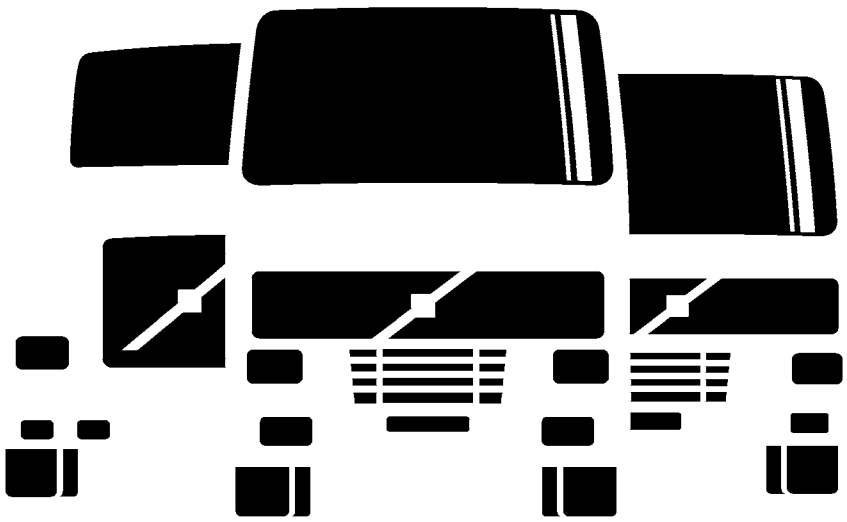
Service Manual
Trucks

Group **87**

Air Heater
Espar D1LC Compact



PV776-TSP133181

VOLVO

Foreword

The descriptions and service procedures contained in this manual are based on designs and methods studies carried out up to November 1999.

The products are under continuous development. Vehicles and components produced after the above date may therefore have different specifications and repair methods. When this is believed to have a significant bearing on this manual, supplementary service bulletins will be issued to cover the changes.

The new edition of this manual will update the changes.

In service procedures where the title incorporates an operation number, this is a reference to an S.R.T. (Standard Repair Time).

Service procedures which do not include an operation number in the title are for general information and no reference is made to an S.R.T.

The following levels of observations, cautions and warnings are used in this Service Documentation:

Note: Indicates a procedure, practice, or condition that must be followed in order to have the vehicle or component function in the manner intended.

Caution: Indicates an unsafe practice where damage to the product could occur.

Warning: Indicates an unsafe practice where personal injury or severe damage to the product could occur.

Danger: Indicates an unsafe practice where serious personal injury or death could occur.

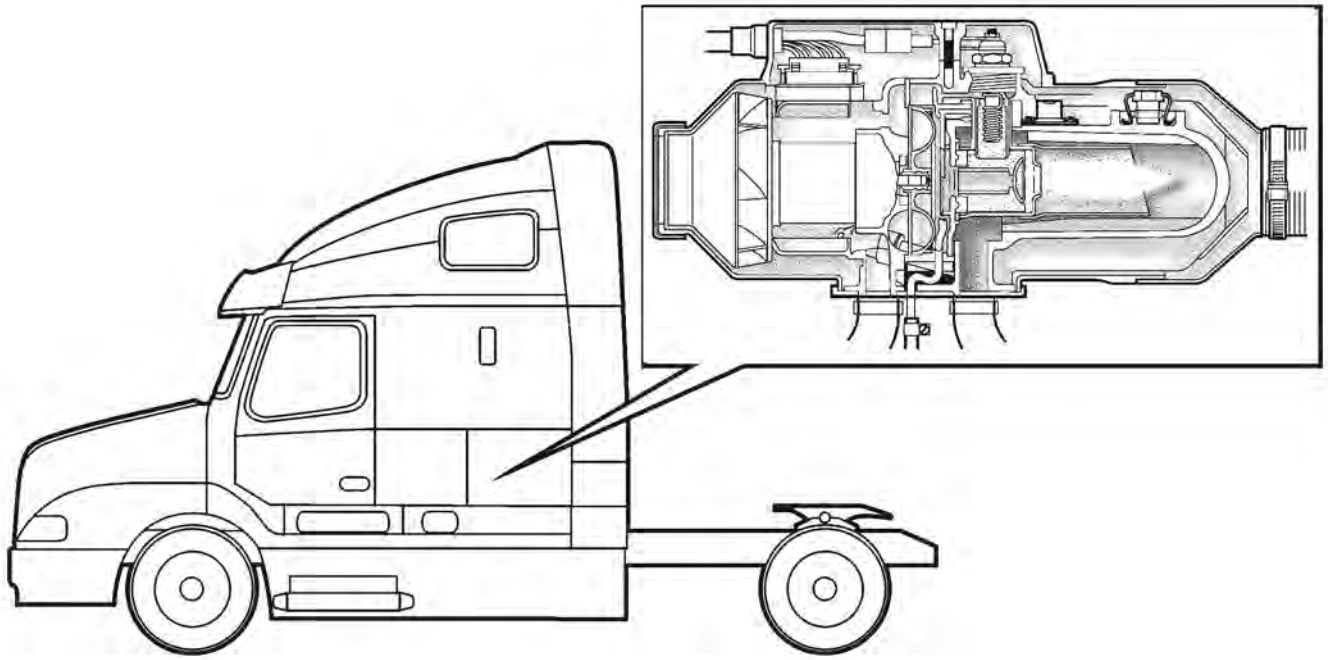
Volvo Trucks North America, Inc.
Greensboro, NC USA

Order number: PV776-TSP133181

Contents

General

Air Heater



W8002505

This manual describes the Espar Air Heater D1LC Compact (D1LCC) available in Volvo VN-trucks from September 1998.

The purpose of the Air Heater is to produce a warm air flow which is distributed into the sleeper section, thus maintaining a comfortable temperature in the cab when the engine is switched off.

The Air Heater operates independently of the vehicle's other temperature regulating system. It is thermostatically controlled and is equipped with a timer.

To safeguard from the heater operating after a turnover accident, there is a roll-over switch cutting off the power to the fuel metering pump.

Specifications

Air Heater

D1LC Compact

Designation		D1LCC
Type		Air heater
Fuel		Diesel
Stated heating output		
For output mode:	”BOOST”	2,200 W, 7,500 BTU/hr
	”HIGH”	1,800 W, 6,150 BTU/hr
	”MEDIUM”	1,200 W, 4,100 BTU/hr
	”LOW”	850 W, 2,900 BTU/hr
Warm air flow without counterpressure [1]		
For output mode:	”BOOST”	110 kg/h, 50 cfm
	”HIGH”	95 kg/h, 43 cfm
	”MEDIUM”	65 kg/h, 30 cfm
	”LOW”	65 kg/h, 30 cfm
Fuel consumption [1]		
For output mode:	”BOOST”	0.27 l/h, 0.07 US gal/hr
	”HIGH”	0.21 l/h, 0.06 US gal/hr
	”MEDIUM”	0.14 l/h, 0.04 US gal/hr
	”LOW”	0.10 l/h, 0.03 US gal/hr
Rated voltage		12 V
Operational range		10.5-15.9 V
Voltage limit [2]		
voltage drop protection triggers at:	glow plug off	10.5 V
	glow plug on	9.5 V

[1] at rated voltage

[2] the voltage values must be achieved for more than 20 seconds

overvoltage protection cuts off at:	glow plug off	15.9 V
	glow plug on	15.2 V

Power consumption at rated voltage, all information ±10%.

during starting		250 W
in operation	”BOOST”	30 W
	”HIGH”	22 W
	”MEDIUM”	10 W
	”LOW”	8 W

Overheating protection

	cuts off at	160-190°C, (320-375°F)

Current draw at 12V (+- 10 %)

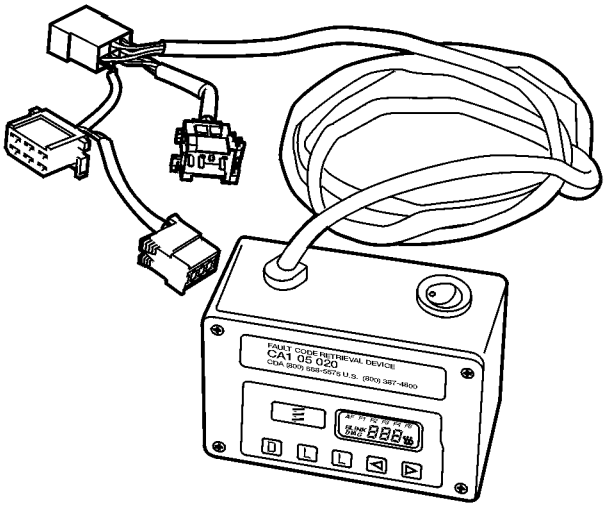
	”START”	20.8 amps
	”BOOST”	2.5 amps
	”HIGH”	1.8 amps
	”MEDIUM”	0.8 amps
	”LOW”	0.8 amps

Fan Speed	”BOOST”	5,000 rpm ±10%
	”HIGH”	4,400 rpm ± 10%
	”MEDIUM”	3000 rpm ± 10 %
	”LOW”	3000 rpm ± 10 %
	Afterblow	1000 rpm

Tools

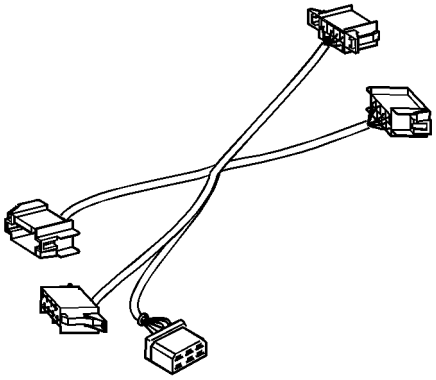
Special Equipment and Special Tools

The following tools or equipment can be ordered from the Parts Department of Volvo Trucks North America, Inc., quoting the specified part numbers.

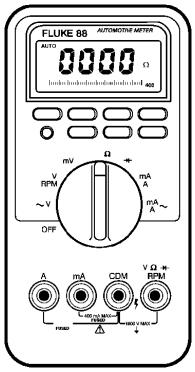


9998546

W0001822



9998548



9510060

9998546	Diagnostic tool displaying the fault codes.
9998548	Adapter cable for the diagnostic tool, connection to cab heater D1LCC.
9510060	Multimeter

Diagnostic Tool

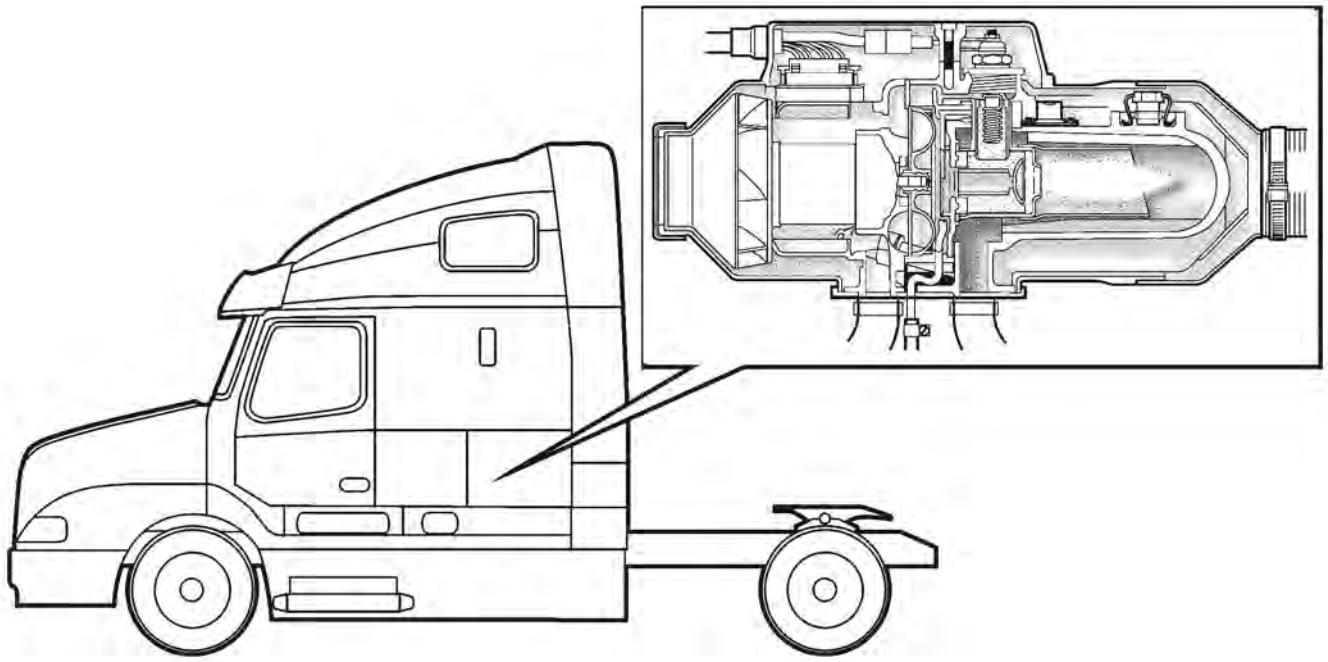
The diagnostic tool consists of a display unit with push buttons and a connection cable. In addition an adapter cable (Part No: 9998548) is required for connection, see “Fault Codes, Retrieval” page 23.

The diagnostic tool displays the three-digit fault codes that have been stored in the control unit.

The control unit can store five fault codes. When a new fault code is stored the oldest one is deleted automatically.

Design and Function

Air Heater



W8002505

The Air heater is located in the left hand side luggage compartment.

The Air Heater runs on diesel and operates independently of the vehicle's normal temperature control system. Its purpose is to provide the cab with warm air when the engine is switched off.

The Air Heater is located in the left hand luggage compartment and uses diesel fuel from the vehicle's own tank fed through a separate fuel line. Air from the cab is fed to the heater and is returned heated. Combustion air is taken from the outside. The exhausts are released to the outside air through a pipe.

The driver sets the desired temperature with a thermostat and the starting time with a timer.

The heater is engaged/switched off with the timer, but can also be manually engaged or switched off.

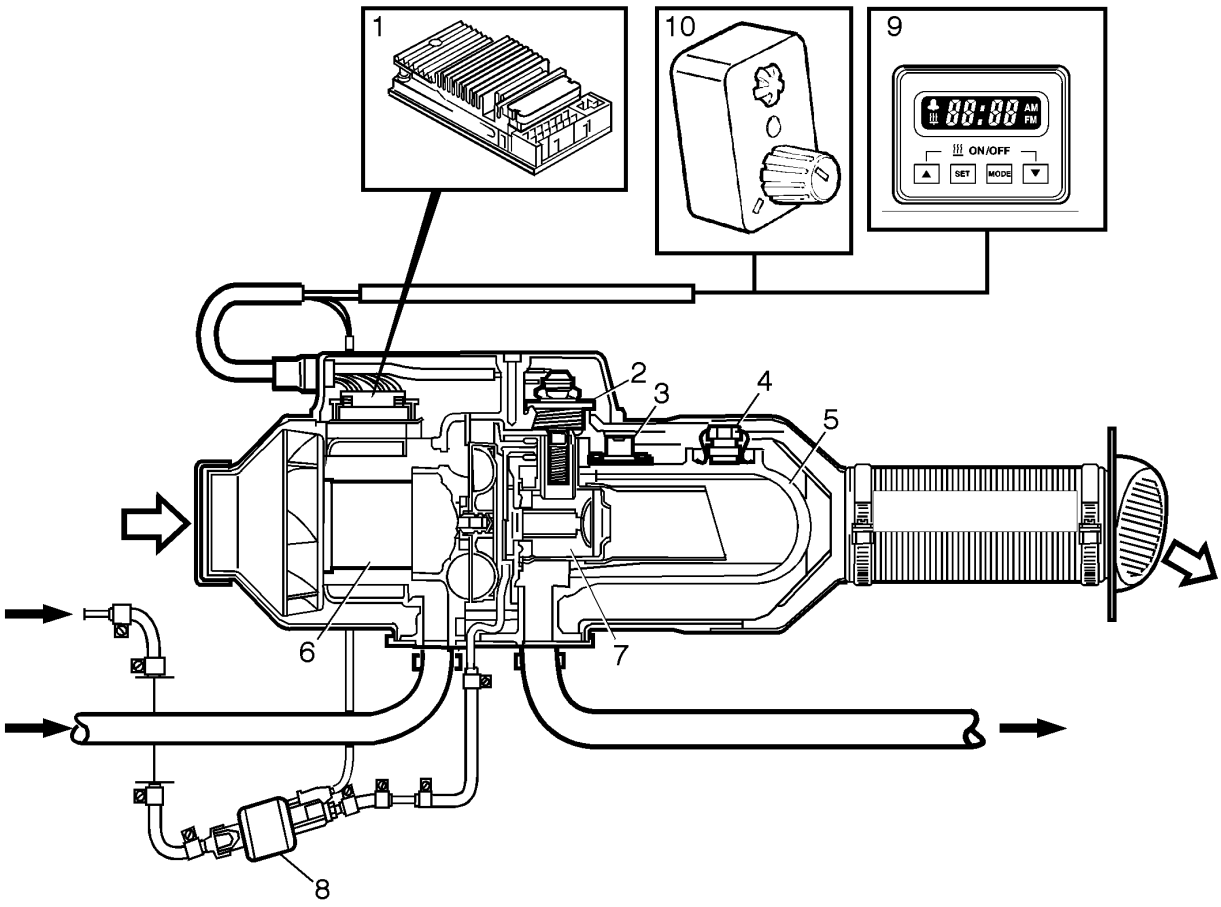
The thermostat is connected to the control unit which gives a signal to a relay engaging the glow plug. Combustion air and fuel are mixed and ignited in the combustion chamber.

The fan blows air through the heat exchanger and the heated air flows into the cab increasing the cab temperature. The temperature sensor is located in the sleeper panel at the bunk. When the desired temperature has been reached, the control unit will lower the output of the heater. This provides better operating fuel economy, reduced electricity consumption and maintains the desired temperature level in the cab.

The Air Heater D1LC Compact has an integrated control unit and glow plug relay inside the jacket casing.

The Air Heater has four output modes: 0.85 kW (LOW), 1.2 kW (MEDIUM), 1.8 kW (HIGH) and the 2.2 kW output (BOOST). The Boost Mode is used only during the start phase to more quickly achieve the desired temperature level.

D1LC Compact, Components



T8008159

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2 “Glow Plug” page 10
3 “Overheat Sensor” page 11
4 “Flame Sensor” page 11
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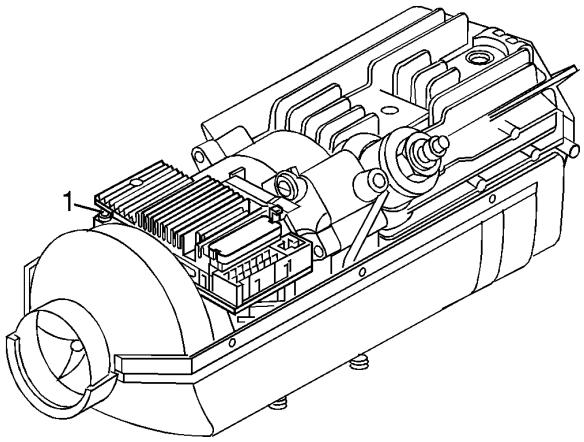
Control Unit

The glow plug relay and fan motor relay on the D1LC Compact are integrated into the control unit which is located under the jacket casing of the heater.

The control unit regulates the switching on and off of the components that control the heating process, fan motor, fuel metering pump and glow plug. The control unit receives signals from the thermostat, the temperature sensor, the flame detector and the overheat sensor.

Via the control unit, the heater is disengaged in the event of a malfunction, or is re-started in the event of an unsuccessful attempt to start, see “Operational Malfunction” page 18.

A maximum of 5 fault codes are stored in the control unit. These are shown in the diagnostics tool as three-digit numbers, see “Fault Codes” page 24.



T8008158

1 Control Unit

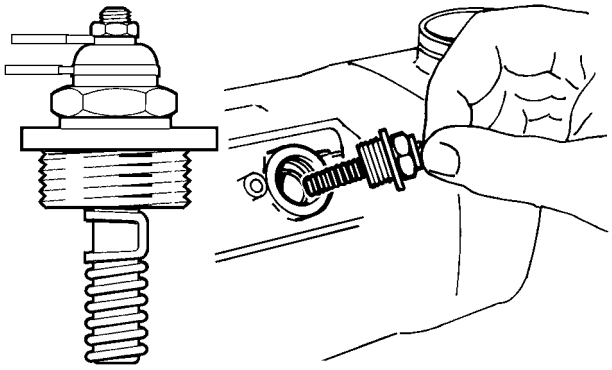
Glow Plug

The purpose of the glow plug is to heat the combustion chamber when the heater is switched on and to ignite the fuel/air mixture.

The operating voltage of the glow plug is 12 V. The voltage is sent in pulses, which reduces power consumption.

The resistance of glow plug is 1–2 Ω.

The glow plug can be checked visually.

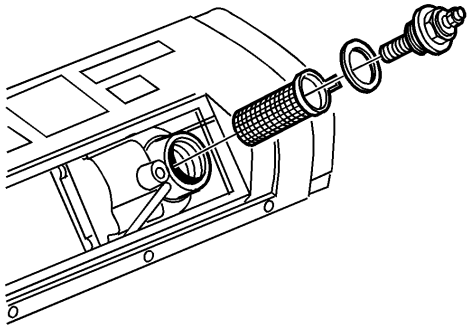


T8007003

Glow Plug Screen

The fuel line feeds into the glow plug socket. The glow plug screen finely distributes the fuel when it flows into the combustion chamber.

The glow plug screen must be replaced at the annual service and every time the glow plug is replaced.

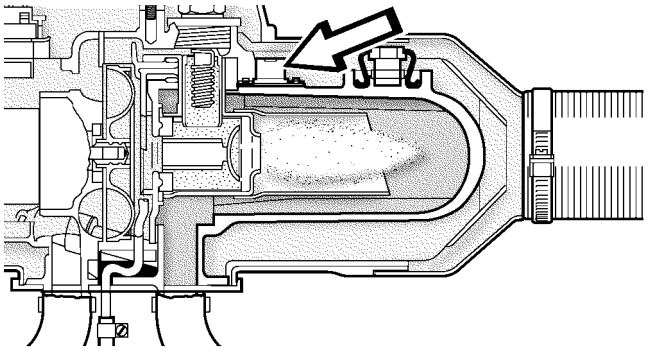


T8008041

Overheat Sensor

The overheat sensor consists of a PTC resistor. Its resistance increases with temperature. The current is cut off in the event of overheating, 160-190°C (320–375°F).

Note: Any faults should be rectified before a new start attempt is made.

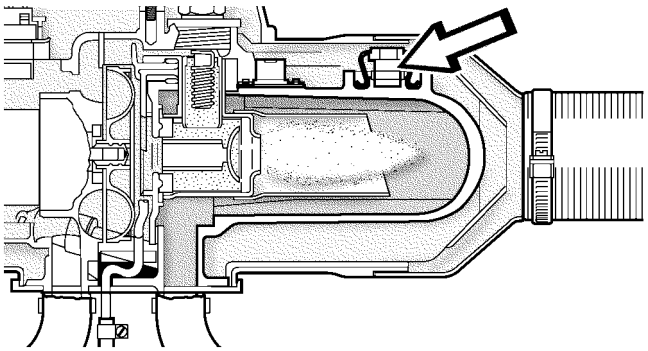


T8007005

Flame Sensor

The flame sensor consists of a PTC resistor. Its purpose is to:

- Disengage the glow plug after combustion has started during the starting process (for a temperature increase of 4°C).
- Repeat the start procedure if combustion is not established.
- Disengage the heater after unsuccessful attempts to start.
- Re-engage the glow plug if interruption in combustion occurs while the heater is in operation. This will take place only for a period of 90 seconds, after which the heater is disengaged.



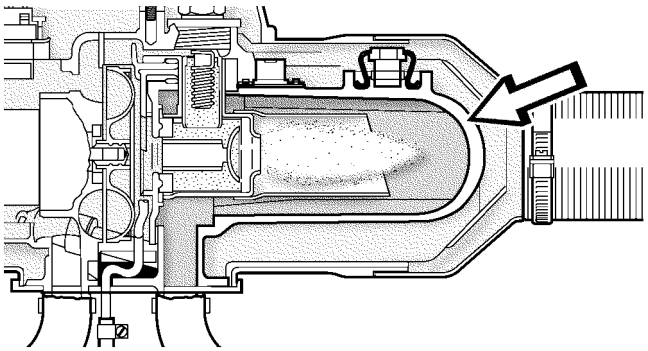
T8007006

Heat Exchanger

The heat exchanger transfers the heat produced in the combustion chamber to the air throughflow.

Cleaning

When cleaning and checking the heat exchanger, the seals should also be changed, see “Heat Exchanger Seals, Replacement ” page 40.



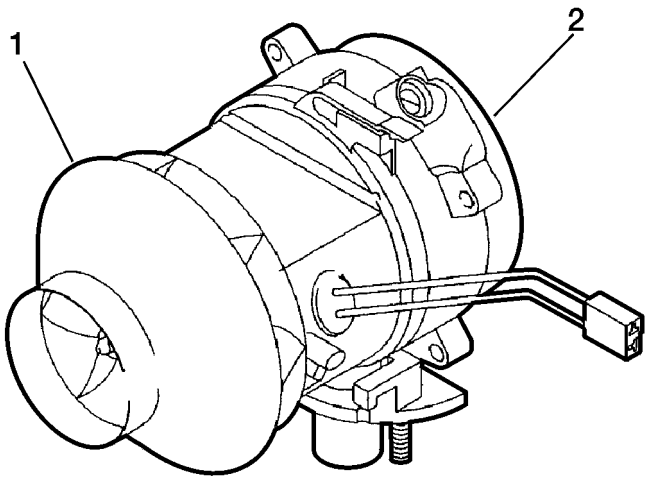
T8007007

Blower Motor

The turbine wheel of the blower motor feeds the air through the heat exchanger and onward into the cab.

The combustion air is sucked into the combustion chamber by an impeller between the blower motor housing and the combustion chamber section.

The impeller and the turbine wheel (the fan) are mounted onto the same shaft and are powered by the same motor.



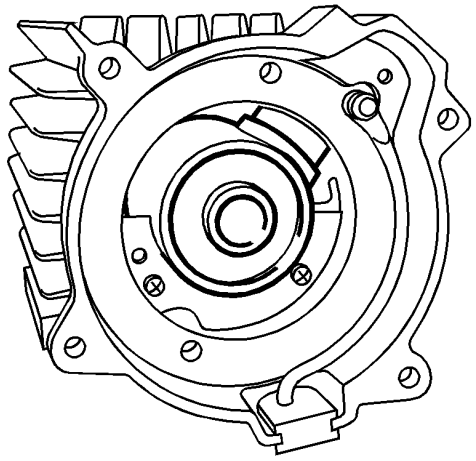
W8002572

1 Turbine wheel
2 Impeller

Combustion Chamber

In the combustion chamber, the fuel is mixed with the combustion air and ignited by the glow plug. When the heater has started, the combustion of the fuel/air mixture takes place in the outer combustion chamber.

The combustion chamber cannot be disassembled for replacing parts or cleaning.



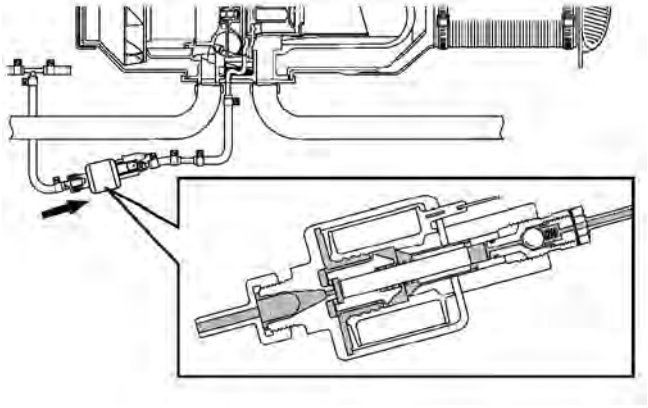
T8007798

Fuel Metering Pump

The fuel metering pump is an electro-magnet with a pump piston pulsating in a magnetic core. The speed of the pump's piston, and thus the fuel supply, varies depending on the power output mode. The higher the speed, the more fuel is supplied. The piston moves with a frequency of 3.9 Hz at full load.

At the pump outlet a non-return valve blocks the flow of fuel completely when the pump stops.

The fuel filter on the pump inlet side can be replaced after the cap nut has been removed.



T8008157

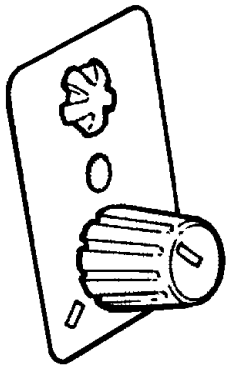
Cab Thermostat

The cab thermostat for factory mounted heaters is located in the sleeper panel at the bunk. A green lamp indicates when the heater is engaged.

Above the lamp a star-shaped air temperature sensor is located. It monitors the cab air temperature and is connected to the control unit.

The thermostat's control range is between 12 - 28 °C, (54 – 82 °F).

Note: For additional instructions, see the Operator's manual.



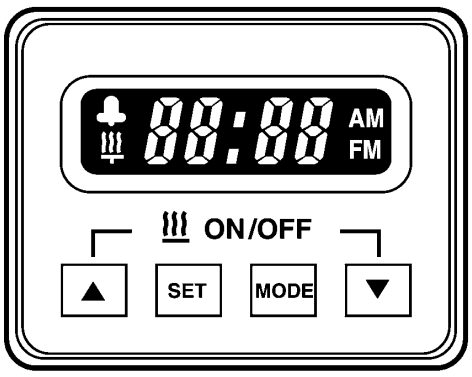
T8007029

Timer

The timer is located in the sleeper panel by the bunk. It allows the driver to either start the heater manually or to pre-program it to start at a particular time.

The timer has four different basic functions (clock, alarm, manual start of heater or delayed start of heater). These are all obtained by pressing the "mode" button. A symbol on the display shows which function is active.

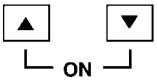
Note: For additional instructions, see the Operator's manual.



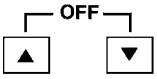
T8007012

Timer Operation

Rapid Start/Stop of the Heater



Start the parking heater by pressing both buttons for at least 3 seconds. The heater is then in operation for 8 hours whereafter it stops automatically.



T8007018

To stop the heater earlier, press both buttons again for at least 3 seconds.

Timer Setting

For information on how to pre-program the timer for start of the heater, please refer to Operator's Manual.

Air Heater Operation

DANGER

To prevent fire, the heater must be switched off while filling fuel tanks. The fuel vapors may ignite, causing an explosion or fire resulting in severe personal injury or death.

DANGER

Do not store flammable or heat sensitive objects in parking heater compartment. The item may ignite and cause a fire resulting in severe personal injury or death.

DANGER

Do not run the heater while vehicle is in an enclosed area. The exhaust gasses contain carbon monoxide (CO). If not vented to the atmosphere, there could be a build-up of dangerous levels of CO which may lead to unconsciousness and later death.

Starting

Switch the heater on by following the instructions in chapter for Timer, Rapid Start and Stop, see “Timer” page 13.

A green light indicates that the heater is engaged. The following sequences take place:

- Control unit performs a systems check (glow plug, flame sensor, temperature sensor, overheat sensor).
- Blower starts slowly and begins to accelerate.
- Glow plug is energized and starts preheating the combustion chamber.
- After a short delay, approximately 15 seconds, the fuel pump delivers fuel.
- Ignition will take place as the fuel/air mixture contacts the glow plug.
- Blower speed and fuel delivery are slowly increased.
- Once the flame is established the glow plug will switch off.
- The heater will begin heating.

CAUTION

The heater air cab inlet is located in the bunk wall in front of the heater. Do not attempt to put small items or store flat items between the bunk and the cabinet/refrigerator. The air intake may become blocked which will cause the heater to overheat and shut down.

WARNING

The parking heater is a very hot object. Do not touch the heater when it is in operation or shortly thereafter. Touching a heater may cause burns.

Temperature Setting and Control

To reach desired temperature, adjust with the potentiometer knob on the sleeper panel.

The heater cycles through Boost, High, Medium and Low heat modes to maintain the desired temperature.

If the desired temperature is exceeded while the heater is operating in Low heat mode the heater will switch off. This is a comfort feature.

The heater will restart in Medium heat mode once heat is again required.

Switch Off

Once switched off manually or automatically, the heater begins a controlled cool down cycle:

1 The fuel pump stops delivering fuel.

2 The glow plug is re-energized for a 15 second afterglow.

3 The blower continues to run for 3 minutes and automatically switches off.

Controls and Safety Equipment

If the heater fails to ignite within two 90 second start attempts, a “no start” shut down occurs.

If the flame goes out after the heater has started, the heater will attempt to restart.

If the flame repeatedly goes out within 10 minutes the heater will not restart.

Overheat shut down will occur if there is a restriction of the heating air flow (i.e. blocked inlet or outlet). The overheat switch will automatically reset once the heater has cooled down. Once the air flow restriction is removed, the heater can be restarted by switching the heater off then back on.

If the voltage drops below 10.5 V or rises above 15.9 V the heater system will shut down.

If the glow plug circuit or fuel metering pump are interrupted the heater will not start.

The blower motor is checked on start up and every 4 minutes. Shut down will occur if the blower does not start or maintain proper speed.

To safeguard from the heater operating after a turnover accident, there is a roll-over switch mounted in the luggage compartment cutting off the power to the fuel pump.

Operational Flow Chart

<table>
<tr><th></th><th colspan="5">STARTING PHASE</th><th colspan="2">RUNNING PHASE</th><th colspan="3">SHUT DOWN PHASE</th></tr>
<tr><td>Operating mode</td><td>System Check</td><td>Preheat</td><td>Ignition attempt</td><td>Preheat 2nd attempt</td><td>Ignition Attempt 2nd. attempt</td><td>Boost</td><td>Controlled heating</td><td>After Glow</td><td>Cool down</td><td>Off or Stand by</td></tr>
<tr><td>Blower</td><td>Off</td><td>On</td><td>On</td><td>On</td><td>On</td><td>On</td><td>On</td><td>On</td><td>On</td><td>Off</td></tr>
<tr><td>Glow plug</td><td>Off</td><td>On</td><td>On</td><td>On</td><td>On</td><td>Off</td><td>Off</td><td>On</td><td>Off</td><td>Off</td></tr>
<tr><td>Fuel Pump</td><td>Off</td><td>Off</td><td>On</td><td>Off</td><td>On</td><td>On</td><td>On</td><td>Off</td><td>Off</td><td>Off</td></tr>
<tr><td rowspan="3">Time</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td>1-3 sec.</td><td>15 sec.</td><td>Up to 90 sec.</td><td>15 sec.</td><td>Up to 90 sec.
If required</td><td>Time dependent on heat exchanger temp.</td><td>Continual Operation until switched off by Operator or temperature control</td><td>15 sec.</td><td colspan="2">3 min.</td></tr>
<tr><td colspan="7"></td><td colspan="3"></td></tr>
<tr><td colspan="10">Note: During controlled heating cycle, if desired heat level is exceeded the heater will cycle off. Heater will automatically restart in medium mode once heat is again required</td></tr>
</table>

Operational Malfunction

The flame is monitored by the flame detector. The overheat sensor monitors the temperature in the combustion chamber. Both affect the control unit so that the heater is switched off in the event of a malfunction, or is re-started in the event of an unsuccessful attempt to start.

The heater does not start within 90 seconds of fuel being supplied.	The start is repeated according to procedure described in "Operational Flow Chart" page 17.
The heater does not start within 90 seconds of fuel being supplied at the second attempt to start.	The heater is switched off and an error code is stored in the control unit, see "Fault Codes" page 24. No further attempts to start are carried out.
The heater starts but interference occurs within 10 seconds.	The heater re-starts automatically and an error code is saved in the control unit, see or "Fault Codes" page 24.
Overheating.	The overheat sensor indicates too high a temperature. The fuel supply is cut off. The heater is switched off and the indicator lamp on the cab thermostat flashes if the direct cause of the malfunction is overheating.
Other malfunctions.	Other reasons for a shut down may be overvoltage/voltage drop in the vehicle's electrical system, or faulty heater components. These faults entail that an error code be saved in the control unit, see "Fault Codes" page 24.

Note: By switching off and re-starting the heater quickly, malfunction shutdowns can be eliminated.

Note: In the event of several overheating malfunctions in succession, the heater should be checked.

Heater Output in Relation to Temperature

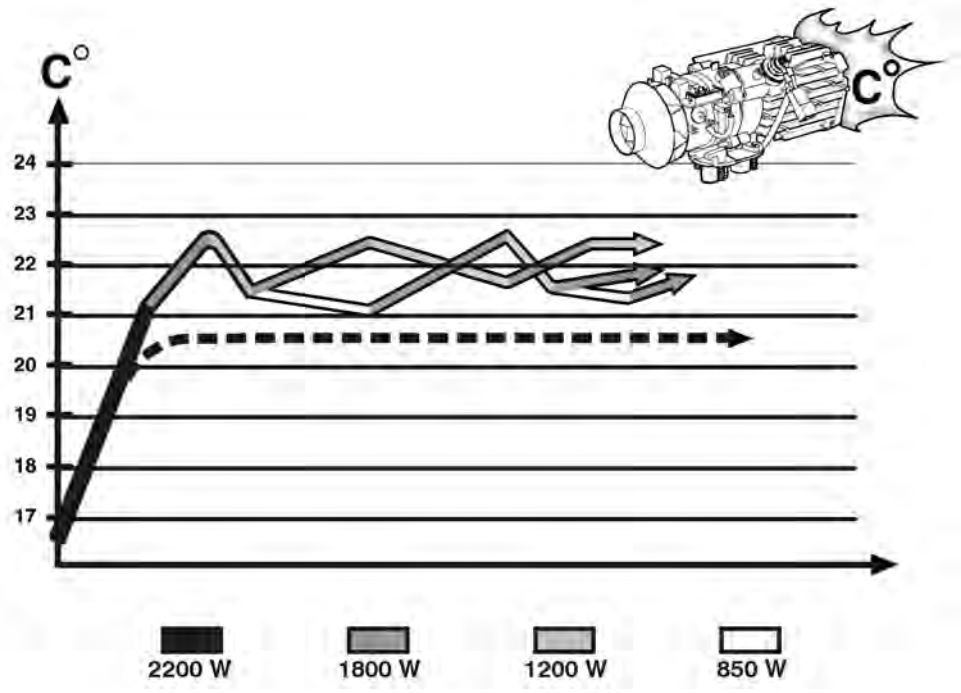


Fig. 1: Starting process, output position “BOOST” as well as running operation

The heater cycles through three different temperature settings during operation (850 – 1,200 – 1,800 W), (2,900–4,100–6,150 BTU). However, during starting the heater always runs at the fourth setting (BOOST) with the output of 2,200 W (7,500 BTU).

The fan has three speeds. The lower power modes, 850 W and 1,200 W, have both the same low fan speed. In the mode BOOST the fan runs at the highest speed. For more information, see table page 5.

Note: The output mode ”BOOST” is engaged only during start. This enables the heater to quickly reach operational temperature. The heater then operates in output mode ”HIGH” until the desired cab temperature is reached.

Troubleshooting

Air Heater, Basic Troubleshooting

What happens when the heater is switched on and ...

The heater doesn't ignite

If blower motor doesn't run — check:

Fuse in power harness

Power to control unit

Power to switch

Electrical connections

Too many overheats — Fault code 015

Too many No Start Attempts — Fault code 050

If blower motor runs approximately 20 seconds and then shuts off — check:

Ensure that voltage at control unit remains above 9.5 volts during start up with glow plug circuit on.

If blower motor runs/Fuel metering pump starts and then shuts down after two 90 seconds start up cycles — check:

Fuel lines and fuel filter

Fuel quantity

Flame sensor

Combustion air or exhaust tube blockage

If blower motor runs but not the fuel metering pump — check:

For electrical pulses at the fuel metering pump

For faulty roll-over switch

If pump is frozen

Blocked fuel line

The heater ignites

If the heater shuts down at random — check:

Fuel metering pump quantity

Possible overheat

Control unit input voltage

If heater smokes and carbons up — check:

Exhaust pipe blocked

Combustion air intake blocked

Exhaust entering combustion air intake pipe

Short cycling, rapid on/off operation

Fuel system

Fuel metering pump quantity

Motor rpm

Diagnostic Tool

For information on operating buttons and display text, see “Diagnostic Tool” page 6

Diagnostic Tool, Connecting

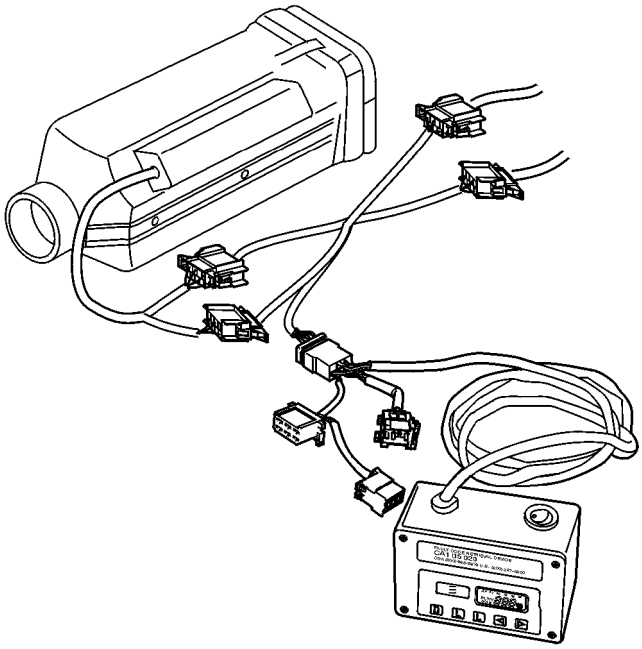
1 Assemble the adapter cable 9998548 and the connection cable.

2 Separate the connectors at the heater and connect the adapter cable.

3 Connect the 8–unit connector on the connection cable to the display unit.

4 The heater starts automatically.

Note: Do not connect the diagnostic tool before the cable is connected to the heater.



W8002526

Fault Codes, Retrieval

Switch on the diagnostic tool and wait for ten seconds

Press the “D”-button

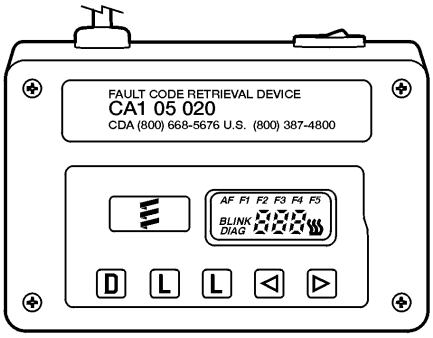
Wait 3–5 seconds for the current fault code to appear (AF)

To review the previous faults use the arrow buttons, (F1= Most Recent, F5= Oldest).

To erase the fault codes that are in memory press both “L”-keys at the same time.

If ”– – –” or ”–” is shown after 4 seconds it means that there is interference between the heater and the diagnostic tool.

For fault codes, see “Fault Codes” page 24.



W8002527

Operating buttons

D	Retrieve fault code		**<**	Scroll downwards F5-F1
L	Delete fault code	Press buttons at the same time for at least 2 seconds.	**>**	Scroll upwards F1-F5
L	Delete fault code			

Display texts

AF	Current error, shown as a flashing signal	***DIAG***	Shown when ”D” is pressed, fault code is shown after 4 seconds.
FLASH	Flashing text, current error.	**- - -**	Max 4 seconds before an fault code is shown. If the signal is shown for a longer time there is interference.
F1-F5	Memory positions for the stored fault codes. The AF and the F1 are the same number	**-**	If this is shown after 4 seconds, there is interference.
	This sign is displayed when the heater is in operation	888	Three-digit fault code e.g. 064 Flame detector incorrect

Fault Codes

Fault code	
Probable cause	**Action**

Always check first that there is fuel in the tank, that the heater's fuses in fuse holder are intact and that the ground connection to the control unit is satisfactory. In addition you must make sure that all electrical cables, unions as well as splices are undamaged. Also check that the overheating protection has not been triggered.

When an operational malfunction has occurred an fault code is stored in the Control Unit. The memory of the Control Unit will store the five last fault codes. The diagnostic tool displays the "recorded errors" which aids in finding the cause to intermittent faults (faults that occur now and then, or only under certain conditions).

For connecting and using, see "Diagnostic Tool" page 6.

Fault code 000 – The heater is in Operation

The heater functions normally.

No action taken.

Fault code 001 – Warning, Overvoltage

Overvoltage is indicated.

Check vehicle charging system.

Fault code 002 – Warning, Undervoltage

Undervoltage is indicated.

Check batteries and connections.

Fault code 004 – Warning, Short Circuit to the Vehicle's Blower

Warning - short in blower signal.

Check for short between pin 1 to blower relay.

If no short exists, replace control unit.

Fault code 005 – Warning, Short Circuit in Anti-Theft Alarm Output

Check for short between pin 2 and alarm relay.

Fault code 010 – Overvoltage Switch-Off

Too high a voltage in the vehicle's electrical system. The heater has been switched off.

Check voltage between terminals 9 and 11. This must be less than 15.9 V (15.2 V with the glow plug on). Check vehicle charging system.

Fault code	
Probable cause	**Action**

Fault code 011 – Voltage Drop Switch-Off

Too low a voltage in the vehicle's electrical system. The heater has been switched off.	Check voltage between control unit pins 9 and 11. This must be greater than 10.5 V (9.5 V with the glow plug on). Check batteries and connections.

Fault code 012 – Overheating

Temperature too high in the heat exchanger.	Check the air hose as well as inlet/outlet with regard to blockage.
Faulty overheat sensor.	Check overheat sensor resistance values; see "Check of Components" page 48.
Incorrect cable between overheat sensor and control unit.	Check cables between overheat sensor and control unit.

Fault code 013 – Overheat at Flame Sensor

The flame sensor detects a temperature above 340°C (resistance value above 2,270 Ω.)	Check flame sensor resistance value as well as overheat sensor resistance values. See "Flame Sensor, Checking" page 49. If the value deviates, the flame sensor is faulty and must be replaced. Is the value OK, see "Fault code 012 – Overheating" page 25.

Fault code 015 – Too many Overheats

The control units limits heater to 3 consecutive overheats (fault codes 12, 13)	Remove cause of overheat. Reset control unit using control unit tester or fault code retrieval device to unlock control unit

Fault code 020 – Glow Plug, Break

Faulty glow plug.	Remove and check the glow plug visually for break in coils. If the glow wire is burned out, replace the glow plug. Check resistance across the glow plug leads. The resistance should be 1-2 Ω. If the value deviates, replace the glow plug. Check the continuity in connections and cables between the glow plug and the control unit, connections 9 and 6 on the connector.
Faulty control unit.	If the glow plug, cables and connections are in good condition, replace the control unit.

Fault code	
Probable cause	**Action**

Fault code 021 – Glow Plug, Short Circuit

Short circuit in the glow plug, or in the cables and connections between the control unit and the glow plug.	Remove and check the glow plug visually. If glow plug short is detected, replace glow plug. Measure the resistance in the glow plug. The resistance should be 1-2 Ω. If the value deviates, replace the glow plug. Check pin 6 and the cable to the glow plug's connection with regard to short circuit. If the checks above are OK, replace the control unit.

Fault code 025 – Diagnostics Output, Short Circuit

Diagnostics output short.	Check for short between pin 4 and diagnostics and output connection.

Fault code 033 – Blower Motor Deviation

Speed deviation that exceeds ±10% of the expected value for more than 30 seconds.	Speed too low: Check the connections to the fan motor. Check for restrictions. Check for short in motor circuit or control unit If none is found replace blower. Speed to high: Check for damage to the magnetic sensor on the control unit. Replace blower motor if damaged. Otherwise replace control unit.

Fault code 047 – Short Circuit — Fuel Metering Pump

Short circuit to fuel metering pump.	Check for short between pin 3 and the fuel metering pump.
Faulty fuel dosage pump.	Check the fuel metering pump. Replace the pump if faulty.

Fault code 048 – Open Circuit — Fuel Metering Pump

Open circuit in cable to fuel metering pump.	Check for open circuit between pin 3 and the fuel metering pump.
Open circuit in fuel metering pump.	Check fuel metering pump.

Fault code	
Probable cause	**Action**

Fault code 050 – Too many No-start Attempts

The control unit restricts the heater to 10 start attempts (20 starts if no flame is detected during start attempts)	Check fuel, glow plug, combustion air and exhaust flow. Use control unit tester or fault code retrieval device to unlock control unit

Fault code 051 – Flame Signal while Starting

Faulty flame sensor.	Check the resistance in the flame sensor, see “Flame Sensor, Checking” page 49.

Fault code 052 – No Start Safety Time exceeded

Flame has not been registered during the start period.

Faulty flame sensor.	Check the resistance in the flame sensor, see “Flame Sensor, Checking” page 49.
Faulty glow plug.	See “Fault code 020 – Glow Plug, Break” page 25 and “Fault code 021 – Glow Plug, Short Circuit” page 26.
Faulty fuel supply.	Check fuel quantity and fuel supply, see “Fuel Consumption, Checking” page 48.
Faulty exhaust or combustion air line.	Check exhaust and combustion air lines.

Fault codes 053, 054, 055, 056 – Interruption in Combustion

Fault code 053 -Interruption in combustion in the position POWER

Fault code 054 -Interruption in combustion in the position HIGH

Fault code 055 -Interruption in combustion in the position MEDIUM

Fault code 056 -Interruption in combustion in the position LOW

The flame sensor indicates interruption in combustion in the start process or in the output position.	Check fuel quantity and fuel supply, see “Fuel Consumption, Checking” page 48. Check exhaust and combustion air lines. Check flame sensor, see “Flame Sensor, Checking” page 49.

Fault code	
Probable cause	**Action**

Fault codes 060, 061– Cab Temperature Sensor

Fault code 060 –Cab Temperature Sensor, break

Fault code 061 –Cab Temperature Sensor, short circuit

The temperature sensor detects a value beyond its range.	Check the cable between the control unit's connections 8 and 13 and the cab thermostat. Check the temperature sensor resistance; the resistance is > 2,800 Ω for a break, the resistance is < 280 Ω for a short circuit. The temperature sensor's normal values, see "Overheat Sensor, Checking" page 49. Replace Cab Thermostat

Fault codes 062, 063 – Cab Thermostat Potentiometer

Fault code 062 –Controls, break

Fault code 063 –Controls, short circuit

Short circuit - set point potentiometer.	Check the cable between the control unit's connections 7 and 13 and the operating control. Check the connection cables: the resistance is > 2,800 Ω for a break, the resistance is < 200 Ω for a short circuit. The normal value should be 1,750-2,080 Ω, ±80 Ω. Replace Cab Thermostat

Fault codes 064, 065 – Flame Sensor

Fault code 064 –Flame sensor, break

Fault code 065 –Flame sensor, short circuit

The flame sensor detects a value that lies outside the control range.	Check the connection cables to the flame sensor: the resistance is > 3,200 Ω for a break, the resistance is < 200 Ω for a short circuit. Normal value, see "Flame Sensor, Checking" page 49.

Fault code	
Probable cause	**Action**

Fault codes 071 – Overheating Protection

Fault code 071 –Overheat sensor, open or short circuit

The overheat sensor detects a value outside the control range.	Check the connection cables to the overheat sensor: the resistance is > 3,200 Ω for a break, the resistance is < 200 Ω for a short circuit. Normal value, see “Check of Components” page 48.

Fault code 091 – External Interference Voltage

The control unit is interfered with by the vehicle’s other electrical systems, e.g. poor battery.	Check the vehicle’s electrical system, rectify the interference voltage.

Fault codes 090, 092, 093, 094, 096, 097 – Control Unit Defect

Fault code 090 -Internal interference voltage

Internal interference in the microprocessor/memory.	Replace the control unit.

Fault code 092 -Control unit defect

ROM fault.	Replace the control unit.

Fault code 093 -Control unit defect

RAM fault.	Replace the control unit.

Fault code 094 -Control unit defect

EEPROM fault.	Replace the control unit.

Fault code 096 -Control unit defect

Internal temperature sensor (PTC-resistance) defect.	Replace the control unit.

Fault code 097 -Control unit defect

Error in the oscillator or voltage drop fault.	Replace the control unit.

Service Procedures

General Service Precautions

Note: For Service Procedures “Heat Exchanger Seals, Replacement ” page 40 and “Air Heater Fan Seal, Replacement” page 42 the Air Heater needs to be removed from the vehicle, see “Air Heater, Removal” page 44.

DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

DANGER

To prevent fire, the heater must be switched off while filling fuel tanks.The fuel vapors may ignite, causing an explosion or fire resulting in severe personal injury or death.

DANGER

Do not store flammable or heat sensitive objects in parking heater compartment. The item may ignite and cause a fire resulting in severe personal injury or death.

DANGER

Do not run the heater while vehicle is in an enclosed area. The exhaust gasses contain carbon monoxide (CO). If not vented to the atmosphere, there could be a build-up of dangerous levels of CO which may lead to unconsciousness and later death.

WARNING

The parking heater is a very hot object. Do not touch the heater when it is in operation or shortly thereafter. Touching a heater may cause burns.

CAUTION

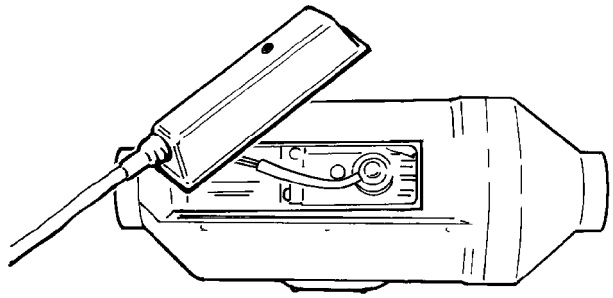
The heater air cab inlet is located in the bunk wall in front of the heater. Do not attempt to put small items or store flat items between the bunk and the cabinet/refrigerator. The air intake may become blocked which will cause the heater to overheat and shut down.

8755-03-02-01
Air Heater Glow Plug, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.

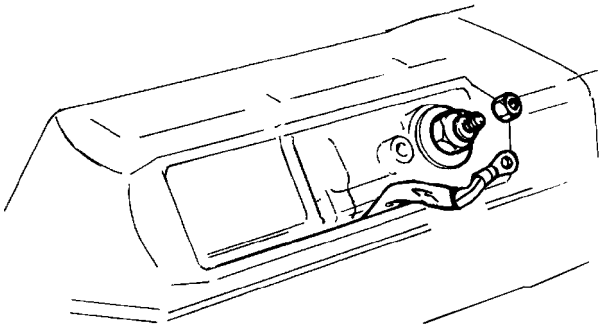
1



W8002528

Remove the access cover.

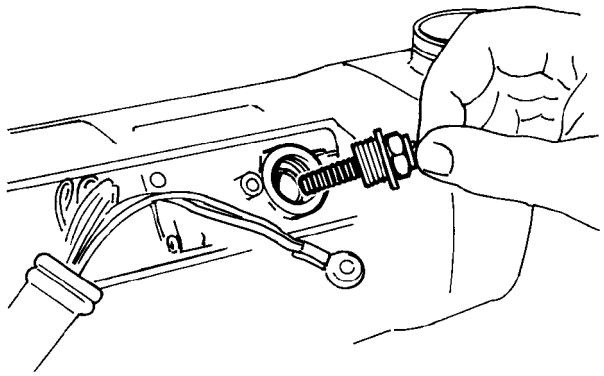
2



W8002529

Disconnect the electrical connections by loosening the nut located on the top of the glow plug.

3



W8002530

Unscrew the glow plug.

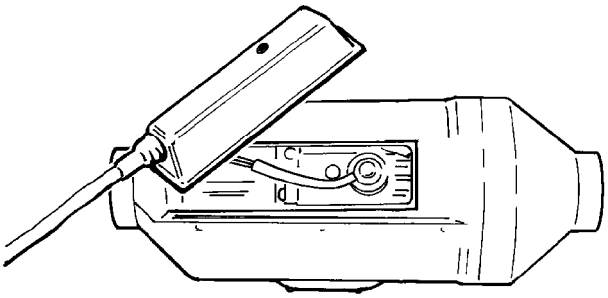
Note: When replacing the glow plug the glow plug screen is also to be replaced. Be sure to position the glow plug screen the correct way. See “Air Heater Glow Plug Screen, Replacement” page 32.

8755-03-02-02
Air Heater Glow Plug Screen, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.

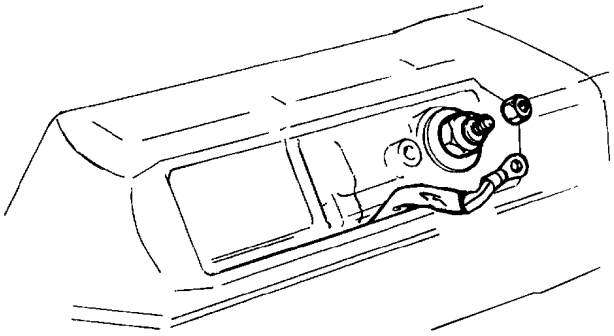
1



W8002528

Remove the access cover.

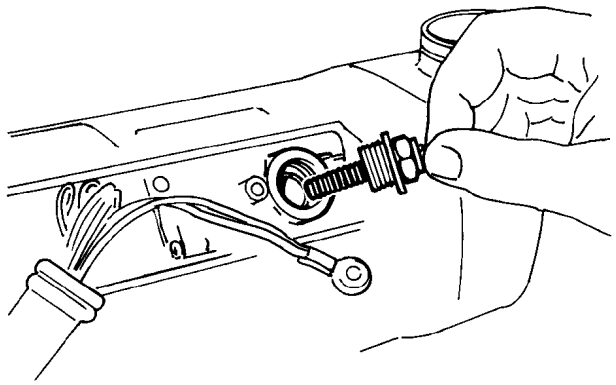
2



W8002529

Disconnect the electrical connections by removing the bolt located on the top of the glow plug.

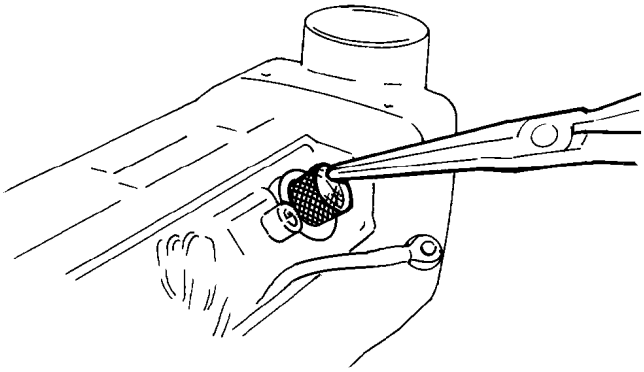
3



W8002530

Unscrew the glow plug.

4



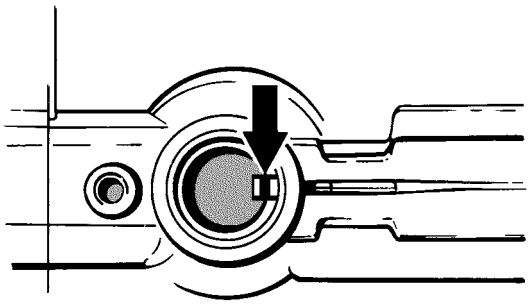
W8002531

Pull the glow plug strainer out of the glow plug socket with a pair of pliers.

5

Check that the hole for the combustion air is not clogged. If it is clogged, clean it using non detergent 100 % volatile carburator cleaner and an air gun.

6



T8006991

The glow plug strainer's position.

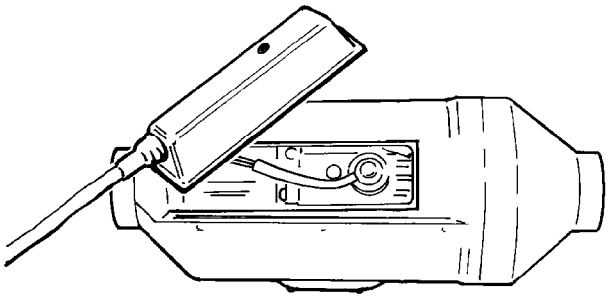
Slide in the glow plug strainer carefully until it stops. Pay careful attention to the position of the lug and the position of the parting joint. The parting joint, or seam, must face away from the Control Unit.

8759-03-02-02
Air Heater Control Unit, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand "General Service Precautions" page 30.

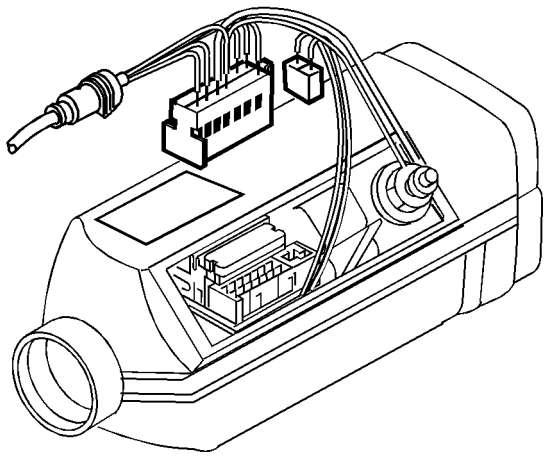
1



W8002528

Remove the access cover.

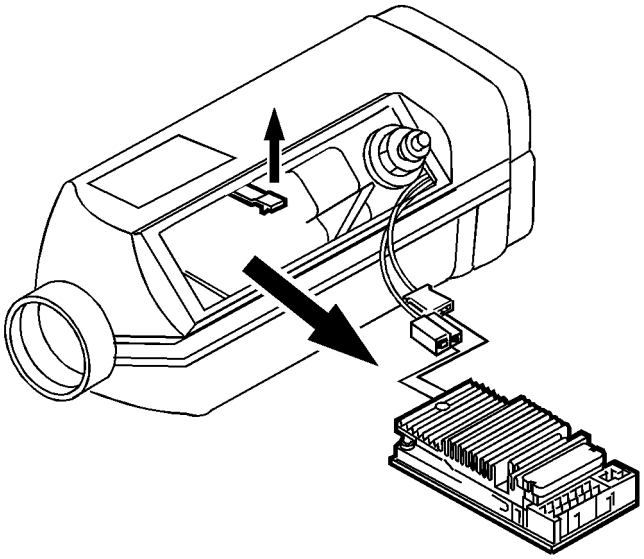
2



T8008045

Disconnect the connectors from the control unit

3



T8008046

Lift up the locking lug and pull out the control unit.

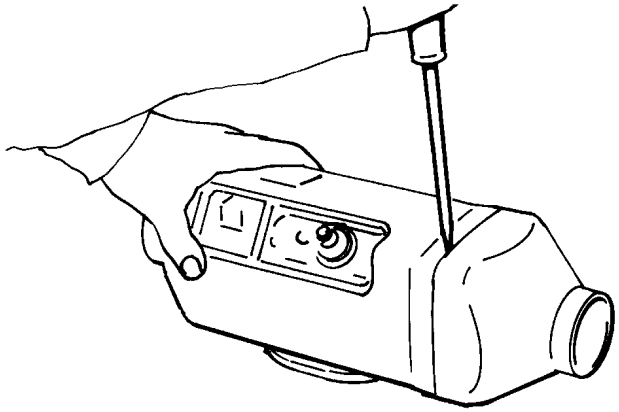
4
When installing the control unit, make sure that the wiring harness is not pinched.

8759-03-02-03
Air Heater Outlet Flow Cowl, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.

1



T8006993

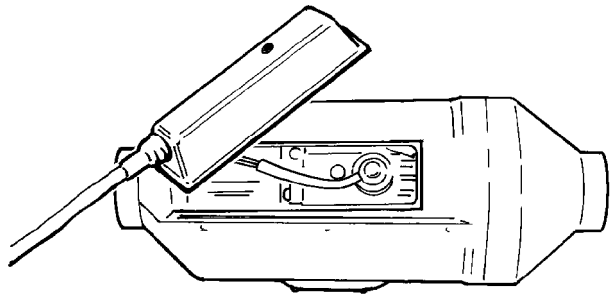
Insert a screwdriver between the outlet flow cowl and the jacket casing.
Carefully pry off the outlet flow cowl.

8759-03-02-04
Air Heater Jacket Casing, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.

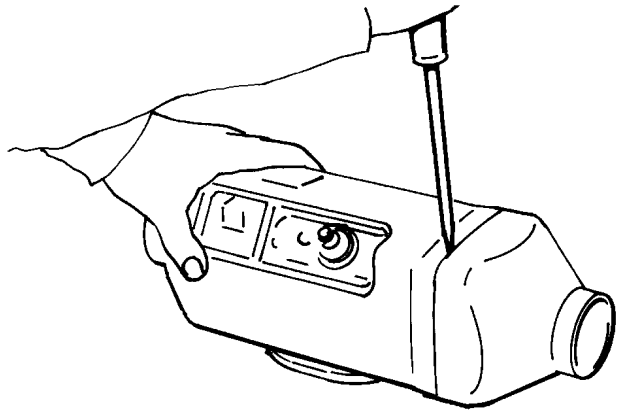
1



W8002528

Remove the access cover.

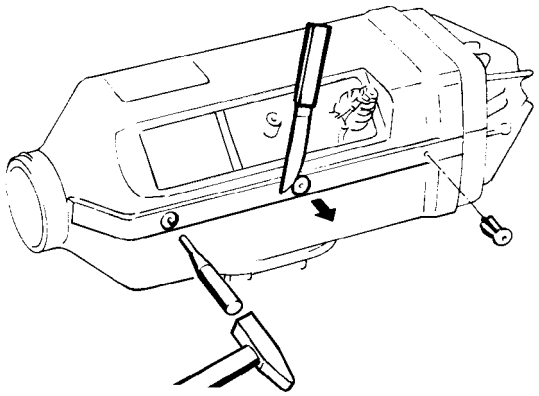
2



T8006993

Insert a screwdriver between the outlet flow cowl and the jacket casing. Carefully pry off the outlet flow cowl.

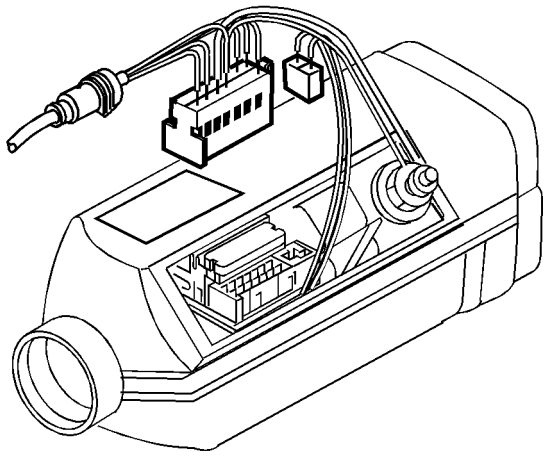
3



W8002532

Tap a small drift through the pin.

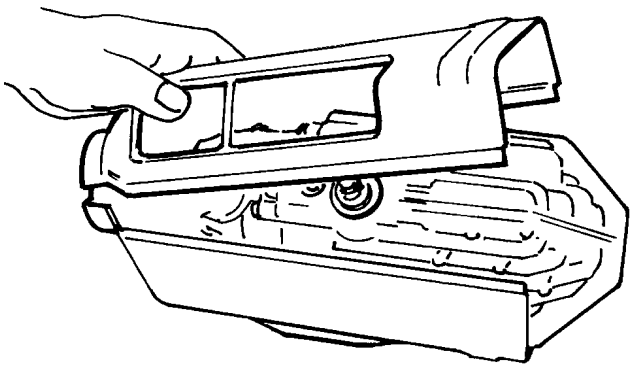
4



T8008045

Disconnect the connectors from the control unit.

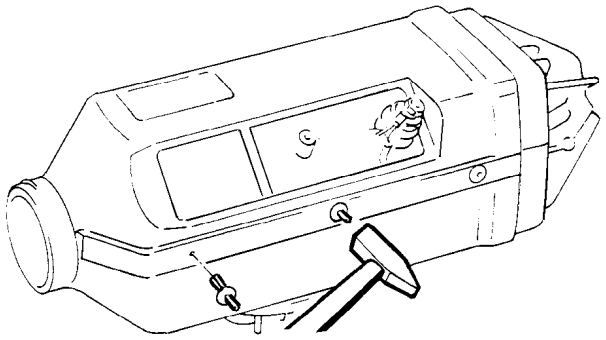
5



T8006985

Lift off the jacket casing.

6



W8002533

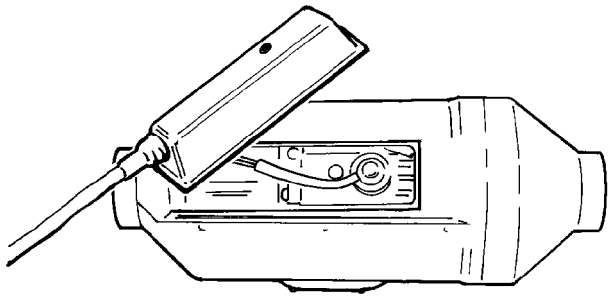
When assembling, use a new rivet.

8757-03-02-01
Air Heater Overheat Sensor, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.

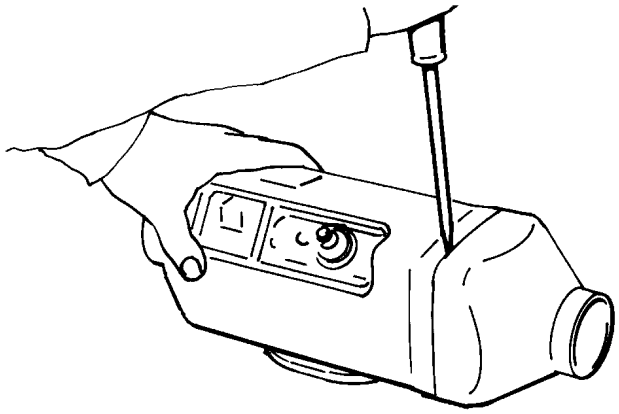
1



W8002528

Remove the access cover.

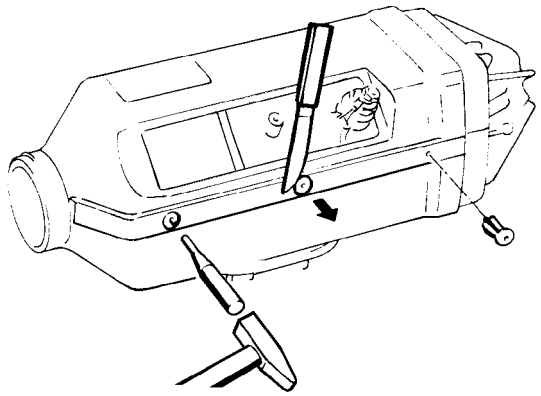
2



T8006993

Insert a screwdriver between the outlet flow cowl and the jacket casing.
Carefully pry off the outlet flow cowl.

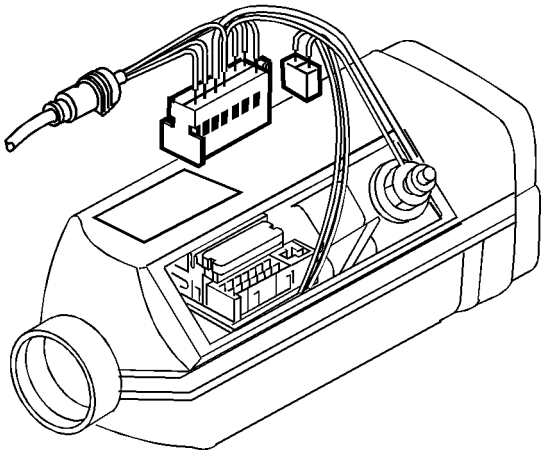
3



W8002532

Tap a small drift through the pin.

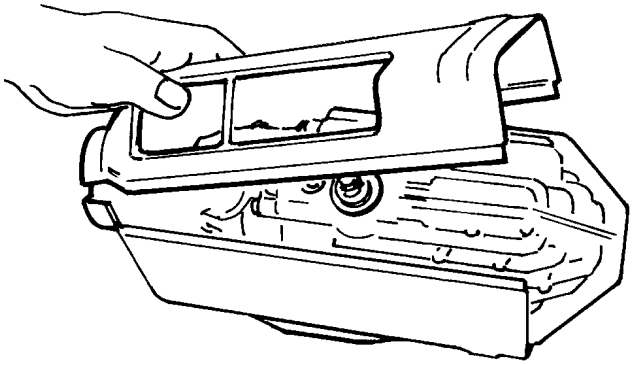
4



T8008045

Disconnect the connectors from the control unit.

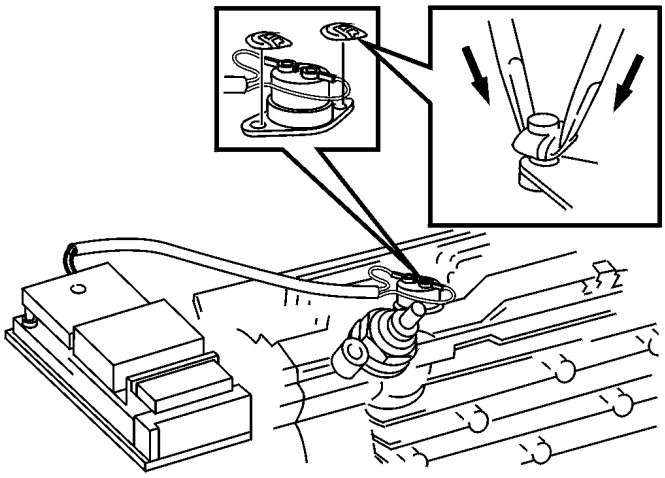
5



T8006985

Lift off the jacket casing.

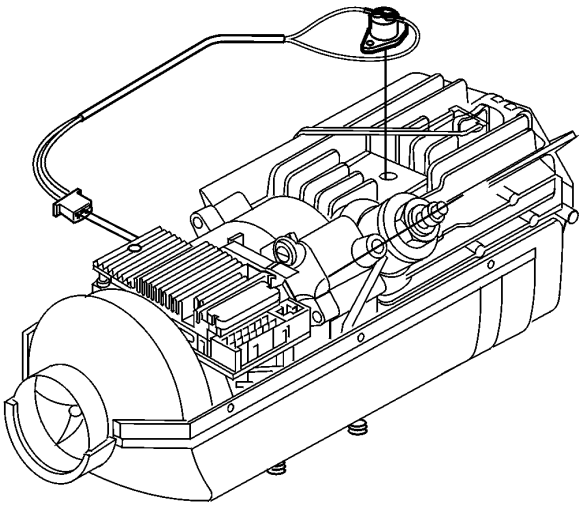
6



W8002573

Compress and lift off the holding clips.

7

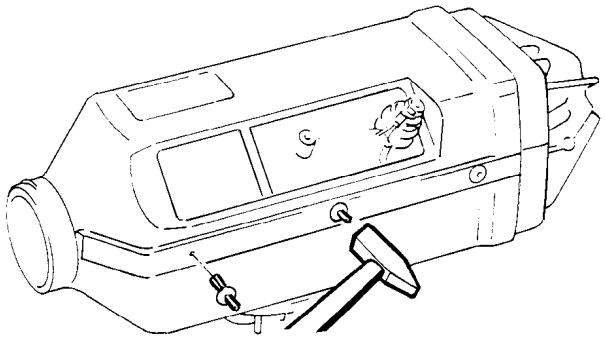


W8002534

Disconnect the connector from the control unit and lift out the overheat sensor.

Note: When replacing the overheat sensor use new holding clips.

8



W8002533

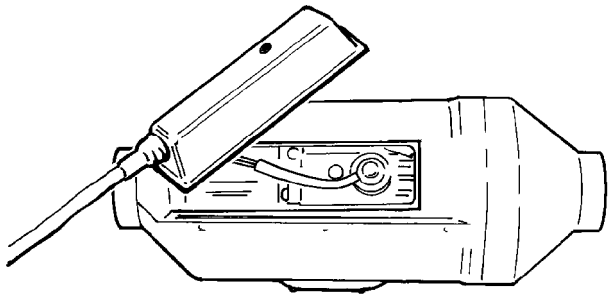
When assembling, use a new rivet.

8759-03-02-01
Air Heater Flame Sensor, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.

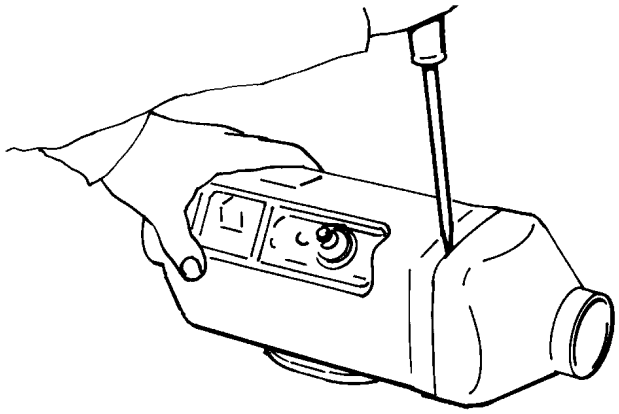
1



W8002528

Remove the access cover.

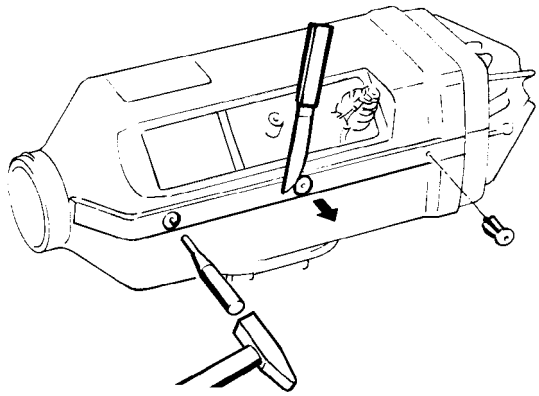
2



T8006993

Insert a screwdriver between the outlet flow cowl and the jacket casing.
Carefully pry off the outlet flow cowl.

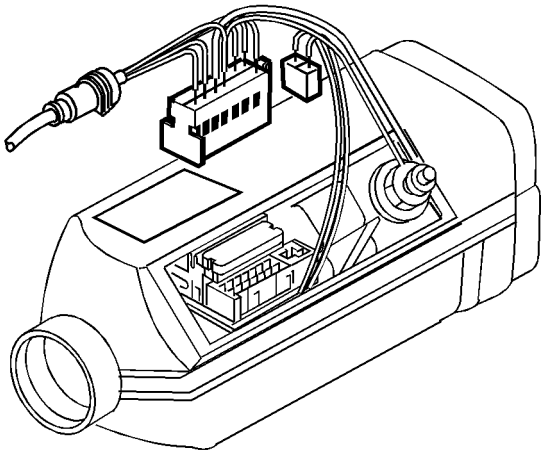
3



W8002532

Tap a small drift through the pin.

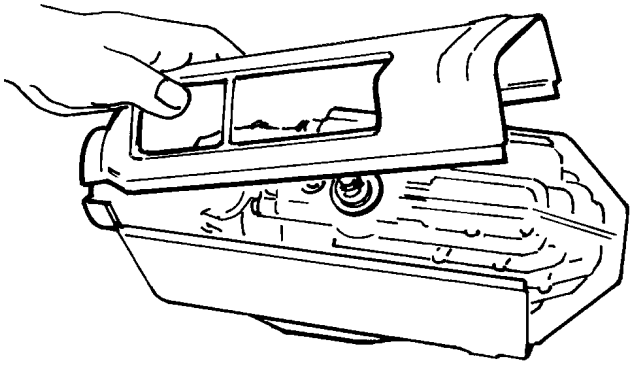
4



T8008045

Disconnect the connectors from the control unit.

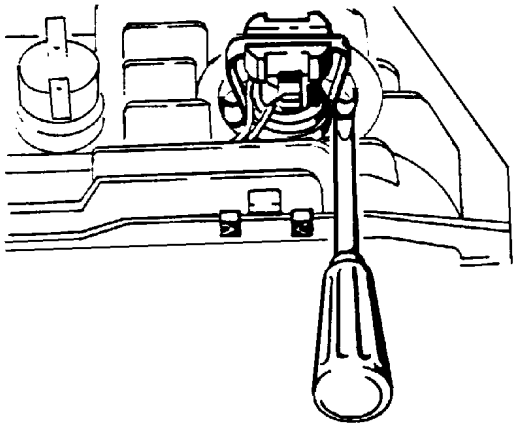
5



T8006985

Lift off the jacket casing.

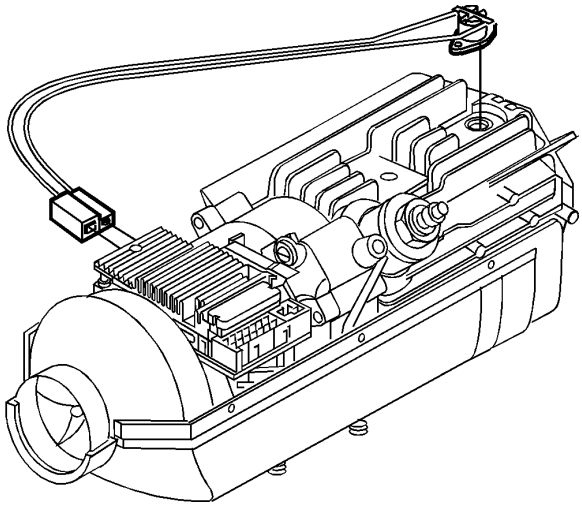
6



T8006988

Lift off the retaining spring as well as the spacer.

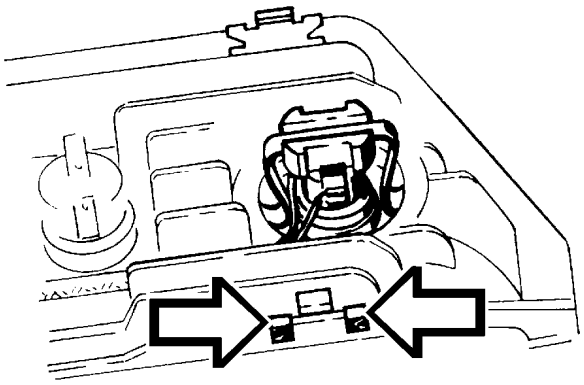
7



T8008049

Disconnect the connector from the control unit and lift out the flame detector.

8

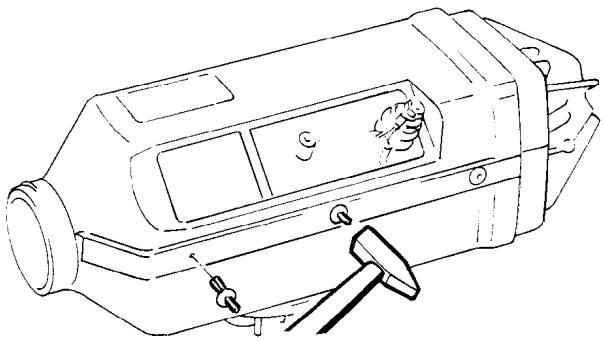


T8006989

Spacer clamps for the jacket casing.

When assembling the flame sensor, check that the spacer clamps are intact.

9



W8002533

When assembling, use a new rivet.

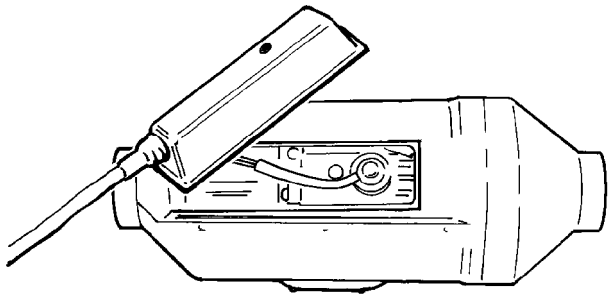
8759-03-05-02 Heat Exchanger Seals, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.

Note: Heater unit removed from vehicle. See “Air Heater, Removal” page 44

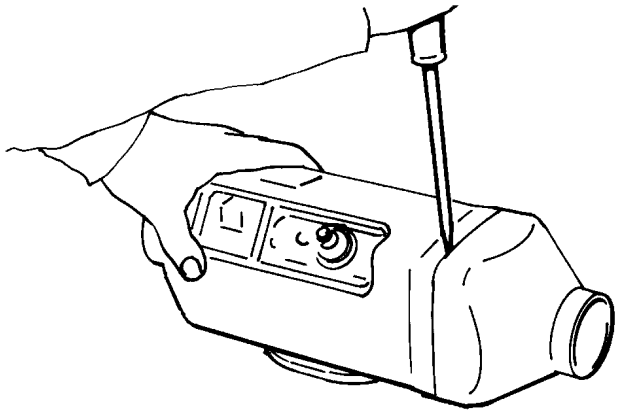
1



W8002528

Remove the access cover.

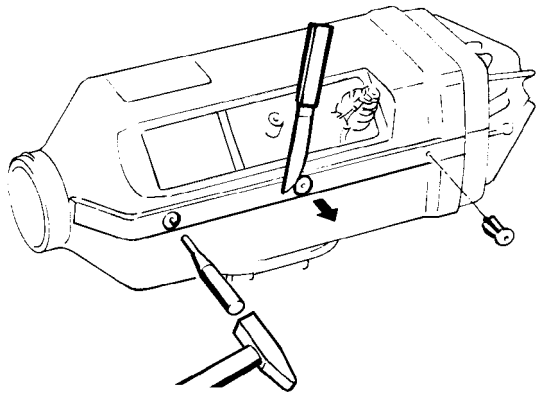
2



T8006993

Insert a screwdriver between the outlet flow cowl and the jacket casing.
Carefully prise off the outlet flow cowl.

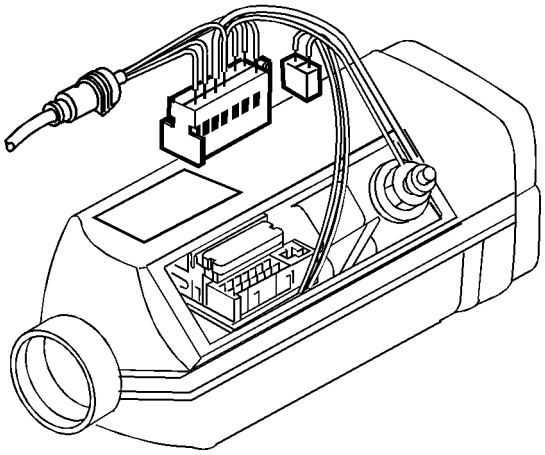
3



W8002532

Tap a small drift through the pin.

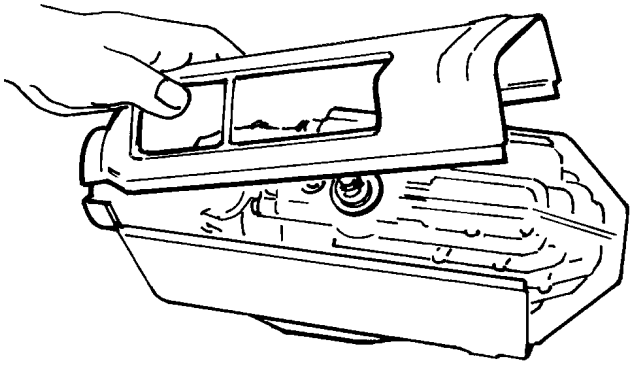
4



T8008045

Disconnect the connectors from the control unit.

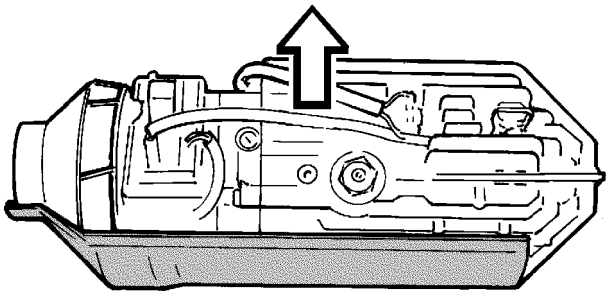
5



T8006985

Lift off the jacket casing.

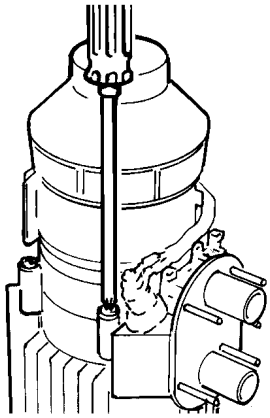
6



T8006990

Lift the heater out of the lower part of the jacket casing.

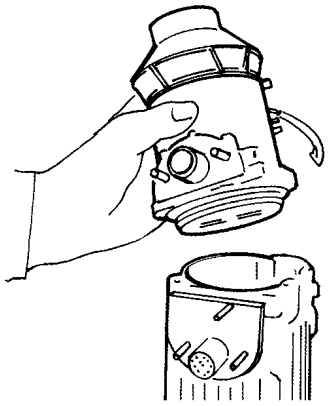
7



T8006995

Unscrew the attaching bolts that are located round the heat exchanger.

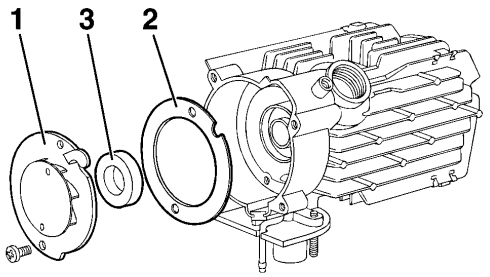
8



T8006996

Lift off the fan.

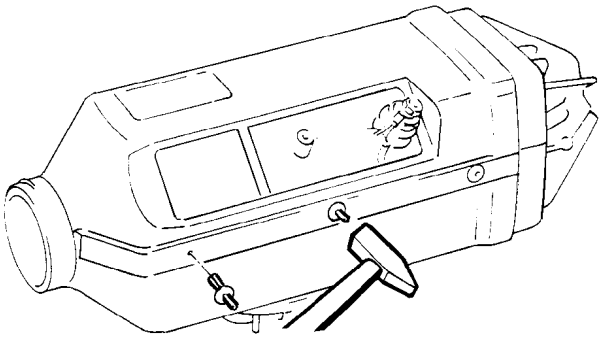
9



T8006994

Unscrew the flange (1) from the heat exchanger. Install new seals (2) and (3) (see figure).

10



W8002533

When assembling, use a new rivet.

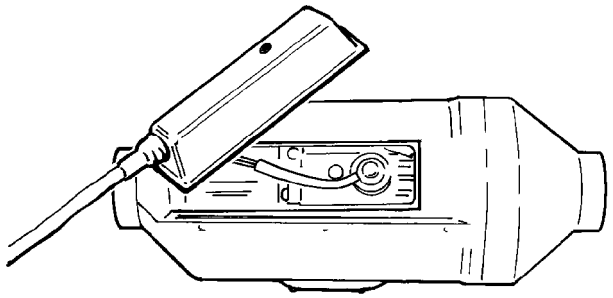
8759-03-05-01
Air Heater Fan Seal, Replacement

CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.

Note: Heater unit removed from vehicle. See “Air Heater, Removal” page 44

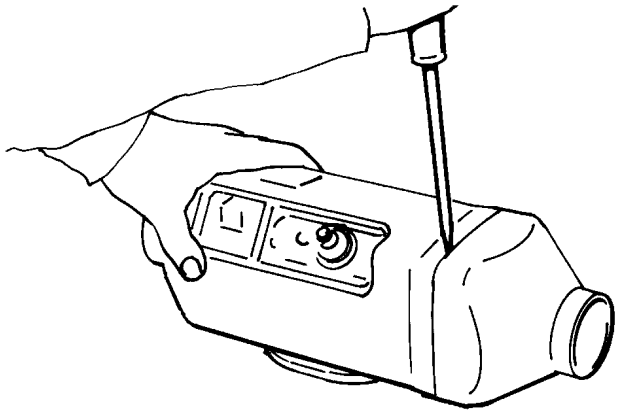
1



W8002528

Remove the access cover.

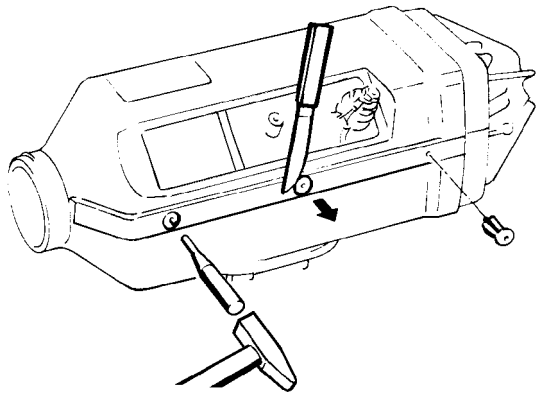
2



T8006993

Insert a screwdriver between the outlet flow cowl and the jacket casing. Carefully pry off the outlet flow cowl.

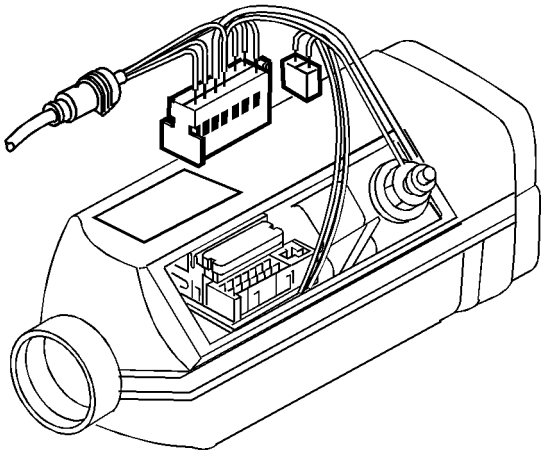
3



W8002532

Tap a small drift through the pin.

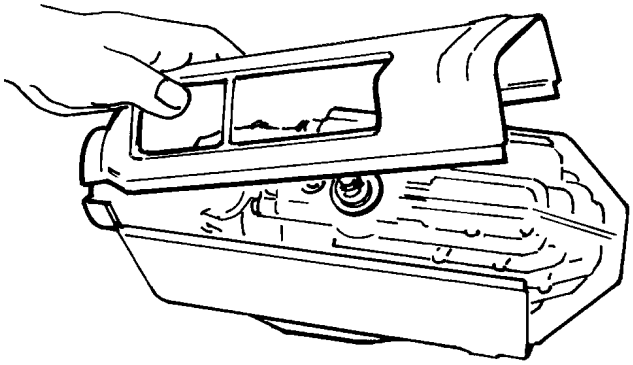
4



T8008045

Disconnect the connectors from the control unit.

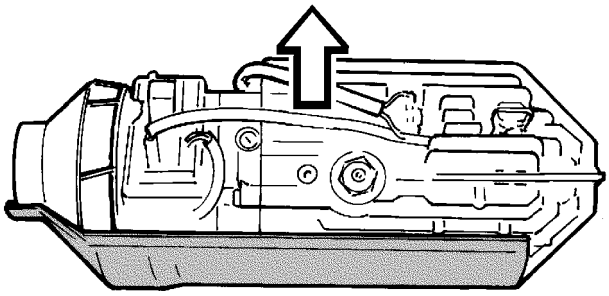
5



T8006985

Lift off the jacket casing.

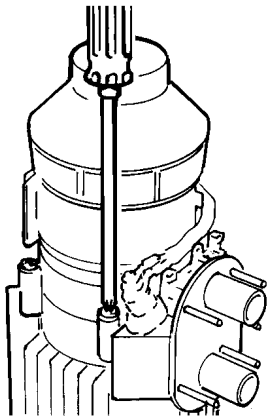
6



T8006990

Lift the heater out of the lower part of the jacket casing (heater unit removed from vehicle).

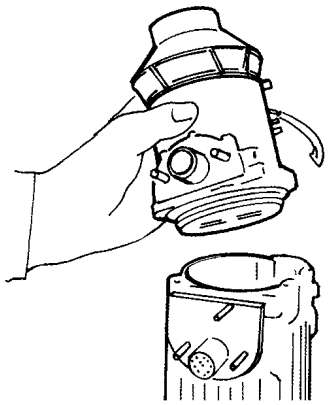
7



T8006995

Unscrew the attaching bolts that are located round the heat exchanger.

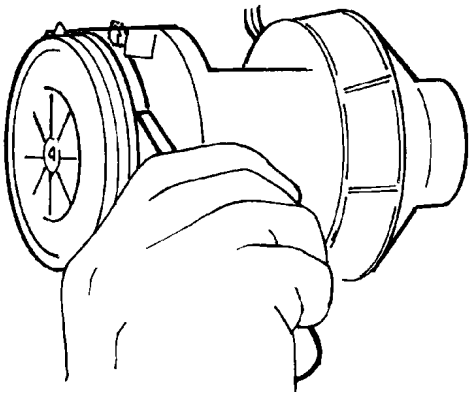
8



T8006996

Lift off the fan.

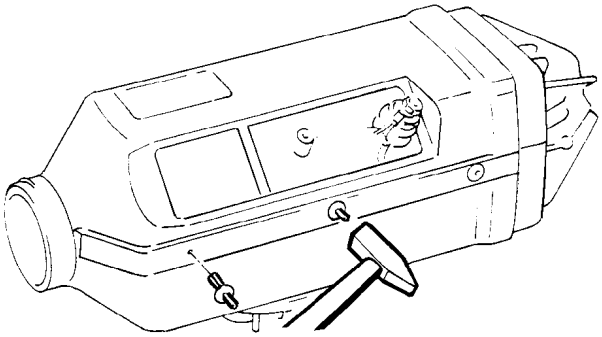
9



T8006997

Scrape off the old seal from the fan flange. Install a new seal (self-adhesive).

10



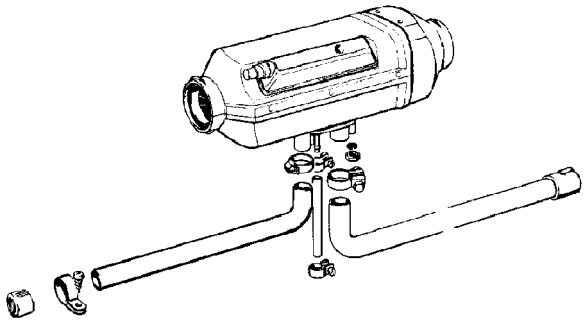
W8002533

When assembling, use a new rivet.

8752-01-02-01
Air Heater, Removal

⚠ CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.



W8002574

Fig. 2: Air Heater mounting

1
Remove the storage compartment heater shield.

12 mm socket
T#25 socket

2
Disconnect the wiring harness connectors.

3
Loosen hose clamps on duct work and remove

7 mm socket
10mm socket

4
Remove the four parking heater mounting nuts

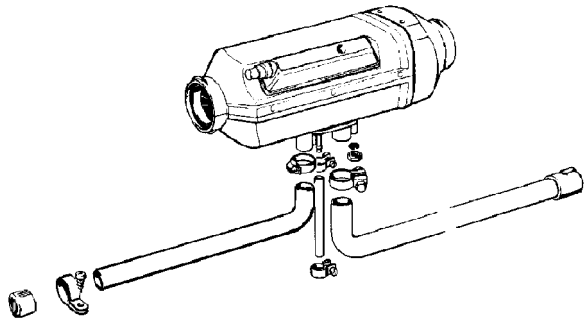
10 mm socket

5
Lift the parking heater up and out from its mounting location. Disconnect fuel line, then remove from the vehicle.

8752-02-02-01
Air Heater, Installation

⚠ CAUTION

Before beginning this service procedure, be sure to read and understand “General Service Precautions” page 30.



W8002574

Fig. 3: Air Heater mounting

1
Inspect the gasket between heater and truck floor. If it will not provide a good seal, replace the gasket.

2
Install the parking heater into its mounting location.

3
Connect fuel line.

4

Install the four mounting bolts and torque to 10 ± 1 Nm (7.5 ± 0.7 ft-lb).	10 mm socket torque wrench 10 ± 1 Nm (7.5 ± 0.7 ft-lb)

5

Install exhaust pipe and torque clamp.	10 mm socket torque wrench

6

Install intake pipe and torque clamp	7 mm socket torque wrench

7
Connect the two wiring harness connectors

8

Put hose clamp on duct work (supply heat &return air) and install torque clamps.	7 mm socket torque wrench

9

Install storage compartment heater shield and torque bolts and screws.	12 mm socket T#25 socket

System Check

Air Heater, Maintenance

The heater should be started regularly even during the summer period (at least once per month) and then be in operation for at least 15 min.

Once a year the heater should be cleaned on the outside from dirt and dust.

Note: Do not hose down with water.

Checks and Inspection

Check the following once a year:

- all electrical connections
- electrical cables with regard to damage caused by short circuiting
- that the heater fuse is intact
- the exhaust line with regard to damage, attachment and free through-flow
- that the exhaust pipe does not come out in the vicinity of the cab ventilation
- the combustion air lines and the air intake silencer with regard to damage (abnormal bends) and free through-flow
- all fuel lines and fuel connections with regard to leakage, dry cracks and proximity to warm parts
- all fuel filters, dosage pump with pressure equalisers with regard to leakage, change of filter in the fuel pump
- fuse, overheating sensor, see “Check of Components” page 48
- that the heater ventilation not is clogged
- that the heater is sealed against the sealing surface at the cab floor (air heater)
- Start the heater and check that the heater functions smoothly without any malfunction
- that the vehicle’s fan operates when the heater is in use (applies to certain models)
- Check glow plug, change glow plug strainer (air heater), see “Air Heater Glow Plug Screen, Replacement” page 32

Check of Components

Fuel Consumption, Checking

Preparation

1 Connect the multimeter 9510060 to 5 and 11 on the control unit, without disconnecting the connector.

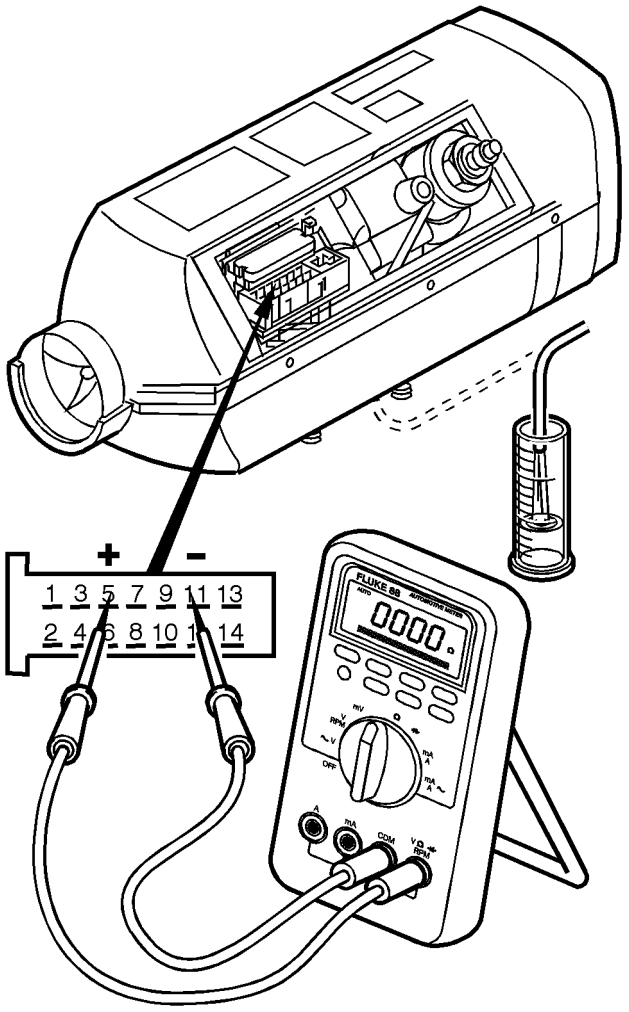
2 Start the heater, check that the value lies within the operating range 10.5–15.9 Volts. Stop the heater.

3 Pull the fuel line off from the heater. Insert the hose into a 10 ml measuring glass.

4 Start the heater, wait 35–65 seconds until the fuel metering pump begins pumping fuel.

5 If the fuel flows out at a steady rate without any air bubbles, the hose is filled and vented.

6 Stop the heater. Empty the measuring glass. Insert the fuel line into the measuring glass.



T8008032

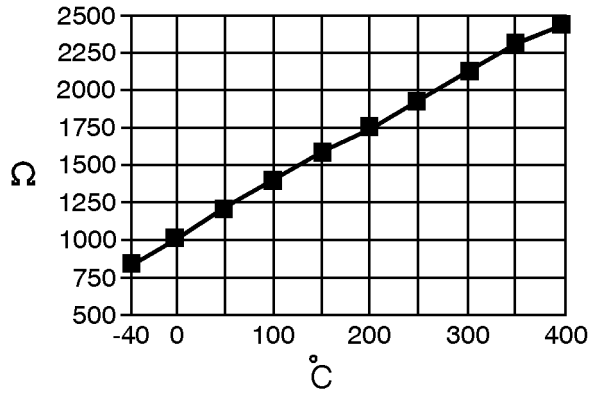
Measurement

1 Start the heater, keep the measuring glass level with the glow plug, wait 45 seconds until the fuel metering pump begins pumping fuel.

2 After approx. 90 seconds, the fuel supply is switched off. Switch off the heater.

3 Read off the level in the measuring glass. Check that the amount of fuel lies within the limits of 3.4 ml and 4.65 ml. If it lies outside, the fuel metering pump must be replaced.

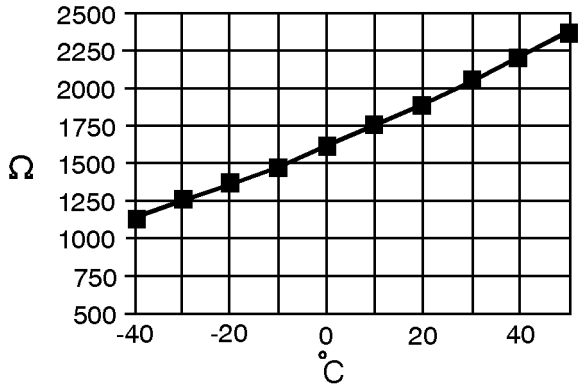
Flame Sensor, Checking



T8008154

The flame sensor's resistance (Ω) at various temperatures

Overheat Sensor, Checking



T8008155

The overheat sensor's resistance (Ω) at various temperatures

Feedback

One of our objectives is that workshop personnel should have access to correct and appropriate service manuals where it concerns fault tracing, repairs and maintenance of Volvo trucks.
In order to maintain the high standards of our literature, your opinions and experience when using this manual would be greatly appreciated.
If you have any comments or suggestions, make a copy of this page, write down your comments and send them to us, either via telefax or mailing directly to the address listed below.

To

Volvo Trucks North America, Inc.

Dept. 516 Service Publications

7825 National Service Road

P.O. Box 26115

Greensboro, NC 27402-6115

USA

Fax (336) 393-3170

From

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Comments/proposals

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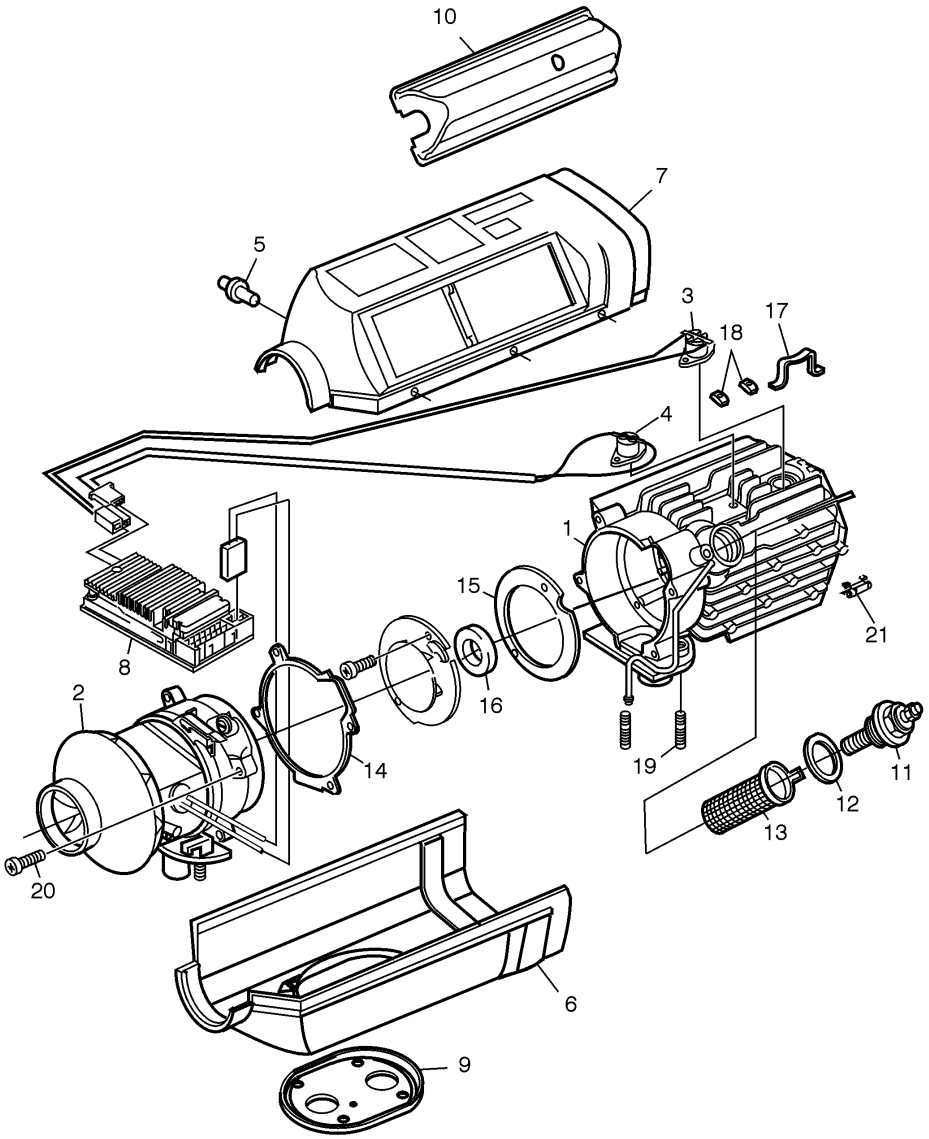
Concerns Service Manual: .....



W8002535

D1LCC

1	Heat exchanger	12	Gasket
2	Fan	13	Glow plug strainer
3	Flame detector	14	Gasket
4	Overheating protection sensor and harness	15	Sealing plate
5	Expansion rivet	16	Sealing ring
6	Jacket casing, lower	17	Brace
7	Jacket casing, upper	18	Securing clips
8	Control unit	19	Stud
9	Gasket	20	Bolt
10	Casing	21	U-brace
11	Glow plug		

Foldout A

Air Heater

Operation Numbers

Volvo Trucks North America, Inc.
P.O. Box 26115, Greensboro, NC 27402-6115
Volvo Trucks Canada, Ltd.
6490 Vipond Drive, Mississauga, Ontario L5T 1W8
http://www.volvotrucks.volvo.com

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