

Air Heaters

Workshop Manual

Air Top Evo 40

Air Top Evo 40 B (Petrol)

Air Top Evo 40 D (Diesel)



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

To install and repair Webasto heating and cooling systems you need to have completed a Webasto training course and have the appropriate technical documentation, special tools and special equipment.



Only genuine Webasto parts may be used. See also Webasto air and water heaters accessories catalogue.

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

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

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

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1 Introduction

1.1 Contents and purpose

This workshop manual is used to support instructed personnel when repairing the Air Top Evo 40 / Air Top Evo 55 petrol or diesel air heaters.

1.1.1 Use of air heaters

The Webasto Air Top Evo 40 / Air Top Evo 55 air heaters are used

- to heat cabins, boats, trucks, minibuses, vans, ambulances and motorhomes
- to defrost vehicle windows
- to heat cargo

They are not designed for heating cargo areas used to carry hazardous substances.

The heaters operate independently of the vehicle engine and are connected to the fuel tank and to the vehicle's electrical system.

They may be used for vehicles with either water or air-cooled engines.

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

If necessary, the operating instructions, installation instructions and the vehicle-specific installation documentation can be used additionally.

1.4 Statutory regulations and safety instructions

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 below (see Section 1.4.2). 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

Type approvals according to ECE-R 10 (EMC) and ECE-R 122 (Heating) exist for the Air Top Evo 40 / Air Top Evo 55 Heater. For the approval number, see Chapter 4, "Technical Data".

The provisions of Appendix 7 of the guideline ECE-R 122 must mainly be observed for the installation.

NOTE:

The specifications of this Directive are binding in the scope of the Basic Directive EEC/70/156 and/or EC/2007/46 (for new vehicle models from 29/04/2009) and should also be observed in countries in which no special regulations exist.

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 out in accordance with the workshop manual and the installation instructions.

The of the exhaust pipe ends is to be routed downward, to the side or, with exhaust gas routing under the vehicle floor, up to the proximity of the side or rear limitation of the cab or the vehicle.

The function of parts important for vehicle operation may not be impaired. It must not be possible for condensate or water to collect in the exhaust pipe. Drain holes may be used.

Electrical lines, switching and control units of the heater must be positioned in the vehicle so that their proper operation cannot be impaired under normal operating conditions.

The ECE-R 122 Appendix 9 3.1.1 must be complied with for the routing of fuel lines and the installation of additional fuel tanks.

The main points from this law:

- All fuel tanks used to supply the heater must comply with the following regulations:
 - (a) If a leak occurs, the fuel must flow off onto the ground without it coming into contact with hot parts of the vehicle or the cargo.
 - (b) Fuel tanks containing petrol must be provided with an effective flame arrester at the filling opening or with a cap with which the opening is kept hermetically sealed.
- The exhaust system and the exhaust lines must be positioned or protected so that the cargo cannot be subjected to dangerous heat-up or ignition. Parts of the exhaust system located directly under the fuel tank (diesel) must be positioned at a distance of at least 100 mm or must be protected by a heat shield.

The heat exchanger of the air heater may be used for a maximum of 10 years and must then be replaced with a genuine spare part by the manufacturer or one of its authorised workshops. The heater must then be provided with a sign which bears the date of sale and the word "Original spare part".

When replacing the heat exchanger, it is also mandatory to replace the blow-out temperature sensor in order to prevent possible faults when using the old blow-out temperature sensor.

When installed in the vehicle interior, the Air Top Evo 40 / Air Top Evo 55 heaters must be prepared for installation and sealing off directly on the cabin floor or on a cabin wall. With the accessories available from Webasto, detachable connections of the combustion air and exhaust lines are not permitted in the vehicle interior.

The seal between the heater mounting and the vehicle floor must always be installed, otherwise harmful emissions may get into the interior of the vehicle.

Cold and combustion air intake openings must be positioned so that no water can penetrate during a water crossing permissible for the respective vehicle.

The combustion heater shall not constitute a risk of fire, even in the case of overheating. This requirement shall be deemed to be met if the installation ensures an adequate distance to all parts and suitable ventilation, by the use of fire resistant materials or by the use of heat shields.

(Requirement from ECE-R 122, Point 5.3.2.2.).

In the case of M2 and M3 vehicles, the combustion heater must not be positioned in the passenger compartment. However, an installation in an effectively sealed envelope which also complies with the conditions in paragraph 5.3.2.2 may be used.

(Requirement from ECE-R 122, Point 5.3.2.3.).

The installation box must have sufficient external ventilation to ensure that a maximum temperature of 40 °C is not exceeded in the box. Malfunctions may occur if the temperature exceeds this level.

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

Wherever inflammable vapours or dust may form (for example in the vicinity of fuel, carbon, wood dust or cereal stores or the like), the heater must be switched off as a result of the risk of explosion.

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

In case of longer lasting smoke emission, unusual combustion noises or fuel odours, the heater must be shut down by removing the fuse and may not be returned to operation again until after it has been checked by personnel trained by Webasto. Claims can only be made if it can be verified that the claimant has complied with the servicing and safety instructions.

The fuel lines may not make direct contact to the exhaust pipe and must be thermally insulated if necessary, as otherwise there is a fire danger.

All fuel-carrying lines must be connected leak-tight, may not be damaged and must be inspected regularly (at least at the same interval as the vehicle inspection).

NOTE

If damage to or leaks in the fuel line are determined, the heater may not be operated until the damage has been eliminated by an authorised Webasto specialist workshop. Put the heater out of action by removing the fuse.

Overheating

Keep the cold air inlet and hot air outlet free of dirt and objects. Blocked air lines can result in an overheating switch-off.

After an overheating switch-off, the air routing must be checked for free passage and all materials which impair the flow of air must be removed or damage to the air routing must be repaired by an authorised Webasto specialist workshop.

Never remove the grille in front of the cold air inlet. Then the fault lock-out must be eliminated by switching the heater off and then on again. If these measures are unsuccessful (overheating occurs again), the vehicle must be taken to an authorised Webasto specialist workshop again.

The air outlet jets or air vents with adjustable flaps must always be opened to some extent so that the air current through the heater is not completely blocked. At least one air outlet must be non-closable.

If the heater is installed in a storage area, you must ensure that no inflammable substances are kept in this area and that other material does not restrict the air supply to the heater.

Air lines must be firmly secured on the heater and at all other connection points (e.g. air outlets) (e.g. with pipe clamps).

IMPORTANT

- The heater may not be exposed to temperatures of more than 85 °C (storage temperature). Otherwise the electronics may suffer permanent damage.
- Do not stand on the heater and do not place any heavy items on the heater or throw items at the heater.
- Do not place any items of clothing, textiles or similar materials over the heater or in front of the cold air inlet and the hot air outlet.
- The current of hot air in the heater must not be restricted or blocked by highly inflammable substances or materials such as rags, cleaning wool, etc.
- Inflammable or explosive substances and gases must not be placed near or in contact with the heater, the hot air line, the hot air flow or the exhaust pipe.
- The heater must not be cleaned with a high pressure cleaner.
- Do not switch the heater off at the main battery switch or battery isolation switch since otherwise it is possible that it may suffer long term damage if it is switched off frequently using the battery isolation switch and this can cause damage and negative influences on the function of the heater.

Liability claims

Failure to follow the installation instructions and the notes contained therein will lead to all liability being refused 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 heater's type approval being voided, and therefore also of the General Homologation/ECE Type Approval.

Be sure to read the operating instructions before putting the heater into operation.

2 General Description

The Air Top Evo 40 / Air Top Evo 55 air heater designed according to the evaporator principle mainly consists of the following:

- The drive unit (drive motor with combustion and heating air fan)
- The heat exchanger
- The evaporator mount with combustion pipe
- The control unit
- The glow plug
- The housing parts
- The base seal

To control and monitor it, the heater has the following components inside it:

- A control unit with room temperature sensor, speed sensor (Hall sensor) and air pressure sensor
- A blow-out temperature sensor
- An exhaust temperature sensor



Fig. 201 Air Top Evo 40 / Air Top Evo 55 air heater

The fuel supply is ensured externally via a fuel pump.

The heater can be controlled with an internal room temperature sensor or an external room temperature sensor (optional).

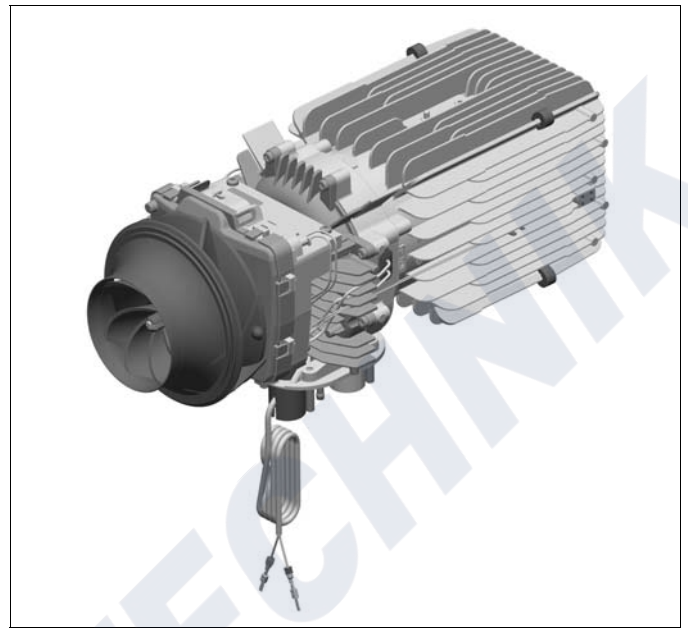


Fig. 202 Air Top Evo 40 / Air Top Evo 55 air heater without housing

2.1 Drive unit

The drive unit consists of the drive motor, the combustion air fan, the heating air fan and the intake housing.

The combustion air fan supplies the air required for the combustion process from the combustion air inlet to the evaporator mount.

The heating air fan transports the cold air from the cold air inlet to the hot air outlet via the heat exchanger.

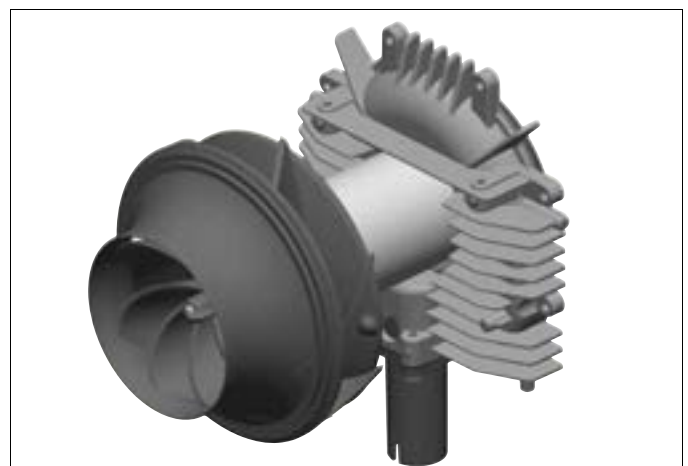


Fig. 203 Drive unit

2.2 Heat exchanger

The heat generated by combustion in the heat exchanger is given off to the cold air transported by the heating air fan.

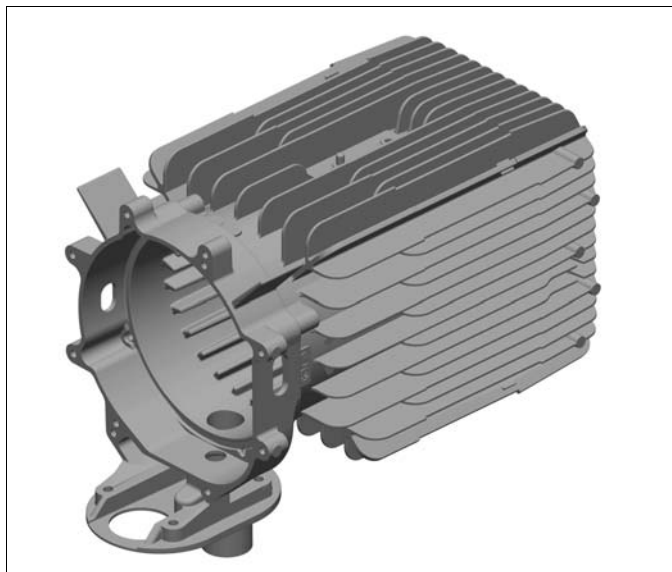


Fig. 204 Heat exchanger

2.3 Evaporator mount with combustion pipe

The fuel is distributed via the metal fibre evaporator (fleece) in the evaporator mount. The mixture of fuel and air burns in the combustion chamber, thus causing the heat exchanger to become hot.

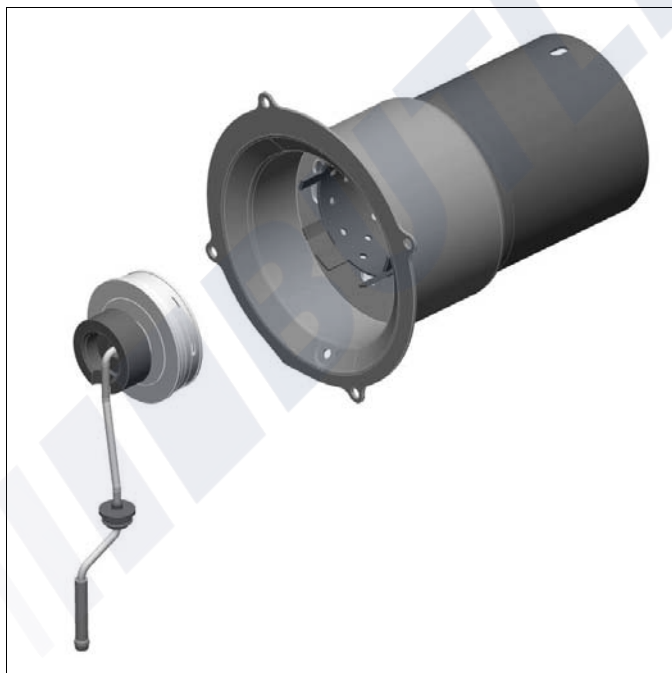


Fig. 205 Evaporator mount (diesel) and combustion pipe



Fig. 206 Evaporator mount (petrol) and combustion pipe

2.4 Glow plug

The mixture of fuel and air is ignited by the glow plug when the heater is started. The glow plug designed as an electrical resistor is positioned in the burner assembly (evaporator mount with combustion pipe) on the side facing the flame.



Fig. 207 Glow plug

2.5 Exhaust temperature sensor

The exhaust temperature sensor is a low-resistance PTC resistor which changes its resistance in dependence on the temperature change of the exhaust gases. This change in resistance is also used for flame monitoring.

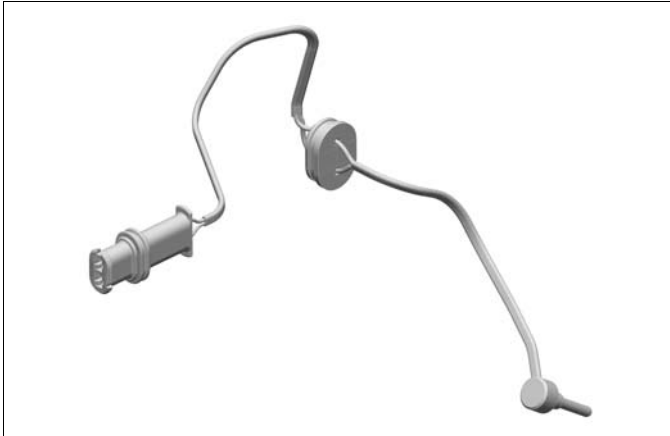


Fig. 208 Exhaust temperature sensor

2.6 Blow-out temperature sensor

The blow-out temperature sensor measures the temperatures in the fin area of the heat exchanger during the entire heater operation.

The control unit evaluates the signal and regulates the hot air outlet temperature and controls the overheating switch-off.

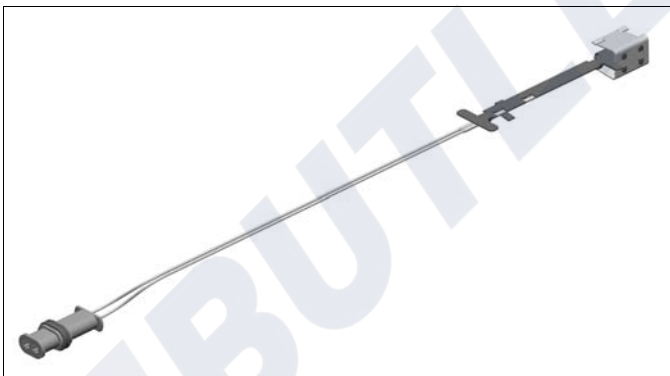


Fig. 209 Blow-out temperature sensor

2.7 Control unit

The control unit is the central component for ensuring the operating sequence. It monitors the components, evaluates the signals of the sensors and regulates the heating mode.

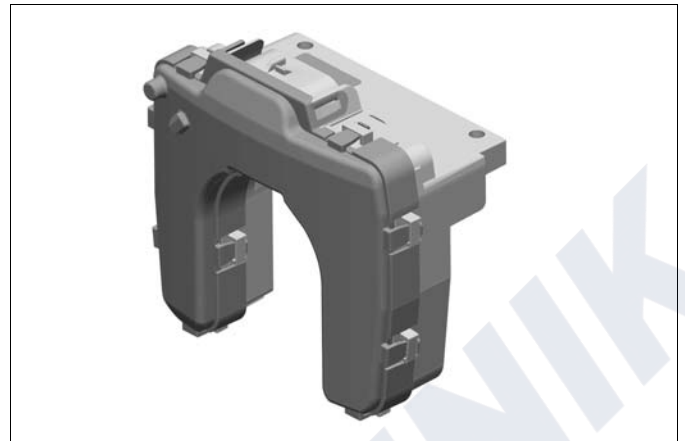


Fig. 210 Control unit

2.8 Fuel pump

The fuel pump is a combined pumping, metering and shut-off system for the heater fuel supply.

The Air Top Evo 40 / Air Top Evo 55 heaters must be operated with the DP 42 fuel pump.

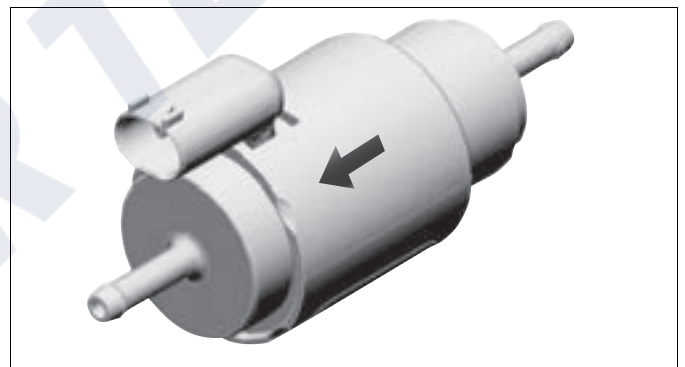


Fig. 211 DP 42 fuel pump

3 Function Description

3.1 Control element

Air Top Evo 40 / Air Top Evo 55 can be activated either with suitable control elements, e.g. rotary selector, combination timer, or an Air Top Evo Multi Control (MC04). Operation is described in the operating instructions of the respective control element.

The control element is used to switch the heater on and off, to set the desired room temperature (between approx. 5 °C and 35 °C) and the operating indicator.

The installed operating indicator is used

- as switch-on check,
- as a fault signal and
- as a service display.

Additional comfort functions (Eco, Normal, Plus and Ventilation) can be controlled with the Air Top Evo Multi Control (MC04) control element.

NOTE

ADR operation:

After an ADR switch-off, the heater is in an ADR lock-out. This is cancelled by switching the device off and then on again.

3.2 Switching on

Switch on heater.

Set the control element to the required temperature.

The starting process begins when the room temperature is below the setpoint temperature.

NOTE

If the room temperature is above the selected setpoint temperature, only the drive motor with the combustion and heating air fan runs. When an external room temperature sensor is connected, the drive unit does not run.

Before starting, a plausibility test of the temperature sensors is carried out and the function of the exhaust-temperature flame monitor is checked. If the flame monitor now reports "light", the system will attempt to cool the flame monitor for up to 100 seconds. If the flame monitor still reports "light" the control unit will suffer a fault lock-out. Also see Section 3.10, "Fault switch-off".

Start

When the heater is switched on the operating display will be lit and the glow plug will be switched on (cycled). The drive motor with the combustion and heating air fan is adjusted to approx. 50 % of the maximum speed.

After approx. 40 seconds, the fuel pump is put into operation and flame formation begins. To improve the starting quality, the fuel pump and the drive unit are controlled with different frequencies and speeds.

After a further 80 to 120 seconds the glow plug will be switched off and the existence of the flame established.

Automatic restart

If the flame monitor does not find a flame, the starting procedure will be repeated. The glow plug will be switched on again (cycled). The drive motor with the combustion and heating air fan is adjusted to approx. 50 % of the maximum speed.

After approx. 40 seconds, the fuel pump is put into operation and flame formation begins.

After a further 80 to 120 seconds the glow plug will be switched off and the existence of the flame established.

If the heater has again failed to ignite properly, the it will be shut down using a fault slow down procedure at maximum speed after approx. 240 seconds and will suffer a fault lock-out.

NOTE

After restarting, a fault lock-out of the heater is carried out. To reset the fault switch the heater off briefly (at least 2 seconds) and then on again.

3.3 Heating mode

Whilst the heater is operating the combustion gases pass through the heat exchanger. In the process, the combustion heat is given off to the walls of the heat exchanger, absorbed by the cold air transported by the heating air fan and routed into the vehicle interior.

The temperature of the cold air intake is measured by a room temperature sensor in the control unit or an external room temperature sensor. If the measured temperature is less than is set on the control element, the heater output increases to the maximum heating capacity.

To increase the burner service life in continuous operation, the delivery capacity of the fuel pump is reduced for 10 seconds every 10 minutes.

In addition, the heating mode is briefly interrupted after every 8 hours and then automatically restarted in the same way as for a control break. This ensures controlled combustion operation.

3.4 Control mode

In the control mode, the drive motor speed and the fuel pump quantity are dependent on the heating capacity. The glow plug is off.

3.5 Control break

After the temperature set on the control element has been reached the heat output is reduced. The speed of the combustion and heating air fan and the pumping quantity of the fuel pump are reduced.

If, at minimum heat output, the intake temperature set on the control element is exceeded, the fuel pump is shut down and the combustion process ended. To burn off the flame properly, the drive motor speed falls after 20 seconds to partial load speed and then returns to the initial speed after 20 seconds, after which it falls to the control break speed in approx. 90 seconds, where it remains for the entire control break.

The control break speed is 0 if an external room temperature sensor is used.

If the temperature set on the control element is dropped below the room temperature sensor, the heater starts again.

NOTE

Changes to the setting on the control element are implemented by the control unit and heater after a delay.

3.6 Switching off

When the heater is switched off, the operating display on the control element goes out. If no fuel has been transported yet or if the heater is in the control break, the heater is switched off immediately without a run-on period.

If the fuel transport has been started it is ended when the heater is switched off. The heater is switched off using the same method as the transition from control mode to control break. The heater is then switched off automatically.

NOTE

It is permissible to switch on the heater again during the run-on. In this case the run-on is completed and the heater is then restarted.

3.7 Functions of Air Top Evo System

3.7.1 System design

The Air Top Evo 40 D and Air Top Evo 55 D heaters (diesel) can be designed as a system with 2 heaters.

Here Unit 1 is defined as the master heater and Unit 2 as the slave heater. The control element and an external room temperature sensor (T) are connected to the master heater (see wiring diagram in Figure Fig. 706). The slave heater is connected as shown in the wiring diagram (see Fig. 707). The units communicate with each other via a serial bus system.

IMPORTANT

The use of an Air Top Evo system is not permitted for dangerous goods transports (ADRs)!

3.7.2 Installation/Commissioning

Installation

1. Installation of the heaters in accordance with Air Top Evo 40 / Air Top Evo 55 installation instructions
2. Ensure that the electrical connections are in accordance with the wiring diagram (Fig. 706, Fig. 707)
3. Installation of control element and external room temperature sensor

NOTE

When the heaters are switched on, the system automatically configures itself as master and slave.

3.7.3 Resetting Master/Slave System

In case of a power failure, the system will be reset to the original state ("Stand Alone").

It is also possible to reset the system with the Webasto Thermo Test PC Diagnosis (from Version 2.13).

3.8 Heater functions when installed in ADR vehicles

NOTE

Only applies to Air Top Evo 40 / Air Top Evo 55 heaters installed in vehicles for transporting dangerous goods (ADR).

If the heater is switched off using the control element the slow down time remains unchanged.

A brief slow down time (max. 40 seconds) is started automatically if

- the vehicle's engine is switched off
- a transport device is started.

The ADR switch-off can also be triggered by vehicle-specific safety mechanisms.

After an ADR switch-off, the control unit is in the "ADR lock-out" position. For repeat start-up, the control element must be set to "OFF" and the auxiliary drive signal or the vehicle-specific safety mechanism must no longer be active.

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

3.10 Fault switch-off

Errors on the various heater components and faults in the starting process and in heating mode are identified in the control unit. For safety reasons, the fuel pump will be switched off after all detected faults. The heater is switched off and switches into the fault lock-out mode. For details, see Chapter 5, "Troubleshooting".

3.10.1 Error monitoring

The overheating, incorrect start and flame abort errors are counted and cause the heater to suffer a fault lock-out after an error has occurred the maximum number of times.

The incorrect start counter is increased by 1 each time the heater fails to start. If the incorrect start counter reaches its maximum permissible value of 9, then the heater is in the heater lock-out status.

The fault counter is increased by 1 for each malfunction for which there is no separate counter. If the fault counter reaches its maximum permissible value of 5, then the heater is in the heater lock-out status.

The overheating counter is increased by 1 each time the heater overheats. If the overheating counter reaches its maximum value of 5, then the heater is in the heater lock-out status.

After a flame abort, a restart is automatically carried out. The condition for a restart is that the heater was in the control mode directly beforehand. During the restart the cycle repetition counter is increased by one. This process is repeated until the heater either burns properly again or the maximum value of 3 for the cycle repetition counter has been reached.

The flame abort counter FAZ is increased by 1 when the cycle repetition counter ZWZ has reached the maximum value. If the flame abort counter reaches its maximum value of 3 the heater will go into the heater lock-out status.

Automatic reset:

Following each heater start-up, the cycle repetition counter is set to 0. The fault counter is set to 0 after a fault-free transition to the control mode and the flame abort counter, overheating counter, false starting counter and cycle repetition counter are set to 0 after (!) fault-free combustion operation (20 min.).

3.10.2 Reset a fault switch-off

1. **Switch on heater**
↓
2. An error has occurred and is detected by the control unit as a **fault**
↓
3. The **error code** is displayed via the control element
↓
4. Any active **heater lock-out** is cancelled (as described below)
↓
- 4.1. The heater detects an error as a **fault**
↓
- 4.2. **Fault switch-off** with subsequent **fault lock-out**
↓
- 4.3. The **error code** is displayed via the control element
↓
5. Switch off heater
↓
6. Determine error cause (e.g. with or without **error code**, visual inspection of fuses and connectors, etc.)
↓
7. Eliminate error
↓
8. Switch on heater
↓
9. **Fault lock-out** unlocked
↓
10. The heater switches into the control mode

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.

Cancel heater lock-out

The heater lock-out can be cancelled

- with the Webasto Thermo Test PC Diagnostics (WTT)
- or by switching on the heater.
Remove fuse **F1** for at least 10 s.
Switch off heater.
Reinstall fuse **F1**.
Switch on heater.

Cancel permanent heater lock-out

Only for "OE" heater variants which are integrated in the vehicle bus system.

Unlocking is only carried out with the vehicle-specific computer diagnosis.

4 Technical Data

Except where limit values are specified, the technical data listed in the table refer to the usual heater tolerances of $\pm 10\%$ at an ambient temperature of $+20\text{ °C}$ and at the rated voltage and in rated conditions.

Electrical components:

The control unit, timer*, glow plug and control element are designed for 12 V or 24 V.

The drive unit, fuel pump, exhaust temperature sensor and external room temperature sensor are independent of voltage.

* not for ADR

Fuel for Air Top Evo 40 B / Air Top Evo 55 B (petrol):

The fuel specified by the manufacturer in accordance with DIN EN 228 must be used.

Fuel for Air Top Evo 40 D / Air Top Evo 55 D (diesel/PME):

The diesel fuel specified by the manufacturer in accordance with DIN EN 590 must be used.

We know of no negative influences due to additives.

If fuel is extracted from the vehicle's tank, follow the additive instructions issued by the vehicle manufacturer.

If you change to low-temperature fuel, the heater must be operated for approx. 15 minutes so that the fuel system is filled with the new fuel.

The Air Top Evo 40 D / Air Top Evo 55 D unit is also approved for operation with PME (bio-diesel) which complies with the standard DIN EN 14214.

About table (Fig. 401): Values in brackets apply to the increased heating capacity which is activated for a limited time during each start-up.

Heater	Operation	Air Top Evo 40B	Air Top Evo 55B	Air Top Evo 40 D	Air Top Evo 55 D
Type test permit		EMC: E1 03 5529 (Air Top Evo 40 / Air Top Evo 55) Heater: E1 00 0385 (Air Top Evo 40) Heater: E1 00 0386 (Air Top Evo 55)			
Model		Air heater with evaporation burner			
Heat output	Control range	1.7 to 3.5 (4.0) kW	1.7 to 5.0 (5.5) kW	1.5 to 3.5 (4.0) kW	1.5 to 5.0 (5.5) kW
Fuel		Petrol DIN EN 228		Diesel/Bio-Diesel DIN EN 590 DIN EN 14214	
Fuel consumption	Control range	0.18 to 0.38 (0.43) kg/h 0.25 to 0.51 (0.58) kg/h	0.18 to 0.54 (0.59) kg/h 0.25 to 0.73 (0.80) kg/h	0.15 to 0.36 (0.41) kg/h 0.18 to 0.43 (0.49) kg/h	0.15 to 0.51 (0.56) kg/h 0.18 to 0.61 (0.67) kg/h
Rated voltage		12 V		12/24 V	
Operating voltage range		10.5 to 16 V		10.5 to 16 V/20.5 to 31 V	
Rated power consumption	Control range	15 to 40 (55) W	15 to 95 (130) W	15 to 40 (55) W	15 to 95 (130) W
Permissible ambient temperature:					
Heater	– Operation – Storage	–40 °C to +40 °C –40 °C to +85 °C			
Fuel pump	– Operation – Storage	–40 °C to +20 °C (petrol), +30 °C (diesel) –40 °C to +85 °C			
Rotary selector	– Operation – Storage	–40 °C to +75 °C –40 °C to +85 °C			
Permissible combustion air intake temperature		–40 °C to +20 °C			
Adjustment range for room temperature	Control range	+5 °C to +35 °C			
Volume flow rate of hot air	against 0.5 mbar	max. 132 (140) m ³ /h	max. 200 (220) m ³ /h	max. 132 (140) m ³ /h	max. 200 (220) m ³ /h
Heater dimensions		Length: 423 ± 2 mm Width: 148 ± 1 mm Height: 162 ± 1 mm			
Heater weight		5.9 kg			

Fig. 401 Technical data Air Top Evo 40 / Air Top Evo 55

Setpoint values:

		12 V	24 V
Glow plug	At 25 °C Test current: < 5 mA	No marking 0.190 - 0.250 ohms	Green marking 0.740 - 0.940 ohms
Drive unit	Outside	< 6 ohms	
Blow-out temperature sensor	at 25 °C	2,195 ohms	
External temperature sensor	at 25 °C	10,000 ohms	
Exhaust temperature sensor		2,160 ohms	
Undervoltage switch-off (triggering time > 20 s)		≤ 10,5 V	≤ 20.5 V
Overvoltage switch-off (triggering time > 6 s)		≥ 16 V	≥ 31 V

Fig. 402 Setpoint values for resistance values of components

5 Troubleshooting

5.1 General information

If a malfunction occurs, a flashing code is displayed on the operating indicator or a fault code F .. on the combination timer.

In addition, the heater can be checked using a personal computer (see Webasto PC Thermo Test PC Diagnosis operating manual).

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. The functional relationships are described in Chapter 2 and 3.

IMPORTANT

The troubleshooting guide is restricted to the localisation of defective components.

The following fault causes should always be checked or a fault should be excluded for the following reasons:

- Corrosion on connector
- Loose connection on connector
- Poor crimp contacts on plugs
- Corrosion on lines and fuses
- Corrosion on battery terminals

If you wish to check individual components, the electrical plug connectors on the control unit must be disconnected.

Conduct a function test in the vehicle after rectifying each fault.

A direct operation of the individual components (with voltage) is not permitted.

5.2 General error symptoms

The following table (Fig. 501) lists possible fault symptoms.

Error symptom	Possible cause	Remedy
Heater cuts out automatically	No combustion after starting and restarting Operating display flashes	Switch heater off and then on again
	Flame extinguishes during operation Operating display flashes	Switch heater off and then on again
	Heater overheated Operating display flashes	Check the hot air guide for free passage, allow the heater to cool down, then briefly switch the heater off and then on again
	Vehicle voltage too low Operating display flashes	Charge battery Switch heater off and then on again
Heater emits black smoke	Combustion air and/or exhaust system blocked	Check that the combustion air and exhaust systems are clear

Fig. 501 General error symptoms

5.3 Error symptoms during function

The following table (Fig. 502) lists the possible error symptoms in the order in which they may occur during operation.

In the event of a fault, the error is to be located using this table and rectified. It is important that the error symptom is correctly identified.

If the error symptom is not included in this table or if the fault is not found under the specific error symptom heading, in an emergency you can contact our technicians on our service hotline.

NOTE

Every fault is indicated by the flashing LED on the control element after the slow down time has finished. If the other components are OK, a defective control unit may be the cause of all the faults.

There are states which are equivalent to faults.

Error symptom	Occurrence	Possible causes
No start and no illumination of the LED on the control element	immediate	Incorrect cabling, defective fuse
No start but LED is lit	immediate	The unit immediately goes into a control break when switched on; the control break speed is 0 rpm when an external temperature sensor is used.

Fig. 502 Error symptoms during function

Fault code	Fault (group)	Additional information during PC diagnostic	Troubleshooting
F 05	Not available		
F 06	Not available		
F 07	Fuel pump defective	88 Open circuit in fuel pump 08 Short circuit in fuel pump	Check electrical wiring and fuel pump and replace if necessary
F 08	Open circuit/short circuit/ overloading/blockage in drive motor	09 Short circuit in drive motor 89 Open circuit in drive motor 15 Blocking guard in drive motor 95 Overload protection in drive motor	Eliminate cause of blockage/sluggishness Check magnets of heating air fan and replace drive unit (drive motor with combustion and heating air fan) if necessary
F 09	Glow plug defective	19 Short circuit in glow plug 99 Open circuit in glow plug	Check glow plug and replace if necessary.
F 10	Overheating	06 Heater overheated - blow-out temperature sensor 5B Heater overheated - PCBs - temperature sensor 17 Temperature gradient exceeded - blow-out temperature sensor 5C Temperature gradient exceeded - PCBs - temperature sensor	Find and eliminate cause of overheating in hot air guide. Possible causes: Pressure loss too high, line kinked, air outlet closed, soiling of blow-out temperature sensor
F 11	Not available		
F 12	Not available		
F 13	Not available		
F 14	Blow-out temperature sensor defective	1B Short circuit in blow-out temperature sensor AB Open circuit in blow-out temperature sensor	Check blow-out temperature sensor and replace if necessary.
F 15	Not available		
F 16	Exhaust temperature exceeded	4F Upper limit of exhaust temperature exceeded	Check free through-flow of combustion air and exhaust system, check CO ₂ setting, clean soot from heat exchanger if necessary
F 17	Exhaust gas temperature sensor defective	1A Short circuit to ground in exhaust temperature sensor 9A Open circuit in exhaust temperature sensor	Replace exhaust temperature sensor
F 18	Setpoint generator defective	9B Open circuit or short circuit to +Ub in setpoint generator	Check wiring and replace control element if necessary
F 19	Plausibility of sensors incorrect	93 Plausibility check not passed	Check exhaust temperature sensor/blow-out temperature sensor for plausibility and replace defective sensor

Fig. 503 Faults and error remedies (Page 2 of 2)

5.5 Maintenance display in control element

The maintenance signal is displayed when an operating period of more than 3,000 operating hours has been reached or the heater is in a restricted operating mode.

In case of restricted operation, either the automatic altitude adjustment or the external room temperature sensor (optional) may be defective. The heater can continue to be operated, however with a considerable reduction in comfort in some cases.

The heater should be inspected by trained professionals as soon as possible.

The maintenance signal is displayed with equipment with a rotary selector or an Air Top Evo Multi Control (MC04) by means of flashing of the operating indicator for 60 seconds each time the heater is started. Flashing signal 1 second on, 1 second off.

With equipment with combination timer, "--" appears on the display.

6 Functional Checks

6.1 General information

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

WARNING

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

6.2 Required test and measuring equipment

The test and measuring equipment must be calibrated and proof of measuring certificates must be available.

Digital multimeter

Testing of electrical resistance [ohms], electrical continuity ≤ 0.1 ohms
Test current < 5 mA

Voltage source, adjustable

Measuring of electrical voltage [V]
10 - 30 V
 ≥ 30 A

CO₂ measuring unit

Testing of CO₂ value [vol. %]
Maximum ± 0.3 vol. %

Heater test bench *1)

Heater function test
Regarding contact Webasto heater test bench: International Technical Support - International Hotline:
hotline.wt@webasto.com

PC (personal computer)

Webasto Diagnosis Adapter incl. software

Diagnosis Adapter ID No. 9009064_ is available from Webasto.
Display of fault memory, operating data and control unit information.

Reference heater Air Top Evo 40 / Air Top Evo 55

The reference heater must be subjected to continual operating checks.

*1)

The following schematic diagram shows the components necessary for operating a heater. Application-specific interfaces must be taken into account. A calibrated fuel pump, which is subjected to continual operating checks, must be used for testing. The technical requirements are contained in the Webasto product documentation. It is preferable to use Webasto components. Particular attention must be paid to work and occupational safety.

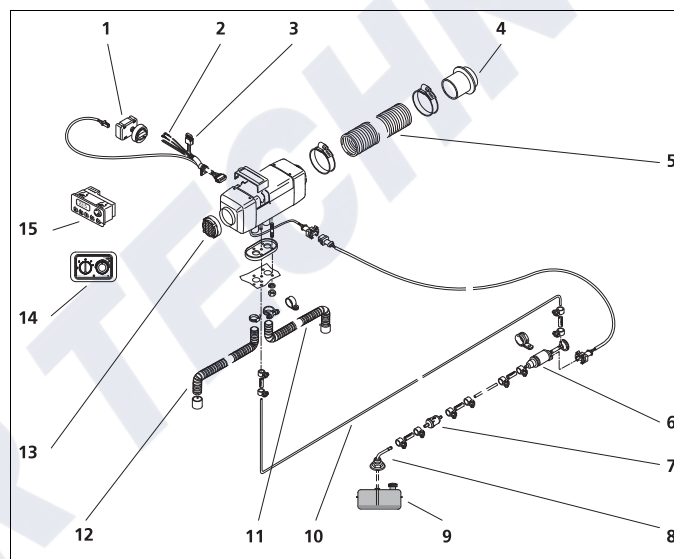


Fig. 601 Components required for operating a heater

- | | |
|---------------------------------|--|
| 1. Rotary selector | 10. Fuel line |
| 2. Electrical vehicle interface | 11. Exhaust pipe |
| 3. Heater fuse | 12. Combustion air intake pipe |
| 4. Hot air outlet | 13. Cold air inlet grille |
| 5. Hot air outlet hose | 14. Air Top Evo Multi Control (MC04) control element |
| 6. Fuel pump | 15. Combination timer |
| 7. Fuel filter | |
| 8. Fuel standpipe | |
| 9. Fuel tank | |

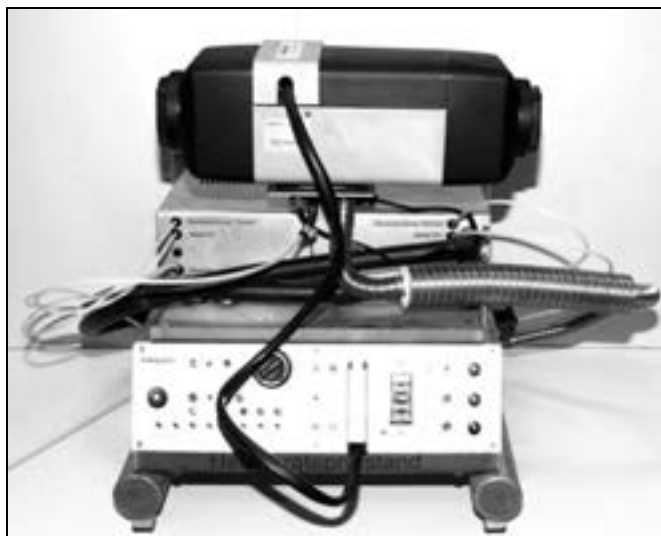


Fig. 602 Heater test bench

6.3 Settings

6.3.1 Factory settings

The heater is set at the factory, based on an altitude of 0 m above sea level, to a specified nominal CO₂ value in accordance with Section 6.3.2.

When used at altitudes above sea level, a higher CO₂ content in the exhaust gas results.

This increased CO₂ content can be corrected to the nominal value with a late CO₂ adjustment.

No setting/correction is necessary for heaters with automatic altitude compensation!

6.3.2 Adjusting CO₂ content

The CO₂ content in the emissions is set using the temperature selector on the control element. In the process, activate any heating mode (Eco, Normal or Plus) with the Air Top Evo Multi Control (MC04) control element.

IMPORTANT

The heater must be switched off.

1. Connect the CO₂ line to minus.
2. Turn the adjustment knob on the control element to the centre position. The heater will start and go automatically to partial load mode.

NOTE

If the heater can be adjusted the operating indicator will flash as if the control unit has suffered an error.

Diesel units:

3. Adjust the CO₂ value by turning the adjustment knob. Turning it anticlockwise will reduce the CO₂ value, whilst turning it clockwise will increase it. The CO₂ content must be set in accordance with Table Fig. 603 at partial load depending on the altitude.

Petrol units:

3. The CO₂ content may only be set with the unit at operating temperature. The unit must be operated for at least 8 minutes for this purpose. Then the CO₂ content must be set in accordance with Table Fig. 603 at partial load depending on the altitude.

Diesel and petrol units:

4. If the CO₂ value is in the permissible range, disconnect the CO₂ line from minus. This saves the setting.

NOTE

The heater will now run in the normal mode again and can be switched off in the accustomed manner using the control element.

	Air Top Evo 40 Air Top Evo 55 Petrol 12 V	Air Top Evo 40 Air Top Evo 55 Diesel 12 V/24 V
0 m above sea level	5,6	6,3
500 m above sea level	6,0	6,7
1,000 m above sea level	6,3	7,1
1,500 m above sea level	6,7	7,6

Fig. 603 Nominal values for CO₂ content in exhaust gas [vol. %]

6.4 Tests of individual components

IMPORTANT

For function tests always disconnect the connection between the control unit and the component to be tested.

NOTE

If a fault occurs which cannot be detected with this procedure, the unit/component must be sent in to the Webasto Warranty Department.

NOTE

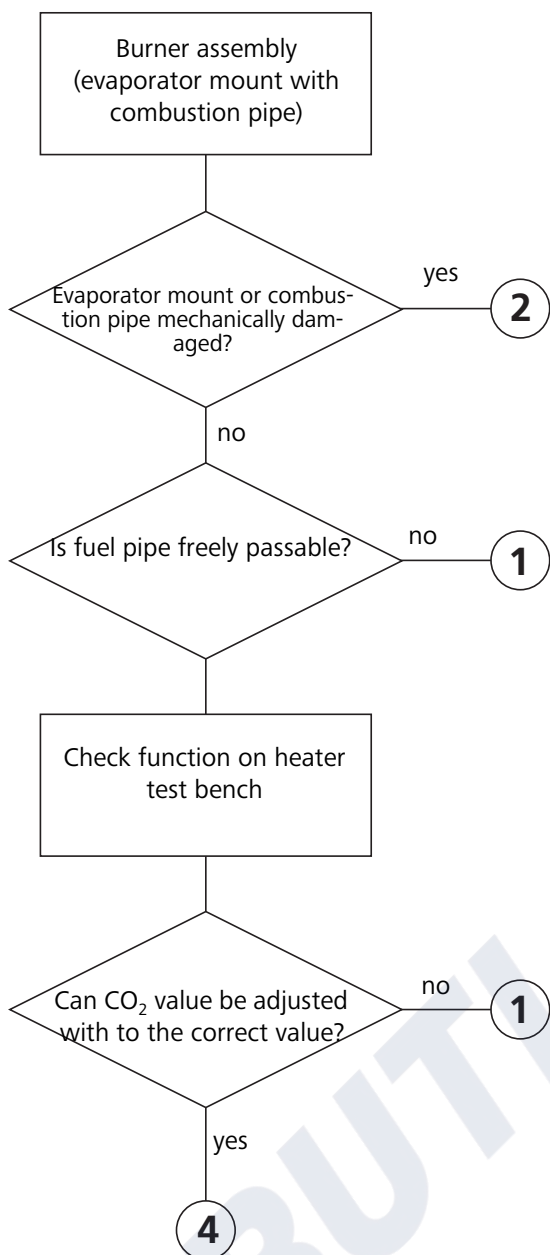
Damage caused by soiling will not be recognised by Webasto!




Graph legend

- (1) Replace component. Send defective components (not entire heater) to Webasto within warranty period.
- (2) Replace component and continue.
- (3) Replace heater. Send defective heater to Webasto within warranty period.
- (4) Continue.

6.4.1 Burner component assembly

See Fig. 907, Item 3 and Item 7



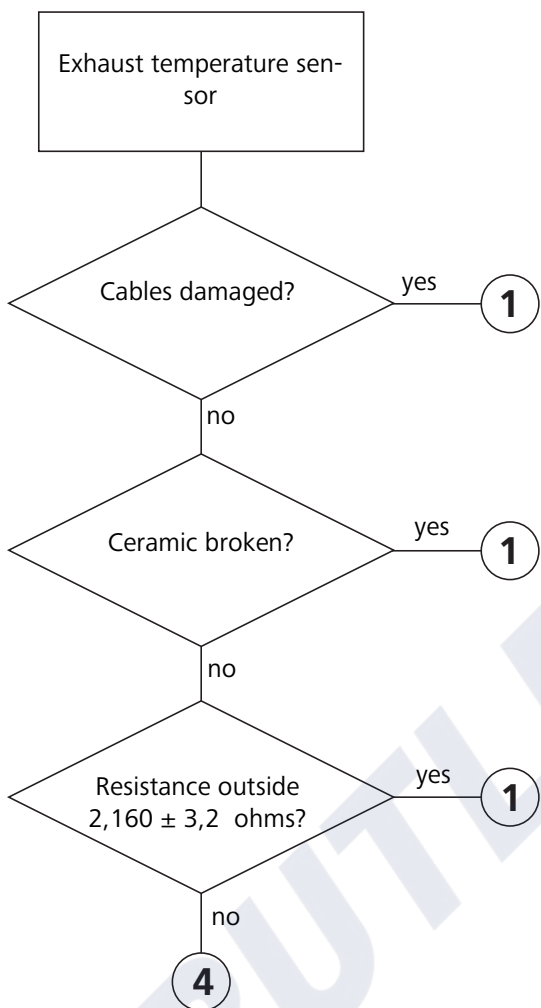
Procedure	Test or measuring equipment	Visual
Visual inspection		
Blow through		
Conduct function test with reference heater. Adjust the reference unit after 5 minutes to CO ₂ nominal value in accordance with graphic on site, install burner assembly to be evaluated in reference unit and measure CO ₂ value after 5 minutes of operation.	<ul style="list-style-type: none"> - Heater test bench - CO₂ measuring unit - Webasto Diagnosis Adapter - PC (personal computer) - Reference heater 	

6.4.2 Resistance test of exhaust temperature sensor

See Fig. 907, Item 10.

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

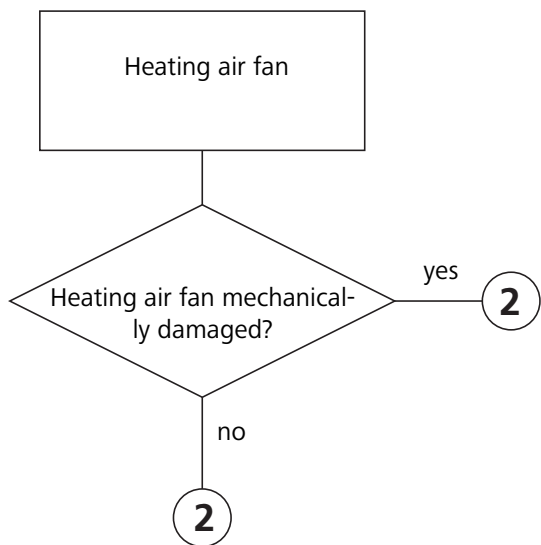
Resistance at 20 °C: $2,160 \pm 3.2$ ohms
 Test current: < 5 mA




Procedure	Test or measuring equipment	Visual
Visual inspection		
Visual inspection		
Resistance measurement	Digital multimeter	

6.4.3 Heating air fan component

See Fig. 903, Item 1



Procedure	Test or measuring equipment	Visual
Visual inspection – Deformation – Magnets present – Locking lug broken		

6.4.4 Glow plug component

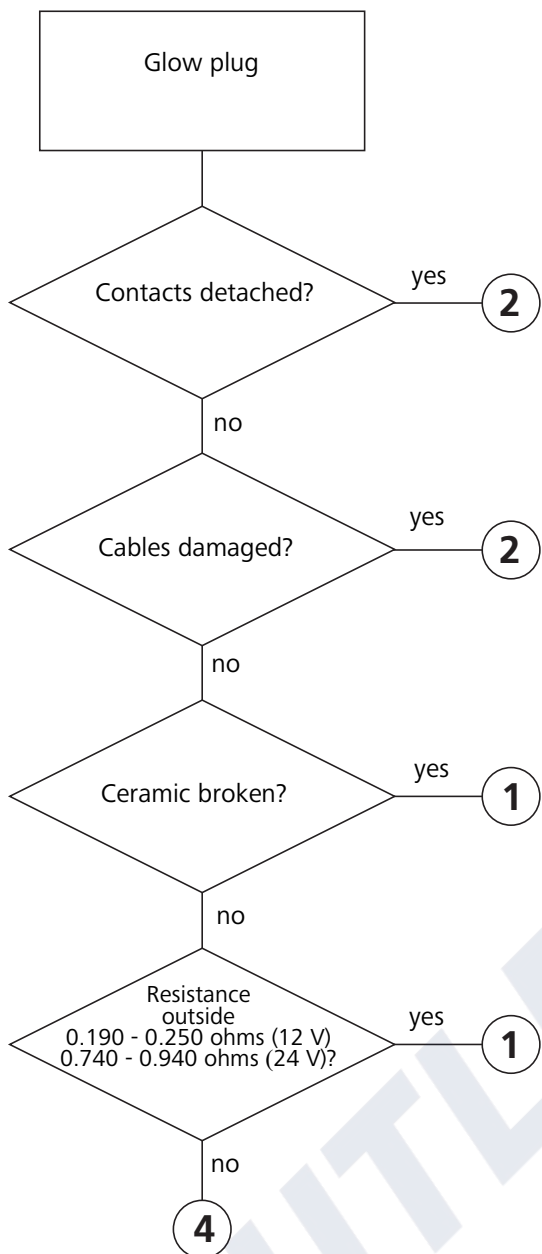
See Fig. 907, Item 8


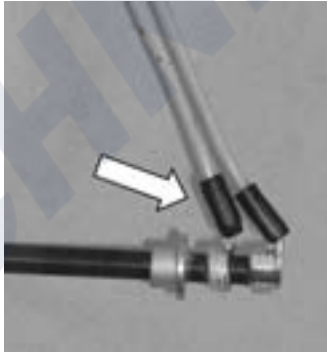


NOTE

The resistance test must be carried out with an ohmmeter suitable for small resistance values. A resistance test with a simple digital multimeter is too inaccurate to find the precise values. A new glow plug can be measured to act as a reference.

The glow plug should have the following values in the test:

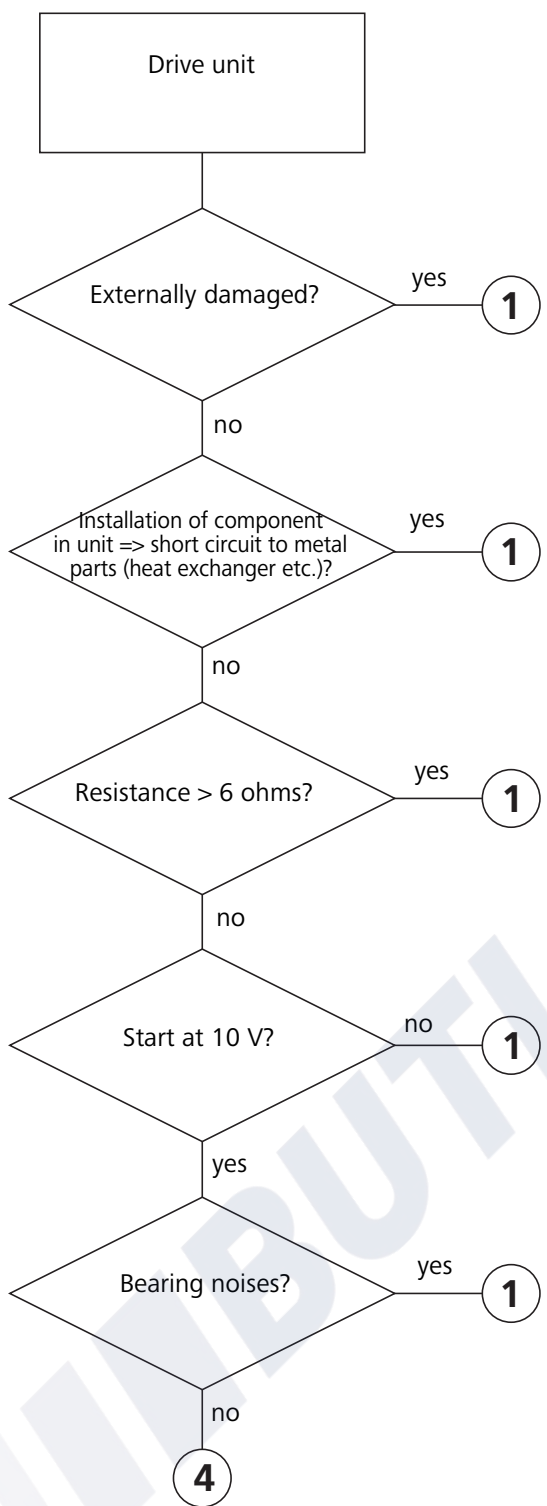
Glow plug:	12 V (no marking)	24 V (green marking)
Resistance at 25 °C:	0.190 - 0.250 ohms	0.740 - 0.940 ohms
Test current:	< 5 mA	< 5 mA






Procedure	Test or measuring equipment	Visual
Visual inspection		
Visual inspection		
Visual inspection		
Resistance measurement	Digital multimeter	

6.4.5 Drive unit component

See Fig. 903, Item 2



Procedure	Test or measuring equipment	Visual
Visual inspection		
Continuity measurement	Digital multimeter	
		
Drive motor start-up	Voltage source	<p>IMPORTANT</p> <p>Ensure correct polarity (+)/(-)</p> <p>(-) = black</p> <p>(+) = red</p>
Subjective test		

6.4.6 Blow-out temperature sensor component

See Fig. 903, Item 9

During the resistance test with a digital multimeter, the blow-out temperature sensor must have values in accordance with the following chart:

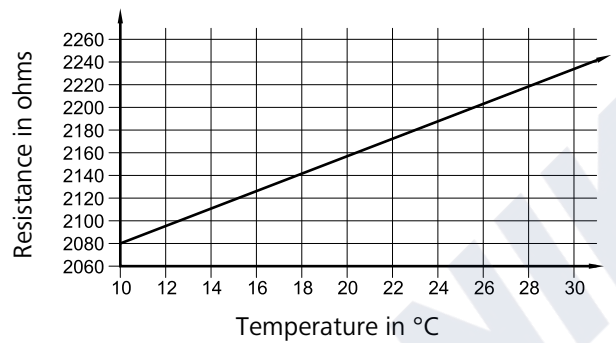
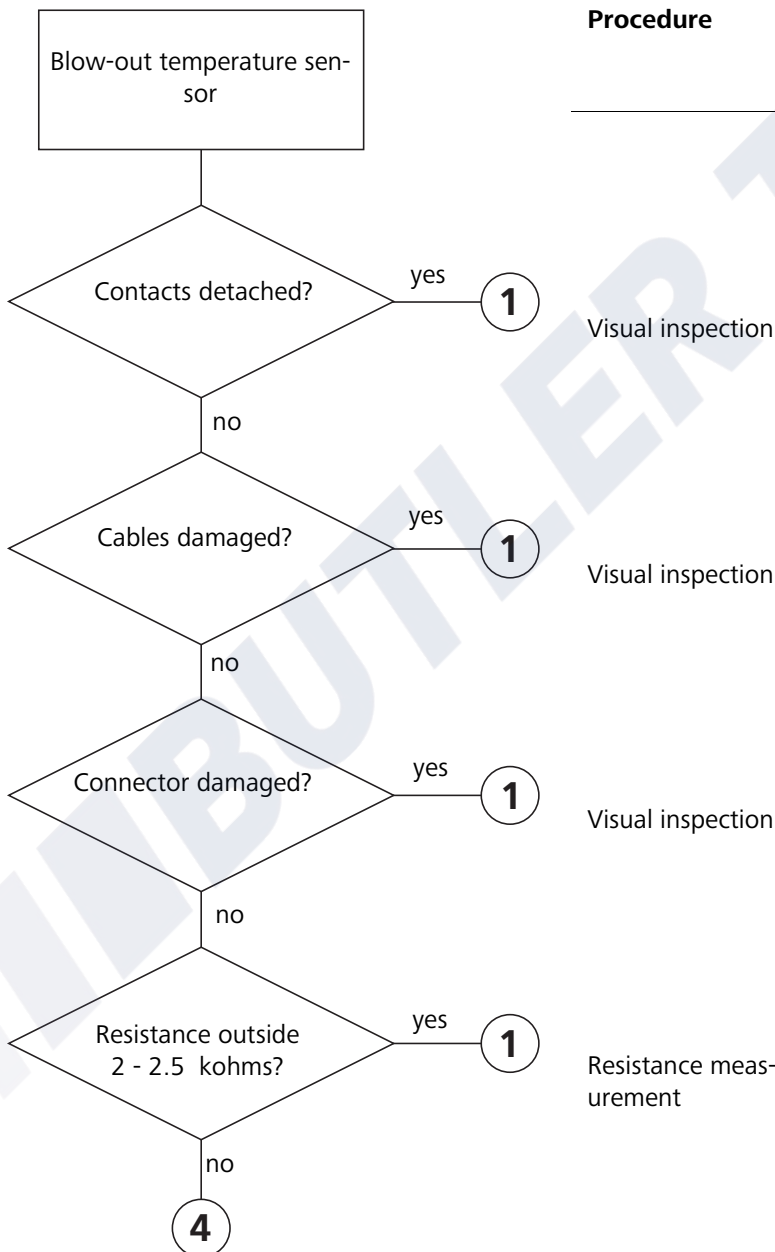


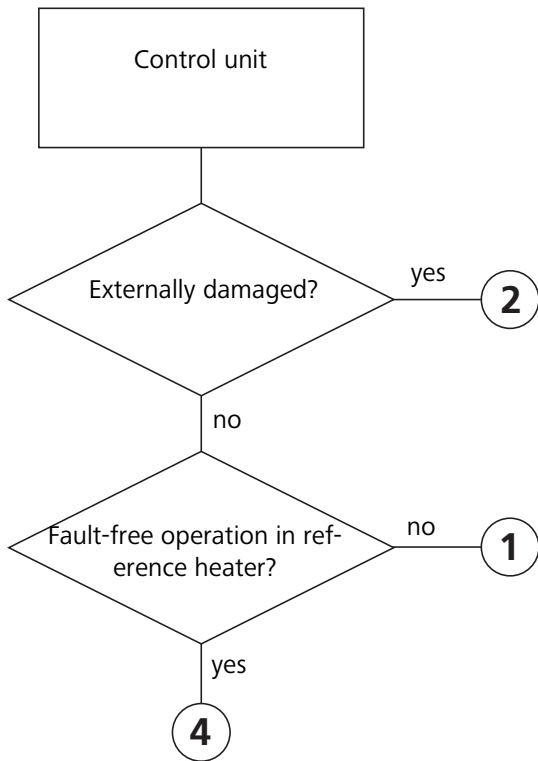
Fig. 604 Characteristic resistance value of a PT 2000 blow-out temperature sensor in the temperature range 10 °C to 30 °C




Procedure	Test or measuring equipment	Visual
Visual inspection		
Visual inspection		
Visual inspection		
Resistance measurement	Digital multimeter	

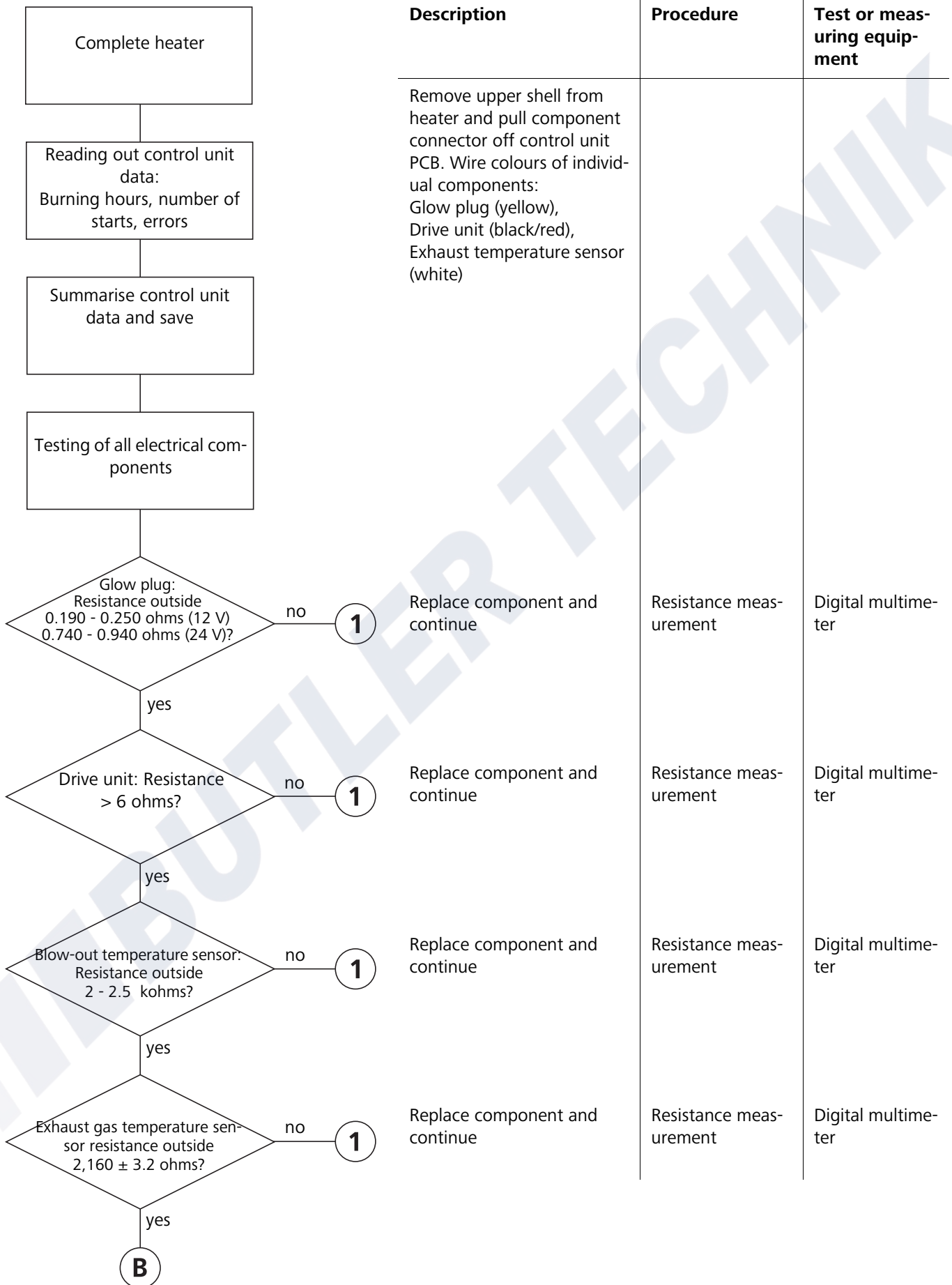
6.4.7 Control unit component

See Fig. 701 and Fig. 903, Item 4



Procedure	Test or measuring equipment	Visual
<p>Visual inspection</p> <ul style="list-style-type: none"> - Housing broken? - All clips engaged? - Clips torn? <p>Conduct function test with the reference unit, mount the control unit to be tested in the reference heater and conduct the function test again</p>	<ul style="list-style-type: none"> - Heater test bench - PC (personal computer) - Webasto Diagnosis Adapter - Reference heater 	

6.4.8 Heater component



Description

Remove upper shell from heater and pull component connector off control unit PCB. Wire colours of individual components:
Glow plug (yellow),
Drive unit (black/red),
Exhaust temperature sensor (white)

Procedure

Resistance measurement

Resistance measurement

Resistance measurement

Resistance measurement

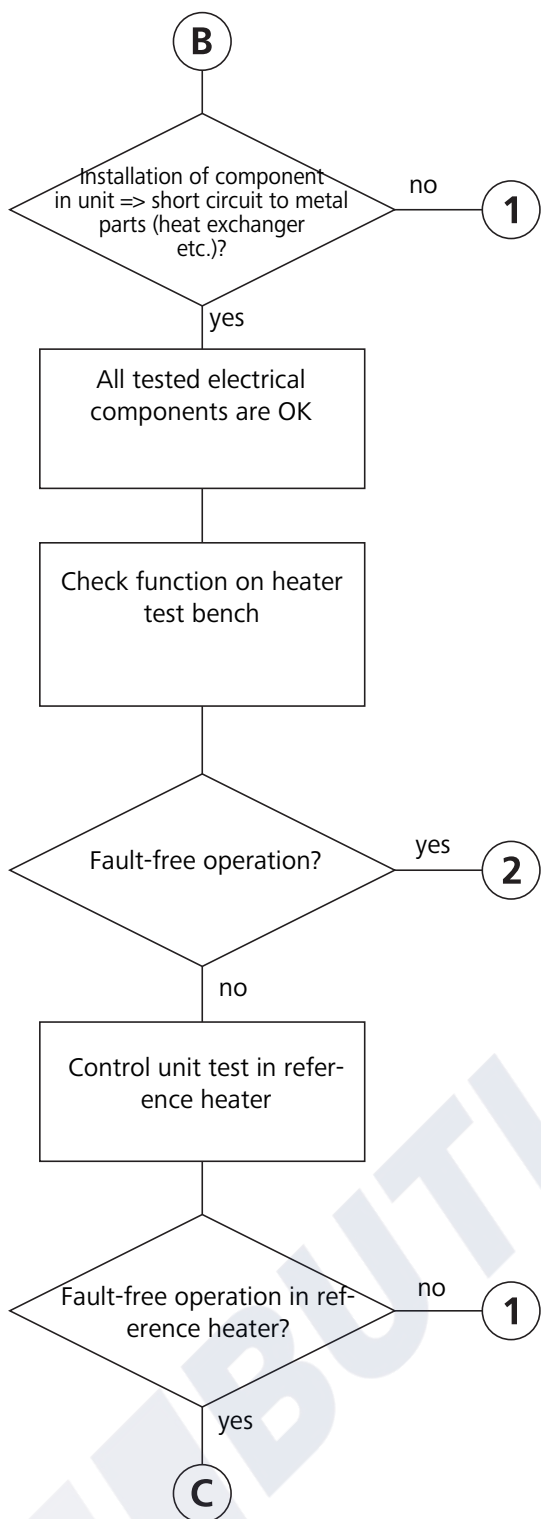
Test or measuring equipment

Digital multimeter

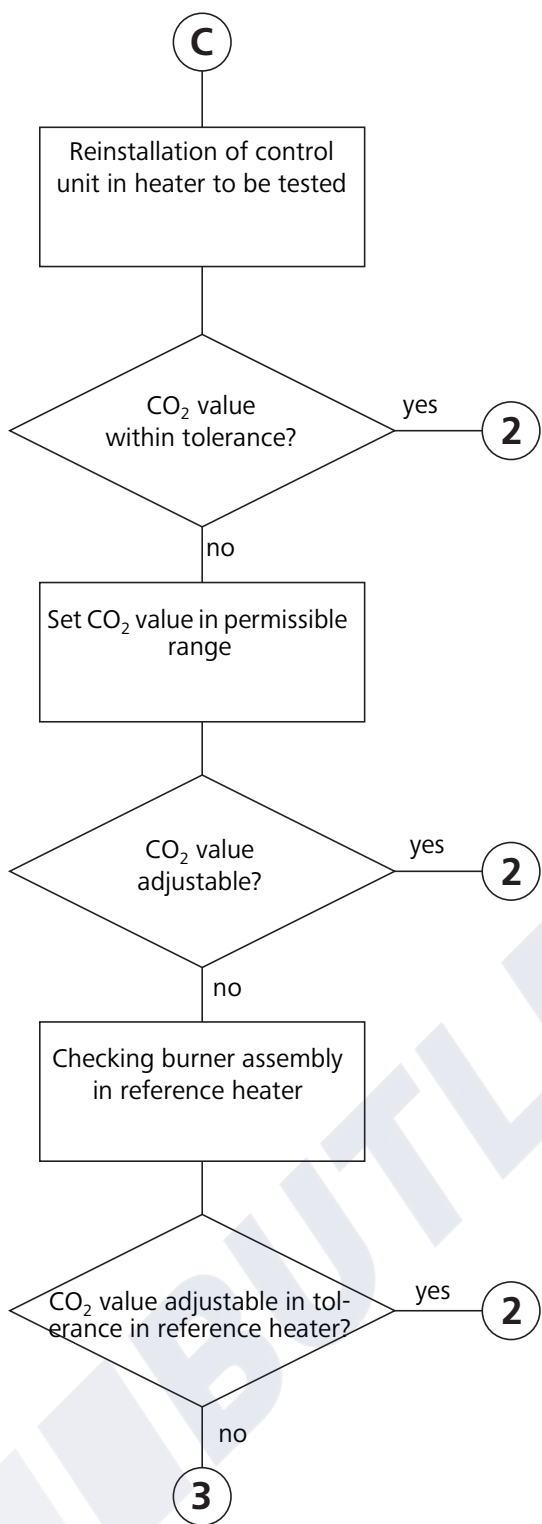
Digital multimeter

Digital multimeter

Digital multimeter



Description	Procedure	Test or measuring equipment
Replace component and continue	Continuity measurement	Digital multimeter
	Function test	<ul style="list-style-type: none"> - Heater test bench - CO₂ measuring unit - PC (personal computer) - Webasto Diagnosis Adapter - Reference heater
	Function test	



Description

Procedure

Test or measuring equipment

Function test
CO₂ measurement

- Heater test bench
- CO₂ measuring unit
- PC (personal computer)
- Webasto Diagnosis Adapter
- Reference heater

Conduct function test with reference heater. Adjust the reference unit after 5 minutes to CO₂ nominal value in accordance with graphic on site, install burner assembly to be evaluated in reference unit and measure CO₂ value after 5 minutes of operation.

7 Wiring Diagrams

7.1 General information

The Air Top Evo 40 / Air Top Evo 55 heaters can be operated with the rotary selector, a combination timer or the Air Top Evo Multi Control (MC04) control element.

The wiring diagrams (Fig. 702 to Fig. 707) show the possible circuits for 12 or 24 V.

- Rotary selector and vehicle fan
- ADR operation with rotary selector
- Combination timer and electrical battery isolation switch
- Air Top Evo Multi Control (MC04) control element
- "Master heater" with rotary selector
- "Slave heater"

Fig. 701 shows the plug assignment on the control unit.

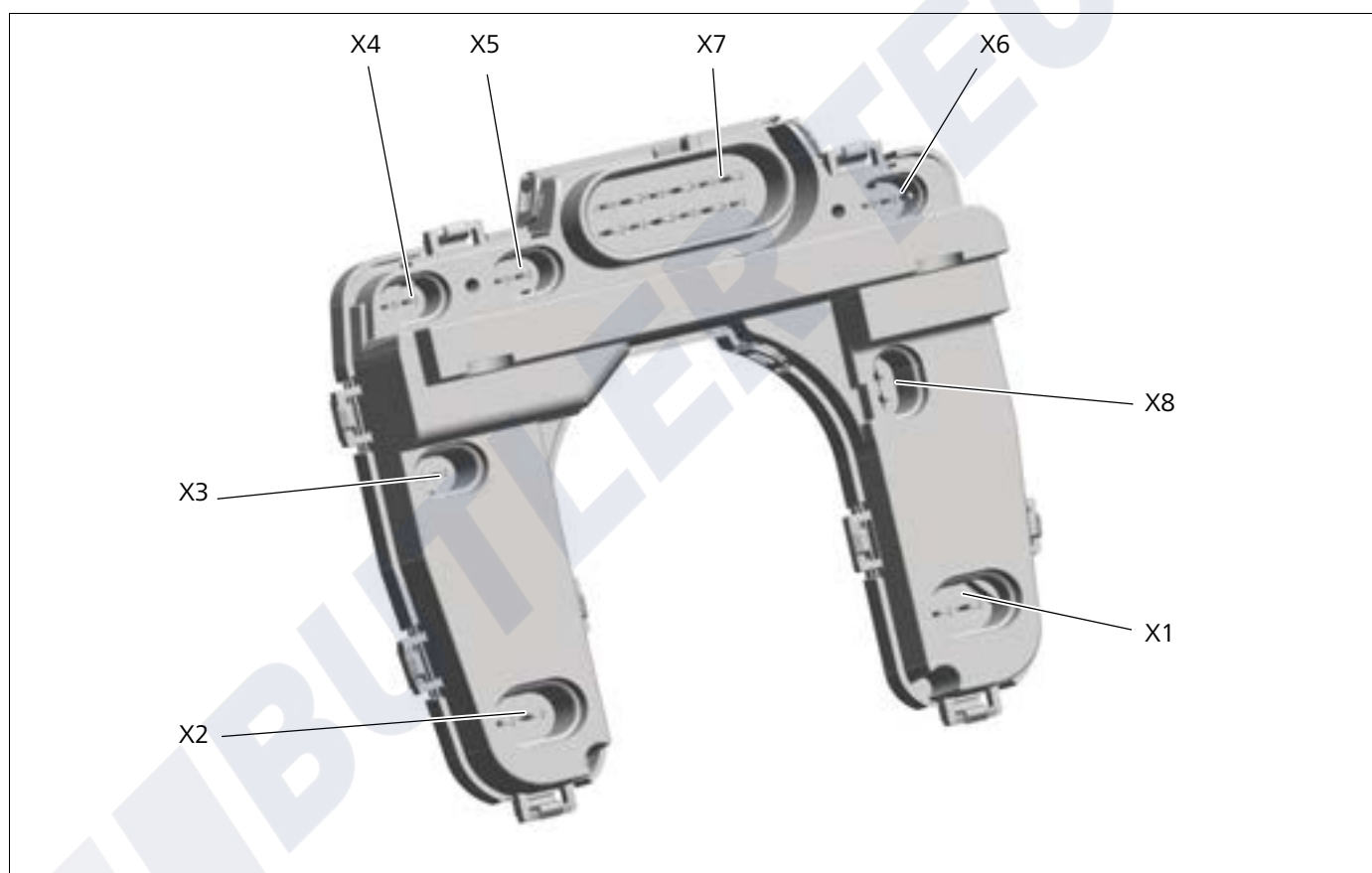


Fig. 701 Connector assignment on control unit

- X1 = Drive motor connection
- X2 = Glow plug connection
- X3 = Blow-out temperature sensor connection
- X4 = Fuel pump connection

- X5 = Connection of external temperature sensor
- X6 = D+ and auxiliary drive unit connection
- X7 = Heater wiring harness connection
- X8 = Exhaust temperature sensor connection

Fig. 708 shows the schematic connection of the combination timer.

Fig. 709 shows the schematic connection of the Air Top Evo Multi Control (MC04) control element.

See Section 7.2 for wiring diagram legends.

IMPORTANT

The use of force when pressing on the connectors can destroy the mechanical coding, i.e. the reverse polarity protection or the correct assignment of the connection is no longer ensured. This can then result in considerable damage to the heater.

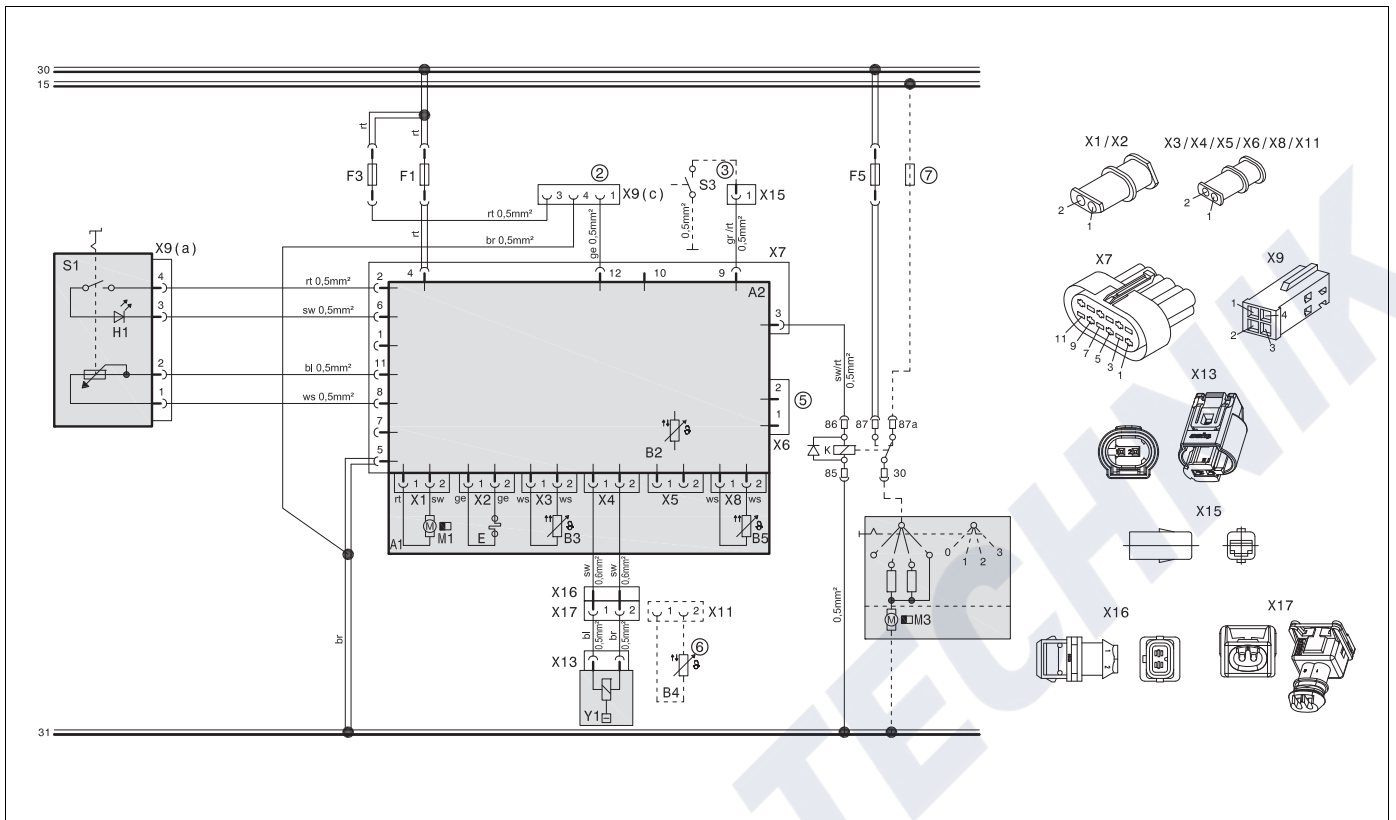


Fig. 702 Wiring diagram for Air Top Evo 40 and Air Top Evo 55, 12 V/24 V with rotary selector and vehicle fan

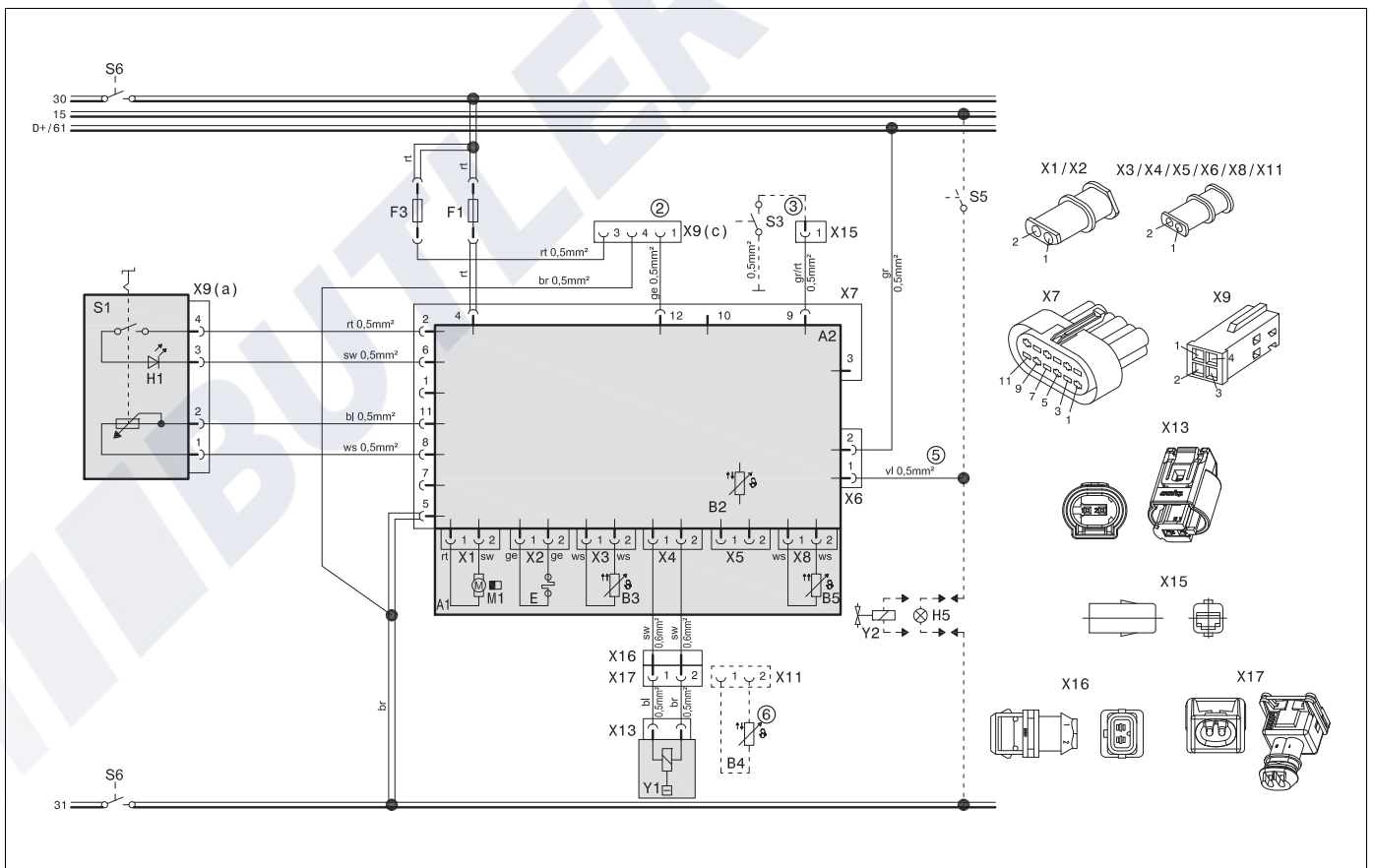


Fig. 703 Wiring diagram for Air Top Evo 40 and Air Top Evo 55, 24 V for ADR operation with rotary selector

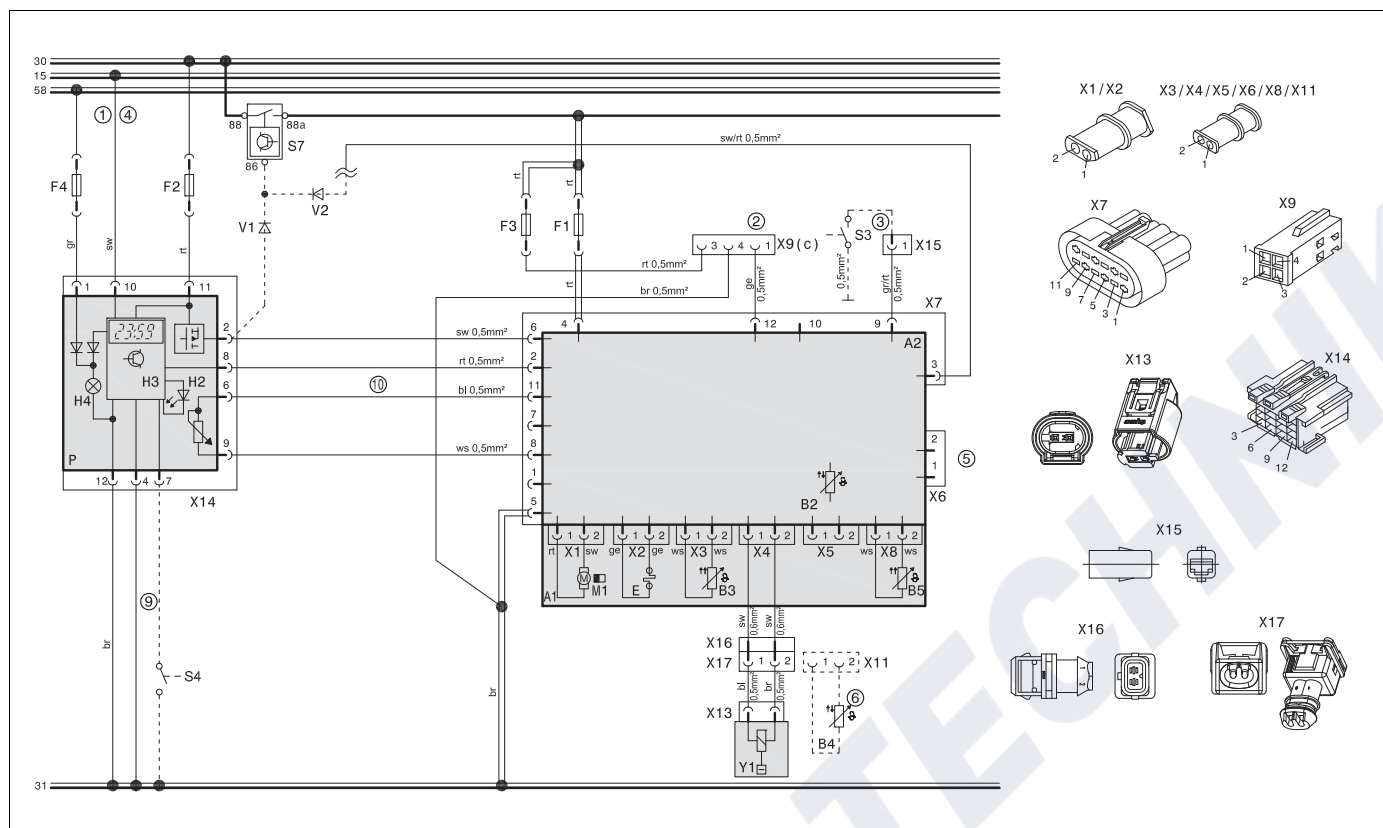


Fig. 704 Wiring diagram for Air Top Evo 40 and Air Top Evo 55, 12 V/24 V with 1531 combination timer and electr. battery isolation switch

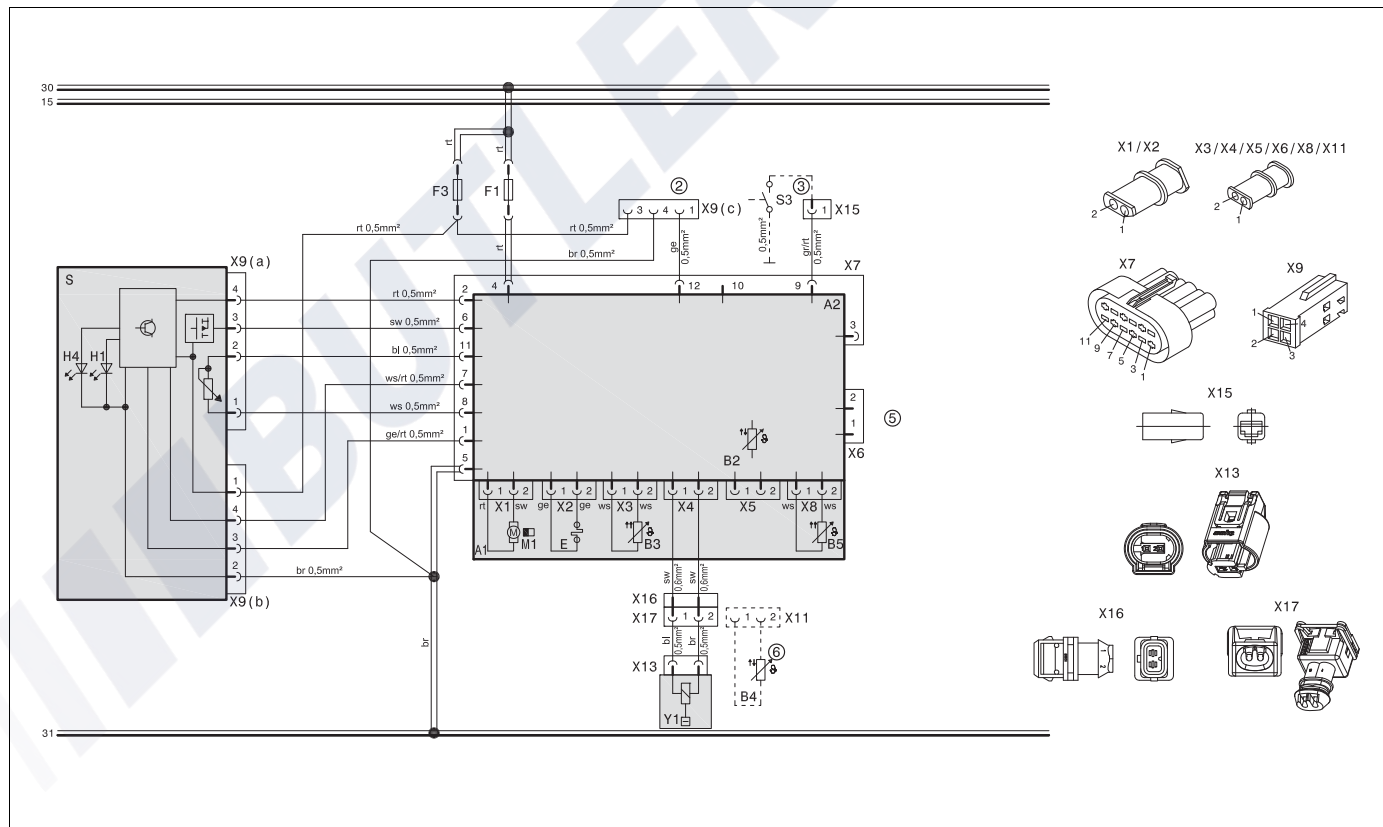


Fig. 705 Wiring diagram for Air Top Evo 40 and Air Top Evo 55, 12 V/24 V with Air Top Evo MultiComfort (MC04) control element. Wiring harness available as an option.

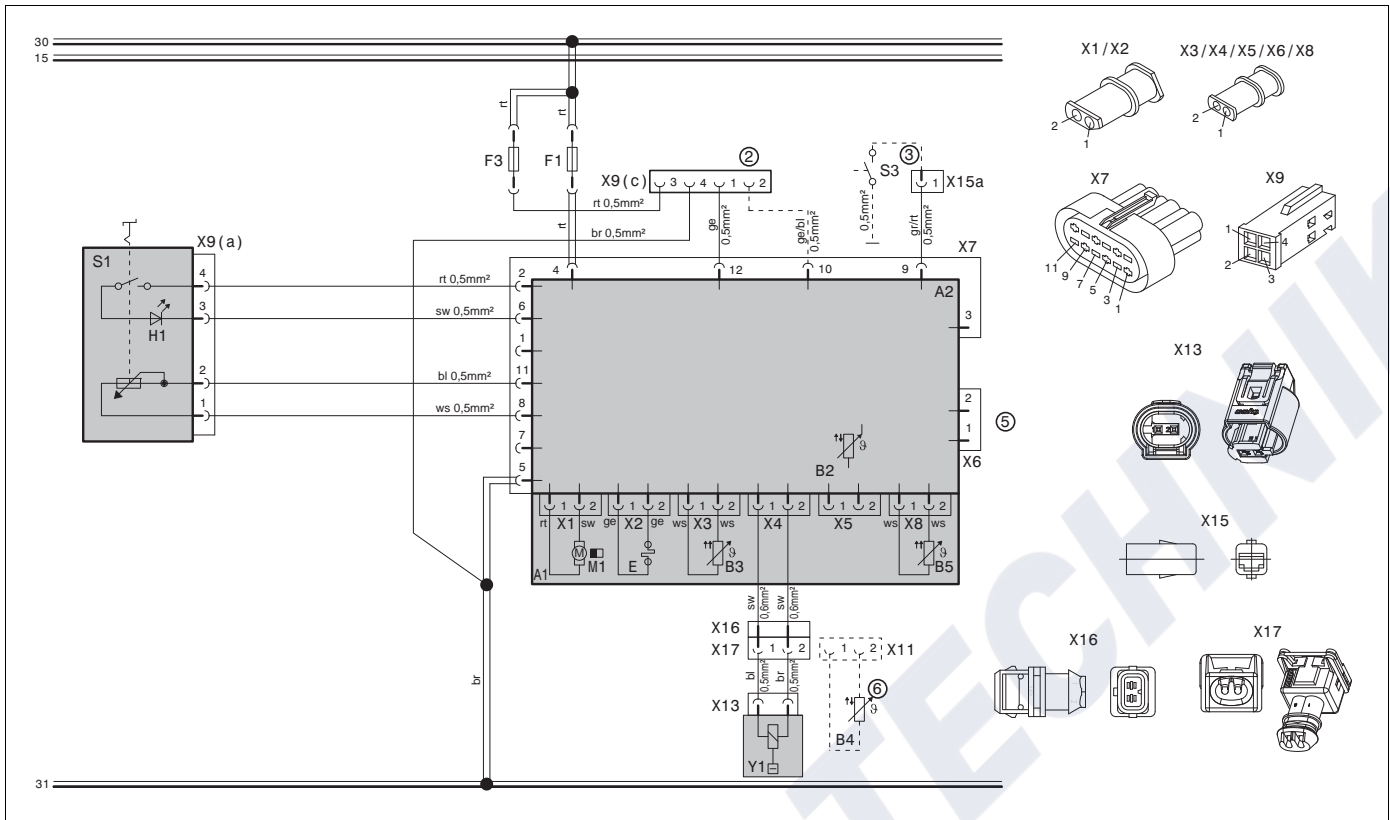


Fig. 706 Wiring diagram for Air Top Evo 40 and Air Top Evo 55 "Master heater", 12 V/24 V with rotary selector

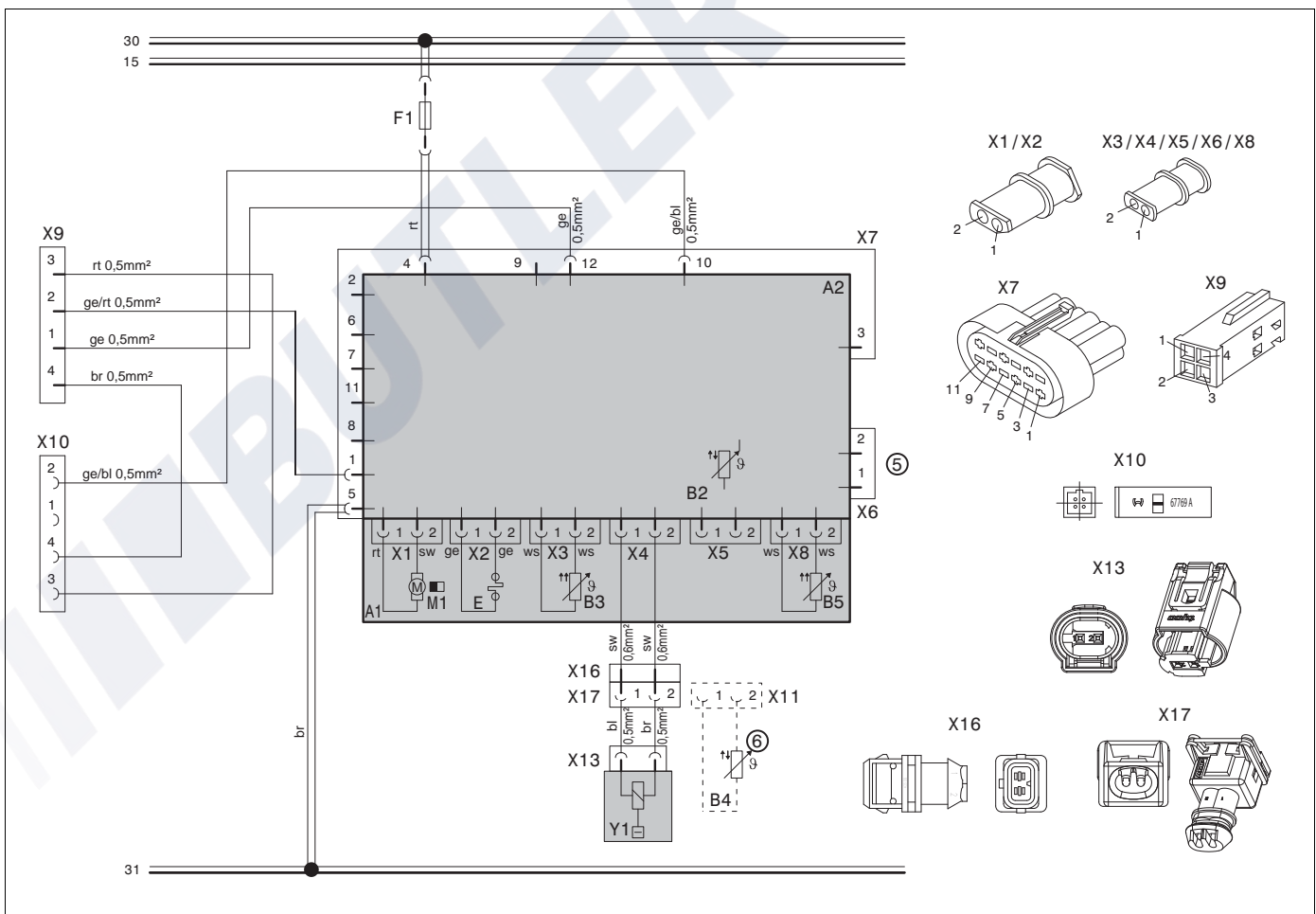


Fig. 707 Wiring diagram for Air Top Evo 40 and Air Top Evo 55 "Slave heater", 12 V/24 V

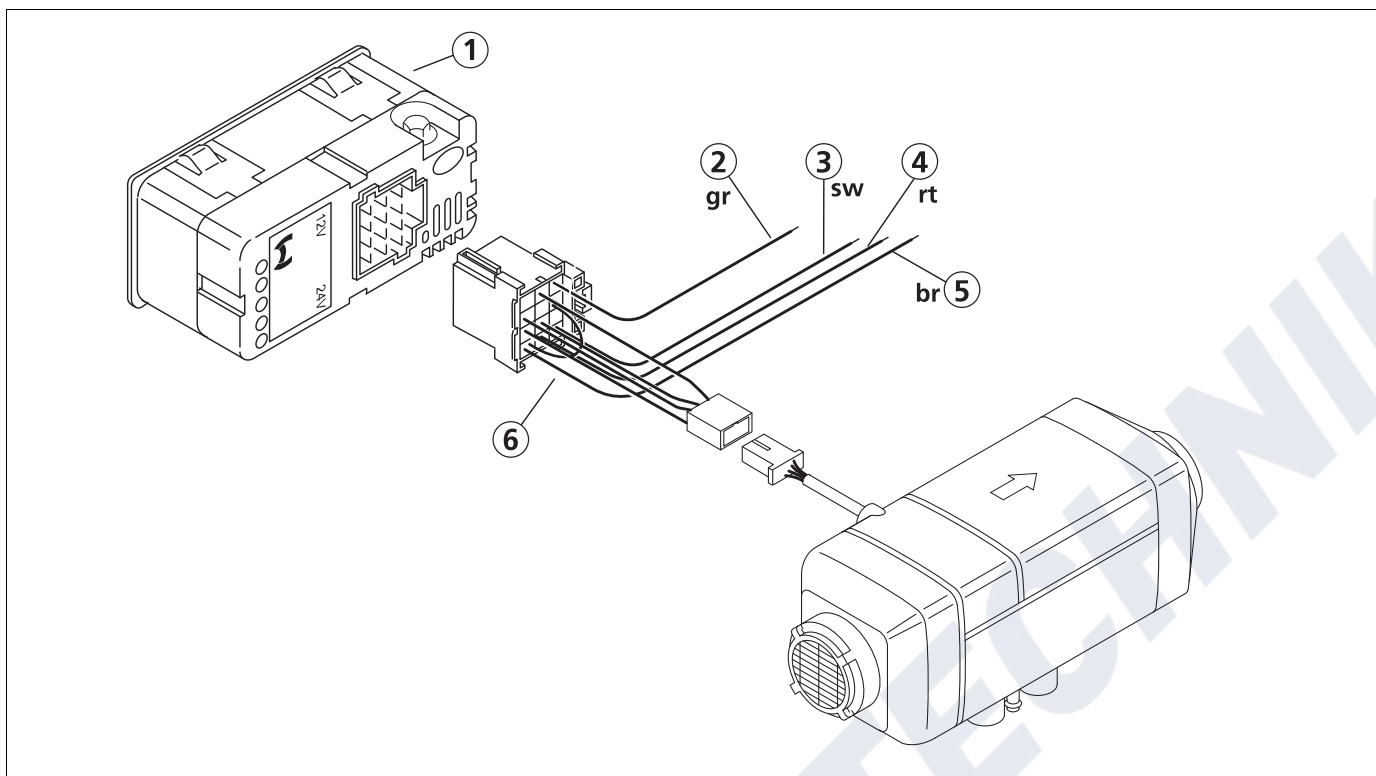


Fig. 708 Connection diagram for Air Top Evo 40 and Air Top Evo 55 with 1531 combination timer

- | | |
|---------------------------|---------------------------|
| 1. 1531 combination timer | 4. red: Terminal 30 |
| 2. grey: Terminal 58 | 5. brown: Terminal 31 |
| 3. black: Terminal 15 | 6. Wiring harness adapter |

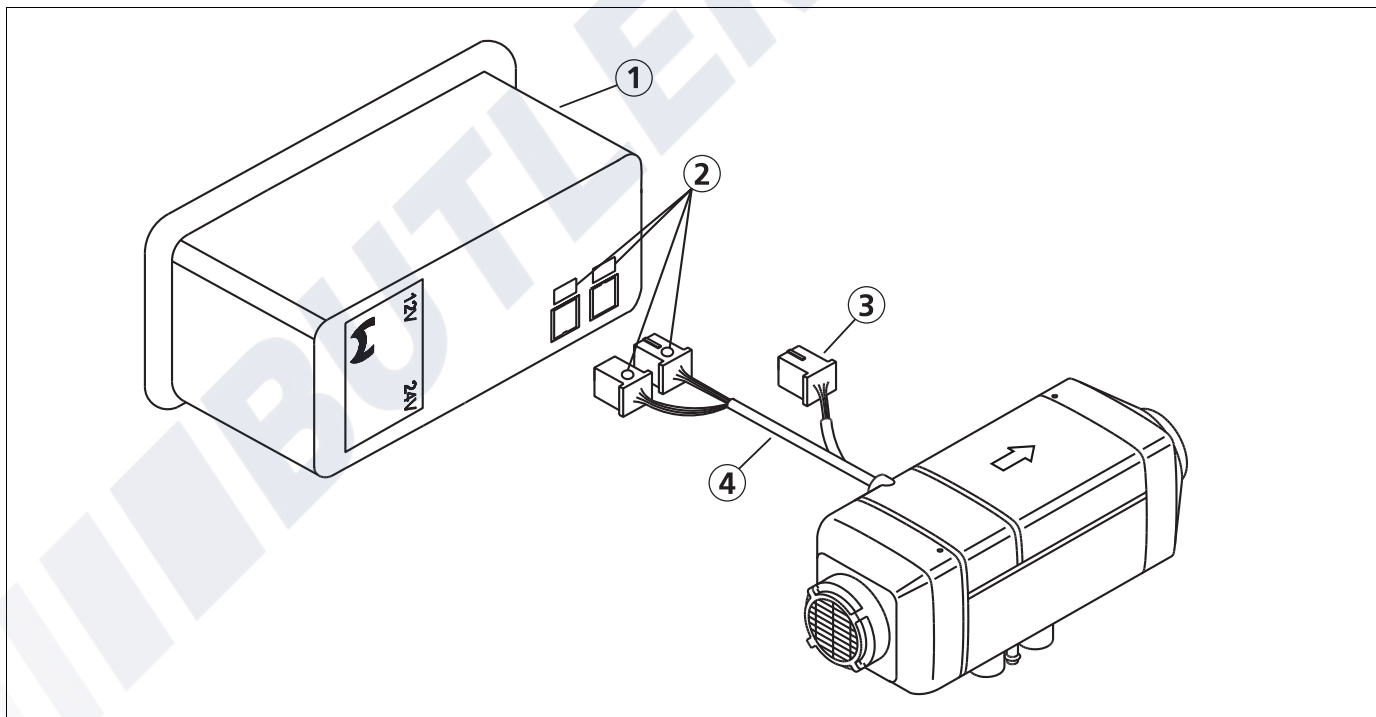


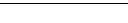
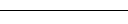
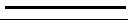


Fig. 709 Connection diagram for Air Top Evo 40 and Air Top Evo 55 with Air Top Evo Multi Control (MC04) control element

- | | |
|---|---|
| 1. Air Top Evo Multi Control (MC04) control element | 3. Optional connection for: |
| 2. Observe coloured markings | - Telearstart/Thermo Call (12 V only) |
| | - Webasto Thermo Test PC Diagnosis |
| | 4. Heater wiring harness (available as an option) |

7.2 Legend for wiring diagrams

Cable cross-sections

	< 7.5 m	7.5 - 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

Cable colours

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

Item	Description	Comment
A1	Heater	Air Top Evo 40 / Air Top Evo 55
A2	Control unit	Control unit 1580
B2	Room temperature sensor	Internal
B3	Blow-out temperature sensor	Overheating guard
B4	Room temperature sensor	External
B5	Exhaust temperature sensor	Overheating protection/flame monitor
E	Glow plug	
F1	Fuse 15 A (24 V) or 20 A (12 V)	Flat fuse SAE J 1284
F2	Fuse 4 A	Blade fuse SAE J 1284, not contained in wiring harness
F3	Fuse 1 A	Flat fuse SAE J 1284
F4	Fuse 4 A	Blade fuse SAE J 1284, not contained in wiring harness
F5	Fuse	Value in [A] to be selected depending on line cross-section
H1	LED green (in Item S1)	Operating Indicator
H2	LED red (in Item P)	Lighting of immediate heat button, operating indicator
H3	Display (in Item P)	Heating symbol, operating indicator
H4	Light bulb/LED (in Item P and S)	Display and button lighting
H5	Light bulb/LED	Switch-on check for pumping device, max. 500 mA
K	Relay with free-wheeling diode	for vehicle fan, max. 500 mA
M1	Drive motor	Combustion and heating air fan
M3	Motor	Vehicle fan
P	Combination timer 1531	Timer and temperature selector

Item	Description	Comment
S	Air Top Evo Multi Control (MC04) control element	On/Off switch, selector switch for additional functions and temperature selector
S1	Heater-control rotary selector	On/Off switch and temperature selector
S2	Switch	Ventilation
S3	Switch	CO ₂ setting
S4	Push button	External instant heat button
S5	Switch	Pumping devices/ auxiliary drive
S6	Switch, single or two-pin	Isolation switch
S7	Battery isolation switch	Electronically controlled isolating switch, max. 500 mA
V1/V2	Blocking diode	min. 500 mA
X1-X8	Plug connector	on Item A2
X9 (a)	Plug connector	on Item S or S1
X9 (b)	Plug connector	on Item S or S2
X9 (c)	Plug connector	W bus, optional connection of Telearstart (12 V) or Thermo Call
X1-X11	Plug connector	In heater on control unit
X13	Plug connector	to Item Y1
X14	Plug connector	to Item P
X15	Plug connector	to Item S3
X16	Plug connector	Connection of wiring harness DP 42
X17	Plug connector	Connection of wiring harness DP 42
Y1	Fuel pump	DP 42
Y2	Solenoid valve/pump	Pumping devices/auxiliary drive, max. 500 mA

Note numbers

- (1) With plus from Terminal 15/75 to Connection 10:
Continuous operation with immediate heating as long as ignition is switched on.
- (2) All heater variants: W bus PC Diagnostics connection.
Heater variants with Air Top Evo Multi Control (MC04) control element and combination timer:
Thermo Call connection
Telestart connection (12 V only).
Master heater variant: Slave heater connection (ye/bl wire).
Prefabricated cable is contained in slave delivery scope.
- (3) CO₂ setting.
- (4) If the connection is made to Terminal 30, continuous heating is possible with the ignition switched off!
In this case, no connection may be made to Terminal 15/75!
- (5) Grey and purple wires are required for ADR function.
On non-ADR vehicles the wire ends must be insulated and tied back.
- (6) External room temperature sensor (optional).
NOTE: The sensor is mandatory for the Master heater variant.
- (7) Fuse present in vehicle.
- (8) Pin 7 "Boost" only for Ambulance heater variant (door contact on Terminal 31).
- (9) Connection necessary when using 1531 combination timer in ADR vehicles.
- (10) Wiring harness adapter is available as an option.

8 Service Work

8.1 General information

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

8.2 Work on heater

Disconnect the main power cable from the vehicle's battery before carrying out any work on the heater. The main battery power must not be disconnected whilst the heater is operating or slowing down as this could result in the heater overheating and the overheating guard thus being tripped. If you wish to carry out extensive repair work on the heater, it may be a good idea to remove it completely.

When the heater is removed and reinstalled, the base seal must be replaced.

With repairs which make it necessary to change the installation location, the installation instructions concerned and the vehicle-specific installation suggestion of the heater must be observed.

8.3 Work on vehicle

IMPORTANT

A temperature of 85 °C must not be exceeded in the vicinity of the heater in any circumstances (for example when completing painting work on the vehicle).

8.4 Heater test operation

WARNING

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

IMPORTANT

The operation of the heater without a cover for the control unit is not permissible and will result in overheating.

8.5 Servicing work

NOTE

To prevent mechanical parts seizing, the heater should be operated for approx. 10 minutes every four weeks.

The heater requires no servicing. However, it should be checked at regular intervals, at least at the start of the heating period (the time after which the heater will be used due to adverse weather conditions) by Webasto-trained personnel.

After 3,000 operating hours a flash code (flashing pulses at one-second intervals) is displayed via the operating indicator. This code indicates the need for maintenance/servicing of the heater to the user. The service signal is displayed for 10 seconds during each heater start-up and can be reset with the Webasto diagnosis with "Delete fault" or by pulling the fuse.

In the interest of the functional reliability of the heater, the following service work must be carried out:

- Check the cold air inlet and hot air outlet for dirt and foreign bodies. (Dirty or blocked cold and hot air lines may cause overheating.)
- Clean the outside of the heater (avoid the penetration of water).
- Check the electrical connections for contact corrosion and to ensure that they are secure.
- Check the exhaust and combustion air lines for signs of damage and to ensure that they are clear.
- Replace fuel filter if installed.
- Check the fuel line and filter for leaks.

8.6 Visual inspections and installation instructions

8.6.1 Cold and hot air system

IMPORTANT

The integration of the heater into the vehicle's own air system is not permitted as a result of the high pressure in the vehicle's system.

Inside the control unit there is a room temperature sensor, which operates the heater in the appropriate heat output range in conjunction with the control element depending on the intake temperatures and the position of the setpoint generator. The heat output is set so that after the selected interior temperature has been reached quickly, it is then kept at this selected value.

As an alternative, the Air Top Evo 40 / Air Top Evo 55 heaters can be operated with an external temperature sensor (see Section 9.1.2).

NOTE

Only materials with a continuous temperature resistance of at least 130 °C may be used for the hot air guide.

The maximum pressure difference between the intake and pressure side of the cold and hot air line is:

Air Top Evo 40:	2.0 hPa
Air Top Evo 55:	3.0 hPa

When this value is exceeded, the heating capacity can be reduced by the hot air outlet temperature controller.

The heater can be used with grills on the cold air inlet and hot

air outlet side if it is used in an air circulation system. A short circuit of the cold and hot air flow must be avoided.

Minimum inside diameter of main branch of hot air line:
80 mm for Air Top Evo 40
90 mm for Air Top Evo 55

The cold and hot air hoses must be secured at the connections.

IMPORTANT

In vehicles in which people are transported, the air outlet opening must be aligned so that a minimum spacing of 20 cm to the body parts is maintained.

The heater automatically checks the internal temperature increase each time it is switched on. If this is above the specified limits, the start is cancelled and error messages F10 is displayed. To enable stable heater operation, the flow resistance of the connected cold and hot air system must be reduced.

If a filter is used for the cold air, it must have the following properties:

- The current of air must not carry any inflammable and/ or harmful fibres or particles into the heater or the interior of the vehicle.
- The filter material must have at least a temperature resistance of 60 °C.
- The filter material must be resistant to all substances which can be drawn in with the cold air (for example moisture, salt, fuel vapours, etc.).
- The resistance of the filter must be taken into account when designing the cold and hot air circuit.

8.6.2 Fuel system

Requirements for the fuel system are contained in the Air Top Evo 40 / Air Top Evo 55 installation instructions.

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

8.6.2.1 Fuel pump

The fuel pump is a combined pumping, metering and shut-off system and is subject to certain installation criteria (for installation positions, see Fig. 801).

The Air Top Evo 40 / Air Top Evo 55 heaters may only be operated with the DP 42 fuel pump.

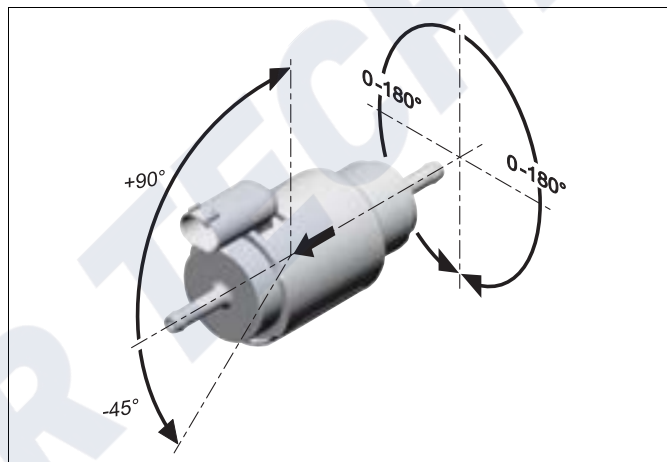


Fig. 801 Installation position of fuel pump DP 42

Installation location

The fuel pump may not be installed in the radiation area of hot vehicle parts. A heat shield must be provided if necessary. The preferred installation space is near the fuel tank.

For the permissible ambient temperature, see Chapter 4, "Technical Data"

Installation and attachment

The fuel pump must be fastened with a vibration-damping suspension. The installation position is restricted as shown in Fig. 801 (maximum fuel pump tilt angle, axial installation position of fuel pump).

The arrow indicates the direction of fuel flow.

8.6.2.2 Fuel filter

If soiled fuel is to be expected, a suitable fuel filter (e.g. We-basto fuel filter) must be installed. Install vertically if possible, however at least horizontally (see Fig. 802).

NOTE:

Observe installation position and flow direction.

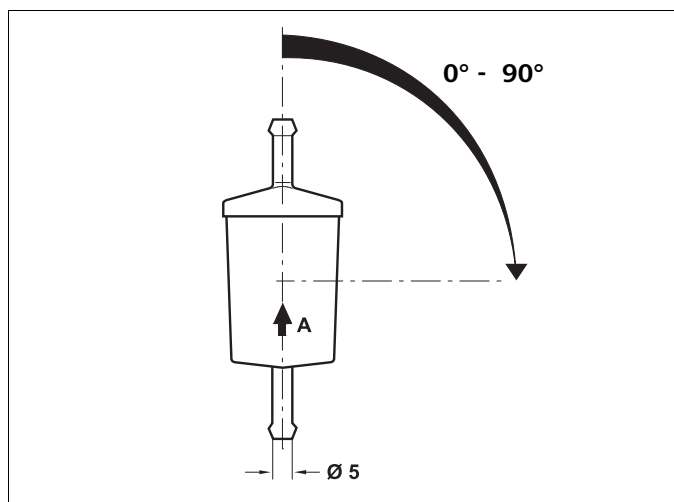


Fig. 802 Fuel filter, installation position and flow direction

8.6.3 Combustion air system

Under no circumstances may the combustion air be taken from areas occupied by people. The combustion air intake opening must not point in the direction of travel. It must be located so that it cannot become clogged with dirt.

NOTE

With petrol heaters, the combustion air must be extracted with a combustion air line at a position that is as cool as possible and protected from splashing water. If the heater is in a sealed installation box, the combustion air must be drawn in from the outside and the emissions fed to the outside. Pipe passage holes must be made in such a way as to ensure that the ingress of exhaust fumes into the interior of the vehicle should not occur.

If soiled combustion air is to be expected, a combustion air filter can be installed (only Air Top Evo 40 D /Air Top Evo 55 D). An intake silencer must be used for an intake hose length of < 0.5 m.

8.6.4 Exhaust system

The exhaust line must be secured on the heater and on the exhaust silencer with a clamp suitable for the exhaust line.

It must be ensured that the exhaust silencer (Fig. 803) is not the lowest part of the exhaust-gas routing and that it is installed near the heater.

The flow direction is arbitrary.

The heater may also be operated without an exhaust silencer.

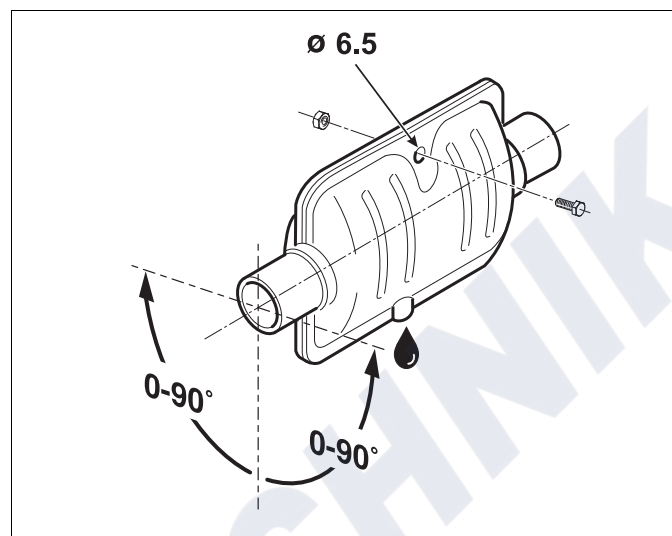


Fig. 803 Permissible installation position of exhaust silencer
Any desired flow direction

8.6.5 Combustion air inlet and exhaust lines

NOTE

To avoid damage to the fuel pump cable, it must be ensured that the combustion air intake and exhaust lines are not confused. The exhaust line must be attached to the exhaust outlet fitting.

Length of the combustion air intake and exhaust lines:
with silencer: max. 2.0 m
without silencer: max. 5.0 m

Both lines are to be installed falling away from the heater. If this is not possible, a condensate drain hole with a diameter of 4 mm must be made at its lowest point or a connection element with a condensate drain must be used.

Internal diameter of the lines:
Combustion air line: 25 mm
Exhaust line: 24 mm

NOTE

If the exhaust line is 2 m or more, insulated exhaust lines must be used (to prevent the temperature falling below the dew point).

Minimum bending radius: 50 mm

Total bends:
Combustion air line: max. 270°
Exhaust line: max. 270°

An attachment is required no further than 150 mm from the end of the exhaust pipe to ensure that an angle of $90^\circ \pm 10^\circ$ is achieved.

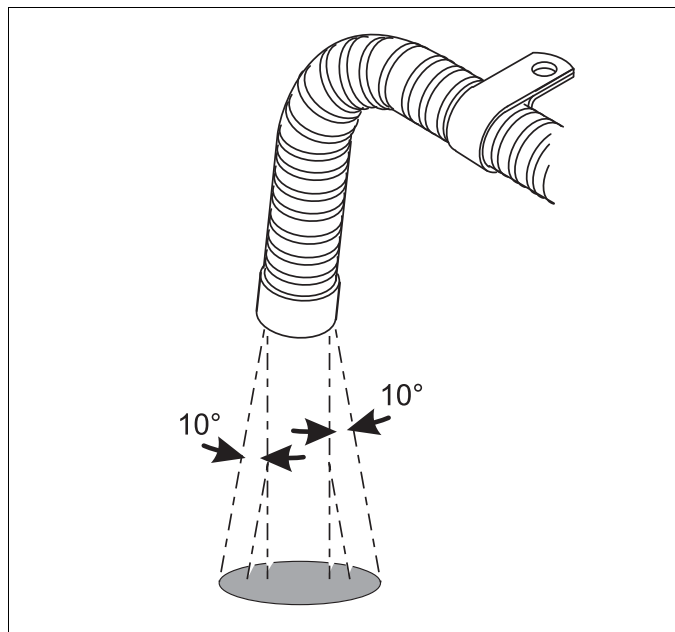


Fig. 804 Permissible installation position of exhaust pipe end

WARNING

If the exhaust pipe ends is other than as shown in the Fig. 804 it will pose a fire risk.

8.6.6 Electrical connections

8.6.6.1 Heater connection, control element

The electrical connection is to be made as shown in the appropriate wiring diagram (see Chapter 7). To connect the wiring harness, remove the cover (see 9.2.1.1) on the heater and connect the wiring harness plug to the control unit.

Before using the heater for the first time fit the cover to prevent the illegal escape of hot air (heater overheating).

The wiring harness can be routed either to the left or right from the heater.

8.6.6.2 Supply voltage connection

Ideally from the vehicle's central electrical system.

An additional blade terminal fuse holder is to be fitted to protect the heater (supplied with the heater). The fuse holder may only be installed in the interior of the vehicle.

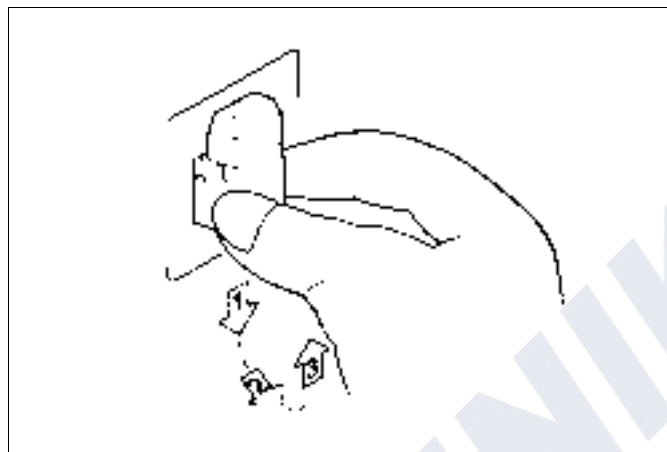


Fig. 805 Remove the fastening plate on the fuse holder

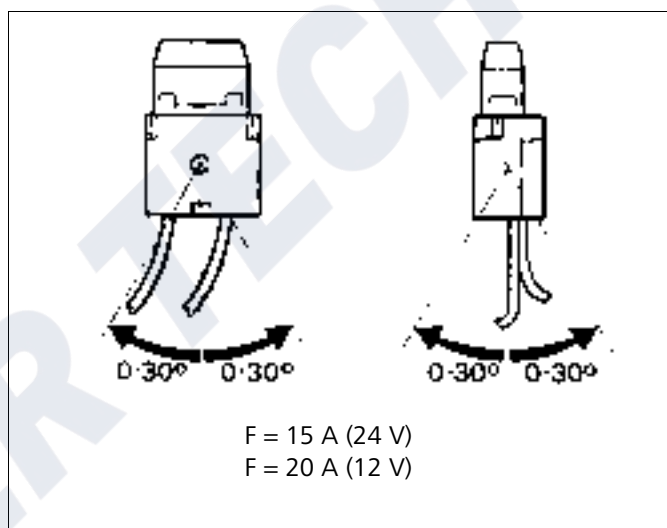


Fig. 806 Fuse holder, installation position

8.6.6.3 Rotary selector connection

The wiring harness is prepared for connection to the rotary selector. Simply pull on connector housing to unplug the connector (see Fig. 808).

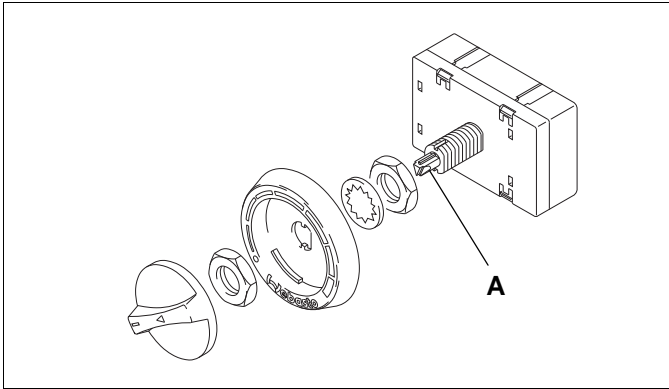


Fig. 807 Rotary selector

NOTE

The fibre optic cable (Fig. 807, "A") must be in contact with the rotary knob.

NOTE

The connector housing can be locked (self-locking action) by simply pulling on the wiring harness.

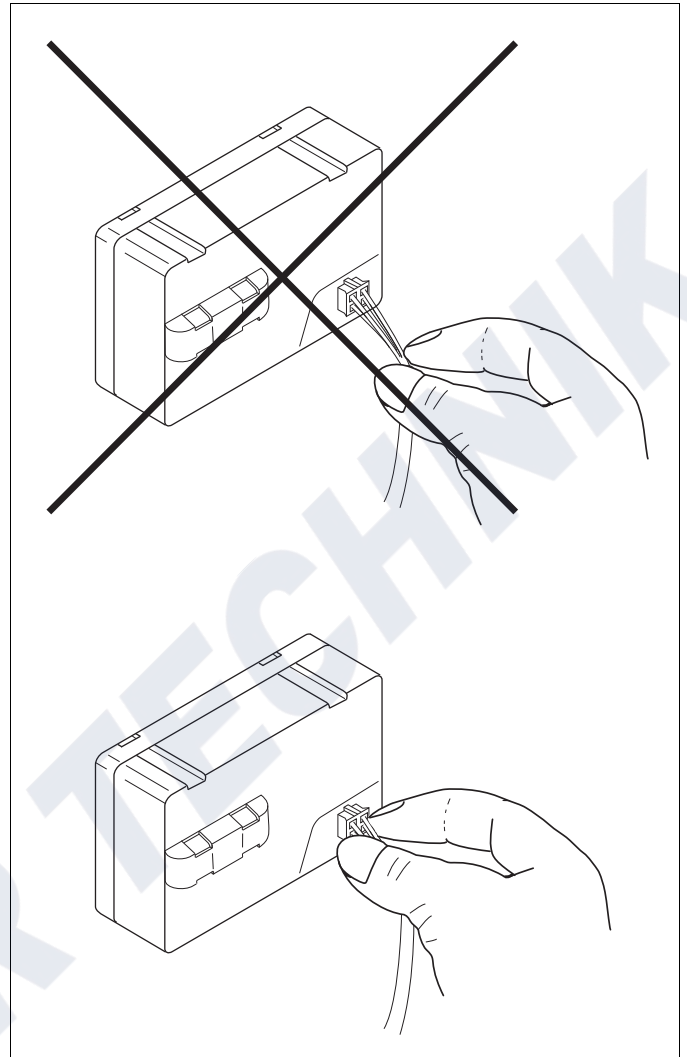


Fig. 808 Disconnect the plug

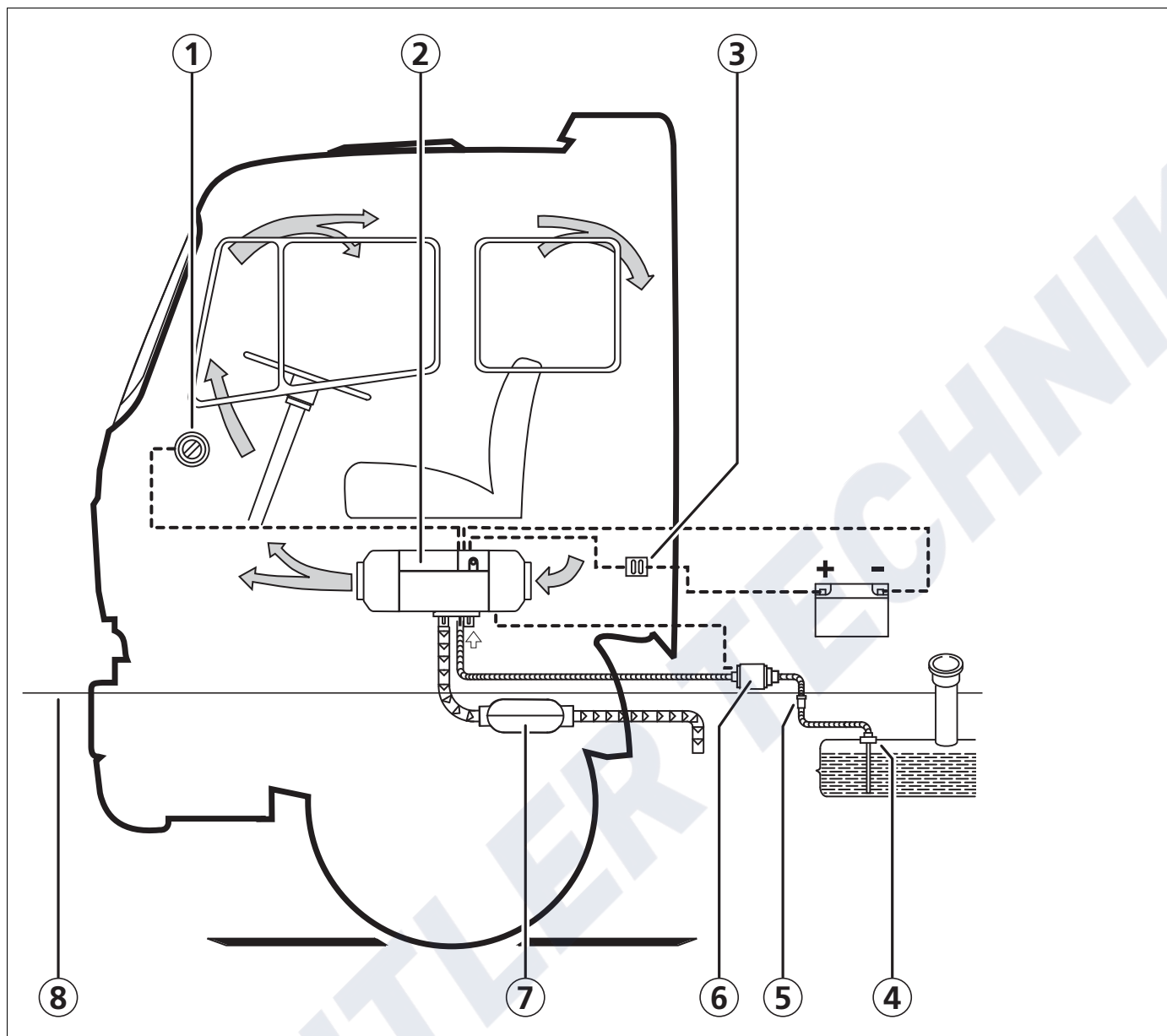


Fig. 809 Installation example for heater in re-circulated air mode

1. Control element
2. Heater
3. Fuse
4. Fuel standpipe
5. Fuel filter (optional)
6. Fuel pump
7. Exhaust silencer (optional)
8. Maximum permissible water passage height

8.7 Removal and installation

IMPORTANT

When the heater is installed it must not be dismantled.

8.7.1 Heater, removal and installation

8.7.1.1 Removal

1. Disconnect vehicle battery.
2. Pull cover off top shell as described in Section 9.2.1.1.
3. Disconnect wiring harness plug from control unit.
4. Disconnect cable to fuel pump at disconnection point.
5. If necessary, disconnect connection of cold and the hot air hose or hoses.
6. Disconnect connection for fuel inlet on heater.
7. Disconnect connections for combustion air inlet and exhaust outlet on heater.
8. Remove four nuts and locking washers from the heater.
9. Remove heater and discard base seal.

8.7.1.2 Installation

1. Move heater into installation position **with new base seal** and fasten with 4 nuts and lock washers (only use genuine Webasto nuts).
2. Tighten the nuts to 6 +1 Nm.
3. Fasten connection for fuel inlet on heater.
4. Fasten connections for combustion air inlet and exhaust outlet on heater.
5. Reconnect fuel pump cable.
6. Connect the wiring harness plug to socket X7 on the control unit.
7. Fit the cover as described in Section 9.2.2.5 and secure it.
8. If necessary, fit cold and hot air hose or hoses and secure them.
9. Connect the battery.
10. Bleed the fuel supply system.

8.8 Start-up

After you have installed the heater, bleed the fuel supply system carefully.

NOTE

As a result of the low fuel consumption the heater must be switched on several times to fill the fuel line.

During test operation of the heater, all connections must be checked for leaks and firm seating. If the heater suffers a fault during operation, troubleshooting must be located and remedied.

9 Repair

9.1 General information

This section describes the repair work that can be carried out on the Air Top Evo 40 / Air Top Evo 55 heater after it has been removed from the vehicle.

Any further dismantling will invalidate the warranty. Only use the spare parts from the appropriate spare parts kits for assembling the heater.

9.1.1 Measures on dismantled components

IMPORTANT

All sealing elements between the dismantled components and the base seal must always be replaced with new seals.

9.1.1.1 Cleaning

- All dismantled components must be cleaned and then dried.
- Existing seal residues on the components must be completely and carefully removed.

9.1.1.2 Visual inspection

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

9.1.2 Carrying out modifications

The constant development of our heaters is aimed at optimising them so as to prevent failures and malfunctions. Generally it is possible to modify heaters that are already in use. Corresponding modification kits are available for this purpose.

The following describes modifications that can be carried out without any great effort during standard repair work:

- Installation of an external room temperature sensor for better temperature control (see Section 9.1.2.1).

9.1.2.1 Installation of an external room temperature sensor

General information

The Air Top Evo 40 / Air Top Evo 55 heater optimally regulates the desired temperature when its temperature sensor is loaded with the air temperature of the main occupied area. In certain circumstances, this is not always possible using the room temperature sensor integrated in the control unit due to the installation circumstances. In this case, optimum temperature control can be ensured using an external room temperature sensor fitted in the appropriate area.

Method

1. Select a suitable position for an external room temperature sensor.

NOTE

- The external room temperature sensor should not be in the direct line of hot air and not close to heat sources (for example the vehicle's own heating system).
 - The external room temperature sensor is to be installed at medium height in the vehicle cabin on surfaces that are as vertical as possible.
 - The installation site should not be exposed to direct sunlight.
 - Do not install the external room temperature sensor behind curtains or the like.
2. Remove the cover and pull blind plug off control unit (connector X5).
 3. Install the external room temperature sensor and route the cable to the heater.
 4. Connect the plug on the external room temperature sensor to socket X5 on the control unit and fit the cover.
 5. Conduct a trial and check the control properties.

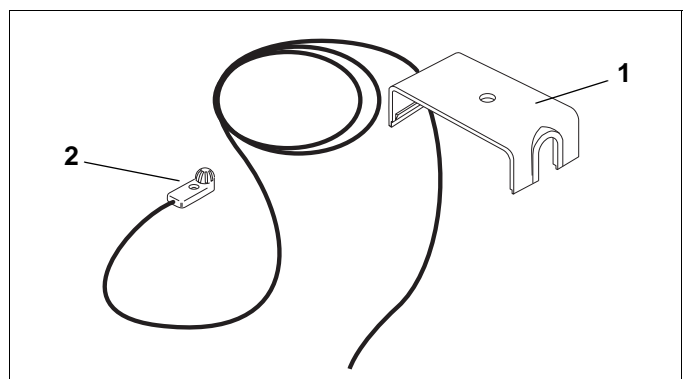


Fig. 901 External room temperature sensor

1. Cover
2. External room temperature sensor

9.2 Dismantling and assembling

9.2.1 Remove housing parts

9.2.1.1 Cover for electrical connection

The cover (1, Fig. 902) can be carefully levered off using a blunt blade in the areas marked "X".

9.2.1.2 Grilles (optional) for cold air inlet and hot air outlet

The grilles (6, Fig. 902, optional) can be released by twisting them out of the latch and pulled off toward the front.

9.2.1.3 Covers for cold air inlet and hot air outlet

Both covers (3 and 5, Fig. 902) can be released from the latch and removed at the top and bottom by pressing in the 4 locking lugs of the upper and lower shell (2 and 4, Fig. 902) with a suitable tool.

9.2.1.4 Top shell

The upper shell (2, Fig. 902) can be lifted off after removing the covers for the cold air inlet and hot air outlet.

9.2.1.5 Bottom shell

Remove base seal.

By slightly spreading to the side on both sides at the lower shell (4), in the "Y" areas, the latch is released and the shell can be separated from the drive unit. Also remove the 4 insulators (7).

9.2.2 Fit the housing parts

9.2.2.1 Bottom shell

1. Make sure that the 4 insulators (7) are properly positioned on the heat exchanger.

IMPORTANT

To avoid crushing the cable, ensure proper routing of all cables between the cooling ribs of the drive unit and heat exchanger.

2. Expand the bottom shell (4, Fig. 902) slightly at the side and fit it to the heater from underneath until the securing pins on the heater engage in the holes in the shell.
3. Fit a new base seal.

9.2.2.2 Top shell

Place the top shell (2, Fig. 902) on the heater and fix it in place in the grooves of the lower shell.

9.2.2.3 Cover for cold air inlet and hot air outlet

NOTE

The covers for the cold air inlet and hot air outlet differ. The cover with the smaller opening at the front must be fitted on the heating air fan.

Slide on the covers (3 and 5, Fig. 902) until the 4 positioning holes engage properly in the locking lugs of the lower and upper cover.

9.2.2.4 Grilles (optional) for cold air inlet and hot air outlet

Place the grilles (6, Fig. 902, optional) on the covers for the cold air inlet and hot air outlet.

9.2.2.5 Cover for electrical connection

NOTE

The wiring harness is to be guided out to the left or right of the heater to suit the installation situation.

Slide on the cover (1, Fig. 902) until it audibly engages in the upper cover.

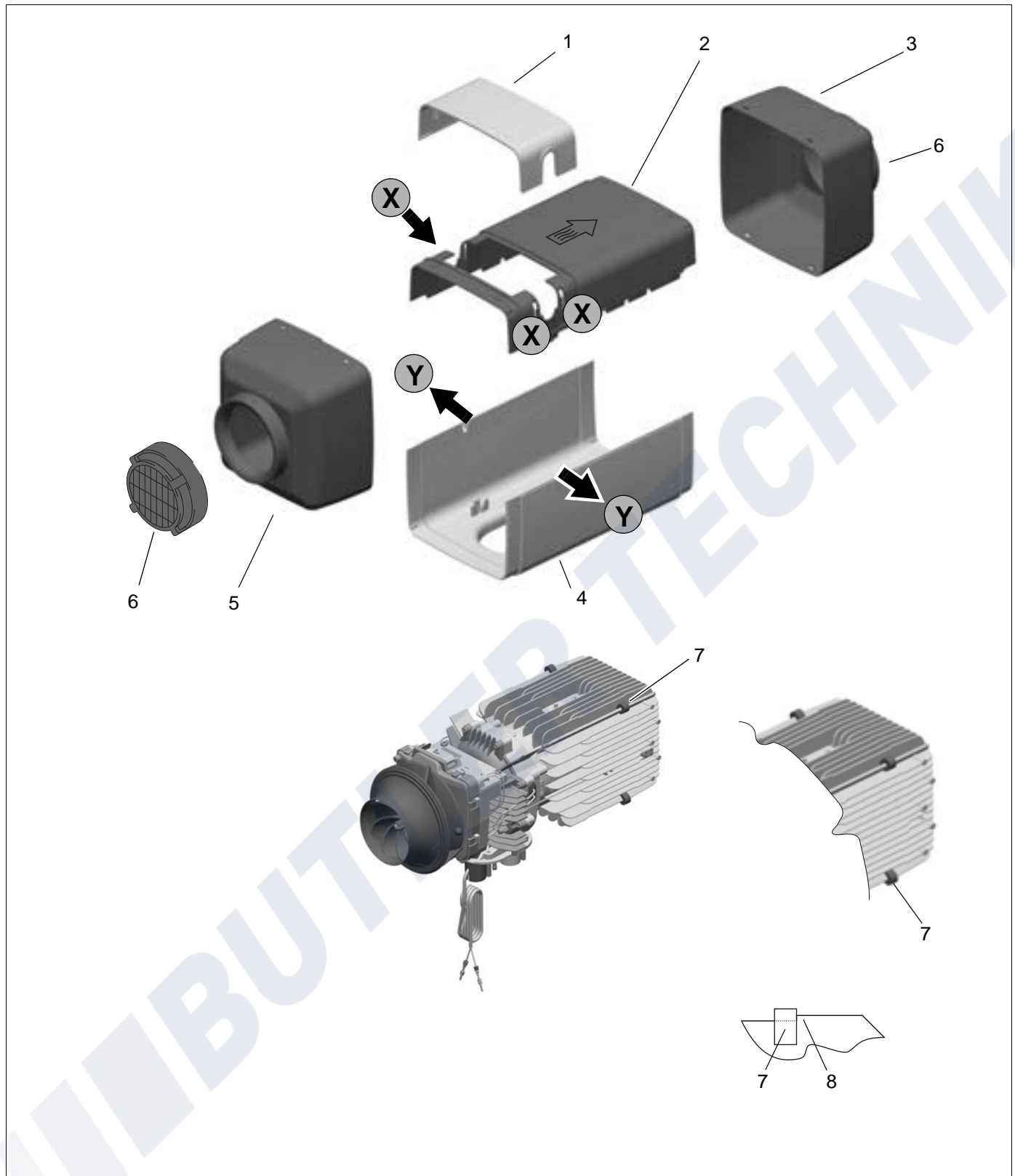


Fig. 902 Removing/fitting housing parts

- | | |
|---------------------------------|--|
| 1. Cover, electrical connection | 5. Cover, cold air inlet |
| 2. Top shell | 6. Grille (on hot air outlet side not shown) |
| 3. Cover, hot air outlet | 7. Insulators (4 pc.). |
| 4. Bottom shell | 8. Widening of corner rib |

9.2.3 Replacing control unit

9.2.3.1 Removal

1. Remove heater (see 8.7.1.1).
2. Remove housing parts (see 9.2.1).
3. Remove screws (5, Fig. 903).
4. Disconnect connectors on control unit (4).
5. Pull out control unit (4) upward.

NOTE

No repairs may be carried out on the control unit.

9.2.3.2 Installation

1. Insert plug connections on control unit as shown in Fig. 701.
2. Fasten control unit (4, Fig. 903) with screws (5).
3. Tighten screws (5) to 3.0 ± 0.3 Nm.
4. Install housing parts (see 9.2.2).
5. Install heater (see 8.7.1.2)
6. Check CO₂ setting and adjust if necessary (see Section 6.3).

9.2.4 Replacing blow-out temperature sensor

9.2.4.1 Removal

1. Remove heater (see 8.7.1.1).
2. Remove housing parts (see 9.2.1).
3. Disconnect plug connection X3 from control unit (4, Fig. 903).

IMPORTANT

Do not pull the cables.

4. Lever blow-out temperature sensor (9) out of heat exchanger's ribs using a suitable tool (see Detail A).
5. Remove blow-out temperature sensor (9).

9.2.4.2 Installation

1. Position blow-out temperature sensor (9) and press it into place by hand.
2. Make sure that blow-out temperature sensor (9) is properly positioned in heat exchanger (8).
3. Connect plug connector X3 on control unit (4).
4. Install housing parts (see 9.2.2).
5. Install heater (see 8.7.1.2)

9.2.5 Replacing heating air fan

9.2.5.1 Removal

1. Remove heater (see 8.7.1.1).
2. Remove housing parts (see 9.2.1).
3. Position a pair of long-nose pliers from the front between the two locking lugs on the motor shaft. Hold heating air fan (1, Fig. 903) with one hand and simultaneously and carefully spread two lugs with a slight twisting movement. Pull off heating air fan (1).

9.2.5.2 Installation

1. Make sure locking lugs are undamaged.
2. Slide heating air fan (1, Fig. 903) onto motor shaft until engaging of lugs on both sides is audible at stop.
3. Install housing parts (see 9.2.2).
4. Check smooth running of heating air fan (1) by hand, then listen for any noises when switching on later. The sensor magnets on the heating air fan (1) must be free from chips containing iron, etc.
5. Install heater (see 8.7.1.2)

9.2.6 Replacing drive unit

IMPORTANT

Only replace the drive unit (2, Fig. 903) with a drive unit with the same performance data and the same ID No.

9.2.6.1 Removal

1. Remove heater (see 8.7.1.1).
2. Remove housing parts (see 9.2.1).
3. Remove heating air fan (1) (see 9.2.5.1).
4. Remove control unit (4) (see 9.2.3.1).
5. Remove screws (3).
6. Remove drive unit (2) toward front.

IMPORTANT

Do not lay drive unit on combustion air or heating air fan!

7. Remove and discard flat seal (7).

9.2.6.2 Installation

1. Make sure that sealing surfaces on drive unit (2, Fig. 903) and on heat exchanger (8) are not damaged.
2. Lay new flat seal (7) on flange of drive unit (2).
3. Move drive unit (2) into assembly position and secure it with screws (3).
4. Tighten screws (3) to 6.0 ± 0.6 Nm.
5. Install control unit (see 9.2.3.2).
6. Fit heating air fan (1) (see 9.2.5.2).
7. Install housing parts (see 9.2.2).
8. Install heater (see 8.7.1.2)
9. Check CO₂ setting and adjust if necessary (see Section 6.3).

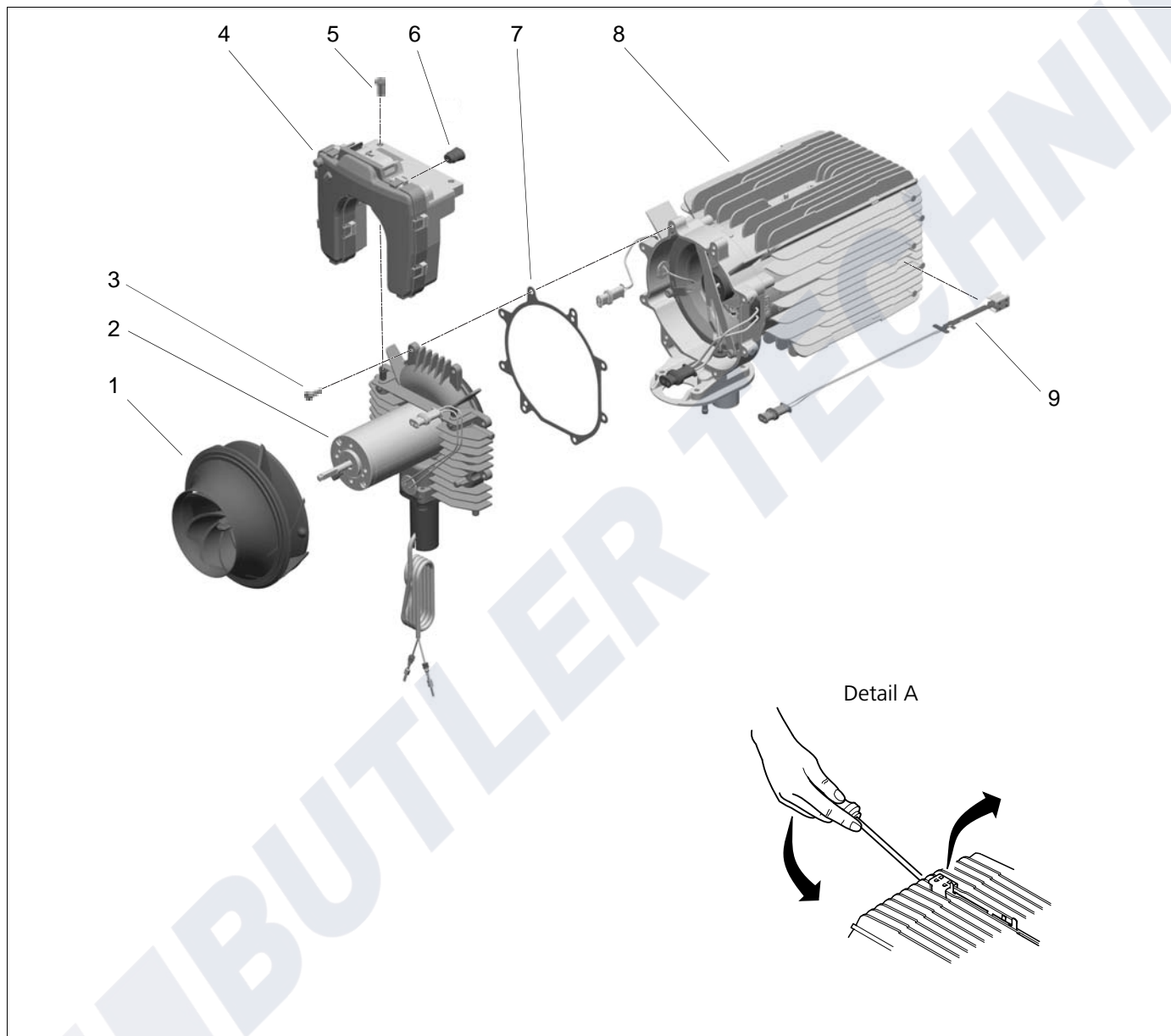


Fig. 903 Replace control unit, blow-out temperature sensor, heating air fan and drive unit

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Heating air fan 2. Drive unit 3. Torx screw (8 pc.) 4. Control unit 5. Torx screw (2 pc.) | <ol style="list-style-type: none"> 6. Blind plug 7. Flat seal 8. Heat exchanger 9. Blow-out temperature sensor |
|--|--|

9.2.7 Replacing exhaust temperature sensor

9.2.7.1 Removal

1. Remove heater (see 8.7.1.1).
2. Remove housing parts (see 9.2.1).
3. Remove control unit (see 9.2.3.1).
4. Remove drive unit (see 9.2.6.1).
5. Remove 2 screws (1, Fig. 907) and take off spring clip (2). Discard spring clip (2).
6. Press out cable grommet on exhaust-temperature sensor connection cable toward inside out of heat exchanger (6).
7. Pull out exhaust temperature sensor (10) and discard.

9.2.7.2 Installation

The exhaust temperature sensor must be handled with care.

IMPORTANT: Ceramic component!

- Pressing and pulling is not permitted.
- Only installation by hand is permissible.
- Use no tools, such as pliers etc.

IMPORTANT

The exhaust temperature sensor and the spring clip must be replaced after every removal!

Permissible bending angle of cable: max. 30° (see Fig. 904).

- Permissible loading max. 10 N per individual wire of cable (see Fig. 904).
- Remove sensor from package with two hands: Gripping points on sensor head and connector.
- When installing, insert sensor with two hands: Gripping points on sensor head and connector.
- Do not pull on cable after installing sensor.
- Discard sensor after dropping and do not install.
- Do not press down cable guide lugs up to stop when installing.
Danger of cable damage.
- Sealing surface must be dirt-free (see Fig. 905).

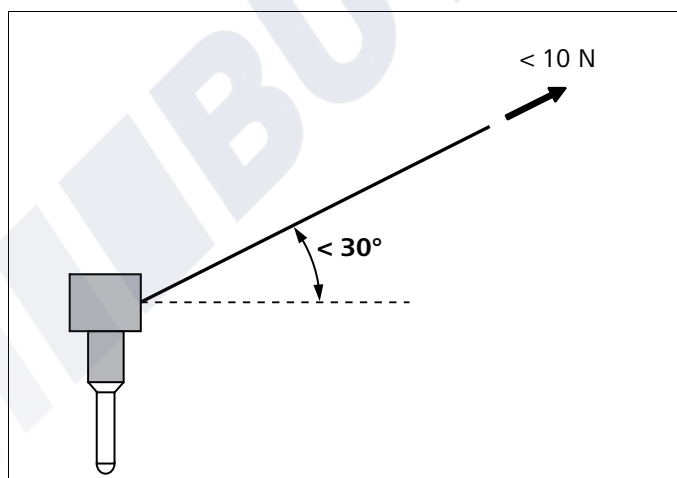


Fig. 904 Cable for exhaust temperature sensor

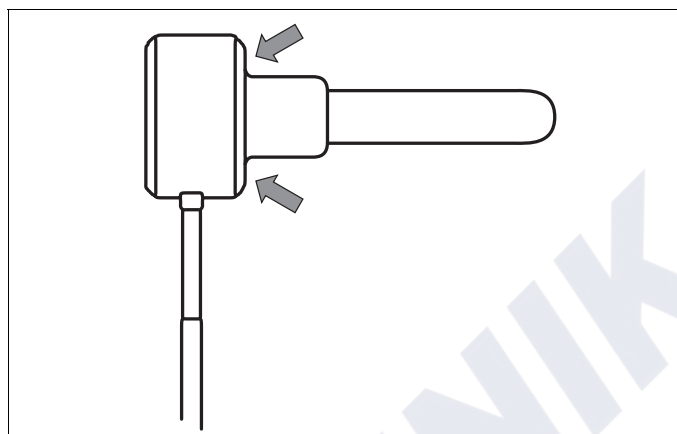


Fig. 905 Sealing surface of exhaust temperature sensor

1. Guide new exhaust temperature sensor (10, Fig. 907) into hole provided for this purpose.
The cable must face toward the hole in the heat exchanger (6).
2. Fit new spring clip (2) with 2 screws (1).
3. Guide connector of exhaust temperature sensor (10) through hole in heat exchanger (6) and press cable grommet on exhaust temperature sensor connection cable from inside into heat exchanger (6) (see Fig. 906).



Fig. 906 Top view of heat exchanger

4. Install drive unit (see 9.2.6.2).
5. Install control unit (see 9.2.3.2).
6. Fit heating air fan (see 9.2.5.2).
7. Install housing parts (see 9.2.2).
8. Install heater (see 8.7.1.2)
9. Check CO₂ setting and adjust if necessary (see Section 6.3).

9.2.8 Replacing evaporator mount and glow plug

9.2.8.1 Removal

1. Remove heater (see 8.7.1.1).
2. Remove housing parts (see 9.2.1).
3. Remove control unit (see 9.2.3.1).
4. Remove drive unit (see 9.2.6.1).
5. Remove 2 screws (1, Fig. 907) and take off spring clip (2). Discard spring clip (2).
6. Press grommet of exhaust temperature sensor (10) from outside inward into heat exchanger (6) and remove exhaust temperature sensor (10).
6. Press grommet of glow plug (8) inward out of heat exchanger housing (6).
7. Press grommet on fuel supply line of evaporator mount (3 or 7) inward out of heat exchanger housing (6).
8. Carefully pull evaporator mount (3 or 7) out of combustion pipe (4). Guide fuel pipe out of heat exchanger housing (6) by turning evaporator mount.
9. Remove retaining clip (9) and pull glow plug (8) out of evaporator mount (3 or 7).

9.2.8.2 Installation

1. Guide glow plug (8, Fig. 907) into evaporator mount (3 or 7) and secure with retaining clip (9) as shown in Fig. 907, Detail A.

IMPORTANT

During the following work step, make sure that the fuel connection is not bent.

2. Guide evaporator mount into heat exchanger (6). Guide fuel pipe through grommet hole in heat exchanger (6) and lay evaporator mount on combustion pipe.
6. Press grommet on fuel pipe into the heat exchanger (6).
7. Thread the cable of glow plug (8) through opening in heat exchanger housing (6).
8. Press grommet of glow plug (8) into heat exchanger (6). Ensure that glow plug cables do not form a loop in heat exchanger (6).
10. Fit new spring clip (2) with 2 screws (1).
11. Install drive unit (see 9.2.6.2).
12. Install control unit (see 9.2.3.2).
13. Install housing parts (see 9.2.2).
14. Install heater (see 8.7.1.2)

9.2.9 Change the combustion chamber and the heat exchanger

9.2.9.1 Removal

1. Remove heater (see 8.7.1.1).
2. Remove housing parts (see 9.2.1).
3. Remove control unit (see 9.2.3.1).
4. Remove blow-out temperature sensor (see 9.2.4.19.2.4.1).
5. Remove drive unit (see 9.2.6.1).

6. Remove exhaust temperature sensor (see 9.2.7 and 9.2.4.19.2.8.1). Discard exhaust temperature sensor and retaining spring.
7. Remove evaporator mount (see 9.2.8.1).
8. Remove 2 screws (1, Fig. 9074) and pull combustion pipe (4) out of heat exchanger (6).
9. Remove round sealing ring (5) from heat exchanger (6) and discard.

9.2.9.2 Installation

1. Fit new round sealing ring (5, Fig. 907) into heat exchanger (6).
2. Secure combustion chamber (4) with 2 screws on opposite sides (1).
3. Tighten screws (1) to 4 ± 0.4 Nm.
4. Install evaporator mount (see 9.2.8.2).
5. Install exhaust temperature sensor (see 9.2.7 and 9.2.4.19.2.8.2).
5. Install drive unit (see 9.2.6.2).
6. Install control unit (see 9.2.3.2).
7. Install blow-out temperature sensor (see 9.2.4.2).
8. Install housing parts (see 9.2.2).
9. Install heater (see 8.7.1.2)

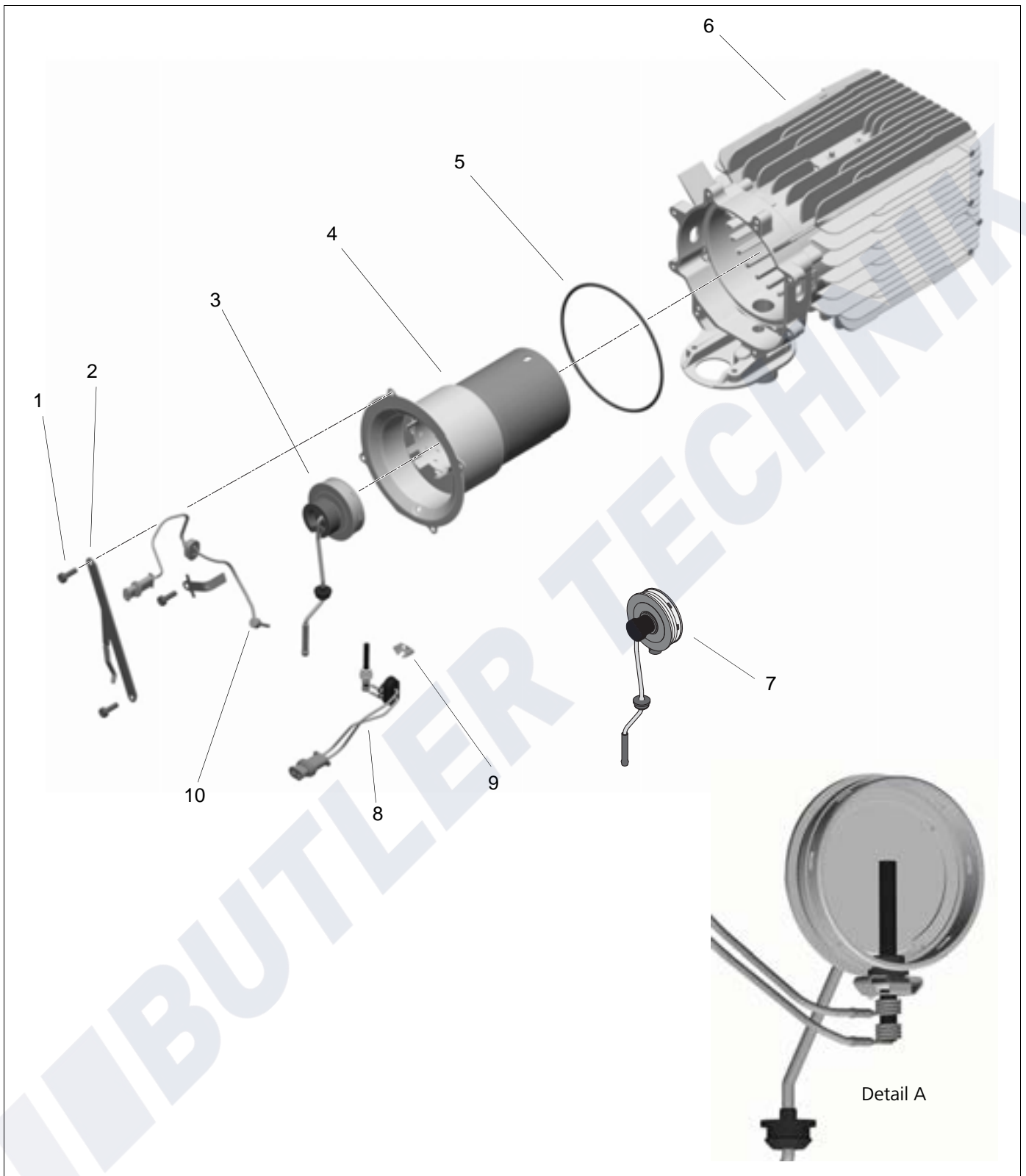


Fig. 907 Replacing evaporator mount, glow plug, exhaust temperature sensor, combustion pipe and heat exchanger

- | | |
|------------------------------|--------------------------------|
| 1. Torx screw (4 pc.) | 6. Heat exchanger |
| 2. Spring clip | 7. Evaporator mount (petrol) |
| 3. Evaporator mount (diesel) | 8. Glow plug |
| 4. Combustion pipe | 9. Retaining clip |
| 5. Round sealing ring | 10. Exhaust temperature sensor |

Packaging, storage and shipping

10 Packaging, storage and shipping

10.1 General information

The heater or its components which are sent to Webasto for testing or repair must be cleaned and packaged so that they are protected against damage when handled, transported and stored.

An ambient temperature of +85 °C or –40 °C must not be exceeded for storage.

Shipment address:

The address of the responsible Webasto service center can be found on <http://dealers.webasto.com>.

Webasto Thermo & Comfort SE
Postfach 1410
82199 Gilching
Germany

Visiting Address:
Friedrichshafener Str. 9
82205 Gilching
Germany

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.

www.webasto.com