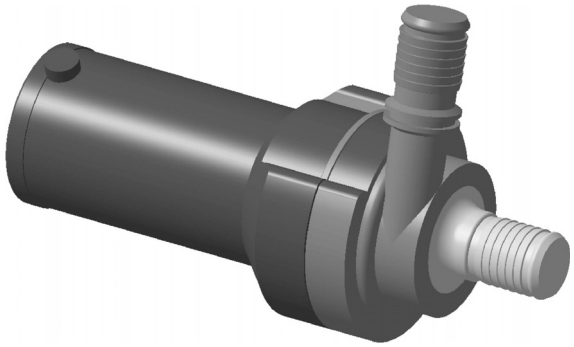


Fig. 207 Circulation pump

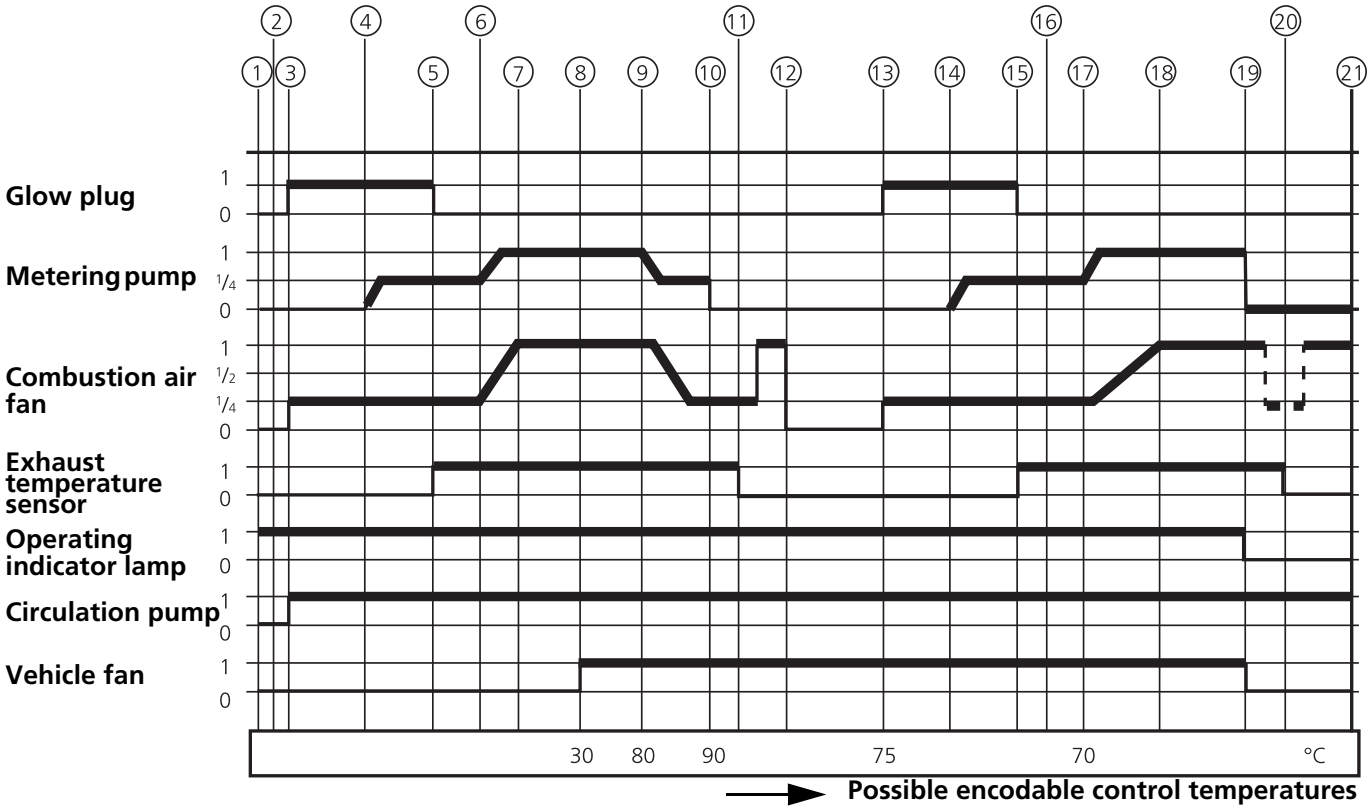
## 2.7 Control unit

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

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:
a) when the lower limit of the operating voltage is reached
b) when the coolant outlet temperature is below 40 °C
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.

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 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)<br>E1 10R 03 6196 (EMC) | |
| Model | | Water heater with evaporator-type burner | |
| Heat output | Max.<br>Control range | 9.1 kW<br>1.8 to 7.6 kW | |
| Fuel | | Diesel DIN EN 590<br>PME DIN EN 14214 | |
| Fuel consumption<br>± 10 % | Max.<br>Control range | 1.14 l/h<br>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<br>± 10 % (without vehicle fan) | Max.<br>Control range | ≤ 90 W<br>37 to 83 W | |
| Perm. ambient temp.:<br>Heater incl. control unit:<br>- Operation<br>- Storage<br><br>Metering pump:<br>- Operation<br>- Storage | | <br><br>-40 to +80 °C<br>-40 to +125 °C<br>(heater off, operating voltage may be connected)<br><br>-40 to +30 °C<br>-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<br>* From control unit to inlet connection piece of circulation pump<br>Also see Fig. 2.<br>(Tolerance ± 3 mm) | | L = Length: 355 (381*) mm<br>W = Width: 131 mm<br>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 <u>with</u> 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 AG.

**Heater lock-out**

<u>With Webasto Thermo Test PC Diagnosis</u>

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

<u>Without Webasto Thermo Test PC Diagnosis</u>

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**

## 5.1 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 ensure electrical terminal is locked into the housing securely (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:<br>– 0.235 to 0.305 ohms for the 12 V variant<br>– 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:<br>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<br>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<br>Measure operating voltage from Webasto Thermo Test PC Diagnosis | Check fuse F1<br>Check power supply |
| | | Without Webasto Thermo Test PC Diagnosis<br>Measure power supply on heater unit connector **X8**, Pin 12 (also see Abb. 703, Abb. 704 and Abb. 705) | |
| 7 | Undervoltage detection | With Webasto Thermo Test PC Diagnosis<br>Measure operating voltage from Webasto Thermo Test PC Diagnosis | – 12 V variant:<br>The voltage may not drop below 10.5 V for more than 10 consecutive seconds<br>– 24 V variant:<br>The voltage may not drop below 20.0 V for more than 10 consecutive seconds<br>– Check fuse F1 |
| | | Without Webasto Thermo Test PC Diagnosis<br>Measure power supply on heater unit connector **X8**, Pin 12 (also see Abb. 703, Abb. 704 and Abb. 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:<br>– Measure power supply on connector **X9**, Pin 11<br>– Check continuity on connector **X9**, Pin 12 to earth<br>– Check fuse F2 |
| | | | Operation indicator of switch:<br>– Measure power supply on switch **S4**, Pin A<br>– Check continuity on switch **S4**, Pin F to earth<br>– 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:<br>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

| Error point | Component | Recommended workshop action | Parameter |
|---|---|---|---|
| 10 | Combustion air fan | Combustion air fan sluggish.<br>Conduct component test on function of fan motor with Webasto Thermo Test PC Diagnosis. | – Specify a set-point speed of 6,000 rpm<br>– Listen for rubbing and friction noises. In addition, start-up must be audible up to the specified speed<br>– 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 intake air 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 intake air 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 | Determine error cause for lock-out, then eliminate lock-out.<br>A distinction is made between 3 types of lock-out:<br>– Fault lock-out<br>Unlocking by pressing ON/OFF switch<br>– ADR lock-out<br>See Fault lock-out<br>When ADR is triggered by the auxiliary drive, it must be deactivated before switching on the heater again<br>– Heater lock-out<br>Unlock:<br>1) Switch on heater (with switch or standard timer)<br>2) Remove fuse **F3** for at least 10 s.<br>3) Switch off heater (only with switch).<br>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

## 5.2 Troubleshooting with error code output

The error code is output due to:
– 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 |
| | | 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 |
| 2 | Flame failure in combustion mode | Fuel system | Check fuel level |
| | | | Check fuel filter |
| | | | Check fuel standpipe and fuel line for leaks |
| | | | Bleed fuel system |
| | | Burner unit | 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 |
| | | Overheating protection defective | Check wiring for damage, open circuit and short circuit |
| | | | Functional check of overheating protection; 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 |
| | | | Functional check of vehicle fan relay (K5, see Chap. 7); replace vehicle fan relay if necessary |
| 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

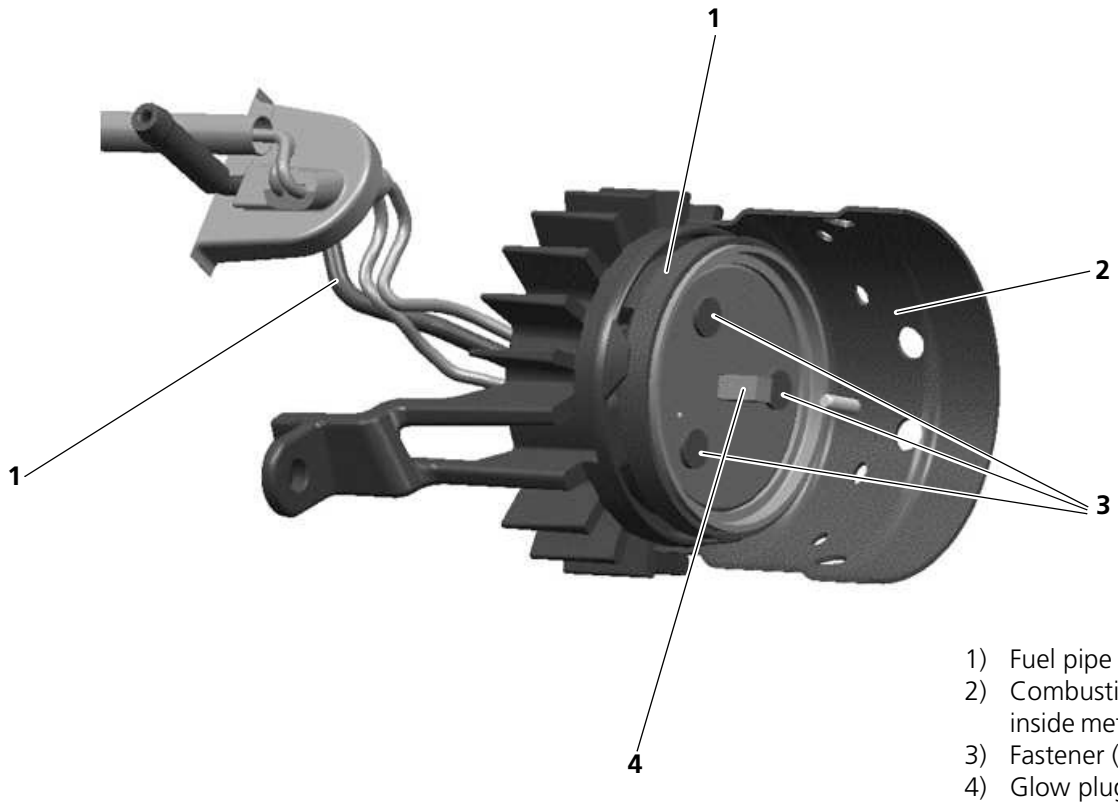
| Error code number/ Number of flashing pulses | Fault message | Possible causes | Recommended workshop action |
|---|---|---|---|
| 16 | Exhaust gas temperature too high | Exhaust temperature sensor defective | Check wiring for damage, open circuit and short circuit |
| | | | Functional check of exhaust 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.




1) Fuel pipe with rear wall
2) Combustion chamber with inside metal fibre evaporator
3) Fastener (3x)
4) Glow plug

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

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

  ***Remedy***
  Replace burner unit.

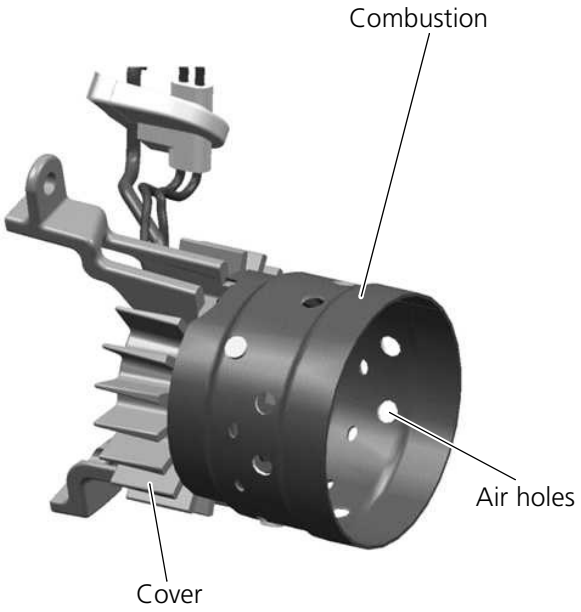



Fig. 505 Visual inspection, entire burner unit

### 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 $CO_2$ content

**NOTE**

After repairing the heater and/or replacing the metering pump, the adjustment of the $CO_2$ value **should** be checked.

**IMPORTANT**

After replacing the burner unit, the combustion air fan or the control unit, the $CO_2$ 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 $CO_2$ adjustment value with Webasto Thermo Test PC Diagnosis.

**Checking and adjusting $CO_2$ content**

- Switch the heater into the "$CO_2$ 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 runs up to the heating capacity level of 9.1 kW, which is used exclusively for $CO_2$ 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 $CO_2$ content must be adjusted as shown in Fig. 601.
  When adjusting, the following applies:
  – $CO_2$ adjustment value is increased => combustion air fan transports more air => $CO_2$ measured value must drop.
  – $CO_2$ adjustment value is decreased => combustion air fan transports less air => $CO_2$ measured value must rise.

**IMPORTANT**

Due to the automatic altitude compensation function of the heater, the $CO_2$ adjustment must be carried out exclusively with the Webasto Thermo Test PC Diagnosis in the "$CO_2$ adjustment" state.

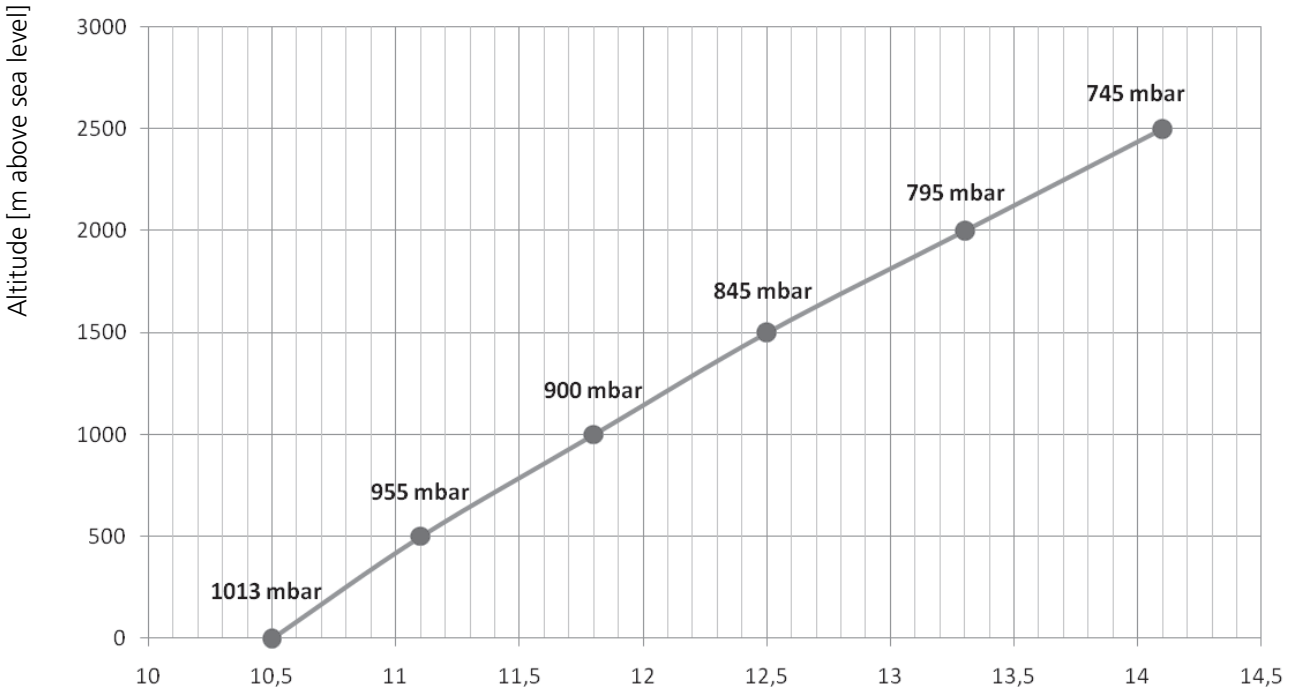



Fig. 601 $CO_2$ adjustment value (permissible from 10.5 to 14.1 vol. %)

## 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

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 |

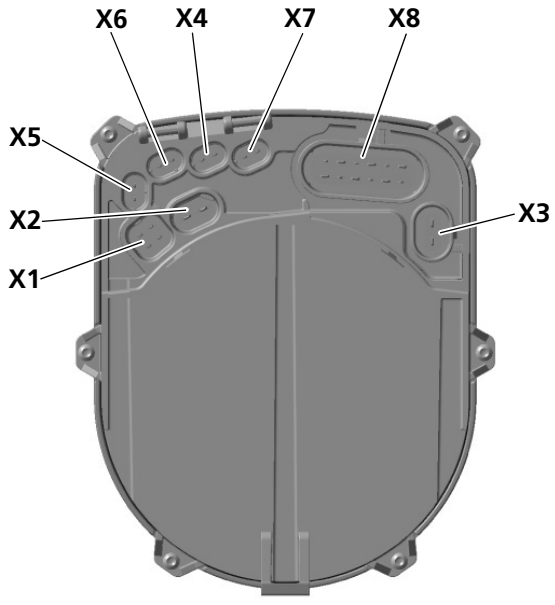



Fig. 701 Connector assignment on control unit

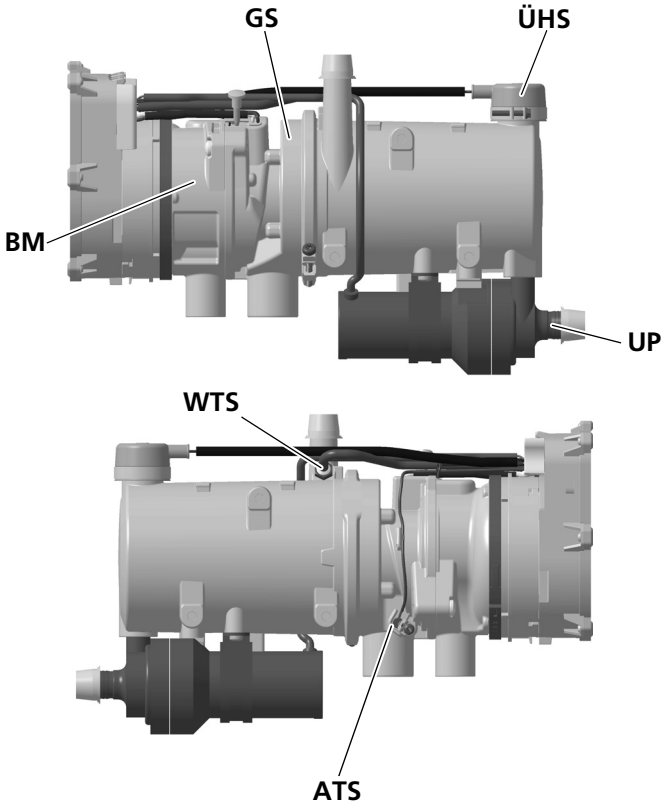



Fig. 702 Positioning of electrical components on heater

**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 | – with ignition (Terminal 15) on connection 10: Continuous operation with immediate heating and ignition on<br>– 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 | Light 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 | Light (in item P2) |
| H5 | Switch-on indicator pumping device | Light 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 | |

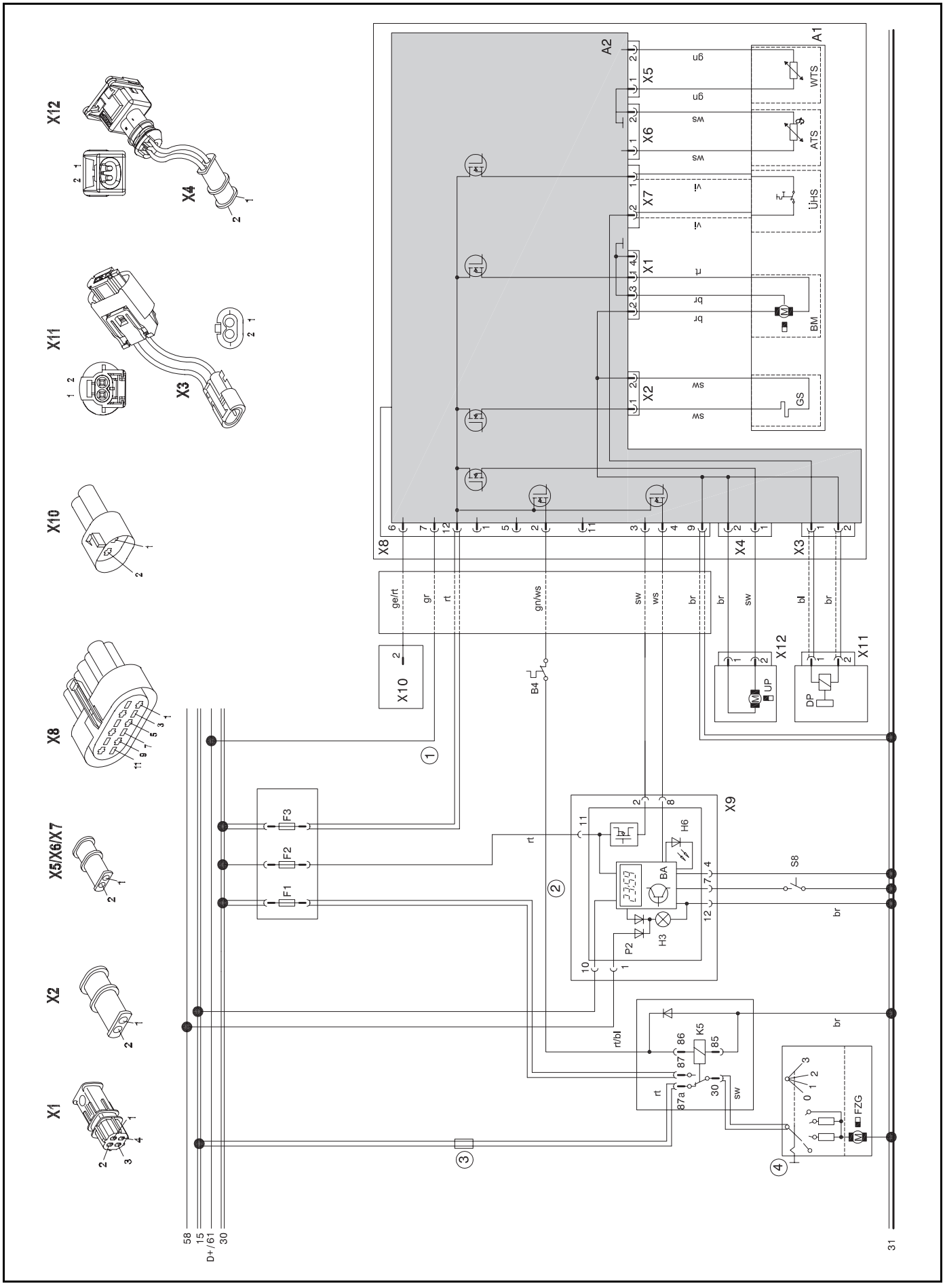



Fig. 703 Wiring diagram for Thermo Pro 90, parking heater with standard timer without ADR.

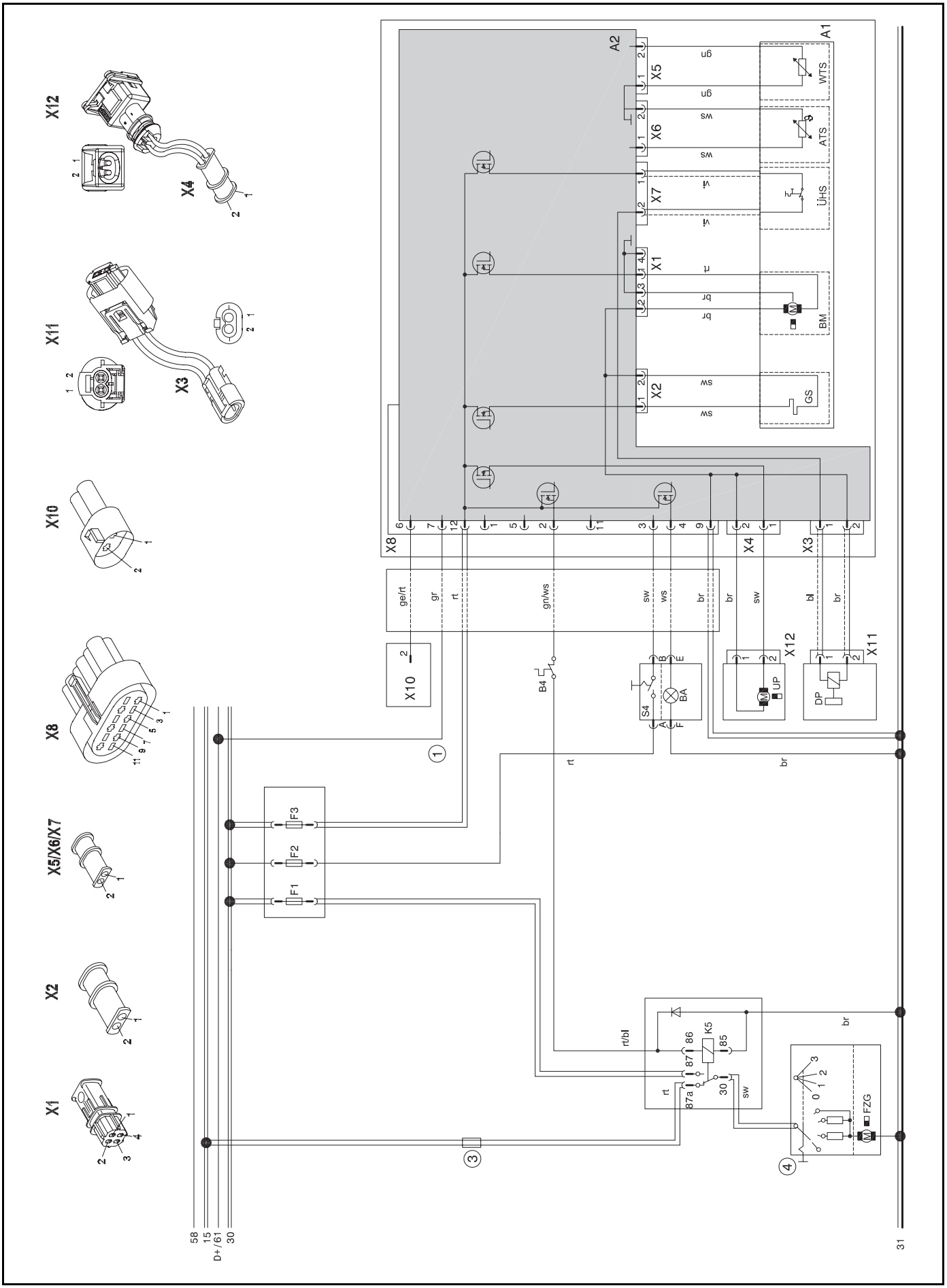



Fig. 704 Circuit diagram for Thermo Pro 90, parking heater with On/Off switch without ADR.

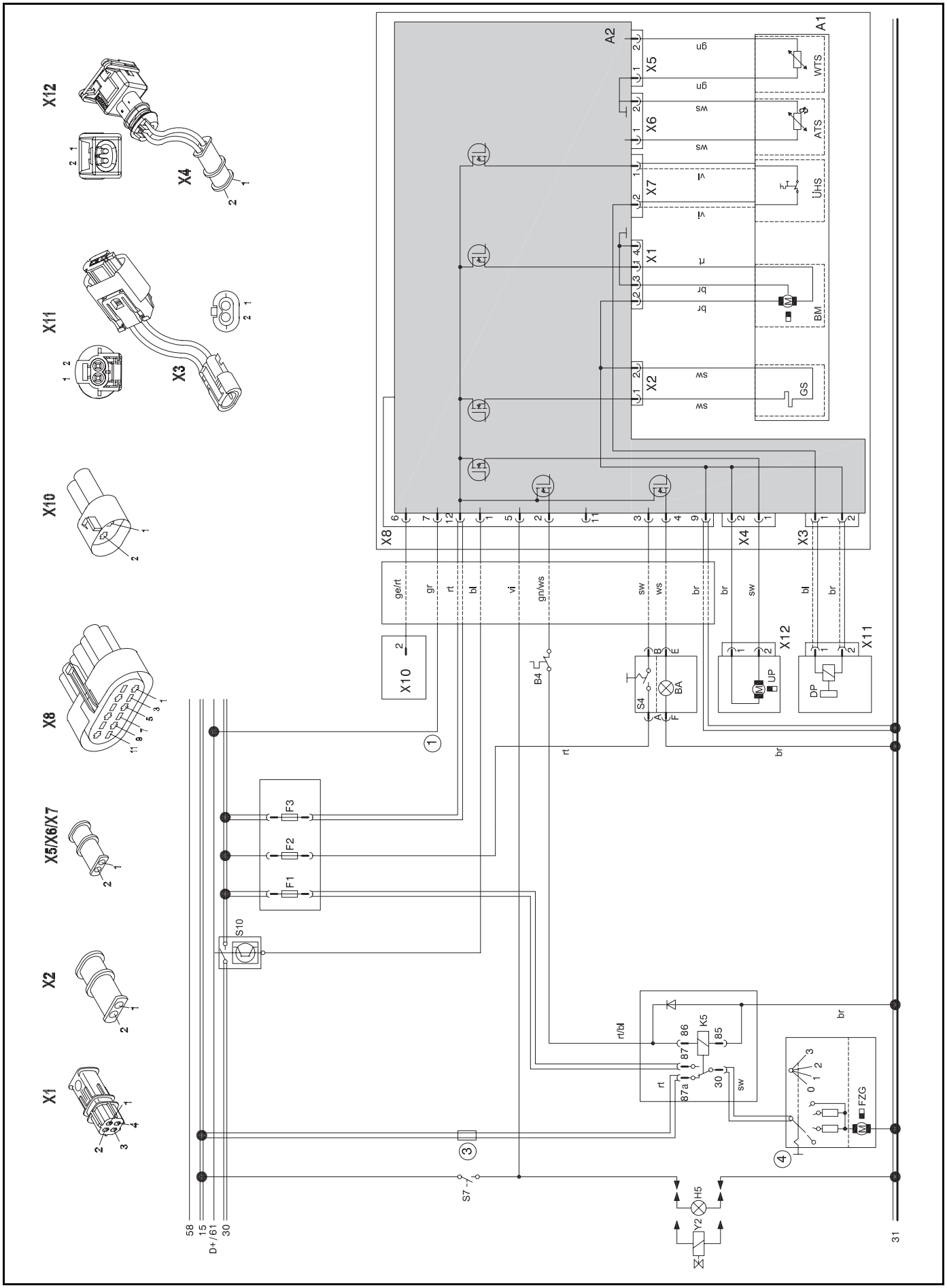



Fig. 705 Circuit diagram for Thermo Pro 90, parking heater with On/Off switch with ADR with auxiliary drive.

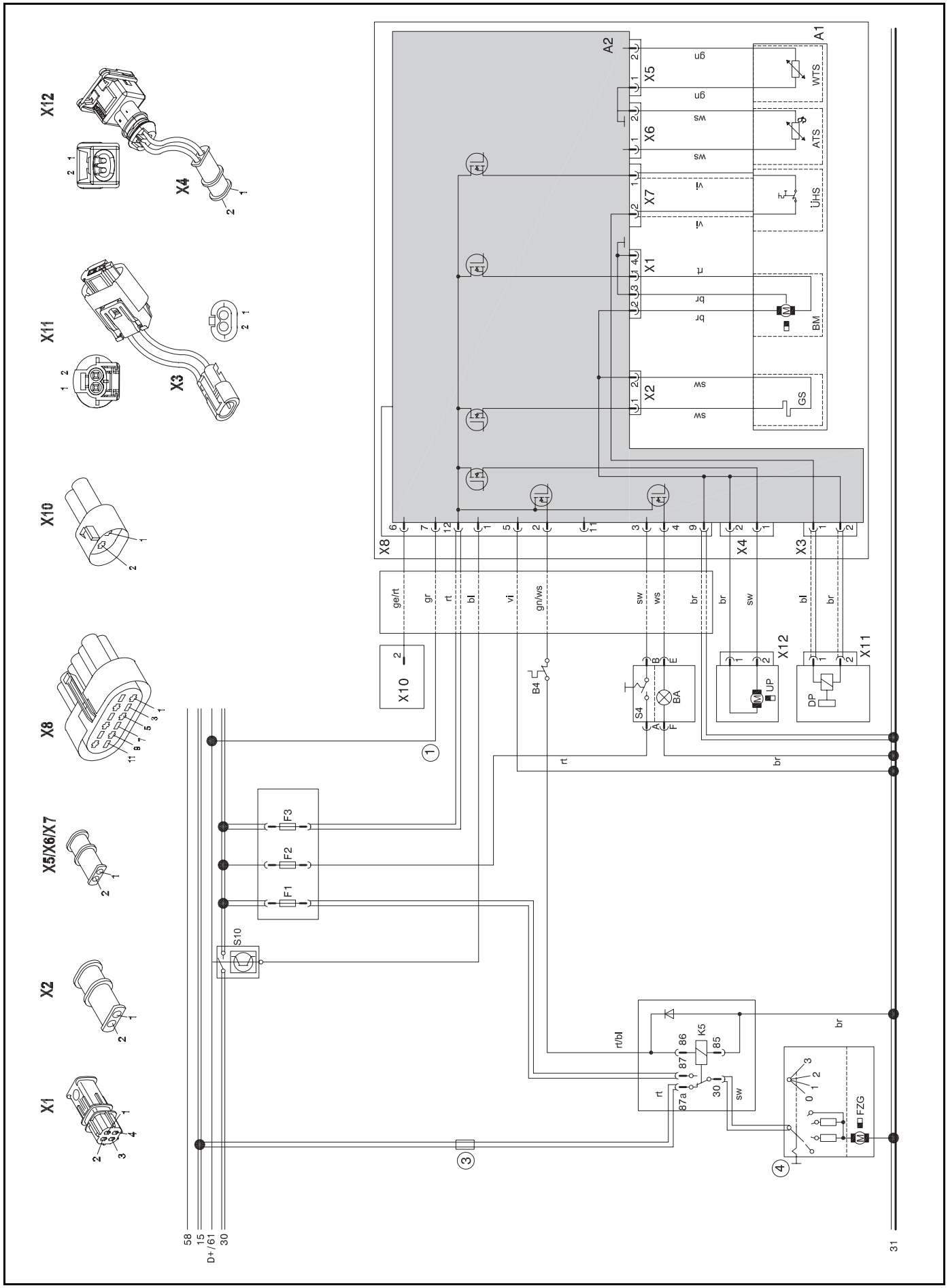



Fig. 706 Circuit diagram for Thermo Pro 90, parking heater with On/Off switch with ADR without auxiliary drive.

# 8 Servicing work

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°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

## 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.

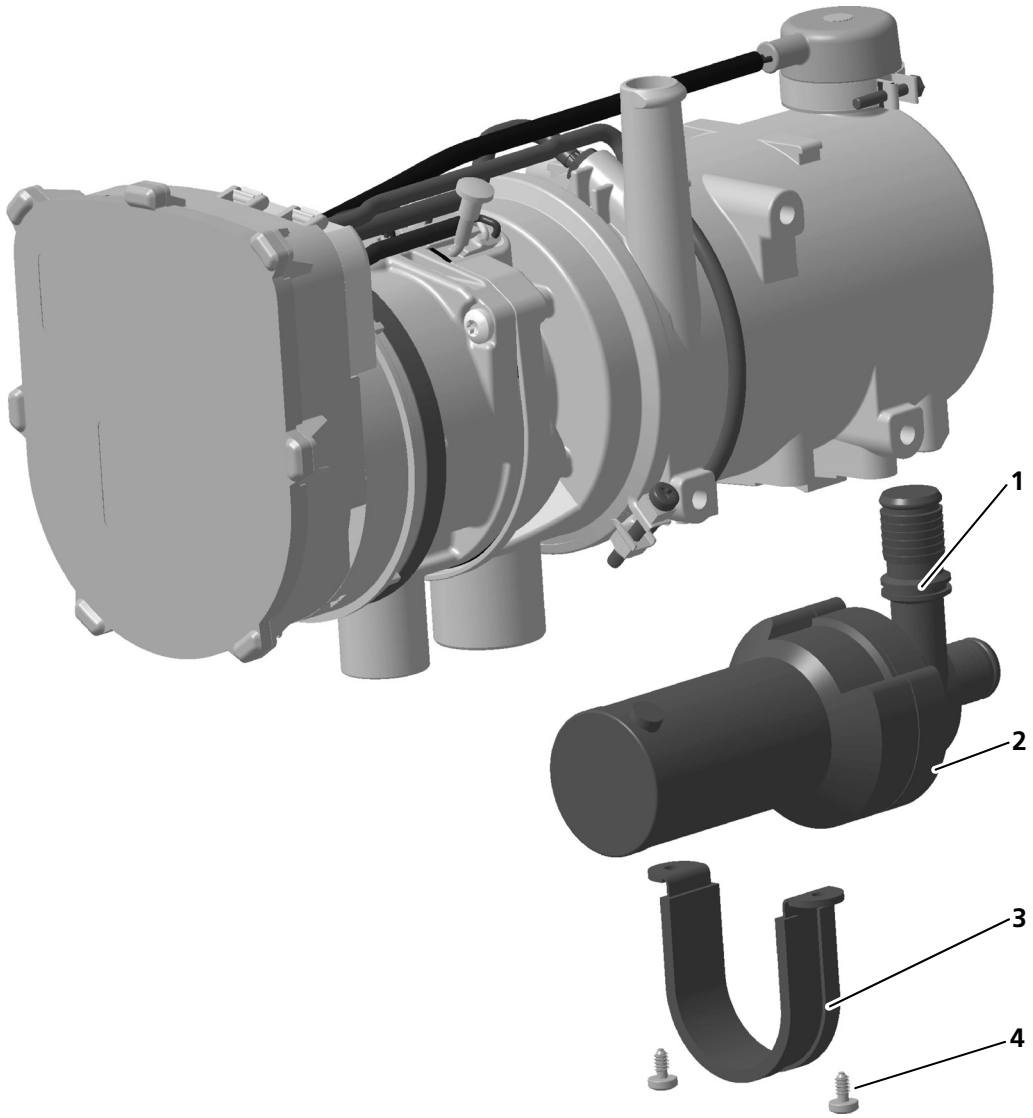
## 9.4 Replacing circulation pump

### 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 Nm ± 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

## 9.5 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 Nm ± 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).

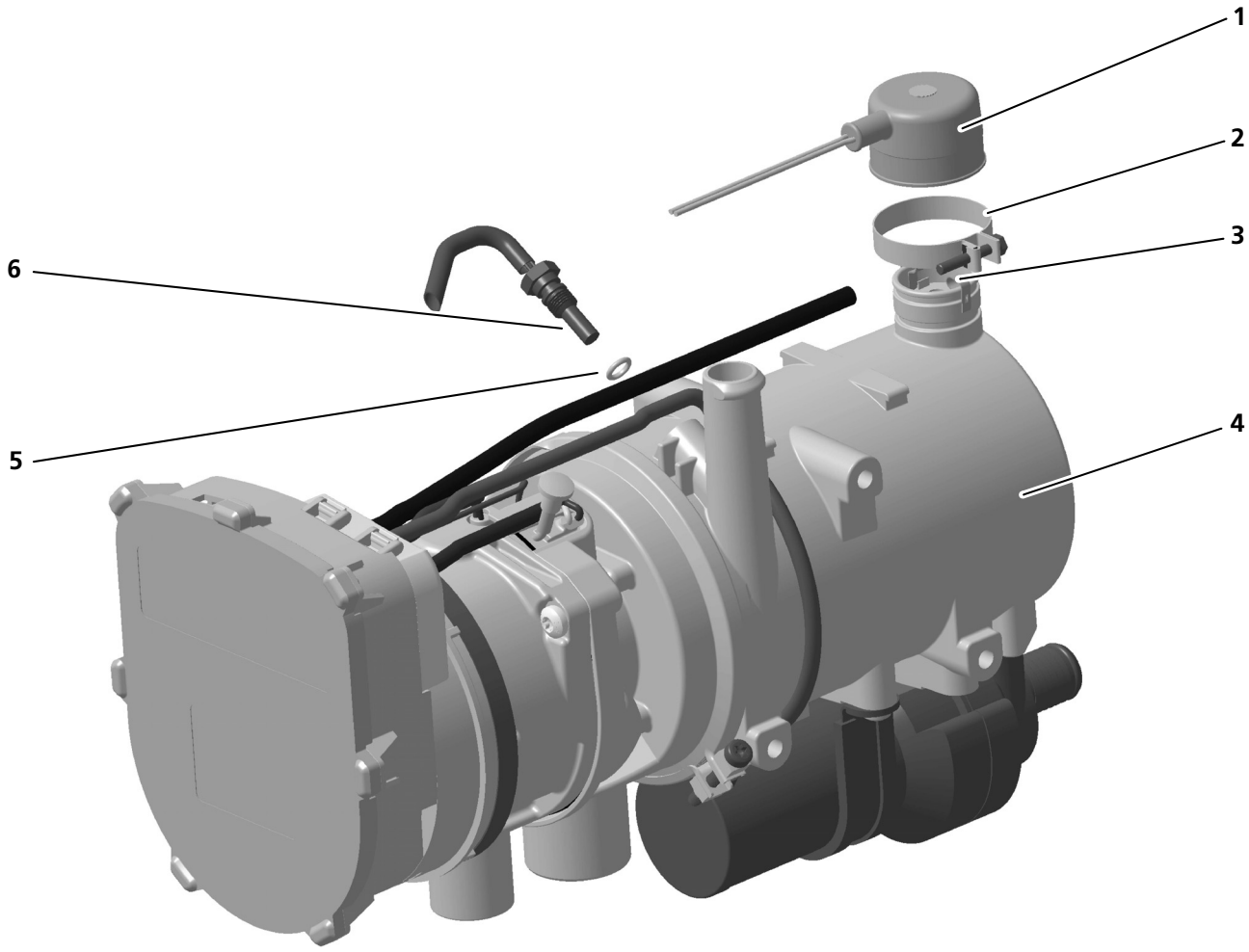
   **WARNING**

   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 Nm ± 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

## 9.7 Replacing combustion air fan

### Removal

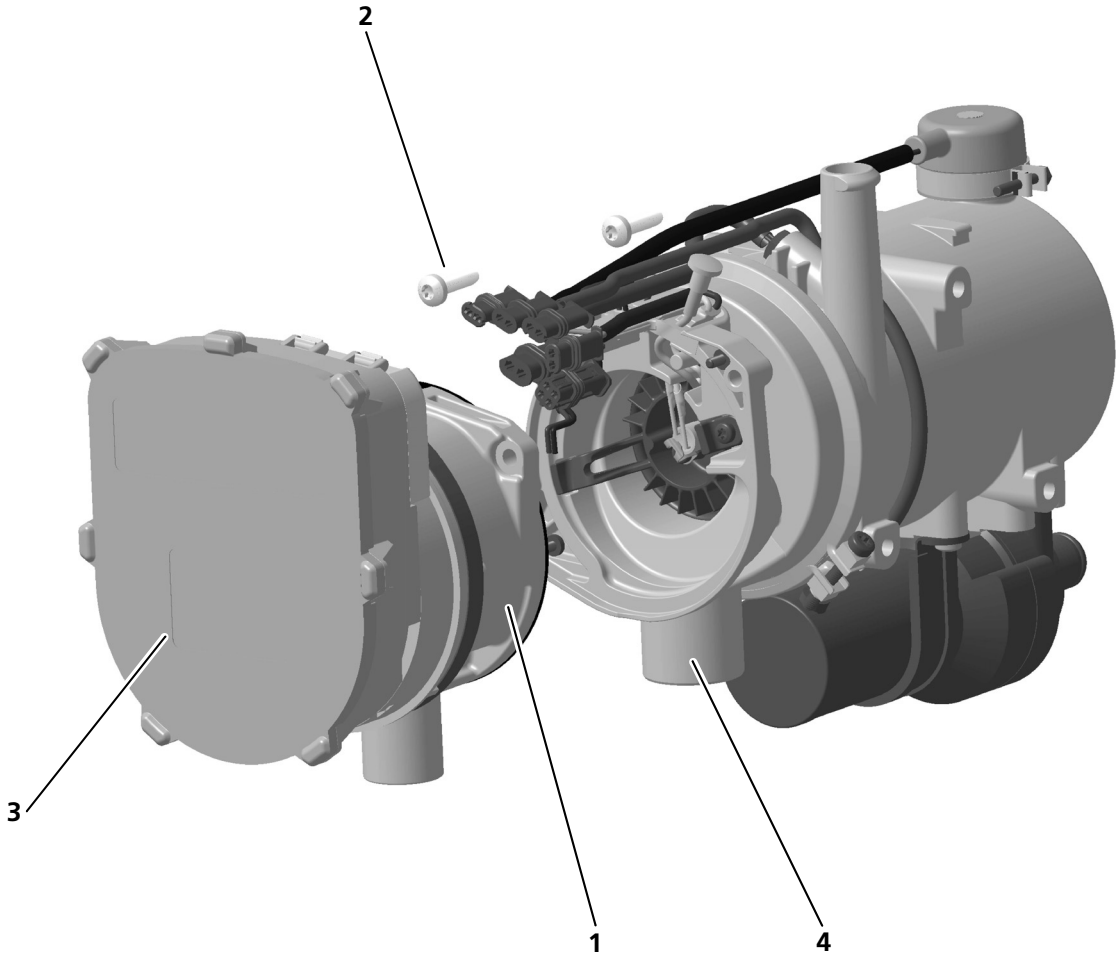
1. Remove heater (see Section 8.5.1), depending on space required.
2. Disconnect electrical connections (see Section 9.3).
3. Remove screws (2, Fig. 903). Pull off control unit if necessary.
4. Pull combustion air fan (1) off burner head (4) and remove.
5. Carry out measures on components when dismantled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

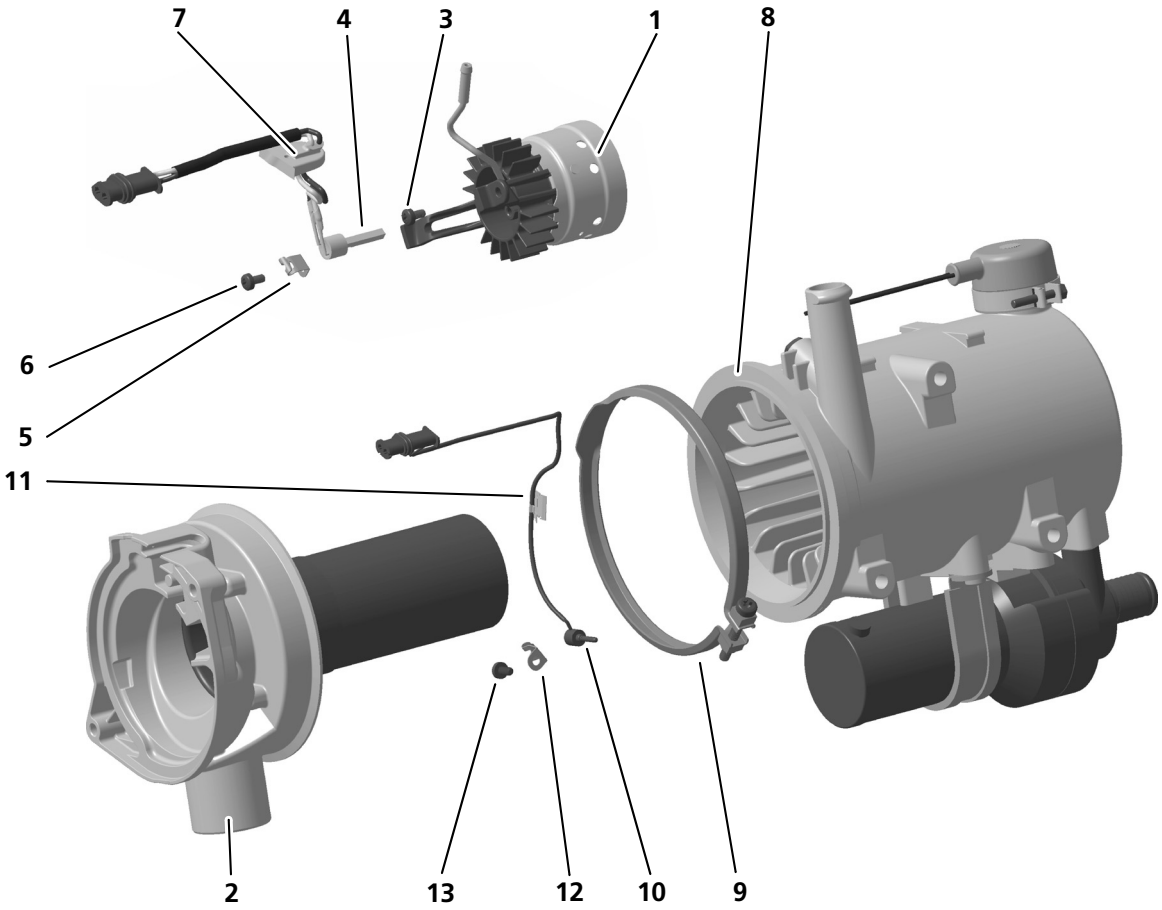
1. Disconnect electrical connections (see Section 9.3).
2. Unlock control unit and pull off of combustion air fan cap.
3. Remove fastening screw of V-clamp (9, Fig. 904) and pull off V-clamp.
4. Pull combustion air fan (4, Fig. 903) with burner head (2, Fig. 904) out of heat exchanger (8, Fig. 904) and 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 Nm ± 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 Nm ± 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).




1 = Burner unit
2 = Burner head
3 = Screw
4 = Glow plug
5 = Hold-down device
6 = Screw
7 = Grommet
8 = Heat exchanger
9 = V-clamp
10 = Exhaust temperature sensor
11 = Cable clip for exhaust temperature sensor
12 = Hold-down device for exhaust temperature sensor
13 = Screw for exhaust temperature sensor

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 Nm ± 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 Nm ± 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.

# 10 Packing, Storage and Shipping

## 10.1 General

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 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.

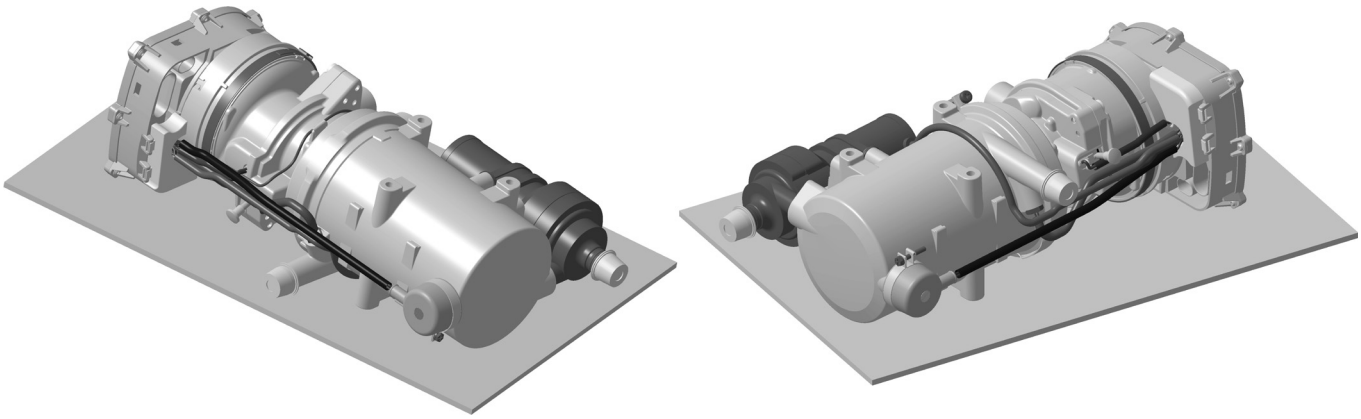


Fig. 1001 Preferred position of Thermo Pro 90 heater for storage and transport

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