

**Air heaters**

**Workshop Manual**

**Air Top Evo 3900**  
**Air Top Evo 5500**

Type Air Top Evo 3900/5500 ST B  
(petrol)

Type Air Top Evo 3900/5500 ST D  
(Diesel/PME)

**04/2008**  
**1313560A**



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.

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 designed to assist trained personnel with repairing both the petrol and the diesel versions of the Air Top Evo 3900/5500 air heaters.

#### 1.1.1 Use of the air heaters

The Webasto Air Top Evo 3900 and Air Top Evo 5500 air heaters are designed

- 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 engine and are connected to the fuel tank and the electrical system of the vehicle.

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

This workshop manual contains all the information and instructions required for repairing the Air Top Evo 3900 and Air Top Evo 5500 air heaters.

Normally, there is no need to use additional documentation. If necessary the operating / installation instructions and the installation suggestion for the specific vehicle may also be used.

### 1.4 Statutory regulations and safety instructions

In principle, the general accident prevention regulations and current works safety instructions are applicable. The "General safety regulations" that go beyond the scope of the above regulations are stated below. 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

The Air Top Evo 3900 and Air Top Evo 5500 heaters have been type-tested and approved in accordance with EC Directives 72/245/EEC (EMC) and 2001/56/EC (heater) with the following EC permit numbers:

e1\*72/245\*2006/28\*5079\* \_\_\_  
 e1\*2001/56\*2006/119\*0219\* \_\_\_  
 e1\*2001/56\*2006/119\*0220\* \_\_\_

Installation is governed above all by the provisions in Annex VII of Directive 2001/56/EC.

#### NOTE

The provisions of these Directives are binding within the territory governed by EU Directive 70/156/EEC and should similarly be observed in countries without specific regulations.

(Extract from Directive 2001/56/EC Annex VII)

1.7.1. A clearly visible tell-tale in the operator's field of view shall inform when the combustion heater is switched on or off.

## 2. Vehicle installation requirements

### 2.1. Scope

- 2.1.1. Subject to paragraph 2.1.2, combustion heaters shall be installed according to the requirements of this Annex.
- 2.1.2. Vehicles of category O (trailers) having liquid fuel heaters are deemed to comply with the requirements of this Annex.

### 2.2. Positioning of heater

- 2.2.1. Body sections and any other components in the vicinity of the heater must be protected from excessive heat and the possibility of fuel or oil contamination.

2.2.2. The combustion heater shall not constitute a risk of fire, even in the case of overheating. This requirement shall be deemed to be fulfilled 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.

2.2.3. In the case of M2 and M3 vehicles, the 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 2.2.2 may be used.

2.2.4. The label referred to in paragraph 1.4 (model plate), or a duplicate (duplicate model plate), must be positioned so that it can be easily read when the heater is installed in the vehicle.

2.2.5. Every reasonable precaution should be taken in positioning the heater to minimise the risk of injury and damage to personal property.

### **2.3. Fuel supply**

2.3.1. The fuel filler must not be situated in the passenger compartment and must be provided with an effective cap to prevent fuel spillage.

2.3.2. In the case of liquid fuel heaters, where a supply separate to that of the vehicle is provided, the type of fuel and its filler point must be clearly labelled.

2.3.3. A notice, indicating that the heater must be shut down before refuelling, must be affixed to the fuelling point. In addition a suitable instruction must be included in the manufacturer's operating manual.

### **2.4. Exhaust system**

2.4.1. The exhaust outlet must be located so as to prevent emissions from entering the vehicle through ventilators, heated air inlets or opening windows.

### **2.5. Combustion air inlet**

2.5.1. The air for the combustion chamber of the heater must not be drawn from the passenger compartment of the vehicle.

2.5.2. The air inlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

### **2.6. Heating air inlet**

2.6.1. The heating air supply may be fresh or recirculated air and must be drawn from a clean area not likely to be contaminated by exhaust fumes emitted either by the propulsion engine, the combustion heater or any other vehicle source.

2.6.2. The inlet duct must be protected by mesh or other suitable means.

### **2.7. Heating air outlet**

2.7.1. Any ducting used to route the hot air through the vehicle must be so positioned or protected that no injury or damage could be caused if it were to be touched.

2.7.2. The air outlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

### **2.8. Automatic control of the heating system**

The heating system must be switched off automatically and the supply of fuel must be stopped within five seconds when the vehicle's engine stops running.

If a manual device is already activated, the heating system can stay in operation.

### **1.4.2 General safety information**

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

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

The electric cables and controls for the air-conditioning system must be arranged in the vehicle so that their proper functioning cannot be adversely affected in normal operating conditions.



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

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

The air heater's heat exchanger can be used for a maximum of 10 years and must then be replaced by the manufacturer or one of its authorised workshops using a genuine spare part. A label must then be affixed to the heater showing the date of sale and the wording "Genuine spare part".

When you change the heat exchanger it is essential that you also replace the overheating protection element (temperature sensor) to prevent possible function faults caused by using the old temperature sensor.

The Air Top Evo 3900 and Air Top Evo 5500 air heaters are prepared for interior installation and sealing direct on the cabin floor or a cabin wall. Non-release connections must be used in the interior for combustion air and exhaust pipes with the accessories available from Webasto.

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.

The hot and combustion air intake openings must be positioned in such a way that no water can ingress into them if the vehicle drives through a water hazard for which it has been approved.

The heater must not be installed in the driver's or passenger cabin of buses (vehicle classes M<sub>2</sub> and M<sub>3</sub>). If the heater is nevertheless installed in such a place, the installation box must be tightly sealed against the vehicle interior. The installation box must have sufficient external ventilation to ensure that a maximum temperature of 40 °C is not exceeded in the box. Fault faults 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 the event of lengthy heavy smoke development, unusual combustion noise or a smell of fuel, the heater must be put out of action by removing the fuse and must not be started again until it has been examined by Webasto-trained personnel. Claims can only be made if it can be verified that the claimant has complied with the servicing and safety instructions.

Installation regulations for Webasto fuel tanks for supplying fuel to heaters in vehicles:

- The tank must not be installed in the passenger or driver's cabin of buses.
- The fuel filler neck must not be inside the passenger or driver's cabin in any vehicle.
- Fuel tanks for normal and super grades of petrol must not be immediately behind the front trim of the vehicle. They must be separated from the engine in such a way that in the event of an accident the fuel will not be expected to ignite. This does not apply to tractor units with an open driver's seat.

The fuel lines (Mecanyl hose) must not be immediately next to the exhaust pipe and must be thermally insulated if necessary, otherwise they will pose a fire risk. All pipes that come into contact with fuel must have sealed connections, they must not be damaged in any way and they must be checked at regular intervals (at least the same intervals as an inspection of the vehicle as a whole).

#### **NOTE**

If any damage or leaks are found on the fuel line, the heater must not be used until the damage has been rectified by an authorised Webasto workshop.

Put the heater out of action by removing the fuse.

## Overheating

Keep the hot air inlet and hot air outlet free of dirt and foreign bodies. Dirty, blocked air lines can cause the heater to shut down due to overheating.

After an overheating lock-out, check that the air system is clear, remove any materials that may block the air current and have any damage to the air lines repaired by an authorised Webasto workshop. After this the heater lockout can be cancelled by switching it off and then on again. If this action does not produce the required success (if the heater overheats again) take it to an Webasto-authorized workshop.

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 vent 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 securely fixed to the heater (using pipe clips, for example) and all other connection points (for example vents).

## IMPORTANT

The errors described below are to be avoided at all costs:

- 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 hot 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 current of hot air 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.

## NOTE

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 invalidation of the type approval for the heater and therefore of its homologation / EC type licence.

You must read the operating manual before starting the heater for the first time.

## 2 General description

The Air Top Evo 3900 and Air Top Evo 5500 air heaters are based on the evaporator principle and essentially consist of the following

- The drive unit with a combustion and hot air blower
- The heat exchanger
- The burner insert with combustion pipe
- The control unit

To control and monitor it, the heater has

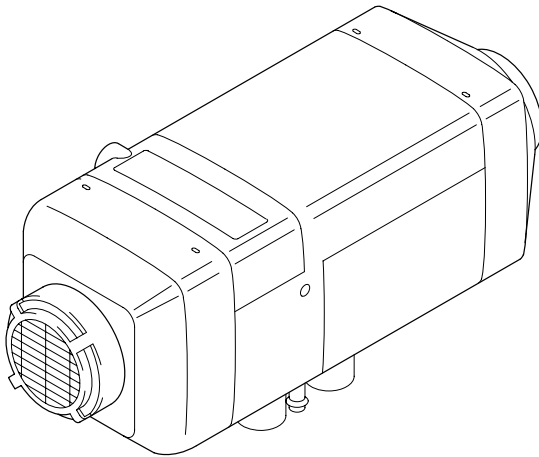
- a control unit with temperature sensor
- a glow plug / flame monitor
- an overheating sensor

inside it.

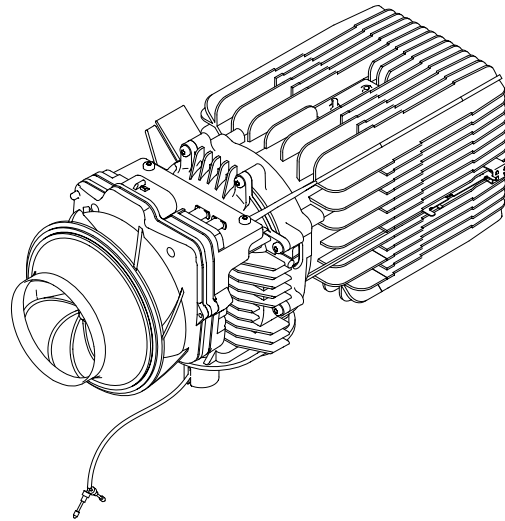
The fuel supply is provided from an external source using a metering pump.

If a fault occurs, an error code will be output in the display of the combination or standard timer. If the heater has a control element, the ON control light will flash. In addition the heater can be checked using a personal computer (see PC heater diagnostic operating manual).

The heater may be controlled using an external temperature sensor instead of the internal temperature sensor.



Air Top Evo 3900/5500 air heater

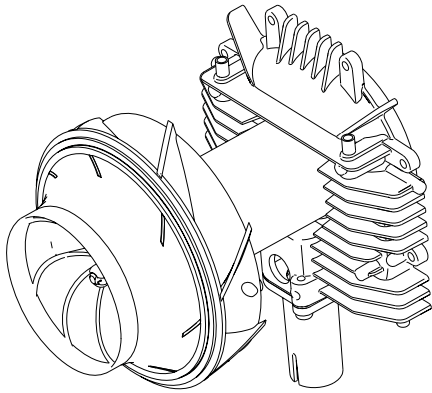


Air Top Evo 3900/5500 air heater without casing

### 2.1 Drive unit

The drive unit consists of the drive motor, the combustion air blower, the heat air blower and the intake casing. The combustion air blower supplies the air required for the combustion process from the combustion air inlet to the burner insert.

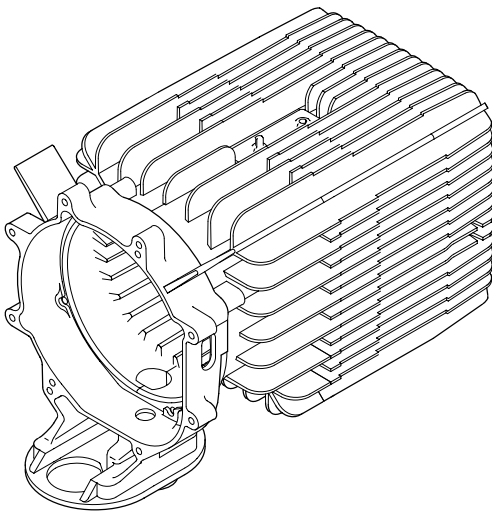
The hot air blower transports the hot air from the hot air inlet via the heat exchanger to the hot air outlet.



Drive unit

### 2.2 Heat exchanger

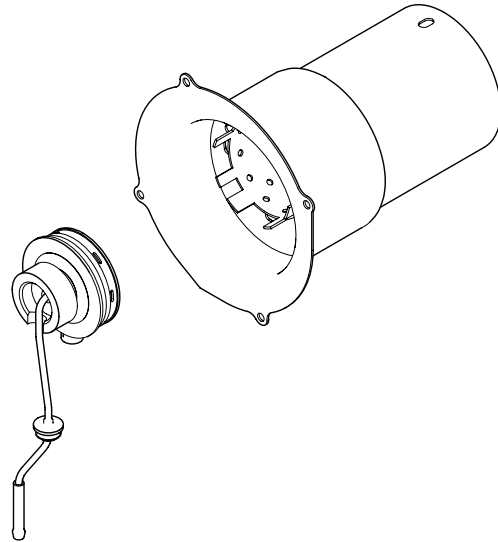
The heat generated by the combustion process is transferred to the air transported by the combustion and hot air blowers in the heat exchanger.



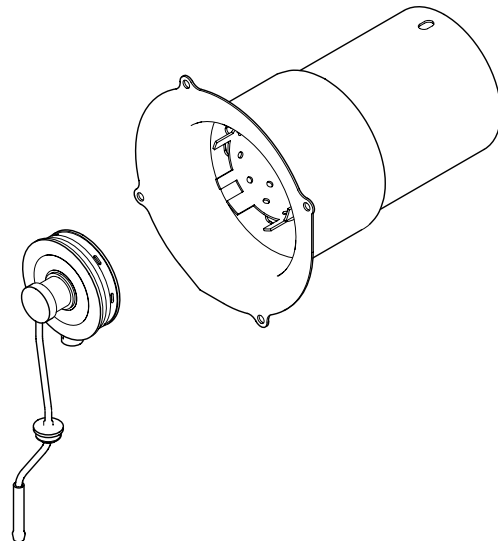
Heat exchanger

### 2.3 Burner insert with combustion pipe

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



Burner insert (diesel) and combustion pipe

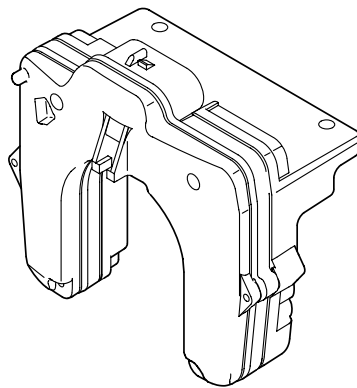


Burner insert (petrol) and combustion pipe

## 2.4 Control unit

The control unit is the central component for ensuring the function is maintained and for monitoring the heater's operation. A temperature sensor in the control unit is designed to control the room temperature. An external temperature may also be connected to all the heaters.

If a fault occurs, an error code will be output in the display of the combination timer. If the heater has a control element, the ON control light will flash. In addition the heater can be checked using a personal computer (see PC heater diagnostic operating manual).

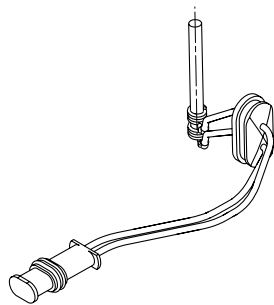


Control module

## 2.5 Glow plug / Flame monitor

The glow plug also acts as a flame monitor. The mixture of fuel and air is ignited by the glow plug when the heater is started. The glow plug takes the form of an electrical resistor and is positioned in the burner on the side facing the flame.

As a flame sensor the glow plug reacts in the same way as a low ohm PTC resistor, which changes its resistance depending on the heat emitted by the flame. The signals are fed to the control unit where they are processed. The flame status is monitored by the flame sensor whenever the heater is operating.

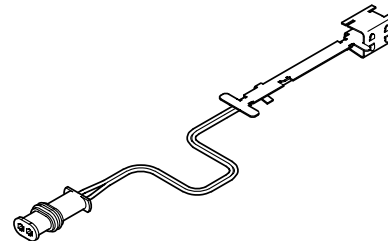


Glow plug / Flame monitor

## 2.6 Overheating sensor

The overheating sensor measures the temperatures in the rib area of the heat exchanger whenever the heater is operating.

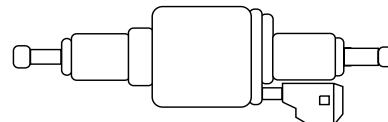
The control unit evaluates the signal and protects the heater from hot air outlet temperatures above 150 °C and surface temperatures above 80 °C by shutting down the combustion process and blowing cold air over the heater. The heater then suffers a fault lock-out and can be restarted by being switched off and on again (see 3.2).



Overheating sensor

## 2.7 Metering pump

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



Metering pump DP 30.2/3



### 3 Function description

#### 3.1 Control element

The control element is designed to switch the heater on and off, adjust the required room temperature (intake temperature between 5 °C and 35 °C) and to reset the heater after a fault.

In addition, other comfort functions (Eco, Normal, Plus, Ventilation, Altitude Compensation) can also be activated with the MC04/05 heater control.

The integral green LED is designed to act

- as an ON signal,
- as a fault signal,
- as service display (LED flashes).

#### NOTE

##### ADR operation:

After an operating voltage has been applied by switching the battery isolation switch and control element to "ON" the control unit will be set to the "Fault lock-out" position. Before it can be restarted the control element must be set to "OFF".

#### 3.2 Switch on

Set the control element to the required temperature.

If the hot air temperature is lower than the nominal temperature the heater will start

#### NOTE

If the temperature of the hot air intake is above the set nominal temperature, only the motor for the hot and combustion air blower will start (control pause). Special feature: The control pause speed is 0 rpm if boat heaters are used.

The function of the flame sensor is checked. If the flame sensor now reports "light", the system will attempt to cool the flame sensor for 60 seconds. If the flame sensor still reports "light" the control unit will suffer a fault lock-out. If another monitored component has suffered a fault, the fault lock-out will take effect without any slow down time.

#### Start

When the heater is switched on the ON signal light will be lit and the glow plug will be switched on (cycled). The motor for the hot and combustion air blower will be set to approx. 50% of its maximum speed.

After approx. 40 seconds the fuel metering pump will start and the flame formation will begin. To improve the starting quality the metering pump and combustion air blower are started with different frequencies and speeds.

After a further 90 seconds the glow plus will be switched

off and the existence of the flame established.

#### Automatic restart

If the flame sensor does not find a flame, the starting procedure will be repeated. The glow plug will be switched on again (cycled). The motor for the hot and combustion air blower will be set to approx. 50% of its maximum speed.

After approx. 40 seconds the fuel metering pump will start and the flame formation will begin.

After a further 50 seconds the glow plus 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 180 seconds and will suffer a fault lock-out.

#### NOTE

After a restart the heater will suffer a fault lock-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. During this process the combustion heat is given off to the walls of the heat exchanger, absorbed by the hot air transported by the hot air blower and fed into the interior of the vehicle.

The temperature of the hot air intake is measured by a temperature sensor in the control unit or an external temperature sensor. If the measured temperature is lower than the value set on the control element, the output of the heater is increased to maximum heat output.

To increase the burner service life when it is used continuously the transport capacity of the metering pump is reduced for 10 seconds every 10 minutes.

In addition, heating mode is interrupted every 8 hours in the same way as for a control pause.

#### 3.4 Control mode

In control mode the blower speed and the metering pump delivery rate are dependent on the heat output. The glow plus is switched off.

### 3.5 Control pause

After the temperature set on the control element has been reached the heat output is reduced. The speed of the heating and combustion air blower and the delivery rate of the metering pump are reduced.

If, at minimum heat output, the intake temperature set on the control element is exceeded, the metering pump is shut down and the combustion process ended. To burn off the flame properly the blower speed falls after 20 seconds to low-fire rate speed and then returns to the initial speed after 15 seconds, after which it falls to the control pause speed in 3 minutes, where it remains for the entire control pause.

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

If the temperature set on the control element is exceeded at the temperature sensor, the heater will restart.

#### NOTE

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

### 3.6 Switch off

When the heater is switched off the ON control LED on the control element goes out. If no fuel has been transported or if the heater is in the control pause, the heater is switched off immediately without a slow down time.

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 pause. The heater is then switched off automatically.

#### NOTE

The heater may be switched on again during the slow down time. In this case the slow down time is completed and the heater is then restarted.

### 3.7 Heater functions when installed in ADR vehicles

#### NOTE 24V

Only for Air Top Evo 3900/5500 D heaters that are installed in vehicles for transporting hazardous substances (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.

After an ADR shut down process the control unit is in the "Fault lock-out" position. Before it can be restarted the control element must be set to "OFF".

#### 3.7.1 Extract from Directive 2001/56/EC Annex IX

Start of extract.

#### ANNEX IX

#### 3 TECHNICAL PROVISIONS

#### 3.1. General (EX/II, EX/III, AT, FL and OX vehicles)

3.1.1. The combustion heaters and their exhaust gas routing shall be designed, located, protected or covered so as to prevent any unacceptable risk of heating or ignition of the load. This requirement shall be considered as fulfilled if the fuel tank and the exhaust system of the appliance conform to the provisions set out in the points 3.1.1.1 and 3.1.1.2. Compliance with those provisions shall be verified on the completed vehicle.

3.1.1.1. Any fuel tanks for supplying the appliance shall meet the following requirements:

- a) in the event of any leakage, the fuel shall drain to the ground without coming into contact with hot parts of the vehicle or the load;
- b) fuel tanks containing petrol shall be equipped with an effective flame trap at the filler opening or with a closure enabling the opening to be kept hermetically sealed.

3.1.1.2. The exhaust system as well as the exhaust pipes shall be so directed or protected to avoid any danger to the load through heating or ignition. Parts of the exhaust system situated directly below the fuel tank (diesel) shall have a clearance of at least 100 mm or be protected by a thermal shield.

3.1.2. The combustion heater shall be switched on manually. Programming devices shall be prohibited.

#### 3.2. EX/II and EX/III vehicles

Combustion heaters using gaseous fuels are not permitted.



### 3.3. FL vehicles

3.3.1. The combustion heaters shall be put out of operation by at least the following methods:

- a) intentional manual switching off from the driver's cab;
- b) stopping of the vehicle engine; in this case the heating device may be restarted manually by the driver;
- c) start-up of a feed pump on the motor vehicle for the dangerous goods carried.

3.3.2 After running is permitted after the combustion heaters have been put out of operation. For the methods set out in points

(b) and (c) of paragraph 3.3.1 the supply of combustion air shall be interrupted by suitable measures after an after-running cycle of not more than 40 seconds. Only heaters for which proof has been furnished that the heat exchanger is resistant to the reduced after-running cycle of 40 seconds for the time of their normal use shall be used.

End of extract.

## 3.8 Fault lock-out

Errors on the various heater components and faults in the starting process and in heating mode are identified in the control unit. The heater is switched off and goes into fault lock-out if the following conditions occur:

- No or incorrect start
- Temperature sensor defective
- Overheating sensor interrupt or short circuit
- Overheating sensor installed incorrectly
- Glow plug/Flame monitor interrupt or short circuit
- Fan motor overload or blocked or short circuit or interrupt
- Error in metering pump circuit
- Undervoltage below 10.5 V / 21 V for longer than 20 seconds
- Overvoltage above 16 V / 32 V for longer than 6 seconds
- Control unit defective
- Overheating

The fuel supply is stopped if the heater overheats. The heater continues to run in the same way as if it is switched off manually.

After it stops the control unit will be set to fault lock-out. The overheating is indicated by the indicator flashing 10 times.

Rectify the cause of the fault.

To reset the fault switch the heater on and off briefly (at least 2 seconds).

### 3.8.1 Error monitor

The overheat, incorrect start and flame failure 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 FSZ is incremented by 1 each time the heater fails to start. If the incorrect start counter reaches its maximum value of 9 the heater will go into the heater lock-out status HGV.

The error counter SZ is incremented by 1 each error for which there is no separate counter. If the error counter reaches its maximum value of 5 the heater will go into the heater lock-out status HGV.

The overheating counter ÜHZ is incremented by 1 each time the heater overheats. If the overheating counter reaches its maximum value of 5 the heater will go into the heater lock-out status HGV.

After a flame abort FAZ, a restart is automatically carried out. The condition for a restart is that the heater unit was in the control mode directly beforehand. During the restart the cycle repetition counter ZWZ is increased by one. This process is repeated until the heater unit 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 unit start-up, the cycle repetition counter ZWZ 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 FAZ, overheating counter ÜHZ and false starting counter FSZ are set to 0 after(!) fault-free combustion operation (6 min.).

### 3.8.2 Reset a fault lock-out

The various fault statuses can be reset as follows.

Fault lock-out:            Switch heater off using the control element and then on again after more than 2 seconds

Heater fault lock-out:    Heater unit is switched on, Fault code F12 is shown. Remove fuse. Switch off heater unit with heater control. Insert fuse again after more than 2 seconds. Switch on heater unit again with heater control.

## 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, combustion air blower, metering pump, timer\*, glow plug/flame monitor and control element are designed for 12 V or 24 V.

The voltage is immaterial for the temperature sensor.

\* not for ADR

### Fuel for Air Top Evo 3900/5500 B (petrol):

The fuel specified by the manufacturer must be used.

### Fuel for Air Top Evo 3900/5500 D (diesel/PME):

The diesel fuel specified by the manufacturer must be used. Class EL heating oil (not L heating oil) may also be used as long as it complies to the normal quality available on the German market pursuant to DIN 51603. 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 3900/5500 ST D heater is also licensed for use with PME (bio-diesel), which complies with DIN EN 14214.

The table shows the values for the Air Top Evo 5500 in brackets.

Heater	Operation	Air Top Evo 3900(5500) B	Air Top Evo 3900(5500) D	
Type test permit	EMC heater	e1*72/245*2006/28*5079*__ e1*2001/56*2006/119*0219*__ e1*2001/56*2006/119*0220*__		
Model		Air heater with evaporation burner		
Heat output	Control range	1.7 - 3.9 (5.5) kW	1.5 - 3.9 (5.5) kW	
Fuel		Petrol	Diesel/PME	
Fuel consumption	Control range	0.17 ... 0.39 (0.57) kg/h (0.19 ... 0.51 (0.73) l/h)	0.15 ... 0.39 (0.55) kg/h (0.18 ... 0.47 (0.66) l/h)	
Rated voltage		12 V	12 V	24 V
Operating voltage range		10.5 ... 16 V	10.5 ... 16 V	21 ... 31 V
Rated power consumption	Control range	15 - 45 (116) W		
Ambient temperatures: Heater	– Operation – Warehouse	–40 °C ... +40 °C –40 °C ... +85 °C		
Metering pump	– Operation – Warehouse	–40 °C ... +20 °C –40 °C ... +85 °C		
Control element	– Operation – Warehouse	–40 °C ... +75 °C –40 °C ... +85 °C		
Combustion air intake temperature		–40 °C ... +20 °C		
Adjustment range for interior temperature	Control range	+5 °C ... +35 °C		
Delivery rate of hot air at fan speed	against 0.5 bar	max. 132 (200) m <sup>3</sup> /h at 3900 (5500) rpm		
CO <sub>2</sub> in exhaust gas (permitted function range)		1.7 kW: 5.0 ... 8.0 % 3.5/5.0 kW: 9.0 ... 12.5 %	1.5 kW: 5.0 ... 8.0 % 3.5/5.0 kW: 9.0 ... 12.5 %	
Heater dimensions		Length 423 ± 2 mm Width 148 ± 1 mm Heights 162 ± 1 mm		
Weight of heater		5.9 kg		



## 5 Troubleshooting

### 5.1 General

This section describes how to identify and deal with errors on the Air Top Evo 3900 and Air Top Evo 5500 heaters.

If a fault occurs, an error code will be output in the display of the combination timer.

If the heater has a control element, the ON control light will flash.

In addition the heater can be checked using a personal computer (see PC heater diagnostic 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. If in doubt, refer to sections 2 and 3 for a description of how the functions interact.

#### NOTE

##### For ADR mode only

After an ADR shut-down or an operating voltage has been applied by switching the main vehicle switch and control element to "ON" the control unit will be set to the "Fault lock-out" position. Before it can be restarted the control element must be set to "OFF" or the Immediate heat button pressed on the combination timer.

#### IMPORTANT

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

The following potential sources of malfunctions are not taken into account and should always be checked so that they can then be excluded as the cause of the particular fault:

- **Corroded plugs**
- **Loose plug contacts**
- **Poor crimp contacts on plugs**
- **Corroded cables and fuses**
- **Corroded 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.

### 5.2 General error symptoms

The following table (Fig. 501) lists the possible error symptoms.

Error symptom	Possible cause	Remedy
Heater unit cuts out automatically	No combustion after start and restart ON indicator flashes	Switch heater off and then on again
	Flame extinguishes during operation ON indicator flashes	Switch heater off and then on again
	Heater unit overheats ON indicator flashes	Check that the hot air system is clear, allow the heater to cool, switch heat off briefly and then on again
	Vehicle voltage too low ON indicator flashes	Charge battery Switch heater off and then on again
Heater unit 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 (see [www.webasto.com](http://www.webasto.com)).

**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.

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 pause when switched on; the control pause speed is 0 rpm when an external temperature sensor is used.

Fig. 502 Error symptoms during function

## 5.4 Error code output

If the heater is fitted with a combination timer, an error code output will appear on the display of the timer after a fault occurs.

### NOTE

The error code is output if the heater is fitted with a control element after an error has occurred by the switch-on indicator/error code indicator flashing. After 5 seconds of fast flashing, the error code will be output by a sequence of long flash pulses, the number of flashes is shown in the table below (for example F04 = 4 long flash pulses).

Error code	Error (group)	Additional information during PC diagnostic	Troubleshooting
F 00	Control unit error/ incorrect parameter set/ warm-start detection	<b>01</b> Control unit error  <b>81</b> EOL checksum error  <b>11</b> Incorrectly coded control unit or incorrect heater (fuel type) installed (the heater will not work if this error occurs)  <b>91</b> Neutrally coded or disabled control unit (the heater will not work if this error occurs)  <b>92</b> Maintain command failed (the heater will not work if this error occurs).  <b>18</b> Customer bus defective	Replace control unit
F 01	No start (after 2 starting attempts)/ no flame formation	<b>02</b> Even after the restart, no flame has formed  <b>82</b> No start in test	Check fuel supply (tank empty, lines blocked) Clean burner insert, replace flame sensor
F 02	Flame abort (repeated >3)	<b>03</b> The flame has gone out during operation and has not reformed after a restart attempt  <b>83</b> The flame has gone out during a heating cycle more than FAZ times (EEPROM)	Check fuel supply (tank empty, lines blocked) Clean burner insert, replace flame sensor
F 03	Undervoltage or overvoltage	<b>84</b> The voltage was less than 10.5 V or 21 V for longer than 20 seconds  <b>04</b> The voltage was more than 16 V or 32 V for longer than 6 seconds	
F 04	Premature flame recognition	<b>05</b> The flame sensor recognised a flame before combustion had started	Replace flame sensor
F 06	External temperature sensor break or External temperature sensor short circuit	<b>14</b> Temperature sensor circuit short circuit to earth  <b>94</b> Temperature sensor circuit break or short circuit to +Ub	Check cables, replace temperature sensor  Check cables and terminating resistor, replace temperature sensor

Fig. 503 Troubleshooting (page 1 of 2)

Error code	Error (group)	Additional information during PC diagnostic	Troubleshooting
F 07	Metering pump interrupt or metering pump short-circuit	<b>88</b> Break or short circuit to +Ub <b>08</b> Short circuit to earth	Check cables, replace metering pump Check cables, replace metering pump
F 08	Fan motor interrupt or fan motor short-circuit or fan motor overload or fan motor blocked	<b>89</b> Break or short circuit to +Ub <b>09</b> The switched drive unit cable (combustion and hot air blower) has a short circuit to earth or the drive unit is overloaded <b>15</b> Burner motor block guard has tripped <b>95</b> Burner motor not turning easily sensor has tripped	Replace drive unit (combustion and hot air blower) Eliminate the cause of the blockage / difficulty in movement Replace drive unit (combustion and hot air blower)
F 09	Glow plug interrupt or glow plug short-circuit	<b>8A</b> Glow plug/Flame monitor: Break or short circuit to +Ub <b>19</b> Glow circuit: The switched cable of the element has a short circuit to earth	Replace glow plug / flame monitor Replace glow plug / flame monitor
F 10	Overheating	<b>06</b> The overheating fault lock-out has tripped (heater overheated) <b>17</b> Incorrect application or illegal insulation (OHS gradient too high)	Find and remove the cause of the overheating <b>NOTE</b> If no other cause can be found for the overheating, the pressure losses caused by the hot air distribution (too many resistance points) are too high or a hot air filter is soiled
F 11	Overheating sensor interrupt or overheating sensor short circuit	<b>AB</b> Overheating sensor circuit: break or short circuit to +Ub <b>1B</b> Overheating sensor circuit: the switched cable of the element has a short circuit to earth	Replace overheating sensor Replace overheating sensor
F 12	Heater unit lock-out	<b>07</b> The permanent heater fault lock-out has been activated	Heater unit is switched on, Fault code F12 is shown. Remove fuse. Switch off heater unit with heater control. Insert fuse again after more than 2 seconds. Switch on heater unit again with heater control. <b>NOTE</b> The following error has occurred several times: Fault counter more than 5 times Incorrect start counter more than 9 times Flame failure counter more than 5 times
F 14	Overheating sensor incorrect position	<b>97</b> Incorrect position of the overheating sensor (OHS gradient too low)	Position the overheating sensor correctly
F 15	Setpoint generator short circuit	<b>9B</b> Nominal value potentiometer circuit break or short circuit to + Ub	Check cables, replace control element

Fig. 503 Troubleshooting (page 2 of 2)



## 6 Function tests

### 6.1 General

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 Settings

#### 6.2.1 Setting the CO<sub>2</sub> content

The CO<sub>2</sub> content in the emissions is set using the adjustment knob on the control element. At a constant blower speed the volume of fuel is controlled by changing the metering pump cycle.

#### IMPORTANT

The CO<sub>2</sub> measuring instruments must be calibrated. The heater must be switched off.

1. Connect the CO<sub>2</sub> line to minus.
2. Turn the adjustment knob on the control element to the centre setting. The heater will start and go automatically to low-fire rate mode.

#### NOTE

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

3. Set the CO<sub>2</sub> value by turning the adjustment knob. Turning it anticlockwise will reduce the CO<sub>2</sub> value, whilst turning it clockwise will increase it. The measured CO<sub>2</sub> content at low-fire rate (1,5 kW) must be between 5,0 % and 8,0 %.
4. If the CO<sub>2</sub> value is within this range, disconnect the CO<sub>2</sub> line from minus. This saves the setting.

#### NOTE

The heater will now run in normal mode again and can be switched off as normal using the control element. The heater is set at the factory to match the fitted combustion air blower.

## 6.3 Testing individual components

#### IMPORTANT

For function tests always break the connection between the control unit and the component you wish to test.

### 6.3.1 Glow plug resistance test

#### NOTE

The resistance test must be carried out with an ohmmeter suitable for small resistance values.

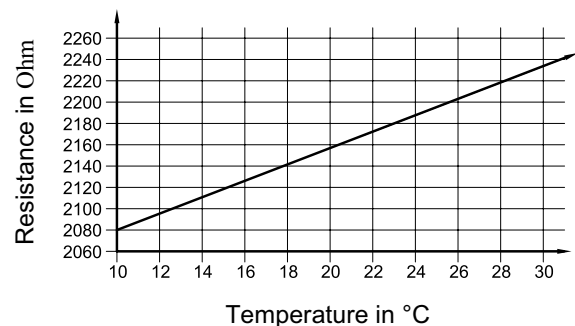
A resistance test with a simple digital multimeter is too inaccurate to find the precise values. A new glow plug can be measured to act as a reference.

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

Glow plug:	12 V (red)	24 V (green)
Resistance at 25 °C:	0.190 ... 0.250 Ω	0.740 ... 0.940 Ω
Test current:	< 5 mA	< 5 mA

### 6.3.2 Overheating sensor resistance test

If you conduct this test with a digital multimeter the overheating sensor must have the values shown in the following diagram:



Characteristic resistance values of a PT 2000 overheating system in a temperature range of 10 °C to 30 °C



## 7 Circuit diagrams

### 7.1 General

The Air Top Evo 3900 and Air Top Evo 5500 heater units can be operated with the heater control (setpoint generator/switch), a combination timer or the MC04/05 heater control.

The circuit diagrams (Fig. 702 to 707) show the possible circuits for 12 and 24 Volt with

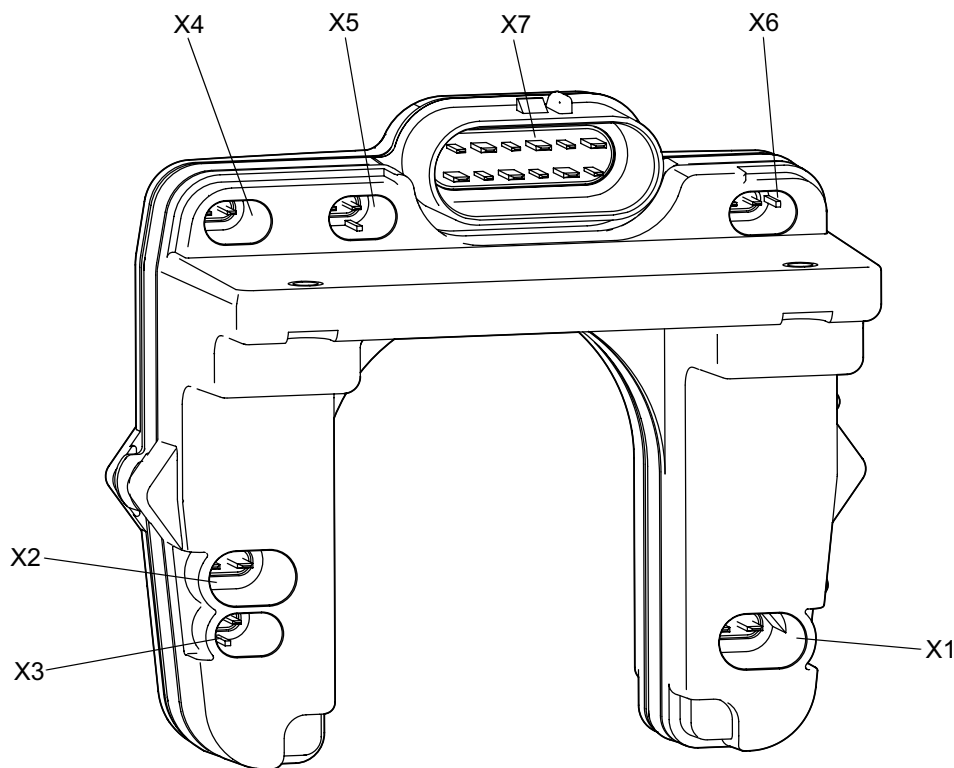
- Control element and vehicle blower
- ADR operation with control element
- Combination timer and vehicle blower
- Combination timer and electrical battery isolation switch
- Control Panel MC04/05 and vehicle blower
- ADR operation with Control Panel MC04/05

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

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

Fig. 709 shows the schematic connection of the Control Panel MC04/05.

See Paragraph 7.2 for the legend of the wiring diagrams.



- X1 = Combustion and hot air blower connection
- X2 = Glow plug / Flame sensor connection
- X3 = Overheating sensor connection
- X4 = Metering pump connection
- X5 = External temperature sensor or terminating resistor connection
- X6 = D+ and auxiliary drive unit connection
- X7 = Heater wiring harness connection

Fig. 701 Plug assignment

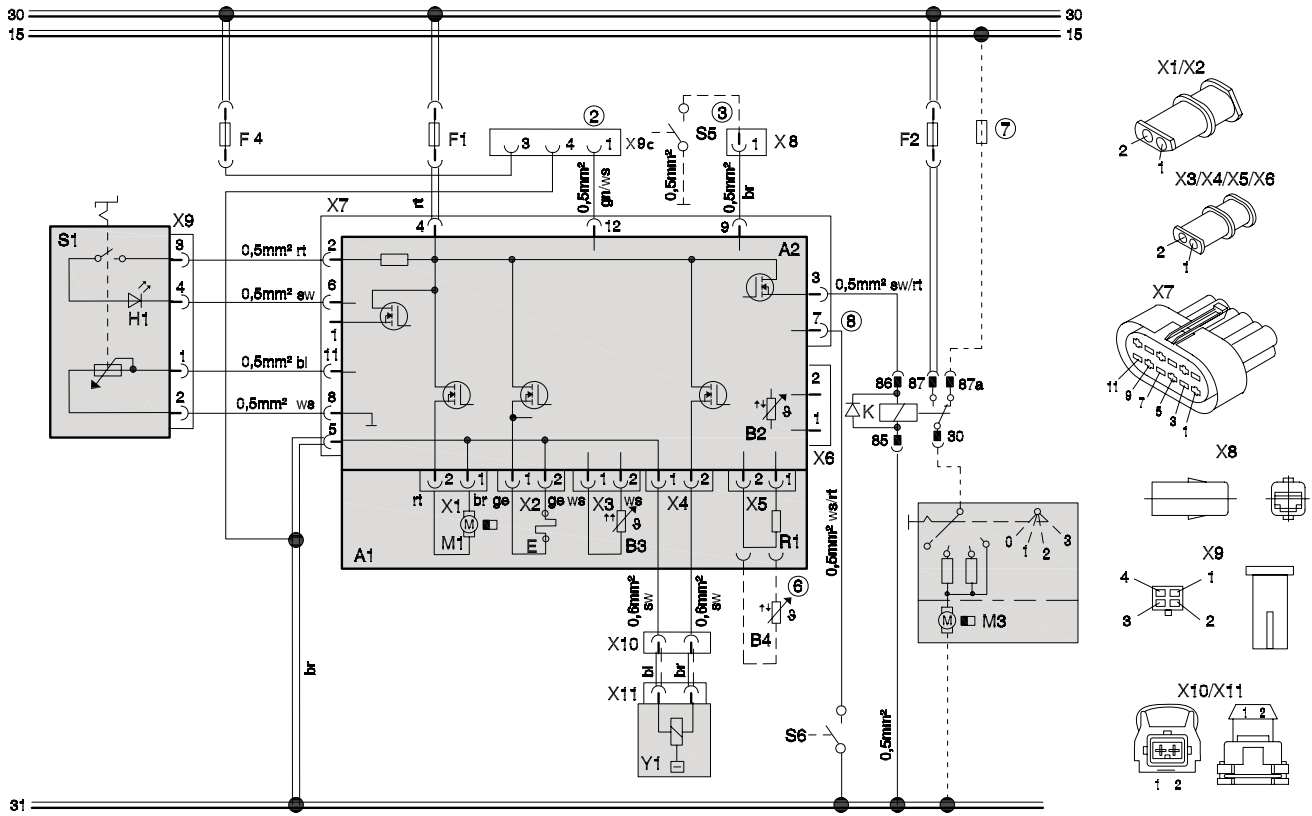


Fig. 702 System circuit diagram 12V/24V with control element and vehicle blower

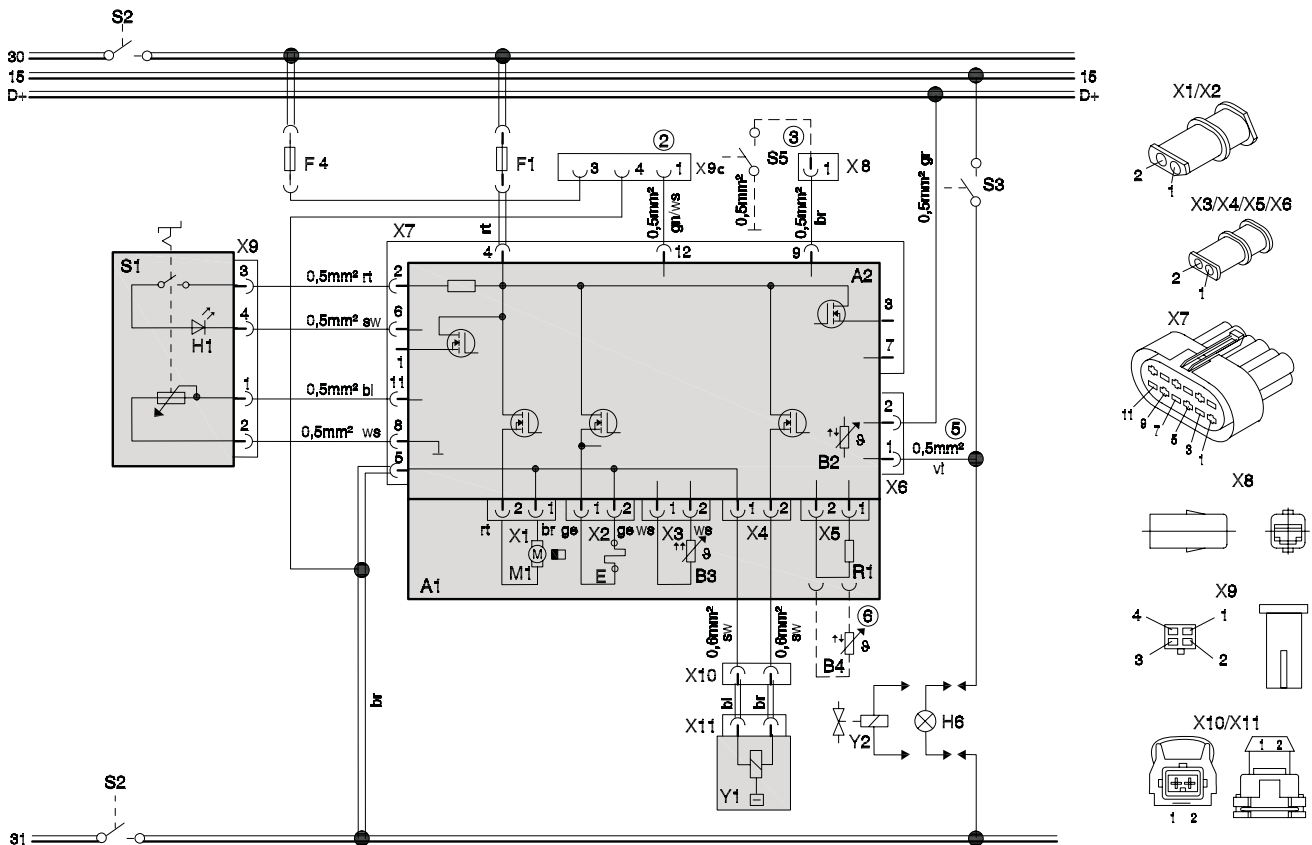


Fig. 703 System circuit diagram 24V ADR operation with control element

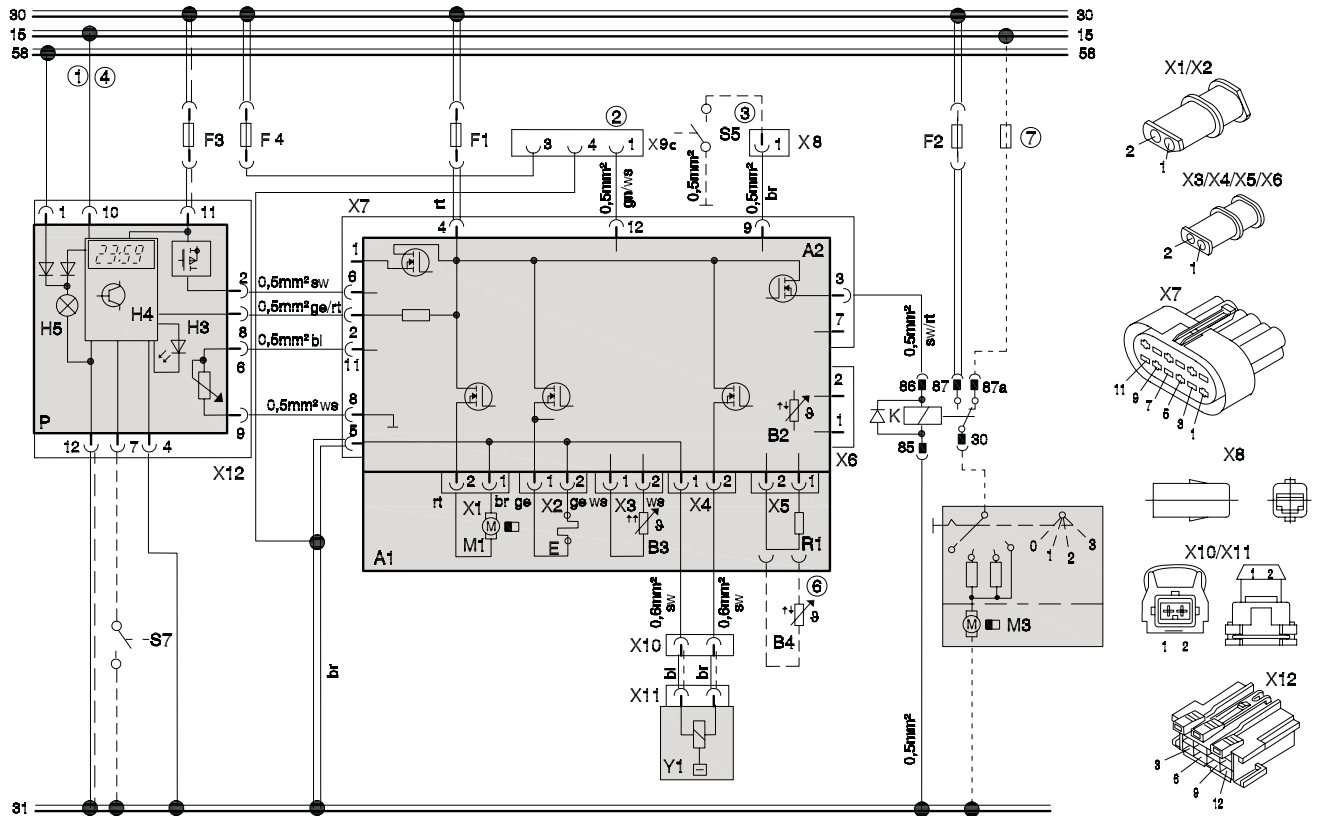


Fig. 704 System circuit diagram 12V/24V with combination timer and vehicle blower

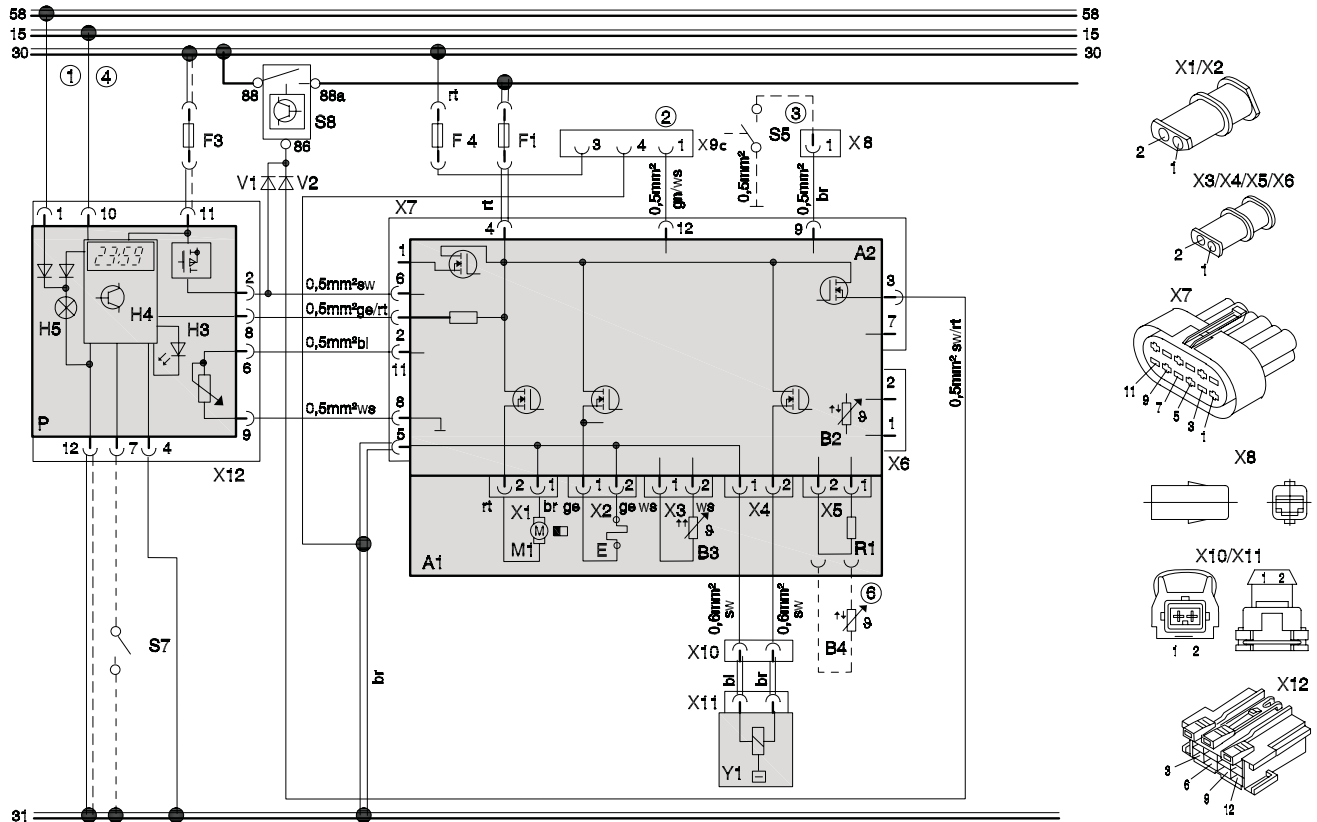


Fig. 705 System circuit diagram (diesel) 12V/24V with combination timer and electrical battery isolation switch

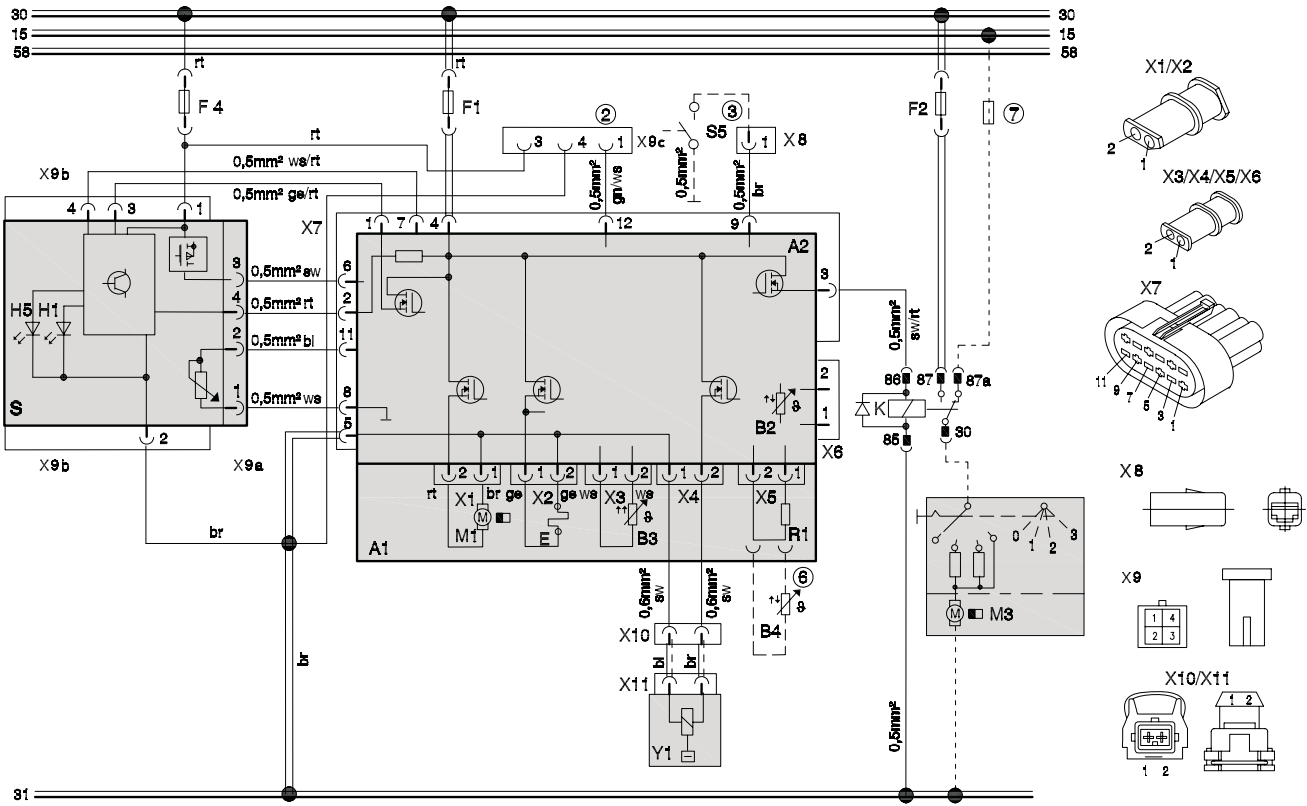


Fig. 706 System circuit diagram (diesel) 12V/24V with Control Panel MC04/05 and vehicle blower

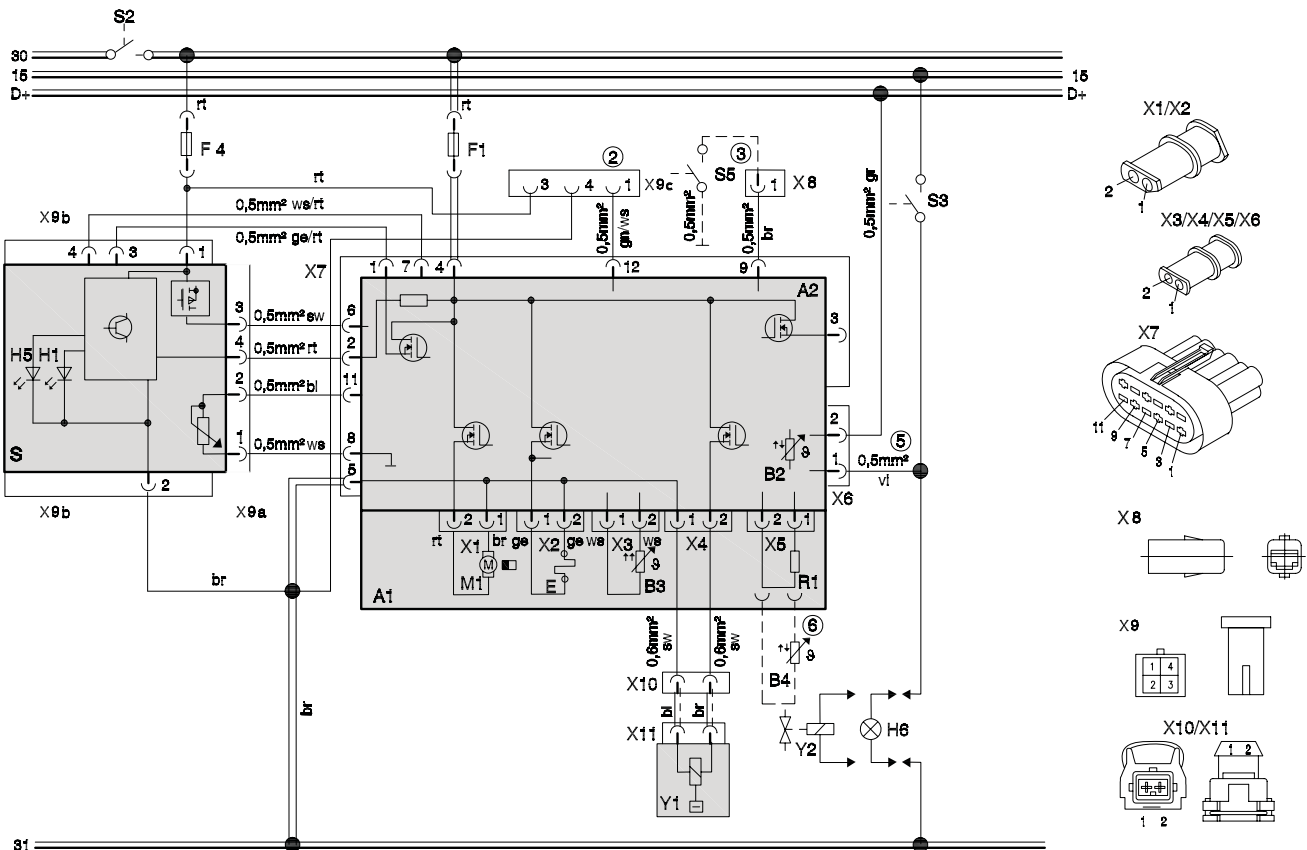


Fig. 707 System circuit diagram (diesel) 24V ADR-operation with Control Panel MC04/05

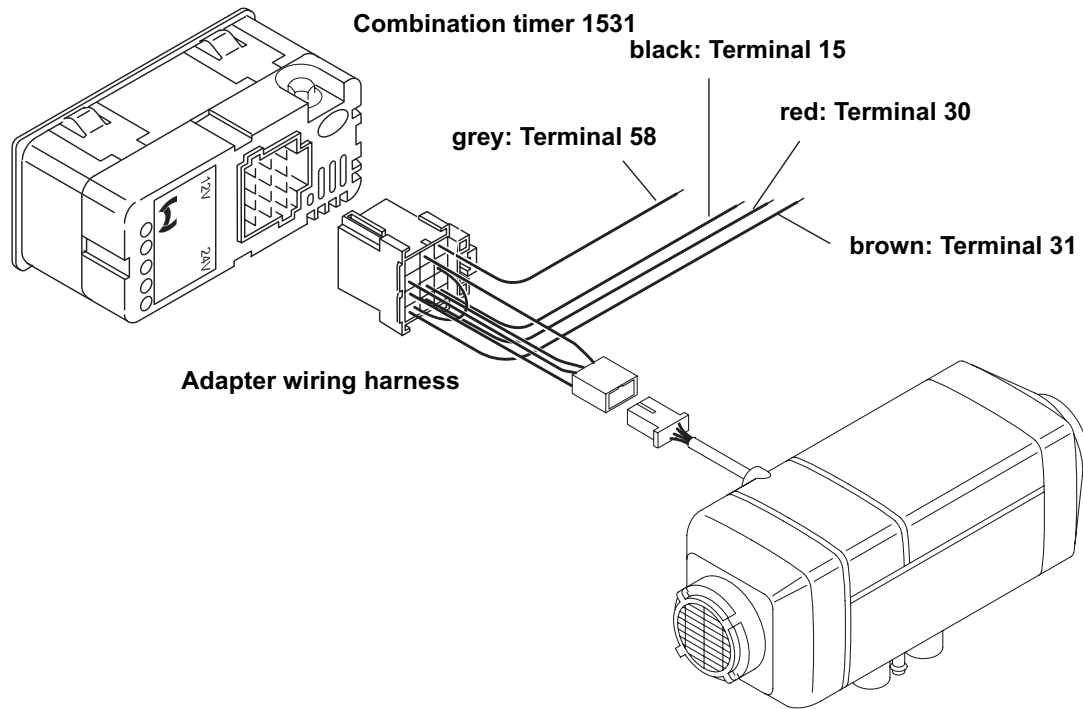


Fig. 708 Schematic connection of the combination timer

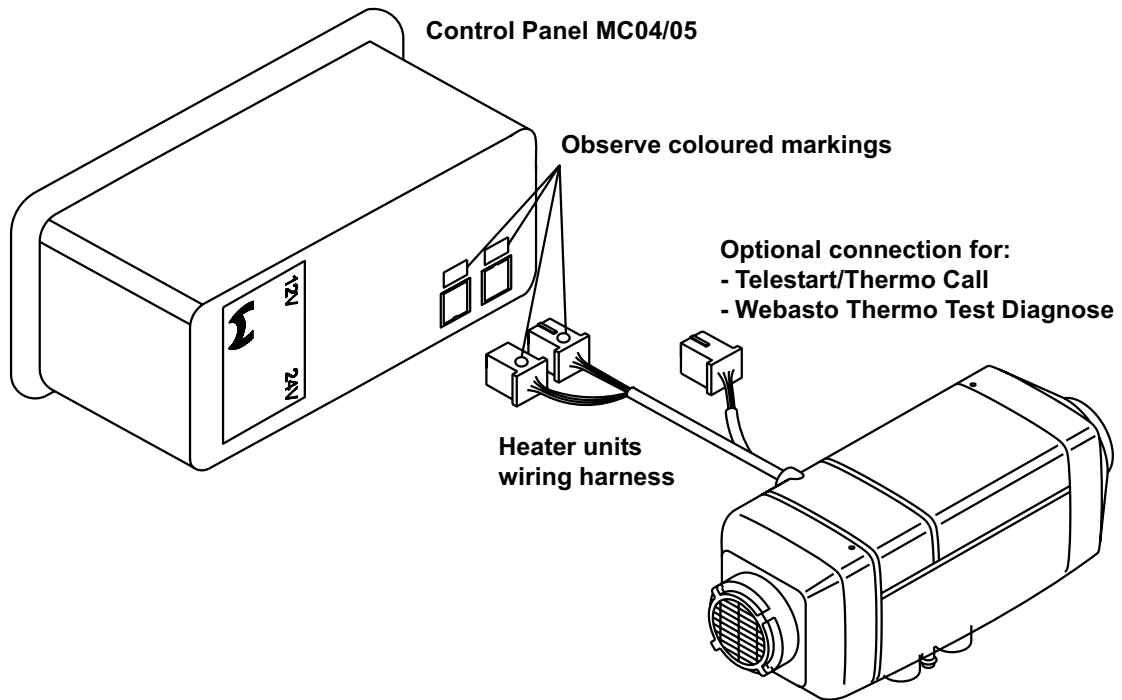

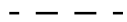





Fig. 709 Schematic connection of the Control Panel MC04/05

## 7.2 Legend for circuit diagrams

- With positive from terminal (15/75) to connection 10:  
Permanent operation for immediate heat as long as the ignition is switched on  
Without positive at connection 10:  
Heating time is variably programmable (10 min to 120 min), default setting 120 min
- Connection for Telestart\*/Thermocall\*/W-bus diagnosis  
(\* only when using Control Panel MC04/05)
- CO<sub>2</sub> adjustment (see workshop manual)
- NOTE:**  
If the connection is made to terminal 30, permanent heating is possible when the ignition is switched off!  
In this case no connection must be made to terminal 15/75.
- NOTE:**  
Grey and violet cables required for ADR function
- External temperature sensor
- Fuse installed in vehicle
- PIN 7 "BOOST" only with boost heaters

Cable cross-sections		
	< 7.5 m	7.5 - 15 m
	0.75 mm <sup>2</sup>	1.0 mm <sup>2</sup>
	1.0 mm <sup>2</sup>	1.5 mm <sup>2</sup>
	1.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>
	2.5 mm <sup>2</sup>	4.0 mm <sup>2</sup>
	4.0 mm <sup>2</sup>	6.0 mm <sup>2</sup>

Cable colours	
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 3900/5500
A2	Control module	
B2	Temperature sensor	In control unit
B3	Overheating sensor	Overheating guard
B4	Temperature sensor	External
E	Glow plug / Flame monitor	
F1	Fuse 24 V 15A/12V 20A	Flat fuse SAE J 1284
F2	Fuse 20 A	Flat fuse SAE J 1284
F4	Fuse 1A	Flat fuse SAE J 1284
F3	Fuse max. 15A	Flat fuse SAE J 1284
H1	Green LED	Indicator
H3	LED red (in item P)	Light in immediate heat button, ready indicator, Switch-on indicator
H4	Heating symbol in the display (in item P)	Indicator
H5	Lights	Display or button illumination
H6	Light (at least 1.2 W)	Switch-on indicator pumping device
K	Relay with free-wheeling diode	for vehicle fan
M1	Motor	Combustion and hot air fan
M3	Motor	Vehicle fan
P	Combination timer (1531)	Timer and setpoint generator
R1	Resistor 620 Ω	With internal temperature sensor only
S	Control Panel MC04/05	Setpoint generator and selector switch for additional functions
S1	Control element	Setpoint generator switch
S2	1 or 2-pin disconnecting switch	Emergency Stop switch
S3	Switch	On and for pumping device
S5	Switch	CO <sub>2</sub> setting
S6	Switch	Boost - only with boost heaters
S7	Momentary-contact switch	Immediate heat button remote control
S8	Battery isolation switch	
V1	Diode	
V12	Diode	
X1	Plug connector, 2-pin	To item A2 (ST B)
X2	Plug connector, 2-pin	To item A2 (ST V)
X3	Plug connector, 2-pin	To item A2 (ST U)
X4	Plug connector, 2-pin	To item A2 (ST Z)
X5	Plug connector, 2-pin	To item A2 (ST Y)
X6	Plug connector, 2-pin	To item A2 (ST X)
X7	12-pin plug connection	To item A2 (ST 1)
X8	Plug connector, 1-pin	
X9	Plug connector, 4-pin	to item S1
X10	Plug connector, 2-pin	
X11	Plug connector, 2-pin	to item Y1
X12	12-pin plug connection	to item P
Y1	Metering pump	
Y2	Solenoid valve	for pumping device



## 8 Servicing work

### 8.1 General

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

### 8.2 Work on the heater

Disconnect the main power cable from the vehicle's battery before carrying out any work on the heater. The main battery power must not be disconnected whilst the heater is operating or slowing down as a result of the risk of the heater overheating and the overheating 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.

Refer to the relevant installation instructions and the installation proposal for the heater for the specific vehicle for repairs that necessitate the installation position being changed.

### 8.3 Work on the vehicle

#### IMPORTANT

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

### 8.4 Heater trial

#### 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 heater must not be operated without the cover for the control unit as this will cause it to overheat.

### 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 the latest at 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) are output with the operation indicator. This code indicates the need for maintenance/ servicing of the heater to the user. The service signal is output for 10 seconds during each heater unit start-up and can be reset with the Webasto diagnosis by pulling the fuse or with "Delete fault".

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

- Check the hot air inlet and outlet for dirt and foreign bodies. (Dirty or blocked hot air lines may cause overheating.)
- Clean the exterior of the heater (avoid the ingress 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 the fuel filter if there is one.
- Check the fuel line and filter for leaks.

### 8.6 Visual inspections and installation instructions

#### 8.6.1 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 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.

Alternatively the Air Top Evo 3900/5500 heaters can be operated with an external temperature sensor (see 9.1.2).

#### NOTE

Only materials that can permanently withstand temperatures of at least 130 °C may be used for the hot air line.

Maximum pressure drop between the inlet and outlet side of the hot air line:

Air Top Evo 3900	2.0 hPa
Air Top Evo 5500	3.0 hPa

1 hPa corresponds to 1 mbar corresponds to 10 mm H<sub>2</sub>O (water column).

If this value is exceeded the heat output may be reduced as a result of the hot air outlet temperature control.

The heater can be used with grates on the air inlet and outlet side if it is used in an air circulation system. Do not short circuit the current of hot air.

Minimum internal diameter of the main section of hot air line:

80 mm for the Air Top Evo 3900  
90 mm for the Air Top Evo 5500

The hot air hose must be secured at its connection points.

**IMPORTANT**

In vehicles used to transport people, the air outlet opening is to be directed in such a way that it is at least 20 cm away from all body parts.

The heaters check the internal temperature rise automatically each time they are switched on. If this is above the specified limits, the start is cancelled and error messages F10 is displayed. To ensure that the heater functions stably, the flow resistance of the connected hot air system must be reduced.

If a filter is used for the hot 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 be able to withstand temperatures of at least 60 °C
- The filter must be resistant to all the substances that may be drawn in with the hot air (for example moisture, salt, fuel vapours, etc.).
- The resistance of the filter must be taken into consideration when designing the hot air system

### 8.6.2 Fuel supply

The fuel is taken from the vehicle fuel tank or from a separate fuel tank. The values for the maximum pressure at the fuel extraction point are shown in Figure 801.

Permissible fuel inflow height H (m)	At max. perm. pressure (bar) in fuel line
0.00	0,20
1.00	0.11
2.00	0.03
Maximum fuel intake height S (m)	At max. perm. negative pressure (bar) in the fuel tank
0.00	-0.10
0.50	-0.06
1.00	-0.02

## 8.6.2.1 Fuel extraction.

## Vehicles with diesel engines

The fuel must be taken from the vehicle fuel tank or from a separate tank (Fig. 802, 803 or 804). This separate fuel pickup precludes any effect of pressure.

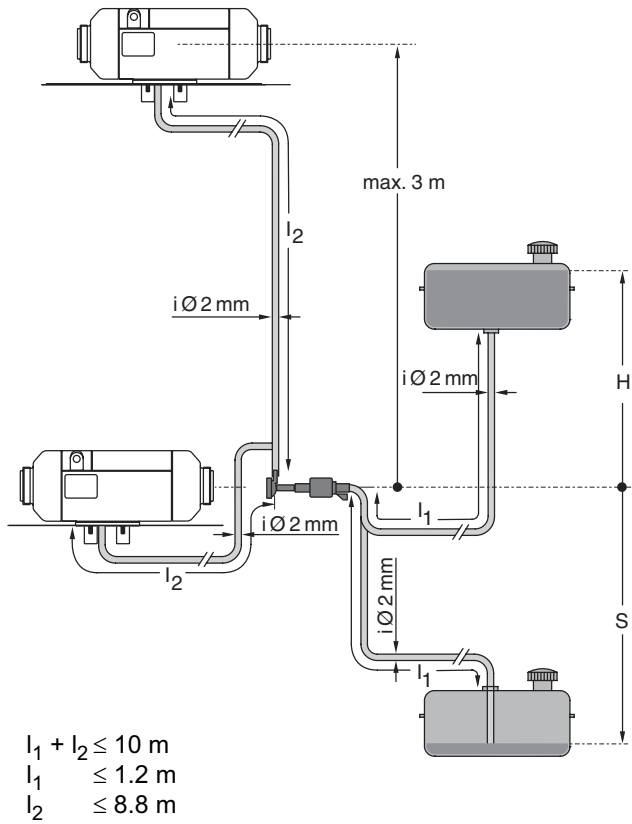


Fig. 801 Fuel supply

**Vehicles with carburettor engines**

The fuel may only be extracted on cars using the special Webasto fuel extractor (for example Part No. 470 910) as close to the tank as possible. The connect may be made in either the supply or return line, in which case the return line must lead almost to the base of the tank. If this is not the case the return line may be extended.

The fuel extractor must be fitted in such a way that any air or gas bubbles are automatically discharged towards the tank.

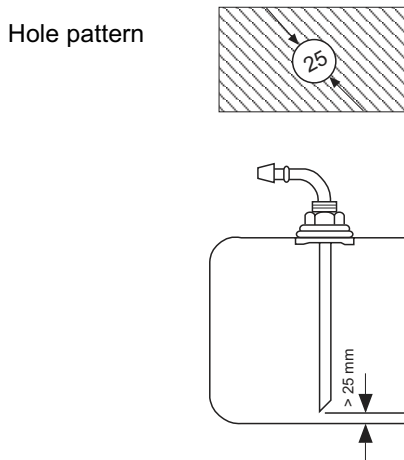
The fuel extractor should not be located near the engine, as gas bubbles may form in the lines on account of heat radiated from the engine. This may cause problems during combustion.

**Vehicles with injection engines**

When installing the heater in a vehicle with fuel injection system, it is important to establish whether the fuel pump is located inside or outside the tank.

If the fuel pump is located inside the tank, fuel can only be extracted from the return line using the Webasto fuel extractor (for example Part No. 470 910), in which case it must be ensured that the return line continues almost to the bottom of the tank. If this is not the case Webasto fuel extractor (see fig. 802, 803 or 804) may be used.

If the fuel pump is installed outside the tank, the fuel connection may also be made between the tank and the fuel pump, again using only the Webasto fuel extractor (for example Part No. 470 910).



**NOTE**

Only use a tank extractor with metal fuel tanks

Fig. 802 Webasto fuel extractor

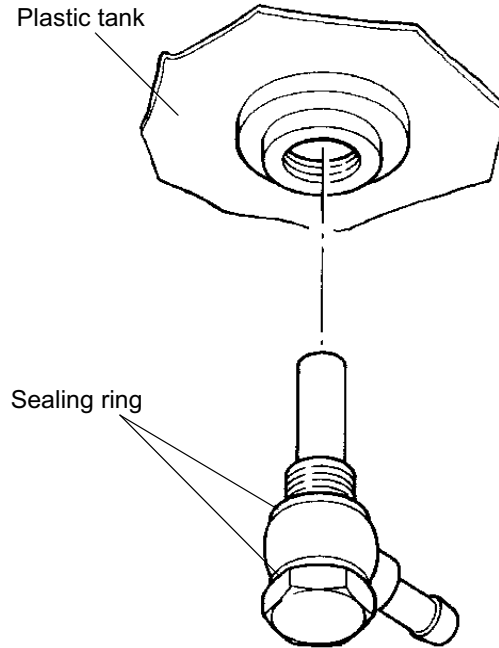
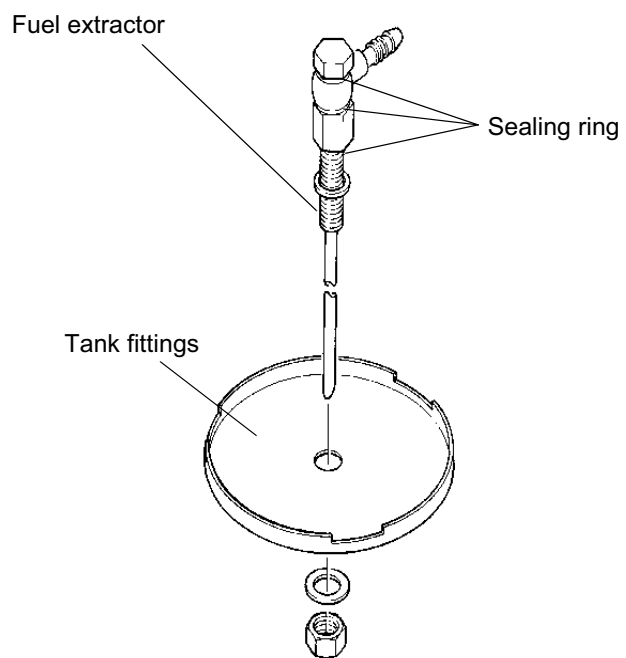


Fig. 803 Fuel extractor from the plastic tank (extraction through tank drain screw)



**NOTE**

The fitting must be made from metal!

Fig. 804 Fuel extractor from the plastic tank (Pickup via tank fitting)

**8.6.2.2 Fuel lines**

Only steel, copper and plastic lines of plasticised, light and temperature-stabilised PA11 or PA12 (e.g. Mecanyl RWTL) pursuant to DIN 73378 may be used for the fuel lines.

Since the lines cannot always be routed with a constant rising gradient, the internal diameter must not be allowed to exceed a certain size. Air or gas bubbles will accumulate in lines with an internal diameter of more than 4 mm and these will cause malfunctions if the lines sag or are routed downwards.

The diameters specified in Fig. 801 will ensure that bubbles do not form.

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

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

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

**Connecting two pipes with a hose**

The correct procedure for connecting fuel lines with hosing is shown in Fig. 805.

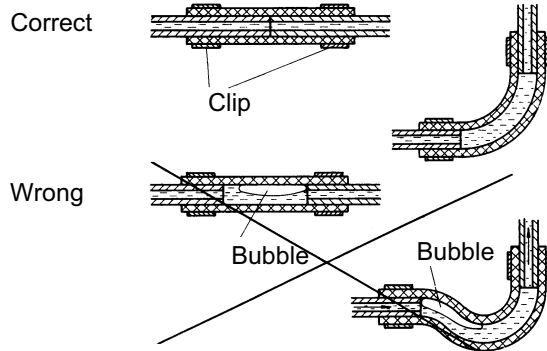
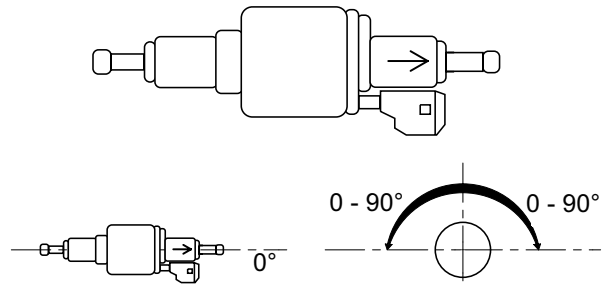


Fig. 805 Pipe/Hose connections

**8.6.3 Metering pump**

The metering pump is a combined delivery, metering and shutoff system and is subject to specific installation criteria (Figs. 801 and 806).



12 V and 24 V - diesel DP 30  
Horizontal installation only

Fig. 806 Metering pump, installation position

**8.6.3.1 Installation location**

It is advisable to install the metering pump in a cool place. The maximum ambient temperature must not exceed +20 °C at any time during operation. The metering pump and fuel lines must not be installed within range of the radiated heat from hot vehicle parts. A heat shield must be used if necessary.

**8.6.3.2 Installation and attachment**

The metering pump must be secured with a vibration-damping mounting. Its installation position is limited as shown in fig. 806 in order to ensure effective auto-bleeding. As a result of the risk of corrosion, only genuine Webasto parts may be used for the plug connections between the metering pump and the metering pump wiring harness.

**8.6.4 Fuel filter**

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

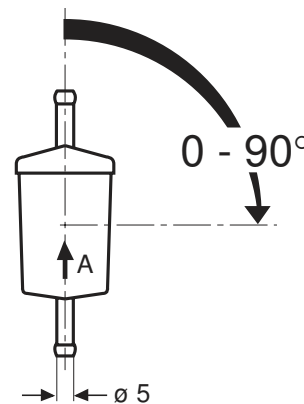


Fig. 807 Fuel filter

8.6.5 Combustion air supply

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**

The combustion air must be extracted using a combustion air line from a position that is as cool as possible and protected from splashing water for petrol heaters. 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 dirty combustion air is expected, a combustion air filter may be fitted. (Air Top Evo 3900/5500 D only). An intake silencer must be used for an intake hose length of < 0.6 m.

8.6.6 Exhaust pipe

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

The exhaust pipe must be secured to the heater and exhaust silencer with a pipe clip, Part No. 20 965A.

The exhaust silencer (fig. 808) should ideally be installed near the heater. The flow direction is arbitrary.

The heater may also be operated without a silencer.

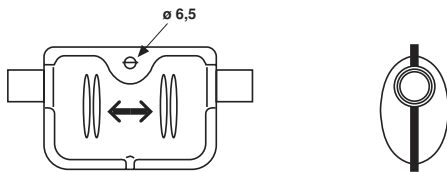


Fig. 808 Exhaust silencer

8.6.7 Combustion air inlet and exhaust lines

**NOTE**

To prevent damaging the metering pump cable, exhaust line must not be used to extend the combustion air supply line.

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 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 the angle of 90° ± 10° is achieved.

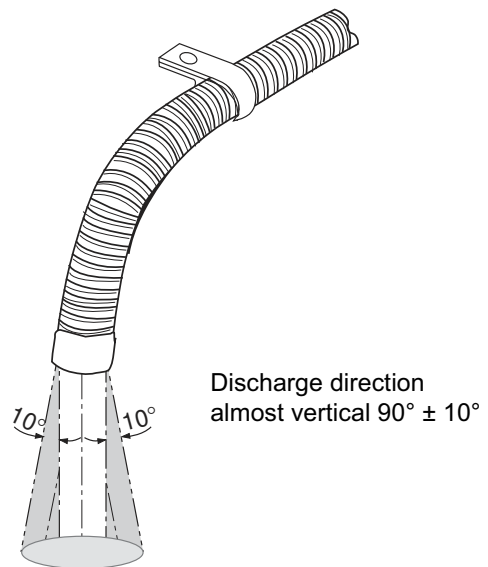


Fig. 809 Exhaust pipe mouth, installation position

**WARNING**

If the exhaust pipe ends is other than as shown in the fig. 809 it will pose a fire risk.

**8.6.8 Electrical connections**

**8.6.8.1 Heater connection, control element**

The electrical connection is to be made as shown in the appropriate circuit diagram (see section 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 fed out of the left or right side of the heater.

**8.6.8.2 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.

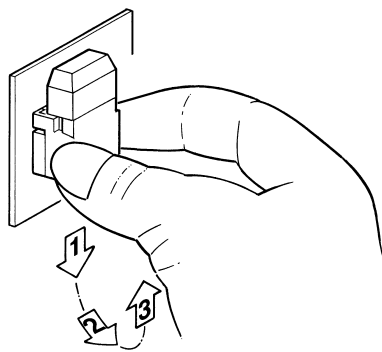


Fig. 810 Remove the fastening plate on the fuse holder

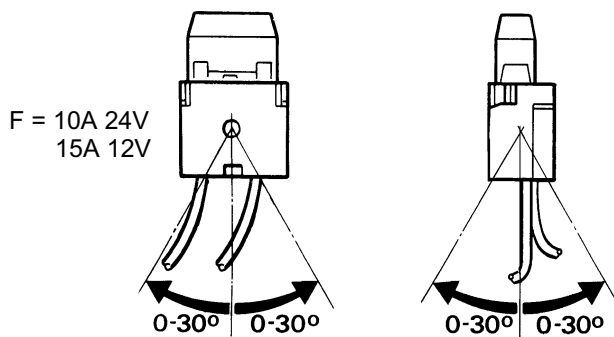


Fig. 811 Fuse holder, installation position

**8.6.8.3 Control element connection**

The wiring harness is prepared for connection to the control element.

Simply pull on connector housing to disconnect the connector (fig. 813).

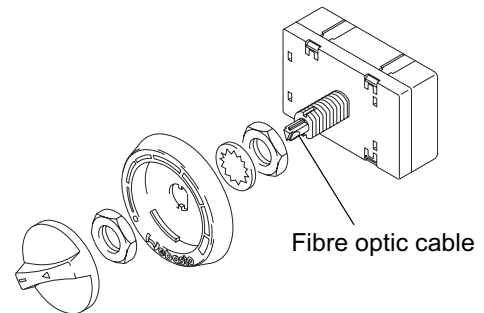


Fig. 812 Control element

**NOTE**

The fibre optic cable 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.

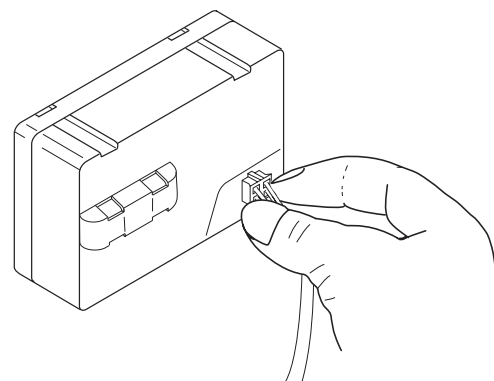
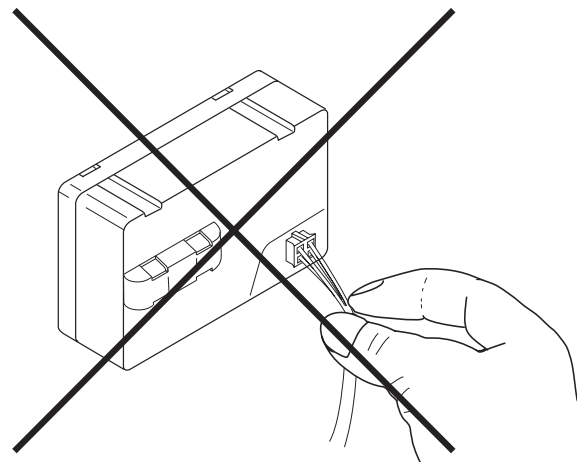
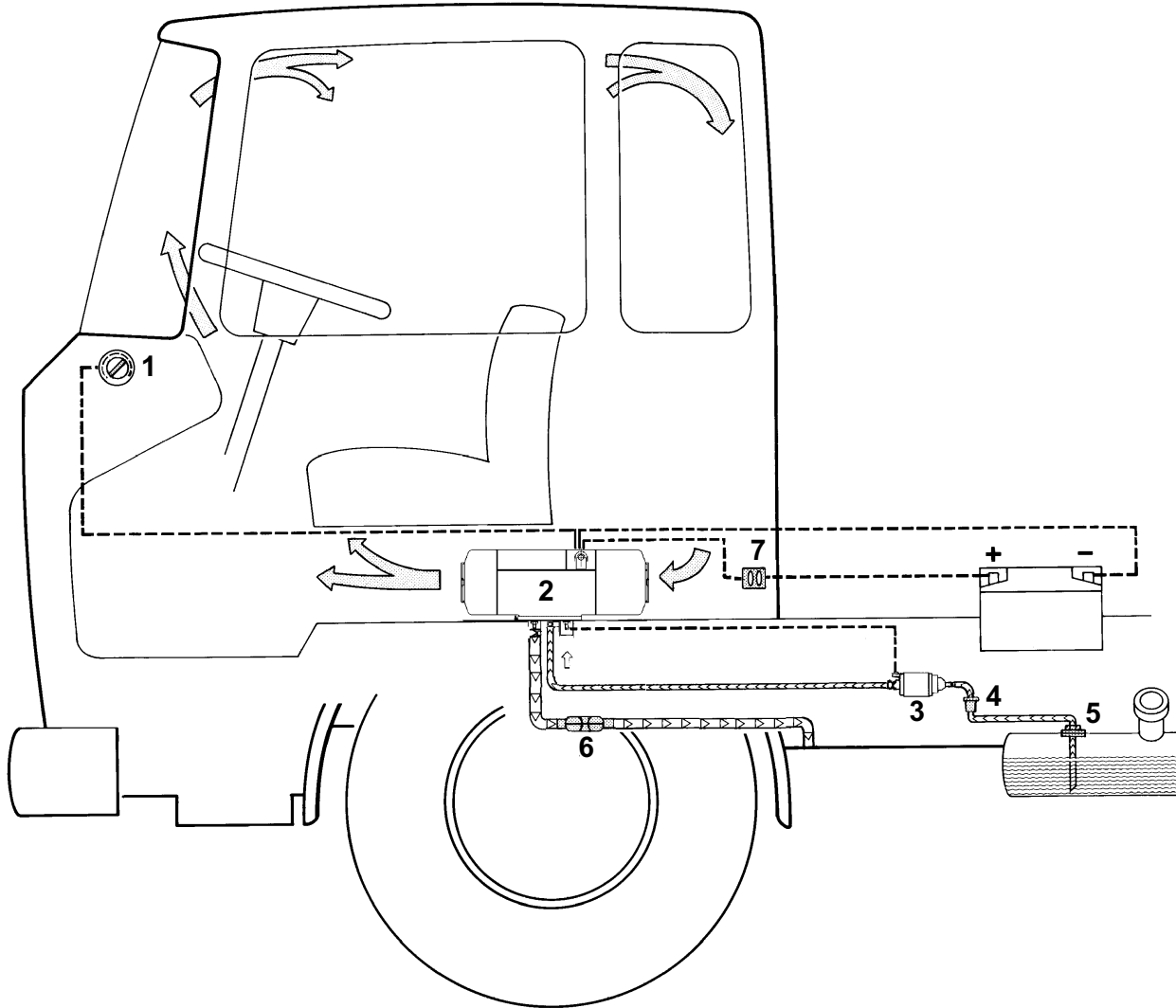


Fig. 813 Disconnect the plug



- 1 Control element
- 2 Heater
- 3 Metering pump
- 4 Fuel filter (accessory)
- 5 Tank connector
- 6 Exhaust silencer
- 7 Fuse

Fig. 814 Specimen installation for heater in an air circulation system



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

**8.7.1.2 Installation**

1. Place the heater with a new seal on the exhaust outlet in the installation position and secure it with 4 nuts and locking washers (use only genuine Webasto nuts).
2. Tighten the nuts to 6 +1 Nm.
3. Secure the connection for the combustion air inlet on the heater.
4. Secure the connections for the combustion air inlet and exhaust outlet on the heater.
5. Connect the metering pump cable to the metering pump wiring harness.
6. Connect the wiring harness plug to socket X7 on the control unit.
7. Fit the cover as described in 9.2.2.5 and secure it.
8. If necessary fit the 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.

Conduct a trial of the heater to check all the connections for leaks and to ensure that they are secure. If the heater suffers a fault during operation, the fault must be located and remedied.



## 9 Repair

### 9.1 General

This section describes the repair work that may be carried out on the Air Top 3900/5500 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 Work on stripped down components

##### IMPORTANT

All sealing elements between the stripped down components and the seal on the exhaust outlet must always be discarded and replaced.

##### 9.1.1.1 Cleaning

- Clean all stripped down components with benzene and then dry them with compressed air.
- Remove all seal residue on the components in full carefully using a suitable tool.

##### 9.1.1.2 Visual inspection

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

#### 9.1.2 Carrying out modifications

##### NOTE

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. We can supply the appropriate modification kits for this purpose.

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

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

#### 9.1.2.1 Installation of an external temperature sensor

##### General

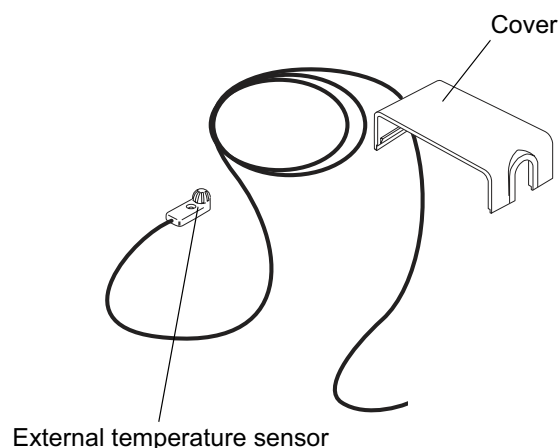
The Air Top Evo 3900 or Air Top Evo 5500 heater can control the required temperature perfectly if its temperature sensor is exposed to the air temperature of the main area of the vehicle. In certain circumstances, this is not always possible using the temperature sensor integrated in the control unit due to the installation circumstances. In this case perfect temperature control can be ensured using an external temperature sensor fitted in the appropriate area.

##### Method

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

##### NOTE

- The 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 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 temperature sensor behind curtains or the like.
2. Remove the cover and disconnect the terminating resistor (5, fig. 902) from the control unit (plug X5).
  3. Install the external temperature sensor and route the cable to the heater.
  4. Connect the plug on the external temperature to socket X5 on the control unit and fit the cover.
  5. Conduct a trial and check the control properties.



## 9.2 Dismantling and assembling

### 9.2.1 Remove the casing parts

#### 9.2.1.1 Cover for electrical connection

The cover (1, Fig. 901) can be levered off using a blunt blade in the areas marked "X".

#### 9.2.1.2 Grate for hot air inlet and outlet

The grate (6, fig. 901) can be released from its mounting by twisting it and then pulled off forwards.

#### 9.2.1.3 Covers for hot air inlet and outlet

Both covers (3 and 5, fig. 901) can be released from their mountings and removed by pressing the four detents at the top and bottom using a suitable tool.

#### 9.2.1.4 Top shell

##### NOTE

The covers for the hot air inlet and outlet must have been removed.

The top shell (2, fig. 901) can be raised after the covers for the hot air inlet and outlet have been removed.

#### 9.2.1.5 Bottom shell

Remove the seal from the exhaust outlet.

##### NOTE

The insulating mat (7, fig. 901) is only fixed on the heater by the casing parts.

By pulling the bottom shell (4) on both sides gently around areas "Y", you can release the fixing and the shell can be taken off the motor casing. Take the insulating mat off (7) at the same time.

## 9.2.2 Fit the casing parts

### 9.2.2.1 Bottom shell

##### IMPORTANT

To ensure that the heater and the overheating sensor work perfectly, please note the following when fitting the casing:

- Position the insulating mat (7, fig. 901) so that half of the width of the mat is under the shells (4 and 2) or under the cover for the hot air outlet (3).
- When you fit the top shell (2) ensure that the insulating mat is secure.
- If the insulating mats are heavily pressed or old, replace them

1. Ensure that the insulating mat (7) is properly positioned on the heat exchanger.

##### IMPORTANT

When you fit the bottom shell (4), spread it slightly so that the spacers on the overheating sensor (9, fig. 902) are not damaged.

2. Expand the bottom shell (4, Fig. 901) 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 seal on the exhaust outlet.

### 9.2.2.2 Top shell

Place the top shell (2, fig. 901) on the heater and secure it in the grooves in the bottom shell.

### 9.2.2.3 Cover for hot air inlet and outlet

##### NOTE

The covers for the hot air inlet and outlet are different. Fit the cover with the larger opening at the front on the hot air blower.

Push on the covers (3 and 5, fig. 901) until the four securing holes engage properly in the detents on the bottom and top covers.

### 9.2.2.4 Grate for hot air inlet and outlet

Fit the grates (6, fig. 901) on the covers for the hot air inlet and outlet and twist them to secure them.

### 9.2.2.5 Cover for electrical connection

##### NOTE

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

Fit the cover (1, fig. 901) until it audibly engages in the top cover.

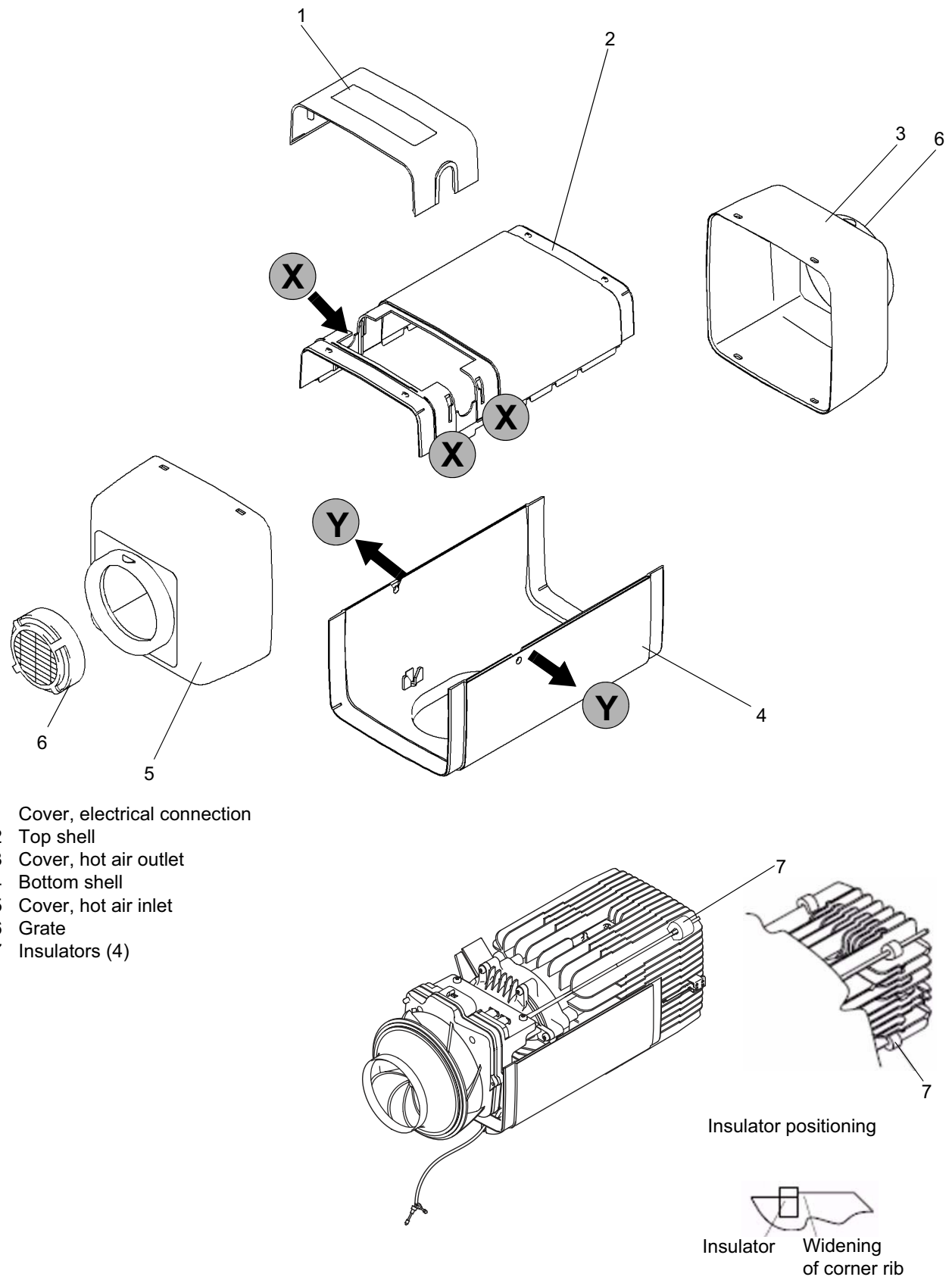


Fig. 901 Remove / fit the casing parts

**9.2.3 Change the control unit****9.2.3.1 Removal**

1. Remove the heater (see 8.7.1.1).
2. Remove the casing parts (see 9.2.1).
3. Disconnect the plug connections on the control unit (3, Fig. 902).
4. Remove the screws (4).
5. Slide the control unit (3) towards the hot air blower and remove it upwards.
6. Complete the work on stripped down components (see 9.1.1).

**NOTE**

Do not carry out any repair work to the control unit.

**9.2.3.2 Installation**

1. Insert the control unit (3, fig. 902) on the combustion and hot air blower (1), push it towards the blower casing and secure it with screws (4).
2. Tighten the screws (4) to  $3.0 \pm 0.3$  Nm.
3. Connect the plug connections on the control unit as shown in fig. 701.
4. Fit the casing parts (see 9.2.2).
5. Install the heater (see 8.7.1.2).
6. Check the CO<sub>2</sub> setting and adjust it if necessary. (see 6.2)

**9.2.4 Change the overheating sensor****9.2.4.1 Removal**

1. Remove the heater (see 8.7.1.1).
2. Remove the casing parts (see 9.2.1).
3. Disconnect plug connection X3 on the control unit (3, fig. 902).
4. Lever the overheating sensor (9) out of the heat exchanger's ribs using a suitable tool (see Detail A).

**IMPORTANT**

Do not pull the cables.

5. Remove the overheating sensor (9).

**9.2.4.2 Installation**

1. Measure the resistance of the overheating sensor (9, fig. 902) (see 6.3.2).
2. Position the overheating sensor (9) and press it into place by hand.
3. Ensure that the overheating sensor is correctly positioned in the heat exchanger (7).
4. Connect plug connection X3 to the control unit (3).
5. Fit the casing parts (see 9.2.2).
6. Install the heater (see 8.7.1.2)

**9.2.5 Change the combustion and hot air blower (drive unit)****IMPORTANT**

Replace the drive unit (1, fig. 902) only with a drive unit with the same rating data and the same Part No.

**NOTE**

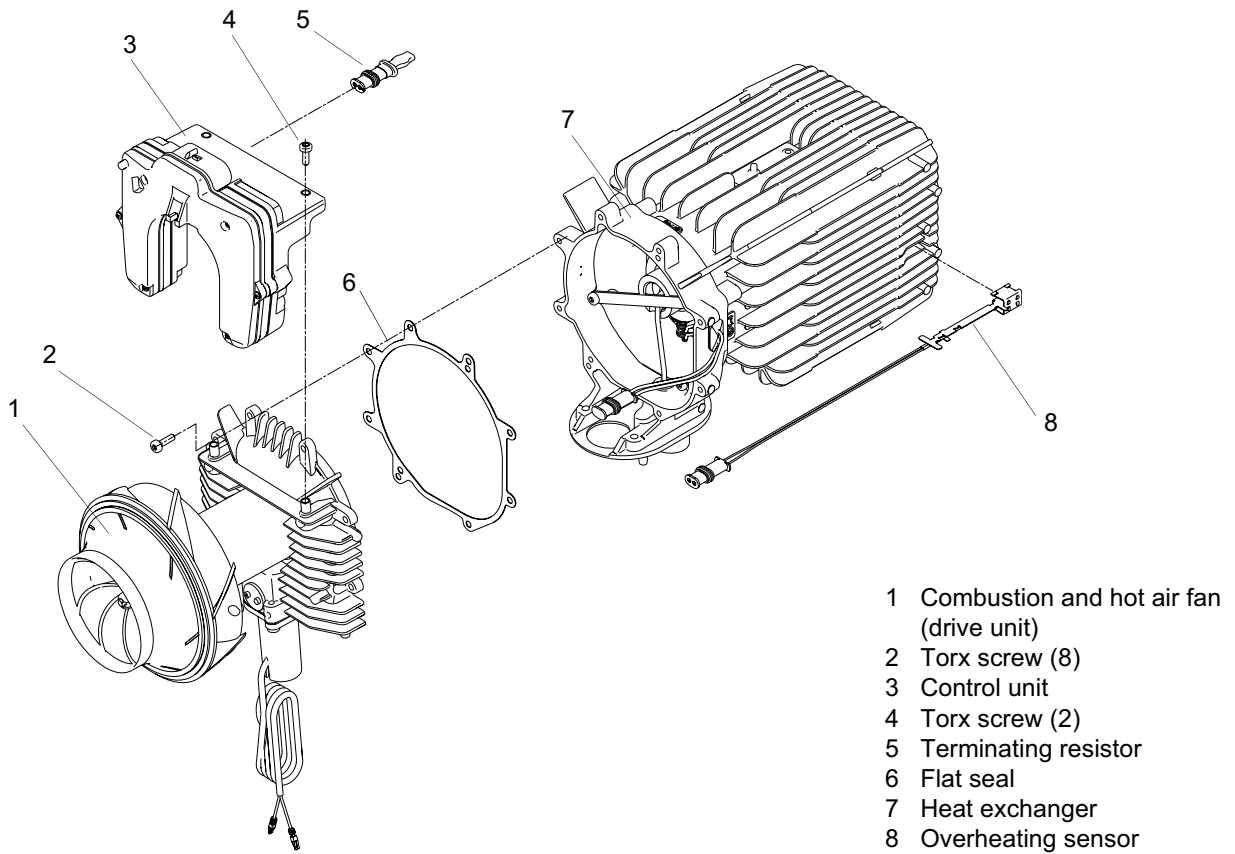
The drive unit (combustion and hot air blower) can only be replaced in full. It cannot be repaired.

**9.2.5.1 Removal**

1. Remove the heater (see 8.7.1.1).
2. Remove the casing parts (see 9.2.1).
3. Remove the control unit (see 9.2.3.1).
4. Remove the screws (2).
5. Remove the combustion and hot air blower (1) forwards.
6. Remove and discard the flat seal (6).
7. Complete the work on stripped down components (see 9.1.1).

**9.2.5.2 Installation**

1. Ensure that the sealing surfaces on the combustion and hot air blower (1, fig. 902) and on the heat exchanger (7) are not damaged.
2. Fit a new flat seal (6) on the flange of the combustion and hot air blower (1).
3. Position the combustion and hot air blower (1) into the assembly position and secure it with screws (2).
4. Tighten the screws to  $6.0 \pm 0.6$  Nm..
5. Fit the control unit (see 9.2.3.2).
6. Fit the casing parts (see 9.2.2).
7. Install the heater (see 8.7.1.2)
8. Check the CO<sub>2</sub> setting and adjust it if necessary. (see 6.2)



**Detail A**

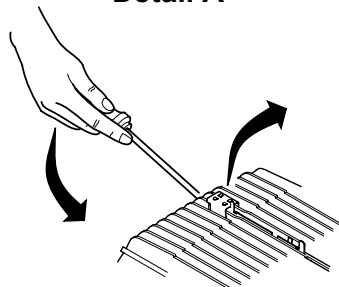


Fig. 902 Change the control unit, overheating sensor and the combustion and hot air blower (drive unit)

**9.2.6 Change the burner and the glow plug/ flame sensor****9.2.6.1 Removal**

1. Remove the heater (see 8.7.1.1).
2. Remove the casing parts (see 9.2.1).
3. Remove the control unit (see 9.2.3.1).
4. Remove the combustion and hot air blower (see 9.2.5.1).
5. Remove 2 screws (1, fig. 903) and take off the retaining bar (2).
6. Press the grommet on the glow plug/flame sensor (8) inwards out of the heat exchanger casing (6).
7. Press the grommet on the burner's fuel line (3 or 7) inwards out of the heat exchanger casing (6).
8. Carefully pull the burner (3 or 7) out of the combustion pipe (4) and take the fuel supply out of the heat exchanger casing (6) by turning the burner.
9. Remove the retaining clip (9) and pull the glow plug/ flame sensor (8) out of the burner (3 or 7).
10. Complete the work on stripped down components (see 9.1.1).

**9.2.6.2 Installation**

1. Insert the glow plug/flame sensor (8, fig. 903) into the burner (3 or 7) (cable towards the opening for the cable grommet) and secure it with the retaining clip (9).
2. Insert the burner (3 or 7) into the heat exchanger (6) in the opposite direction and insert it into the combustion pipe (4).
3. Place the retaining bar (2) in its assembly position and secure it with 2 screws (1).
4. Tighten the screws to  $4 \pm 0.4$  Nm.
5. Press the grommet on the fuel line into the heat exchanger (6).
6. Thread the cable for the glow plug/flame sensor (9) through the opening in the heat exchanger casing (6).
7. Press the grommet into the heat exchanger. Ensure that the glow plug cables do not form a loop in the heat exchanger.
8. Fit the combustion and hot air blower (see 9.2.5.2).
9. Fit the control unit (see 9.2.3.2).
10. Fit the casing parts (see 9.2.2).
11. Install the heater (see 8.7.1.2).

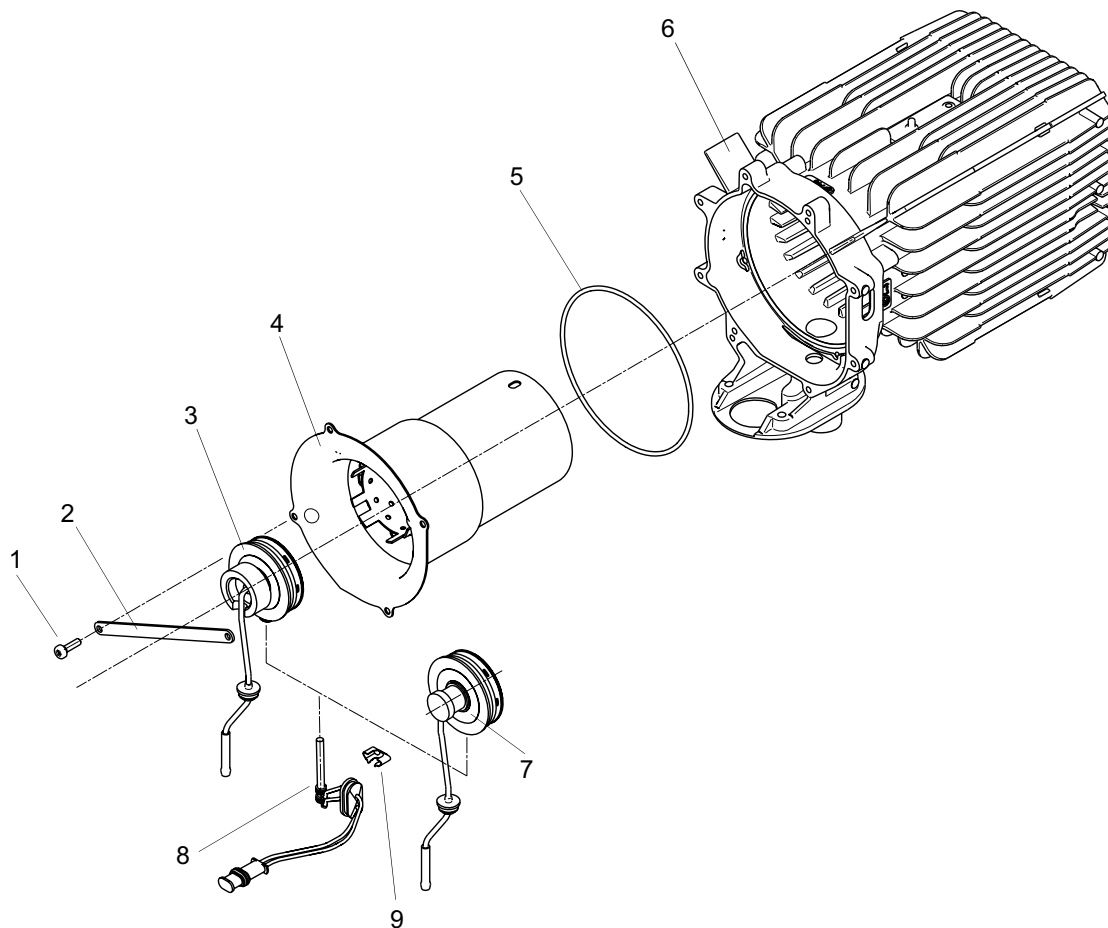
**9.2.7 Change the combustion pipe and the heat exchanger****9.2.7.1 Removal**

1. Remove the heater (see 8.7.1.1).
2. Remove the casing parts (see 9.2.1).
3. Remove the control unit (see 9.2.3.1).
4. Remove the overheating sensor (see 9.2.4.1).
5. Remove the combustion and hot air blower (see 9.2.5.1).
6. Remove the burner (see 9.2.6.1).
7. Remove 2 screws (1, Fig. 903) and pull the combustion pipe (4) out of the heat exchanger (6).
8. Remove and discard the round sealing ring (5) from the heat exchanger (6).
9. Complete the work on stripped down components (see 9.1.1).

**9.2.7.2 Installation**

1. Fit a new round sealing ring (5, fig. 903) into the heat exchanger (6).
2. Secure the combustion pipe (4) with 2 screws on opposite sides (1).
3. Tighten the screws to  $4 \pm 0.4$  Nm.
4. Fit the burner (see 9.2.6.2).
5. Fit the combustion and hot air blower (see 9.2.5.2).
6. Fit the control unit (see 9.2.3.2).
7. Fit the overheating sensor (see 9.2.4.2).
8. Fit the casing parts (see 9.2.2).
9. Install the heater (see 8.7.1.2).





- 1 Torx screw (4)
- 2 Retaining bar
- 3 Diesel burner
- 4 Combustion pipe
- 5 Round sealing ring
- 6 Heat exchanger
- 7 Petrol burner
- 8 Glow plug/Flame monitor
- 9 Retaining clip

Fig. 903 Change the burner, glow plug/flame sensor, the combustion tube and the heat exchanger



## **10 Packaging, 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 damage during handling, transport and storage.

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

Shipment address:

Webasto AG  
Werk Neubrandenburg  
Garantieabteilung  
Speicherstraße 3/4  
D-17033 Neubrandenburg

**Webasto AG**  
Kraillinger Strasse 5  
82131 Stockdorf  
GERMANY

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<http://www.webasto.com>

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IDENT.-NR. 1313560A