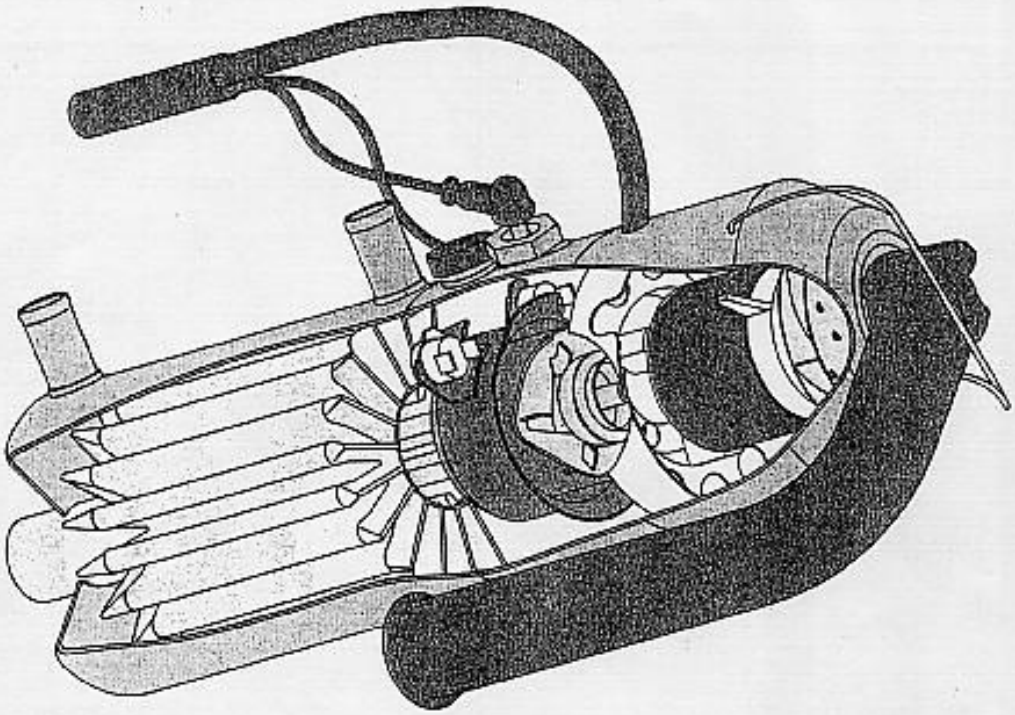
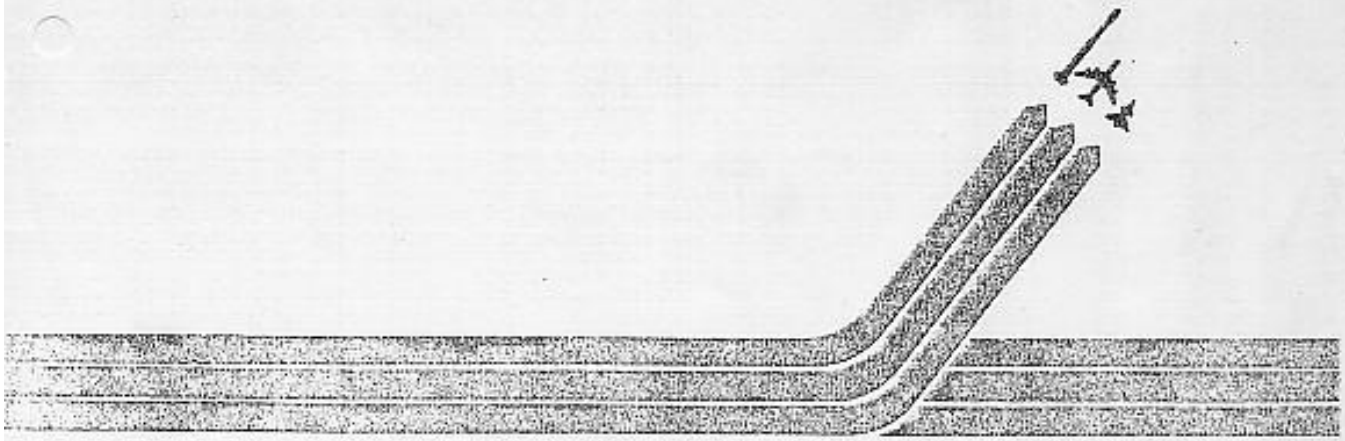
Service Manual

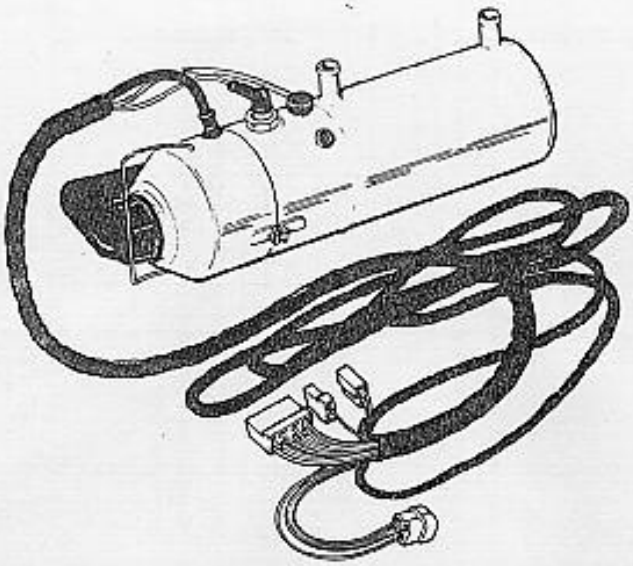
091-B, 12V 091-D, 12V 091-D, 24V





VFA 3714932 August 1988

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The vehicle heater is available in three different versions, one for petrol operation, 091-B and two for diesel operation, 091-D for 12 and 24 volts.

The parking heater is a water heater. It is connected to the vehicle's cooling system, fuel system and electrical system.

It heats the coolant in the engine and the vehicles own heater. Heat is transferred to the passenger compartment by the heater fan.

Specifications

Type	091-B	091-D 12 V / 24 V
Model	Water	Water
Heats	Engine/cab	Engine/cab
Output	4 700W	4 700W
Fuel	Petrol (including leadfree)	Diesel
Fuel consumption	0.65 L/h (continuous operation)	0.6 L/h (continuous operation)
Power consumption	30W (exc. heater fan)	30W (exc. heater fan)
Voltage	12V	12V / 24V
Range	10–14V	10–14V, 20–28V
Operating temperature	–40 – +80°C	–40 – +80°C
Water pump flow rate	750 L/h	750 L/h / 960 L/h
Flame sensor resistance dark illuminated	 more than 50 000 ohms less than 15 000 ohms	 more than 50 000 ohms less than 15 000 ohms
Fuel pressure, average	1000 mm VP	1000 mm VP
Current consumption, ignition	13.5 A	13.5 A / 9.5 A
Weight, inc. water	3.7 kg	3.7 kg
Size: length diameter	 325 mm 102 mm	 325 mm 102 mm

Wax point of diesel fuel should not be higher than operating temperature.

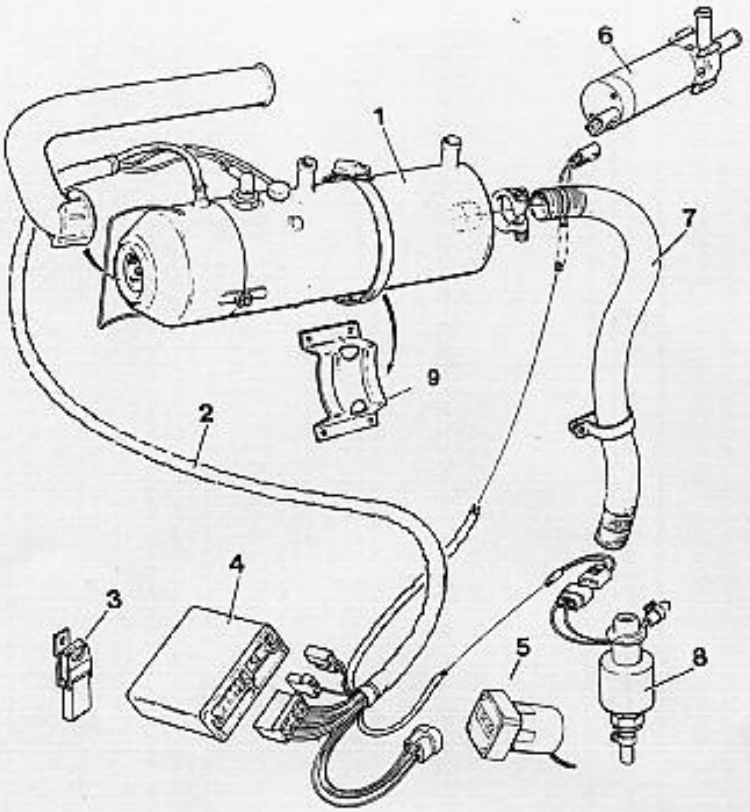
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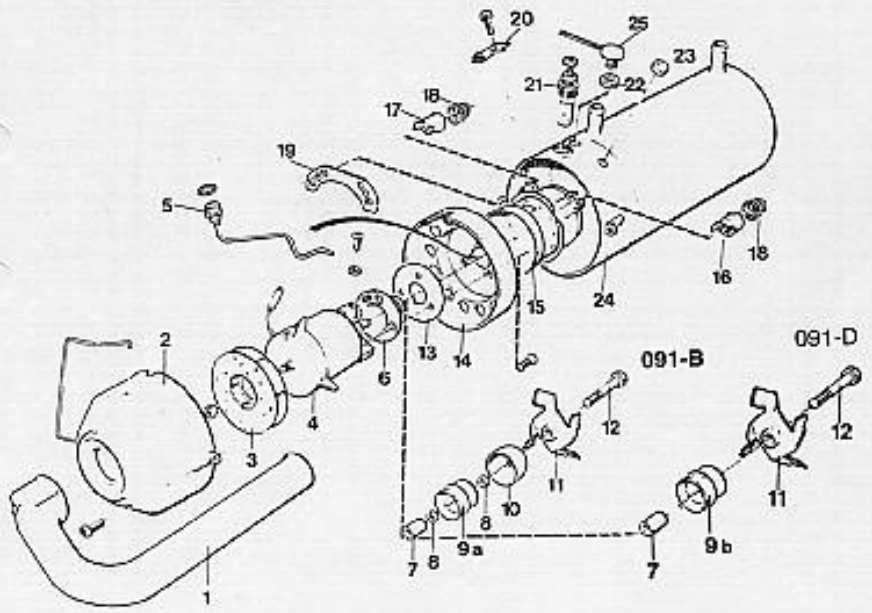
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Heater – main components



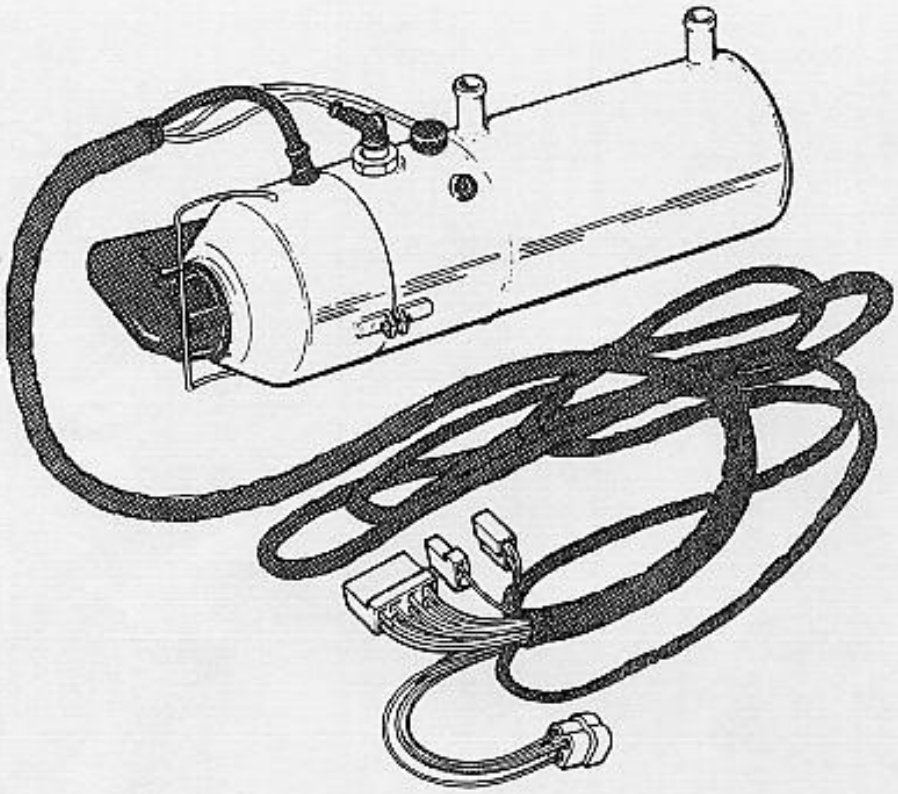
1 Heater unit
2 Cable harness
3 Fuse + Fuse holder
4 Control unit
5 Timer
6 Water pump
7 Exhaust hose
8 Fuel pump
9 Bracket

Heater components



1 Fan inlet
2 Fan casing
3 Fan
4 Fan motor (type 1)
5 Fuel pipe
6 Plate
7 Spacer (only for type 1 motor)
8 Washer
9 Fuel atomizer a 091-B b 091-D
10 Outer cup
11 Turbulator
12 Screw
13 Insulation washer
14 Motor mounting
15 Combustion chamber
16 Overheating thermostat
17 Operating thermostat
18 Spring
19 Plate
20 Fuel nipple Bracket
21 Glow plug
22 Bush
23 Seal
24 Heat exchanger
25 Flame sensor

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Once the timer switches on the starting circuit, the control unit activates the following components: water pump, car heater fan and parking heater glow plug.

After about 50 seconds the control unit activates the fuel pump and fan motor. Fuel is then injected into the combustion chamber where it is ignited. When the intensity of the flame is sufficiently great, the flame sensor sends a signal to the control unit which deachtivates the glow plug.

Exhaust gases from the combustion chamber are directed past a heat exchanger in which engine coolant is circulating. A thermostat controls coolant temperature and interrupts heating should the temperature rise to 90°C. It restarts combustion when the temperature drops to 60°C.

If heating is interrupted inadvertently, the flame sensor sends a signal to the control unit to re-activate the glow plug and restart combustion.

The ignition cycle is engaged for max. 90 sec.

If the heater does not fire within this time the timer automatically switches off the heater.

Operating time is one hour, at which point the timer automatically switches off the heating. It is also possible to switch off or on the heating manually.

When heating has stopped the fan continues to run for about 100 seconds to evacuate any combustion gases.

Control unit 3714412, 12V / 3714413, 24V

When a first start of the heater fails (not interrupted in advertently) it restarts again a second time.

If the temperature of the heater becomes too high a overheating thermostat de-activates the fuel pump, and automatically switches the heater off. Once activated the overheating thermostat can be reset when cold by depressing a reset button on the thermostat.

The evacuation cycle is not activated if the heater is switched off within 5 seconds.

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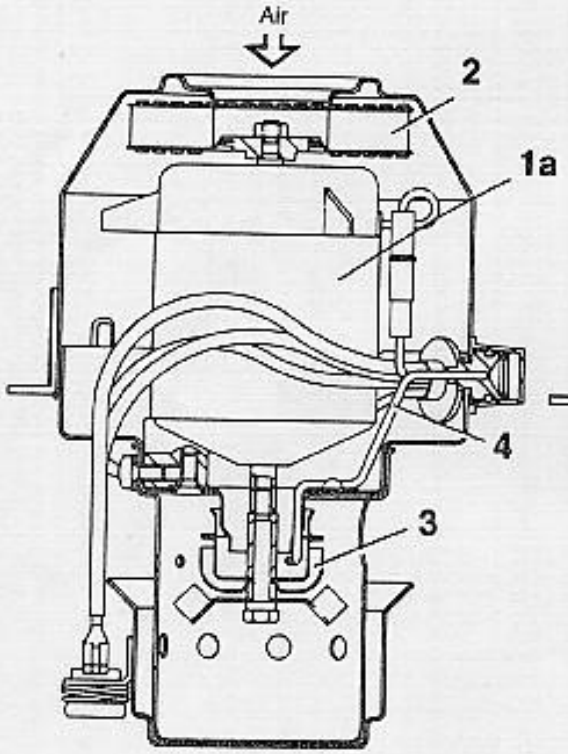
Burner unit

The burner unit contains an electric motor fitted with an fan wheel, which draws air into the combustion chamber through the fan intake.

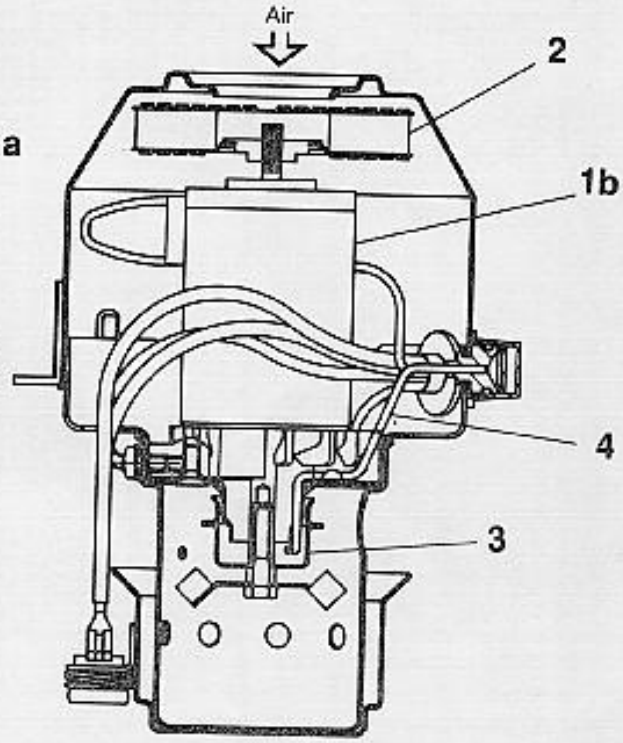
A rotating fuel atomizer is fitted on the other end of the motor shaft.

Fuel is supplied by means of a fuel pump and a fuel tube.

Two different types of motor types can be used in the burner unit.



091-B



091-D

1. Electric motor a) type 1. b) type 2.
2. Fan wheel
3. Atomizer
4. Fuel tube

Type 091-B and 091-D parking heaters are equipped with the same type of burner unit except the atomizer system.

Fan speed: 12/24V

Fan motor (non rigid) with fan wheel: 7200 ± 500 r/min

Fan motor/burner unit mounted in heater:

a) Cold heater 6700 r/min

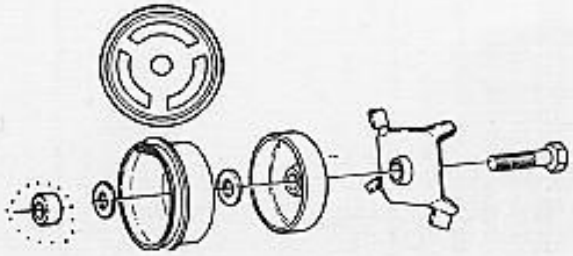
b) In function after 10 min: 6900 r/min

To ensure good combustion the fan speed shall not be lower than indicated revolutions.

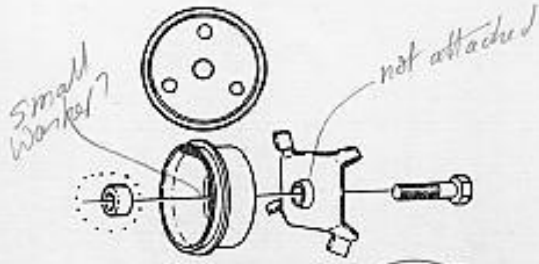
Power consumption: 15 W

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Fuel atomizer



Fuel atomizer, type 091-B type 2 motor



Fuel atomizer, type 091-D type 2 motor

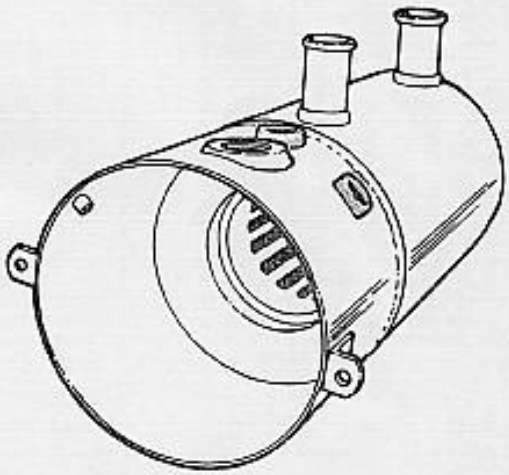
Note: Fan motor type 1 add spacer 

Note: For motor type 1 add spacer 

The fuel atomizer and outer cup are mounted on the fan drive shaft. The turbulator mixes air and fuel before combustion.

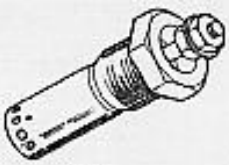
Different burnor components are used for type 091-B and 091-D units because of the different characteristics of the fuel being supplied.
Look at illustrations above.

Heat exchanger

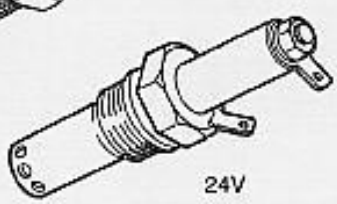


The heat exchanger is made of stainless steel. The internal part is star shaped and welded to the outer casing.

Glow plug



12 V



24V

The glow plug is special made for 091-heater.
Current consumption: 12 V ≃ 11 A
24 V ≃ 8 A

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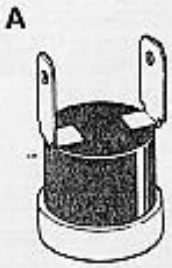
Flame sensor



The flame sensor contains a light sensitive transistor, the resistance of which drops when light shines onto it. The drop in resistance is signalled to the control unit which cuts off the flow of current to the glow plug.

Note! The flame sensor is polarity sensitive.

Operating thermostat, overheating thermostat





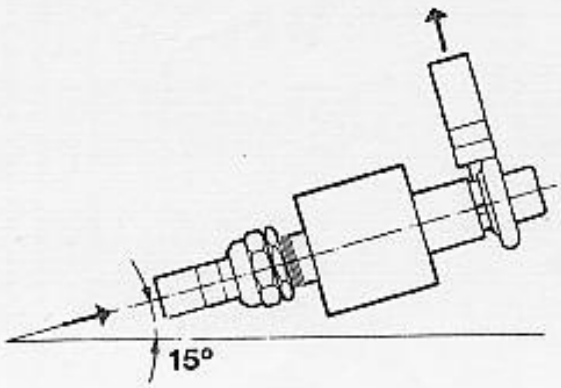
Operating thermostat (A)
Regulates water temperature by switching off current to combustion unit at approx. 90°C, and switching it on again at approx. 60°C.

Overheating thermostat (B)

The thermostat is of the bimetallic type. It is activated at approx. 115°C, a temperature which could be reached when the operating thermostat malfunctions or coolant level is too low.

To reset the thermostat depress knob (1) when cold.

Fuel pump



The fuel pump is of the piston type. It contains a pressure equilizer and a relief valve which maintain a constant line pressure, regardless of varying counterpressures.

The pump should be mounted vertically or at a 15° angle.

The outlet should be at the top if the pump is installed at 15°.

Note: 091-B and 091-D parking heaters are not equipped with the same type of pump. Always use genuine replacement pumps.

Suction capacity, empty pump ≤ 1 m
Max pressure height – 2500 mm fuel column
Power consumption approx. 2W

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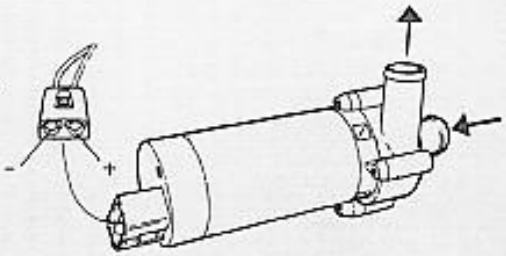
Water pump

The water pump is of the centrifugal type.

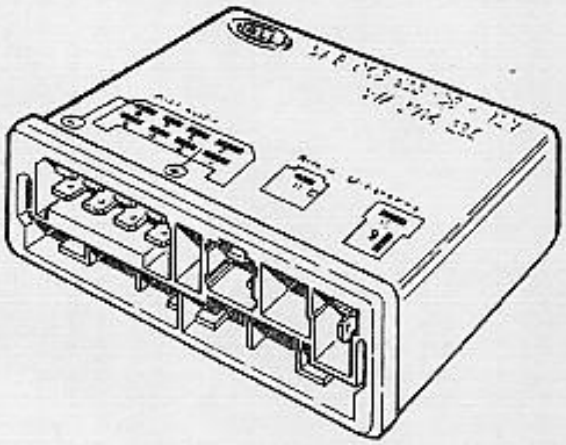
It pumps coolant through the parking heater heat exchanger.

Capacity: 12V, 750 L/hr. at 0.1 bar
24V, 960 L/hr. at 0.15 bar

Power consumption: approx. 10W



Control unit



The control unit is connected to the parking heater components by a wiring harness.

Three relays are incorporated in the control unit, and are connected to the fan motor, glow plug and water pump/main heater fan.

Control unit circuits:

- starting circuit. The fan motor and fuel pump are activated for one second to check their condition. The overheating thermostat is also checked.
- low voltage protection circuit. The fuel pump and parking heater are switched off if voltage drops to below 9.5V (19.0 Volt for 24V heaters).

The following time-delay circuits are also incorporated in the control unit:

50 second circuit

The glow plug is energized for 50 seconds. After this the fuel pump and fan motor are switched on.

90 second circuit

Maximum time the glow plug is heated. If combustion has not started by this time the flame sensor signals the control unit to switch off the parking heater.

100 second circuit

After the parking heater has been switched off the fan continues to evacuate exhaust gases for 100 seconds.

Two different types of control unit are in use:

A. Control unit incorporating a circuit to attempt one start only (P/N 37114225) 12V, P/N 3714226, (24V).

B. Control unit incorporating a circuit to attempt two starts only (P/N 3714412) 12V, 3714413, 24V.

Variation of fuel pump frequency with voltage

Voltage	Switching voltage	Above	Below
12V / 24V	11V / 22V	3.05 Hz	2.56 Hz

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Timer

The timer is a microcomputer-controlled digital clock with the following functions:

- 24-hour clock function
- Manual starting and shut-off of the heater
- Automatic starting of the heater with three independent setting times.

When the ignition is switched on, the timer shows the time of day.

When the ignition is switched off, the time display will be extinguished after around 20 seconds. But the time will be held in the memory until the ignition is switched on again.

Description

1 Manual starting and shut-off of the heater
2 Pre-setting of starting times
3 Time-setting (forward)
4 Time-setting (backward)
5 Button for setting time of day
6 Three indicator lamps for starting time
7 Indicator lamp (lights up when the heater is running)
8 Display, which presents the following information:
- time of day
- pre-set starting time
- running time remaining

When the ignition is switched on, the display (8) indicates the time.

Time setting

Press button (5) towards you and hold it while setting the time by means of buttons (3) and (4).

Parking heater timer

With this function the timer can be set to start at a chosen time, when you want a warm car.

Three different starting times can be set, for example one morning, one lunch and one evening time.

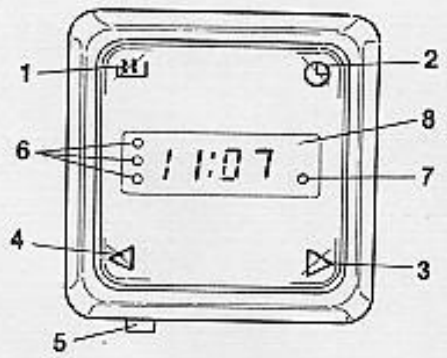
Heater timer setting

Press button (2). The first LED is lit. Desired starting time is set by pushing (4) or (3) buttons.

Press button (2) again. The next LED is lit. Set the time a.s.o.

Only with pre-set heater start

The heater timer can be activated after each operation by pushing button (2). Otherwise the heater will not start at the next pre-set time.



Direct start of parking heater

If you get into a cold car and want to start the heater right away, you press button (1). When the LED is lit the heater starts up and runs for 60 minutes.

When the heater runs the LED (7) flashes. At the same time the clock changes to show the remaining heater operating time.

The heater can be turned off by pressing the button (1) again.

NOTE! If the display shows 8888 the power supply has been disconnected. All pre-set times have then been erased.

Timer with 24 hours preset

Setting, 24-hour pre-selection (24V)

Press the desired pre-setting time 1, 2 or 3 by means of (2).

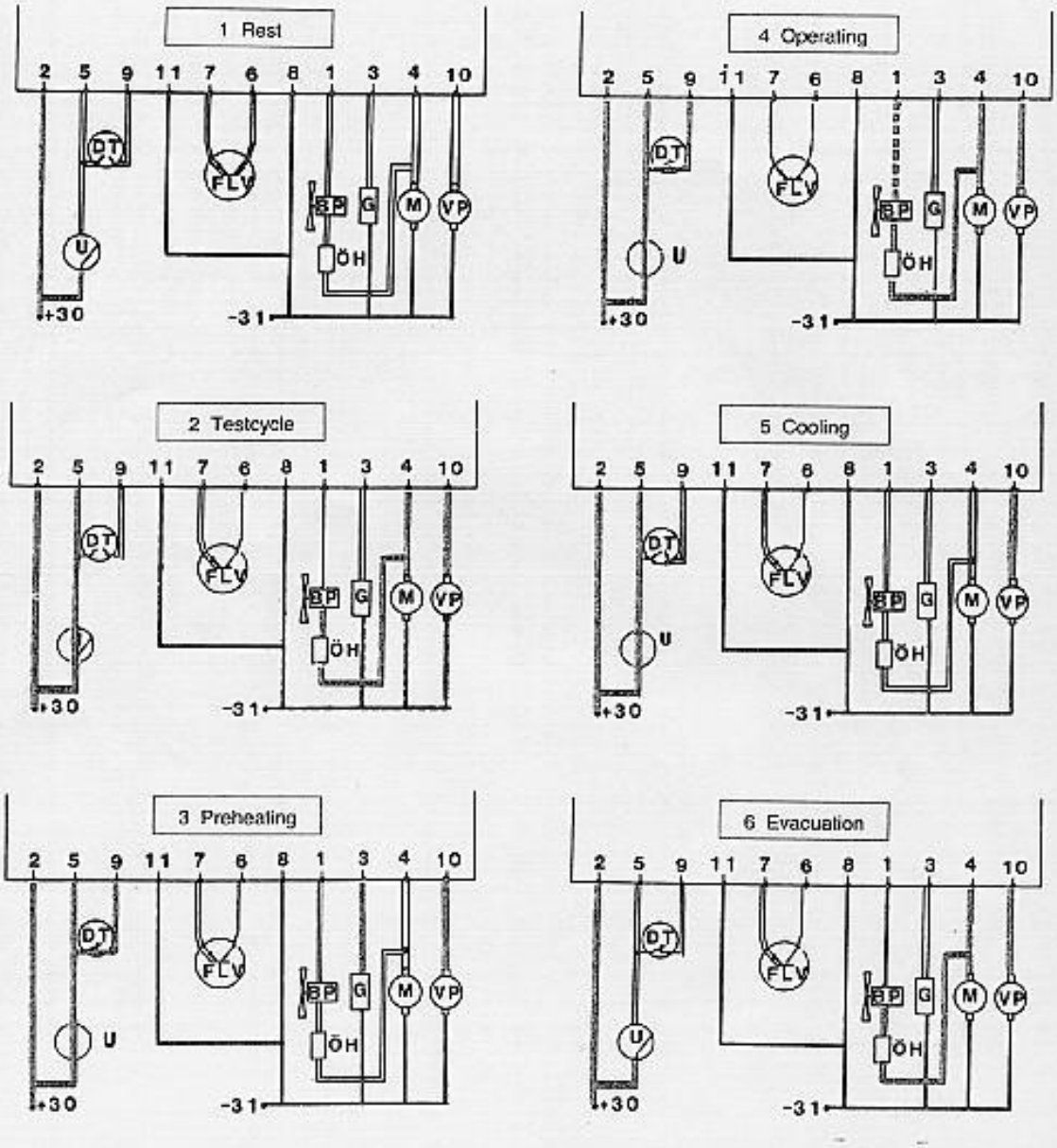
Then the desired 24-hour pre-selection (max 10 days and nights) can be set by means of the knob on the timer underside (5).

Pull the knob forward (towards you). For about 20 seconds, set time and 24-hour pre-selection time will flash alternately. When the 24-hour pre-selection shows 00, the heater will be in operation within the following 24 hours.

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Control unit, circuit diagrams

(Control units P/N 3714225, 314412, 12V
3714226, 3714413 24V

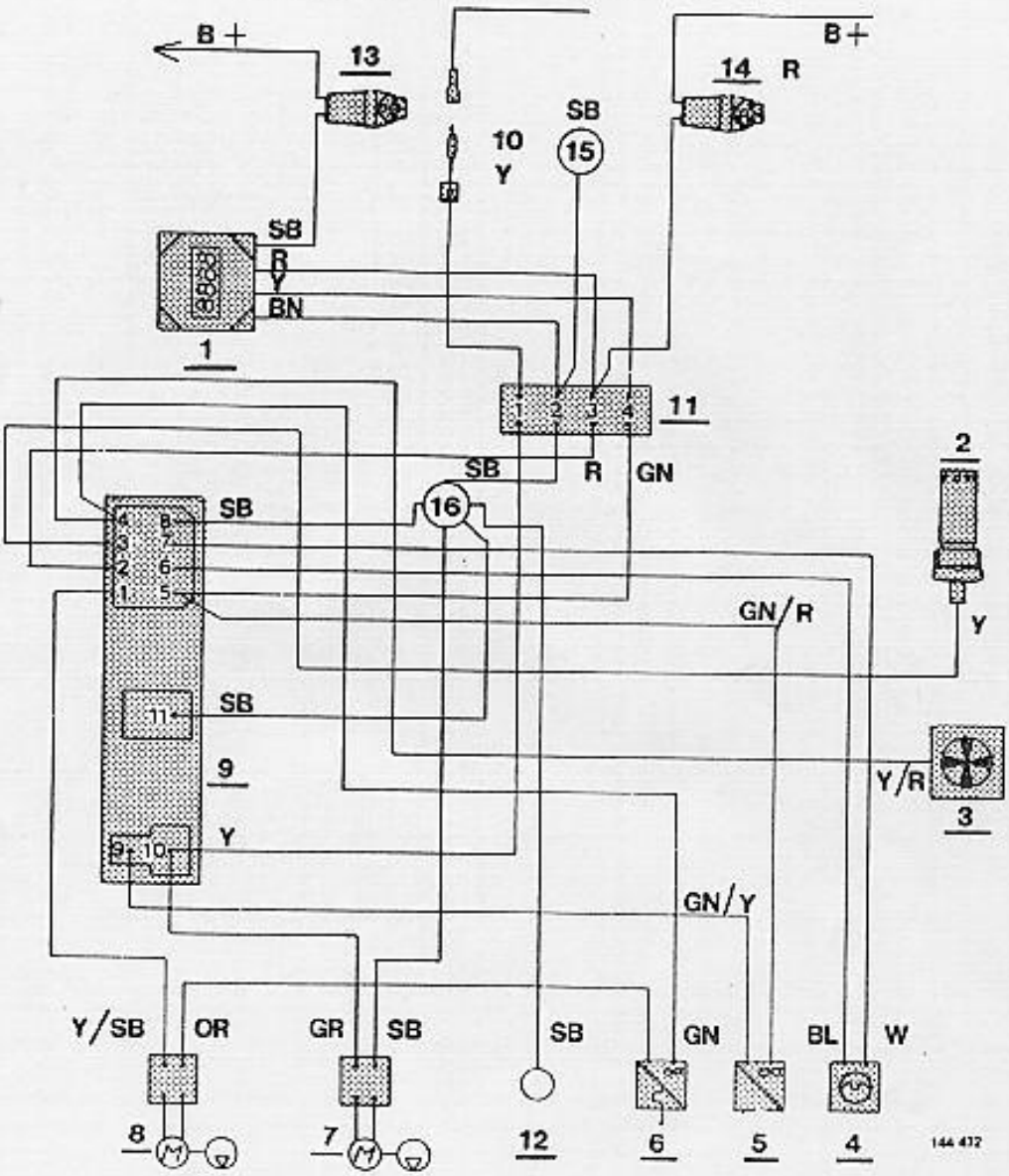


Designation	Component
BP	Fuel pump
U	Timer
ÖH	Overheating thermostat
DT	Operating thermostat
G	Glow plug
M	Fan motor
FLV	Flame sensor
VP	Water pump

= No voltage
= 12V
= Earth
= Earth pulse
= Flame sensor

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(Control units P/N 3714225-4, 3714412-2)



1 Timer
2 Glow plug
3 Fan motor
4 Flame sensor
5 Operating thermostat
6 Overheating thermostat
7 Water pump
8 Fuel pump
9 Control unit
10 Fan heater supply
11 Connector
12 Earth
13 Timer fuse
14 Parking heater fuse
15 Earth
16 Connector

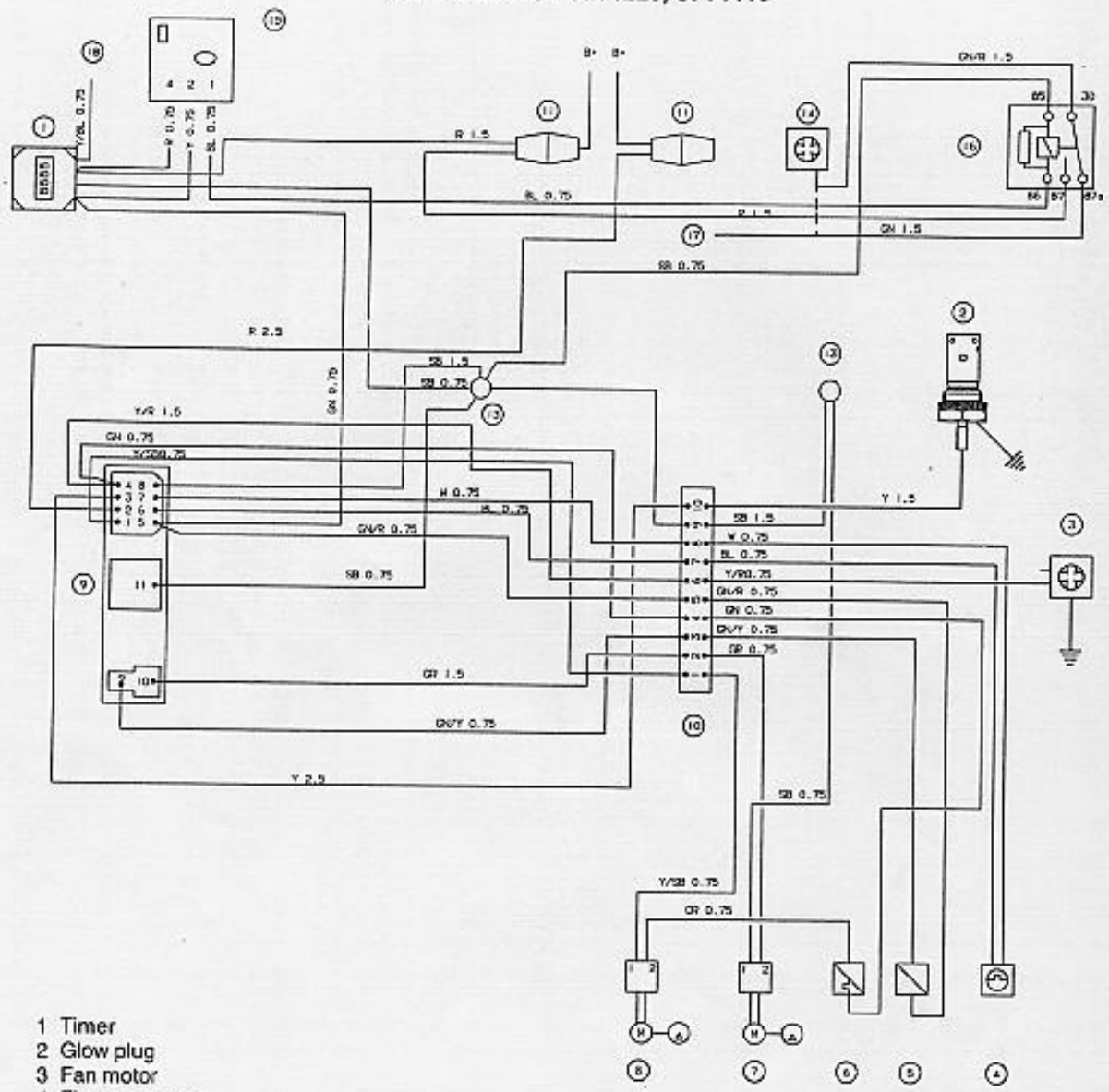
Colour codes

Orange	OR
Red	R
White	W
Blue	BL
Black	SB
Green	GN
Grey	GR
Yellow	Y
Brown	BN
Green/Yellow	GN/Y
Yellow/Red	Y/R
Green/Red	GN/R
Yellow/Black	Y/SB

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Wiring diagram 24V

Control unit P/N 3714226, 3714413



1 Timer
2 Glow plug
3 Fan motor
4 Flame sensor
5 Operating thermostat
6 Overheating thermostat
7 Water pump
8 Fuel pump
9 Control unit
10 Connector
11 Fuse
12 Plus side
13 Earth
14 Cabin fan
15 Cabine thermostat
16 Relay
17 Cabin fan cable harness
18 Display ignition

Colour codes

Orange	OR
Red	R
White	W
Blue	BL
Black	SB
Green	GN
Grey	GR
Yellow	Y
Brown	BN
Green/Yellow	GN/Y
Yellow/Red	Y/R
Green/Red	GN/R
Yellow/Black	Y/SB

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VFA 3712684

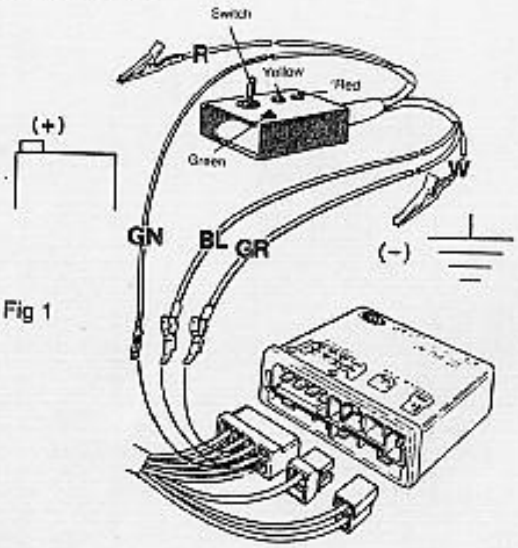


Fig 1

VFA 3714099

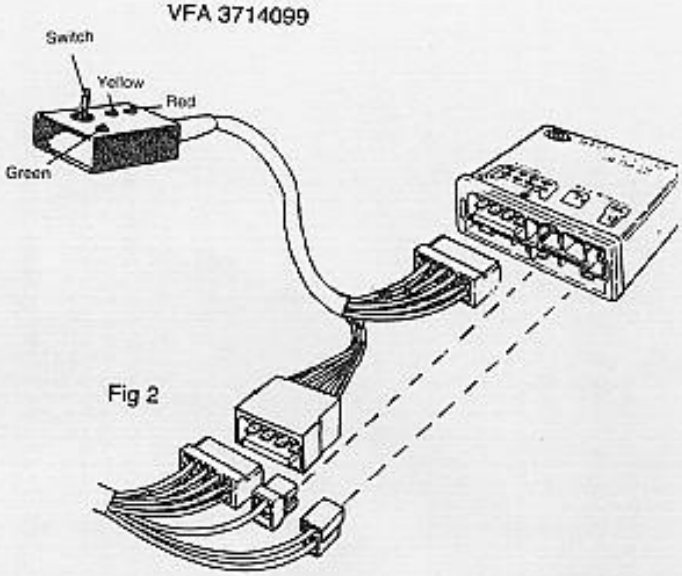


Fig 2

Fault tracing sequence

Test unit P/N 3712684 (alt. 3714099) should always be used when testing the parking heater.

1. Connect test unit, see above.
2. Start parking heater with test unit.
3. Determine type of fault, see below.
4. Rectify according to fault tracing chart.
5. Restart parking heater with timer and check function.

Faults

1. Parking heater does not start (no current to fans and indicator lamps).
2. Parking heater starts but does not ignite.
3. Parking heater ignites but goes out after 90 sec.
4. Irregular combustion.

Test unit P/N 3712684. Fig. 1

Wire colour	Connect to
Grey (GR)	Control unit terminal 3 (glow plug)
Blue (BL)	Control unit terminal 1 (on motor and fuel pump)
Green (GN)	Control unit terminal 5 (timer)
Red (R)	Battery (+)
White (W)	Earth (–)

Test unit P/N 3714099 (Fig 2)

Disconnect the eight pin connectors from the main cable harness in the control box and connect the test unit.

Indicator lamp shows:

- ● on
- ○ off
- ◑ flashing
- ◒ slow flashing

Red glow plug live. If lamp is off, see fault tracing chart.

Yellow fan motor and fuel pump live.

Green parking heater on.

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Fault tracing chart, heater type 091

Fault class	Symptom	Lamps Red	Lamps Yellow	Cause	Check	Remedy
1	Parking heater does not start (no indicator lamps light up)	○	○	Blown fuse (A)	Check for short	Rectify. Fit new Fuse
				Overheating thermostat actuated	Check: Opening temperature of overheating thermostat Operating thermostat Check water system for vapour locks Water pump Fuel flow	Fit new thermostat Fit new thermostat Bleed Fit new pump Faulty fuel flow Change fuel pump
				Flame sensor shorted (A)	Resistance of flame sensor in dark should be more than 50 kΩ	Fit new flame sensor
				Defective timer (A)	Check for short	Fit new timer
				Defective wiring harness	Check for break, oxidation, earth connection	Rectify
	Water pump and in-car heater function			Engine temp. above 60°C (A)		Wait until temp. drops 60°C
2	Parking heater starts but does not ignite (indicator lamps light up but safety circuit switches heater off and cooldown phase starts)	●	○	Defective glow plug	Visible check	Fit new glow plug
		●	◑	Insufficient fuel		
		●	○		Check fuel pump	Replace
		●	◑		Check fuel line	Blow-clean. Replace if required
		○	●			
		○	○			
				Insufficient combustion air	Check for blockage of inlet or exhaust	Remove blockages
				Defective fan motor	Check fan speed varvat 7200 ± 500 rpm	Fit new fan motor
3	Parking heater ignites but is switched off by safety circuit	●	○	Flame sensor dirty	Check flame sensor glass	Clean with rag soaked in petrol
		●	◑	Flame sensor passage blocked	Check passage	Remove blockage
	(lamps usually come on but switched off by safety circuit-cool down phase starts)	●	○	Open circuit in the flame sensor	When parking heater ignites, short circuit wiring harness to flame sensor and check if combustion continues	Fit new flame sensor
		●	◑			
		○	●			
		○	○			
4	Rough combustion (red lamp flashes)	◒	◑	Insufficient fuel	See fault class 2	
				Insufficient combustion air	See fault class 2	
				Excessive fuel supply	Check fuel supply	Incorrect fuel flow Replace pump
				Blocked heat exchanger	Check exhaust	Clean and remove blockage
				Loose fuel distributor	Check distributor cups	Tighten or replace as required

NOTE! Control unit faults are not covered in the above diagnosis. If the parking heater does not function satisfactory despite carrying out the diagnosis, fit a new control unit and retest

(A) indicates no test programme frm control unit.

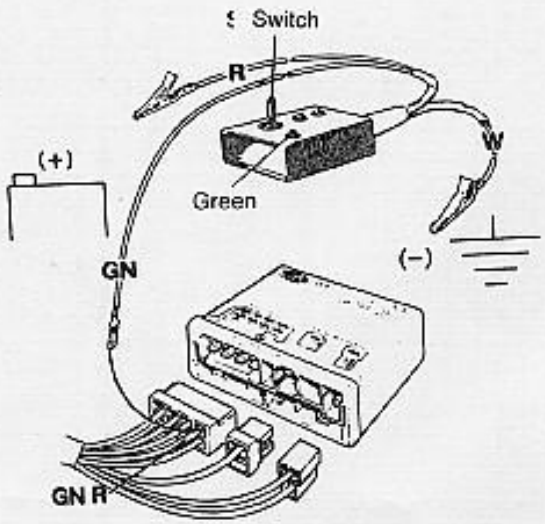
Indicator lamps ● On
○ Off
◑ Flashing
◒ Slow flashing

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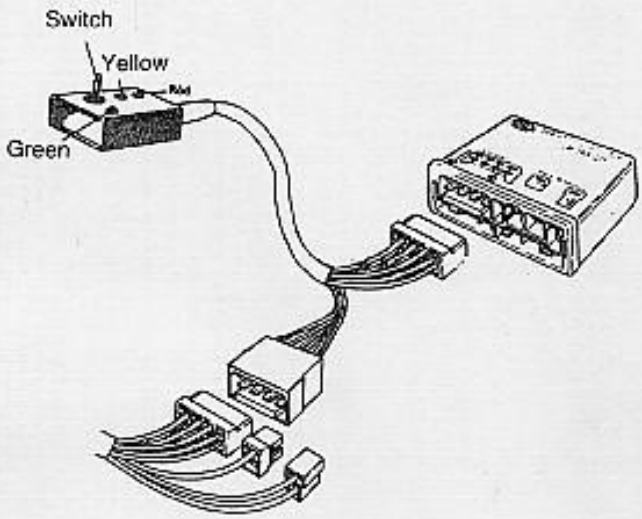
Fuel flow measurements

Measuring equipment P/N 3712196-9 alt. 3714696, should be used to check that the flow rate is according to specification. The equipment consists of a calibrated fuel pipe and a graduated measuring glass.

Test unit 3712684



Test unit 3714099



Make sure that the timer is connected and that the test instrument is switched off (i.e. pointing towards the green lamp).

Test unit 3712684

Connect the instrument as follows:

Red wire (R) to 12V battery.
White wire (W) to battery earth.
Green wire (GN) to pin 5 in control unit connector (large) (green/red wire (GN/R)).

Test unit 3714099

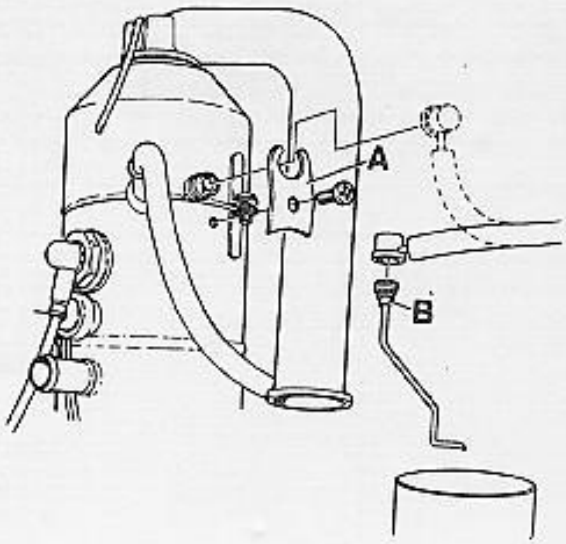
Connect as picture above.

Engagement of measure fuel pipe

Remove fuel pipe bracket (A) and disconnect fuel pipe.

Connect the calibrated fuel pipe (B) to the fuel line. Place pipe in a suitable container.

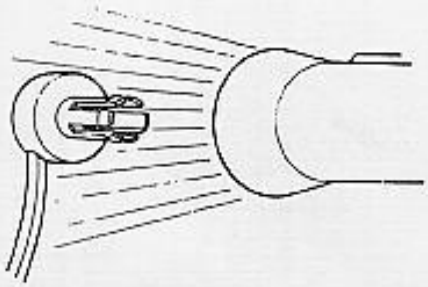
Start heater with the test instrument (green lamp should light up).

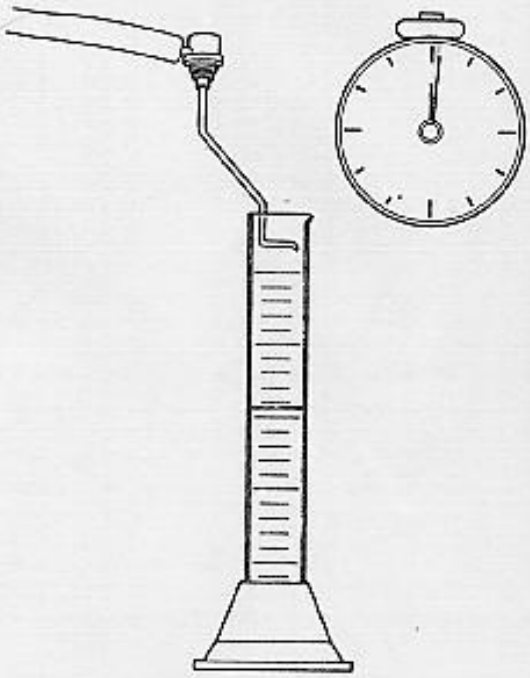


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Remove flame sensor when fan has started and fuel pump ticks. Shine torch on sensor.

Bleed air from the system thoroughly before taking measurements. Also make sure that the fuel spray is continuous and evenly distributed.





Measuring fuel flow

Note: Take measurements **after** the glow phase i.e. when fan speed has increased.

Place pipe in measuring cylinder and read off fuel level after one minute.

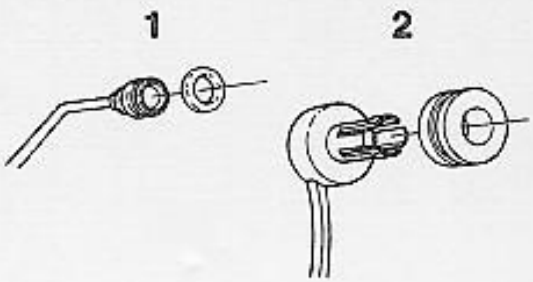
Note: Keep fuel away from glow plug.

Flow rate should be:

Type 091-B 10–11.5 ml/min
Type 091-D 9–10.5 ml/min

If fuel flow rate is not as specified, check for obstruction in fuel supply if this is in order, install a new fuel pump.

60ml = 6' 15" mm

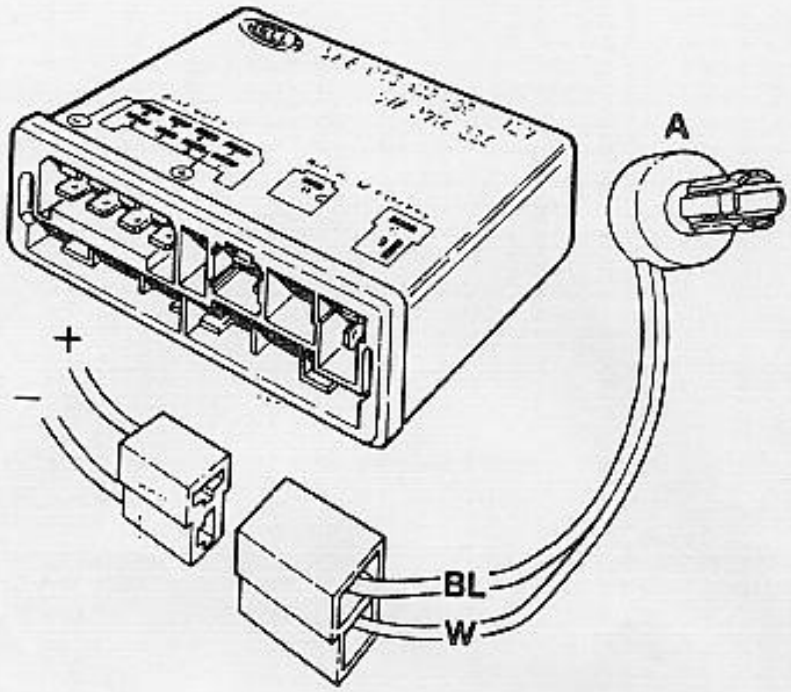


Switch off heater using test instrument. Remove the test instrument and the calibrated fuel pipe.

Reconnect fuel pipe and fit the flame sensor, making sure that seals (1 & 2) are intact.

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Checking the flame sensor



Measure instrument: Standard muiltmeter

Check of short circuit

- Make the instrument ready for ohm measurement.
- Check that the heater is not started.
- Check the main cable harness at the control unit.
- Measure over the blue and blue/white wires to the flame sensor from connection 6 and 7.
- The resistanse shall be more than 50 kΩ when it is dark.

If the measurement is as specified above the flame sensor is not short circuit.

Control of function

- Put the instrument for voltage measurement.
- Connect the instrument as follows:
  plus (+) to control unit, connector 6
  negative (–) to control unit, connector 7

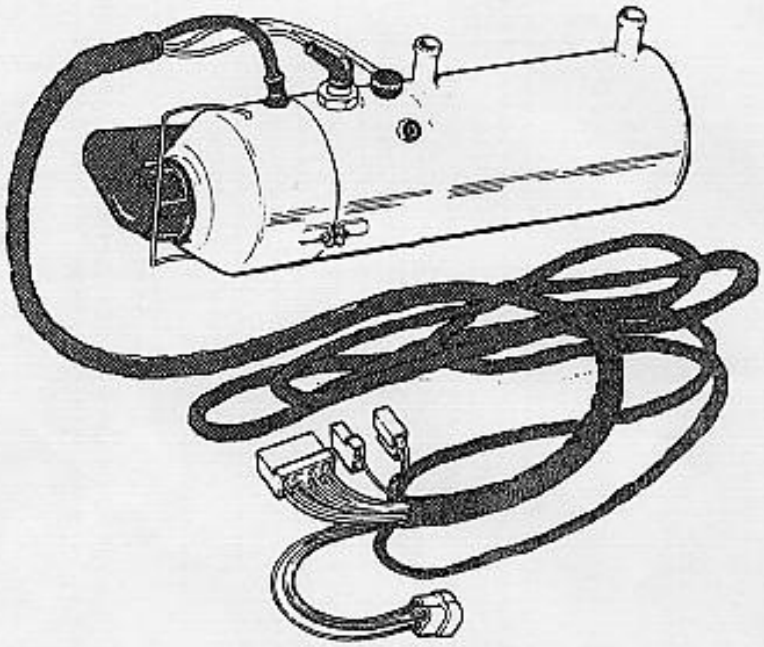
Start the heater

- When glowing – measure should be ~ 5 V
- When burning – measure should be — 1 V

If the measurement is as specified above the function is OK.

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Parking heaters should be serviced annually just before winter.

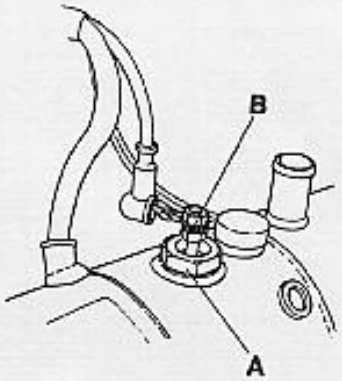


Check the following:

- security of all components
- security of wiring and insulation
- fuses and electrical connections are free from corrosion
- exhaust hose is intact and correctly secured
- fuel lines, check for kinking and loose clamps
- water hoses, check for damage and for loose clamps.

Check operation of parking heater.

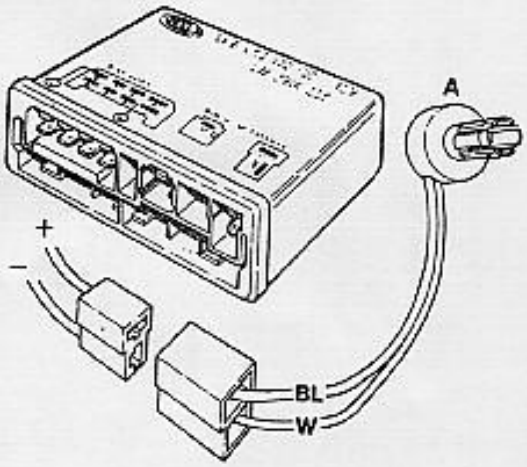
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Glow plug (A), replacement

Disconnect (B) from glow plug. Install new plug and re-connect (B).

(A) 22 mm width across flats.
(B) 8 mm width across flats.



Flame sensor (A), replacement

Withdraw flame sensor and cut wires.

Connect the new flame sensor using a spade connector and insulator.

Note: Connect the blue wire (+) to control unit terminal 6. The flame sensor is polarity sensitive.

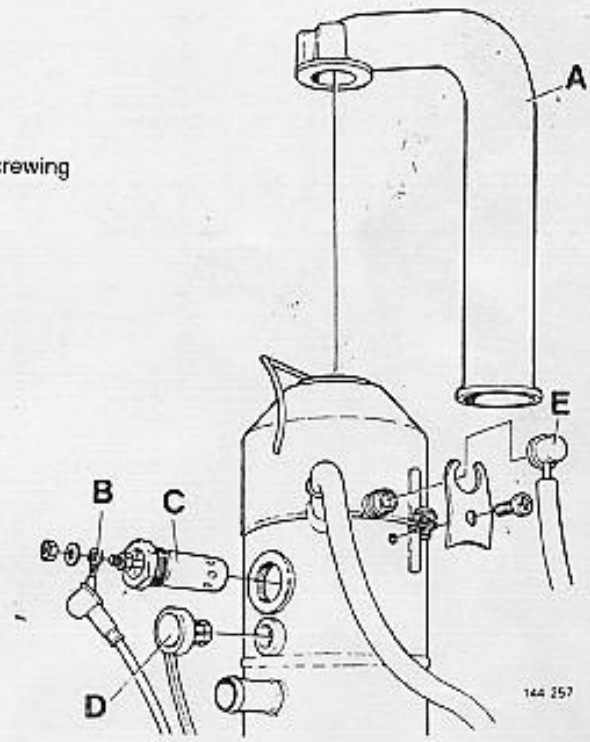
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Disassembly of combustion unit

Remove:

– fan inlet (A)
– electrical connection (B) on glow plug
– glow plug (C)
– flame sensor (D)

Disconnect and remove fuel pipe (E) by unscrewing mounting bracket.



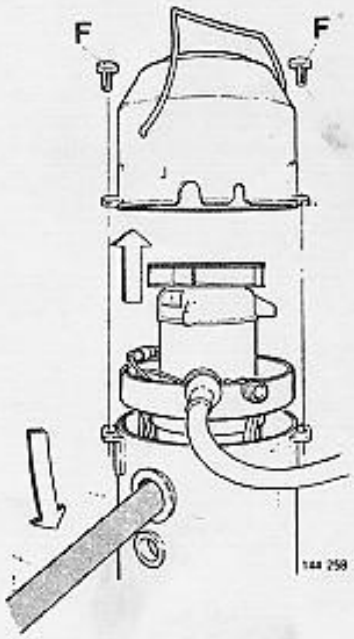
Remove two screws (F), securing fan outer casing. Lift off casing.

Insert suitable tool into glow plug opening and carefully pry out combustion unit.

Note: Take care not to damage threads.

Install in reverse order.

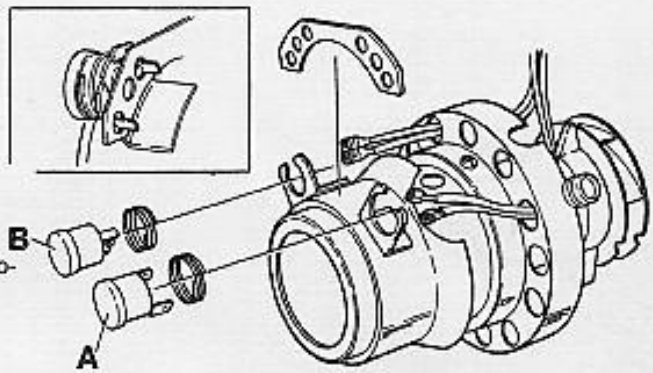
Note: Make sure that glow plug opening is aligned properly when re-installing combustion unit.

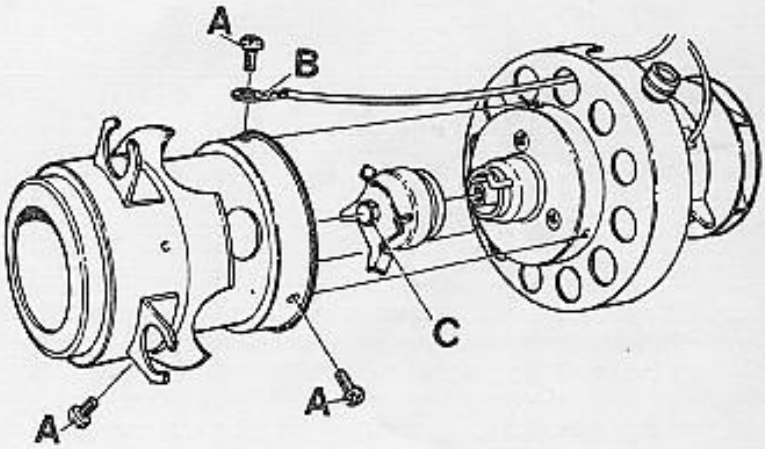


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Thermostat (A & B), replacement

Remove combustion unit as previously described.
Disconnect wiring as required and replace thermostats.
Re-install in reverse order.





Fuel distributor cup and turbulator, replacement

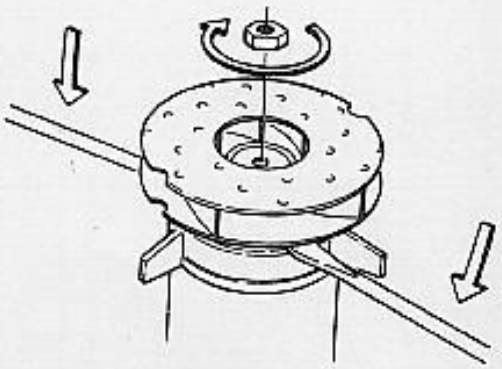
Remove combustion unit as previously described.
Remove three screws (A), securing combustion unit.
Disconnect earth wire (B).
Hold fan and remove screw (C), securing vane and distributor cup.
Replace parts as required. Install in reverse order.
Socket size 7 mm.
Tightening torque = 2.0–2.3 Nm.

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Fan

The fan is secured to the drive shaft by means of a nut (only motor type 1).

Note: On motor type 2 can fan wheel not be disconnected.



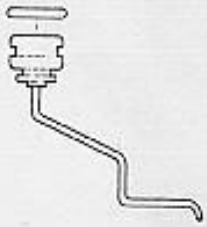
Fan, replacement (only type 1)

Remove:
– combustion unit
– combustion chamber
– fuel distributor
– fan motor mounting bracket

Hold fan motor and carefully unscrew nut. **Note:** LEFTHAND THREAD.
Lever off fan with two screwdrivers.

Re-install in reverse order.

Socket size 7 mm.
Tightening torque 2.7–3.0 Nm.



Fuel line, cleaning/replacement

Remove:

– combustion unit
– combustion chamber
– fuel distributor

Remove three screws (A), securing fuel pipe and lift pipe to free it.

Cleaning

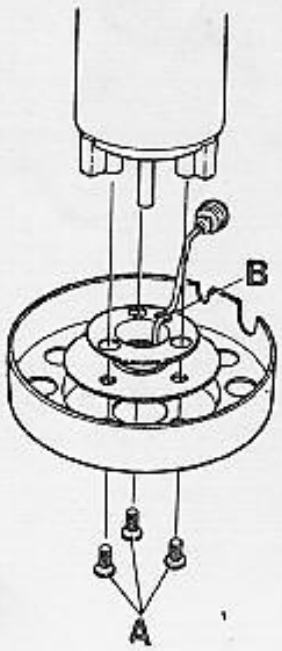
Release clamps (B), securing fuel pipe, and lift pipe to free it.

Clean pipe if blocked (use suitable solvent if necessary).

Blow into pipe to make sure that it is free from blockages.

Re-install in reverse order.

Note: If cleaning pipe doesn't help, install a new pipe.



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Fan motor

Powers the fan and fuel distributor.

Fan motor, replacement

Remove:

- combustion unit
- combustion chamber
- fuel distributor
- fan motor mounting bracket
- fan

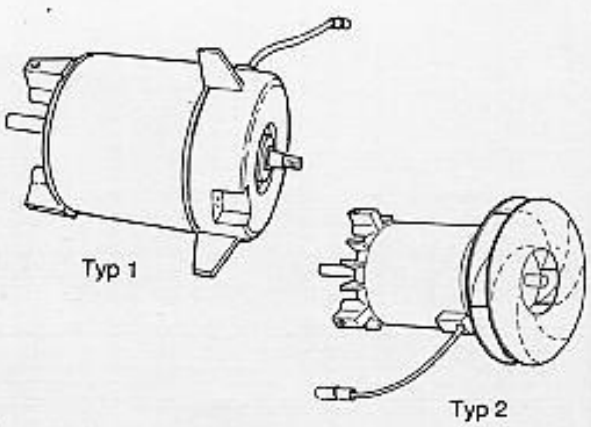
Type 1

Replace fan motor.

Re-install in reverse order.

Type 2

- Fit fan motor mounting bracket to motor with 3 new self-tapping screws.
- Fit fuel distributor.
- Fit combustion chamber with 3 new self-tapping srews.

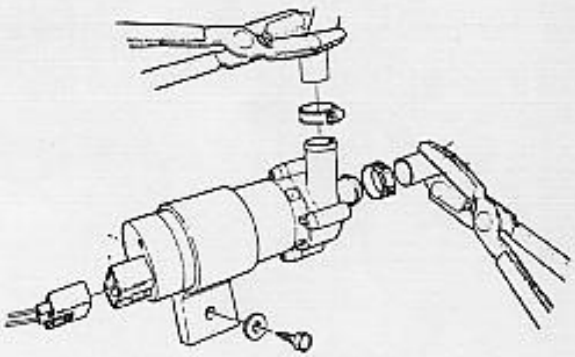


Water pump, replacement

Clamp off hoses, release clips and disconnect from pump.

Install rubber bracket on new pump.

Re-install in reverse order.

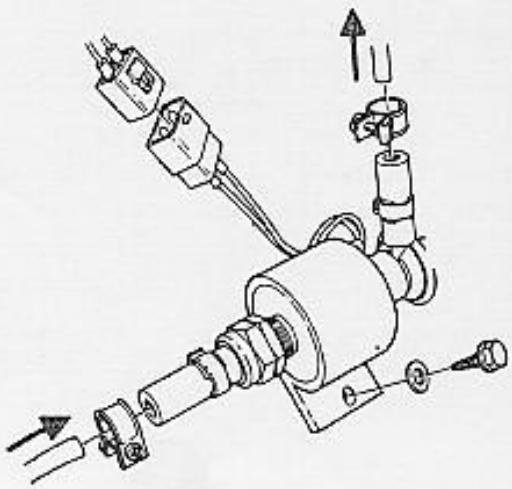


Fuel pump replacement

Release clips securing fuel lines. Disconnect electrical connections and unscrew pump.

Mount rubber bracket on new pump.

Re-install in reverse order.



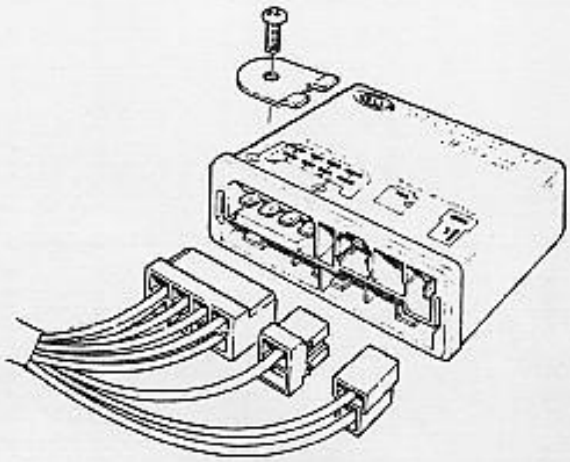
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Control unit

Control unit, replacement

Disconnect all electrical connections. Remove mounting bracket.

Re-install in reverse order.



Timer, replacement

- Loosen the timer from its bracket and withdraw the timer.
- Disconnect the connectors.
- Connect connector to new timer and install timer in the bracket.
- Set timer and test operation.

Connections

Connections (look at wiring diagram p)

A. From heater

1. Green wire (GN), live.
2. Black wire (SB), (alt vit (W), earth (–).
3. Red wire (R), 12V (+).

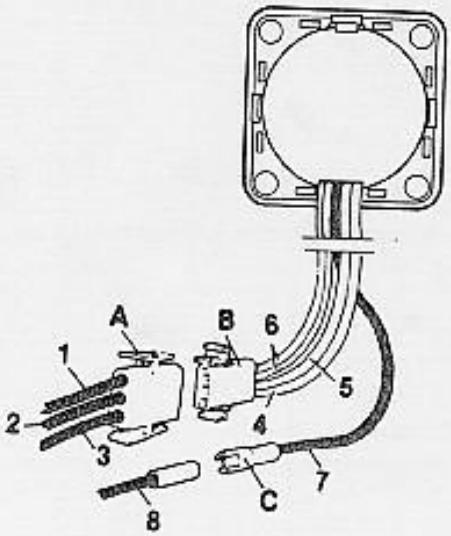
B. From timer

4. Yellow wire (Y), live.
5. Brown wire (BN), earth (–).
6. Red and white wire (R), (W), 12V (+).

C. From central electrical unit

7. Black wire (SB), to terminal C.
8. Yellow/blue wire (Y/BL), to ignition lock (+ 15 supply).

7 & 8 illuminate the display.



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INSTALLATION

General

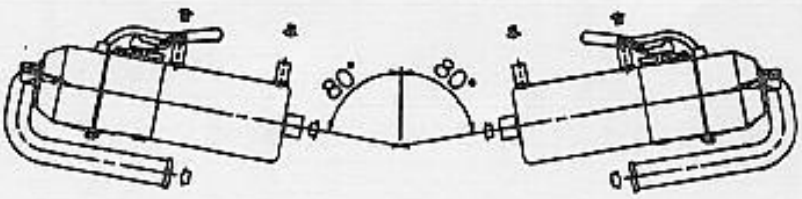
At installation, the heater should be positioned below the highest water level in the cooling system of the vehicle. The water pipes should be laid so as to assure an automatic bleeding of air in the system.

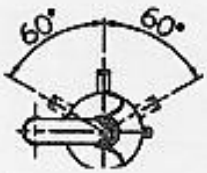
If possible, shall the heater be installed in the engine compartment. If this is not possible, the heater may be installed elsewhere, close to the engine. The heater may be built into a box, close to the engine compartment and the cab.

The heater should be positioned slightly above the highest fuel level in the tank.

When installation has been completed, the manufacturer's instruction label must be clearly visible.

Mounting position heater





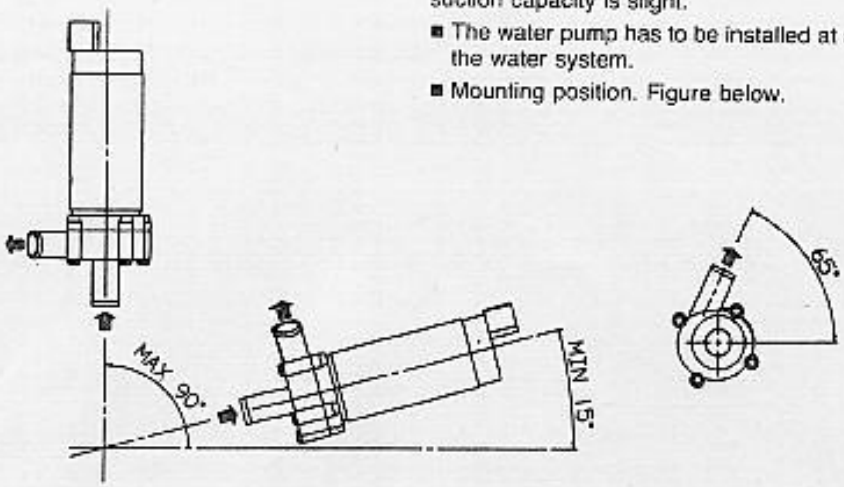
Max angle of inclination for the glow plug = 60°.

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Water pump – general

The water pump should be placed in such a way, that it pumps water to the lower part of the heater, as the suction capacity is slight.

- The water pump has to be installed at a low point in the water system.
- Mounting position. Figure below.



Water system – general

- If necessary, nonreturn valves are mounted so as to prevent water flowing in the wrong direction.
- Always mount a venting nipple between the hot water outlet of the heater and the connection to the engine.
- The hoses from the heater are routed slightly rising, so as to give an automatic venting of the system.
- – The hoses are attached or clamped at suitable points to keep them secured. They must, however, be able to take up the vibrations of the engine. All the hoses are supplied with hose clamps. Make sure the hoses do not touch sharp edges or hot parts of the engine.
- In the cooling system of the vehicle, a pressure relief valve is assumed. The maximum pressure should be 0.4–2.0 bar. The water hoses and couplings included in the installation kit should be used at installation, whenever possible.
  If the kit material can not be used, fabric coated hoses should be used, according to DIN 73411.

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Mode of operation and connection to vehicles main heating system

The heater is normally connected to the cooling system of the vehicle according to one of three principles:

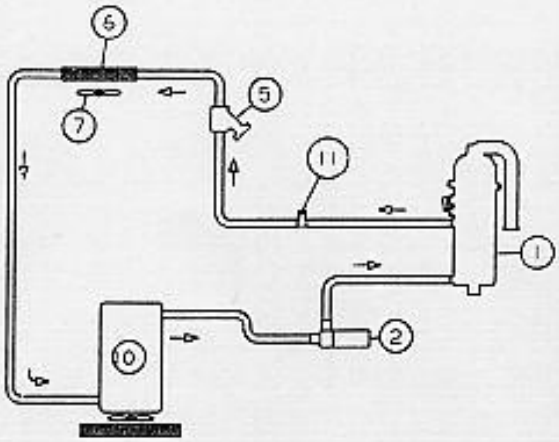
I Series
II Parallell
III Termo-mixing

Series connection

a. Without T-pieces

The heater is connected between the engine block and inlet interior heater. It is not necessary to use T pipes or nonreturn valves. The water for the interior heater always runs through the heater.

1. Heater
2. Water pump
5. Control valve
6. In-car heater
7. Fan
10. Engine
11. Air bleeding valve



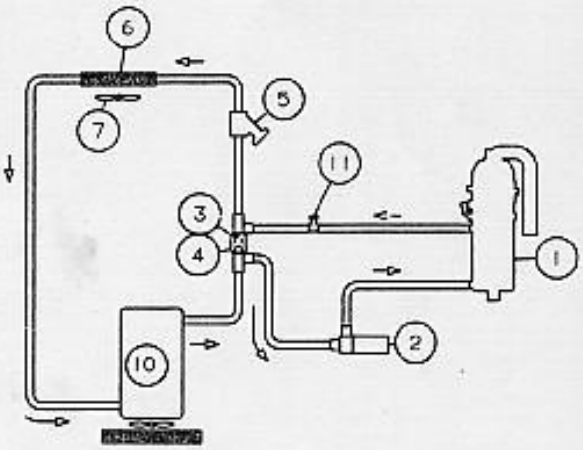
b. With double T-piece

The parking heater (1) heats the water in the heat exchanger. The water pump (2) then pumps this water to a double T-joint (3), where a non-return valve (4) prevents it from flowing back to the pump.

After passing the T-joint, the water flows past the heater control valve (5) into the in-car heater (6). Here the air is heated before being blown by the fan (7) into the passenger compartment.

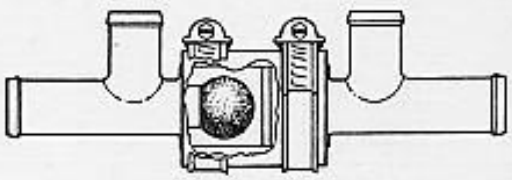
From the heat exchanger the water flows via the engines cooling system (10) to the parking heater.

The parking heater can be operated at the same time as the engine.



Non return valve (Dubble T-piece)

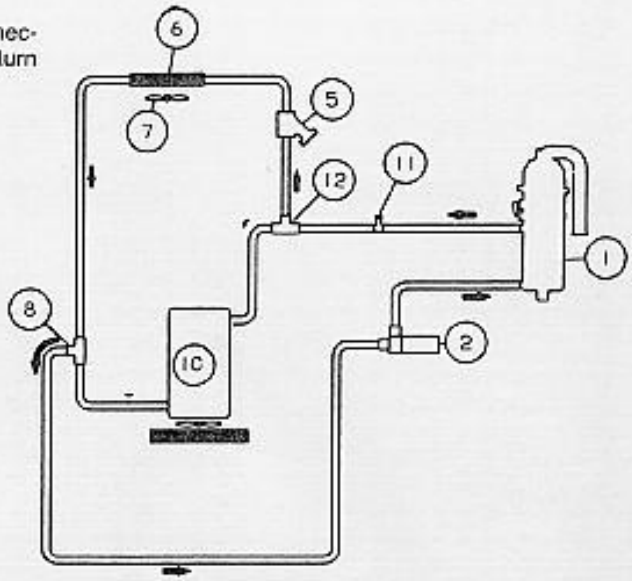
Heated water is prevented from entering the parking heater by means of a non return valve.



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II Parallel

This method is the most prevailent. The water connections are made with suitable T pipes and non-return valves.



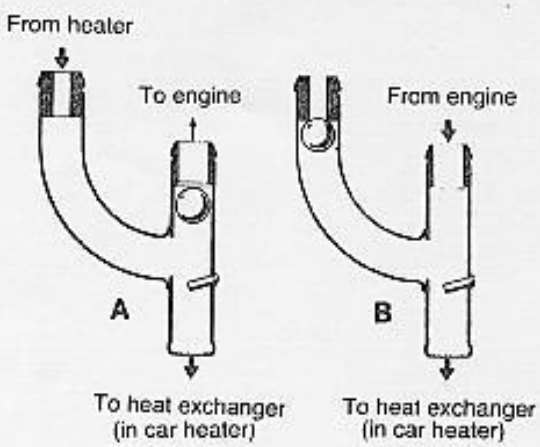
The parking heater (1) is mounted between the engine (10) and in-car heater (6), and functions as a shunt valve.

A T-connector (12) regulates the flow of hot water from the parking heater and engine. It shuts off the flow of water through the heater when the engine is running.

If the parking heater and engine are both operating at the same time, the heater operates normally as long as pump pressure and engine speed are low. If the pressure rises (eg at high engine speeds), a check valve in the T-connector cuts off the flow of hot water to the heater. This causes the temperature to rise and the operating thermostat to stop combustion.

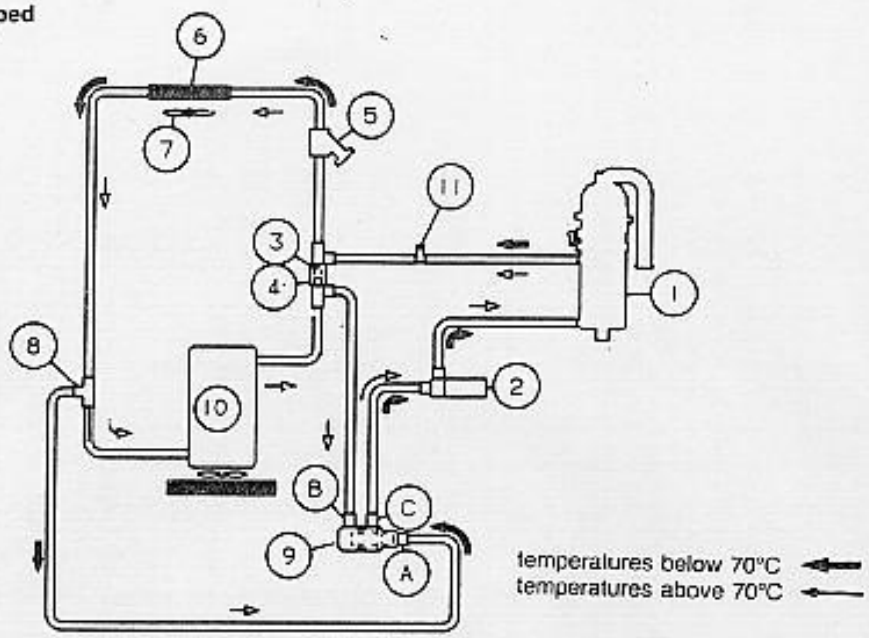
A. Parking heater operating. Engine off.

B. Engine running. Parking heater off.



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Parking heaters equipped with a thermo-mixing valve



The parking heater (1) heats the water in the heat exchanger. The water pump (2) then pumps this water to the double T-joint (3) where a non-return valve (4) prevents it from flowing back to the water pump or to the parking heater via the thermo-mixing valve (9) inlet B.

After passing the T-joint, the water flows past the heater control valve (5) into the in-car heater (6) where the passenger compartment fan (7) blows warm air into the compartment.

From the heat exchanger the water flows through the T-joint (8) to the thermo-mixing valve's inlet A. If the water temperature is under 70°C, the thermo-mixing valve's thermostat is closed causing the water to flow through outlet C to the water pump and heat exchanger.

Temperatures above 70°C cause the thermo-mixing valve's thermostat to open gradually, which closes inlet A and allows water to pass from T-joint (8) via the motor to inlet B. From there, the water flows through outlet C to the water pump and parking heater, completing the cycle.

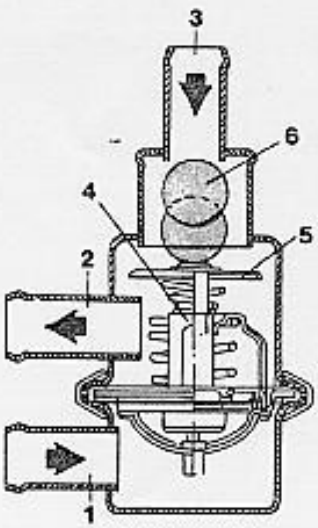
If the engine and parking heater operate at the same time, the parking heater continues to function as long as the engine runs at low r.p.m. and the pressure from the car's water pump is low. Higher r.p.m. increase the pressure from the car's water pump.

Thermo-mixing valve

The main function of the valve is to allow faster heating of the passenger compartment and to prolong the parking heater's combustion period.

The valve consists of:

1. Inlet from engine
2. Outlet to water pump
3. Connection to car heater
4. Thermostat
5. Washer
6. Non-return valve



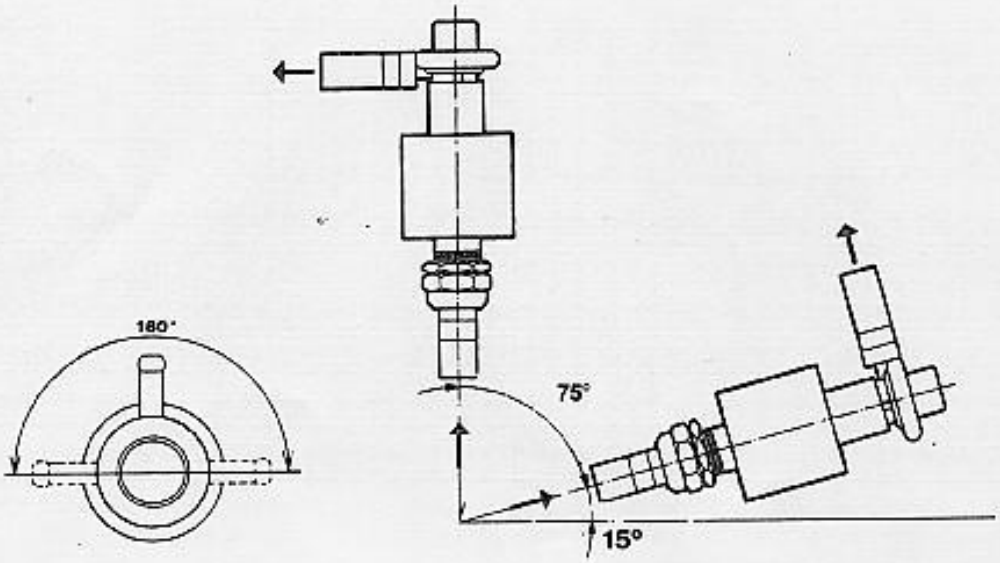
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Fuel pump, general

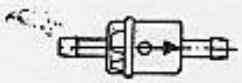
- The pump should be placed as low as possible. The fuel line between the pump and the heater should be rising, so as to avoid air pockets in the system.

Mounting position: 15° to vertical

The pump outlet must be faced up.



Fuel filter



- Fuel filter shall be mounted between tank and fuel pump on diesel heaters.
- The filter shall be placed verticaly or down to 30 degres to the horizontal.

Make sure the filter is positioned in the flow direction, according to the arrow on the filter.

Secure with hose clamps.

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Fuel connections – general

- Should the hose supplied in the kit not be sufficient, or if the hose is missing, fuel hoses of an equivalent quality should be used (DIN 73379).
- The heater should be placed slightly above the highest fuel level in the fuel tank. If the heater for some reason must be positioned below the fuel tank level, a separate, manually operated shut-off valve should be mounted in the fuel line. This valve is always closed unless the heater is operating.
- The fuel hose should be laid so as not to touch the hot parts of the heater or the engine, sharp edges or warm hoses.
- Fuel hose, filter and fuel pump shall not be mounted so its temperature can not reach more than 30°C.
- This will cause risks for air bubbles and problems with the petrol heaters.

  When connecting fuel with T-pieces close to the rear axle, allow for the spring operation of the axle.

  For connection of the fuel branches, always use rubber tubing, never plastic pipe.
- The fuel hose should have a slight rise to avoid air pockets and should be attached or clamped securely in its entire length.
- All connections should be clamped.

Note: Important
Cut fuel tubes and pipes to length only with a sharp knife. Cuts may not be distorted, and must be burr-free. Fig. 1.

Connect up fuel pipes with rubber fuel tube so that they fit the fuel pipe flush. Fig. 2.

Don't connect fuel hoses with extra bends. Fig. 3.

Fig. 1

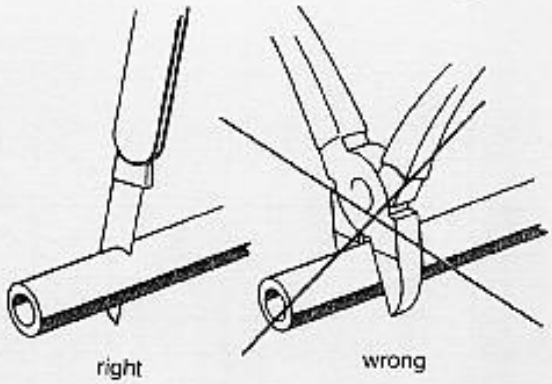


Fig. 2

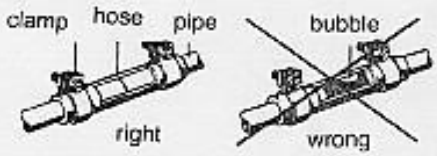
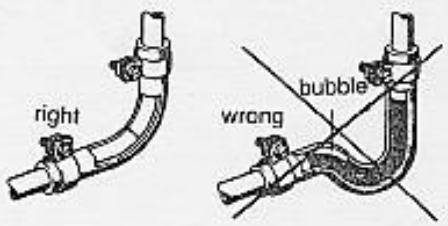
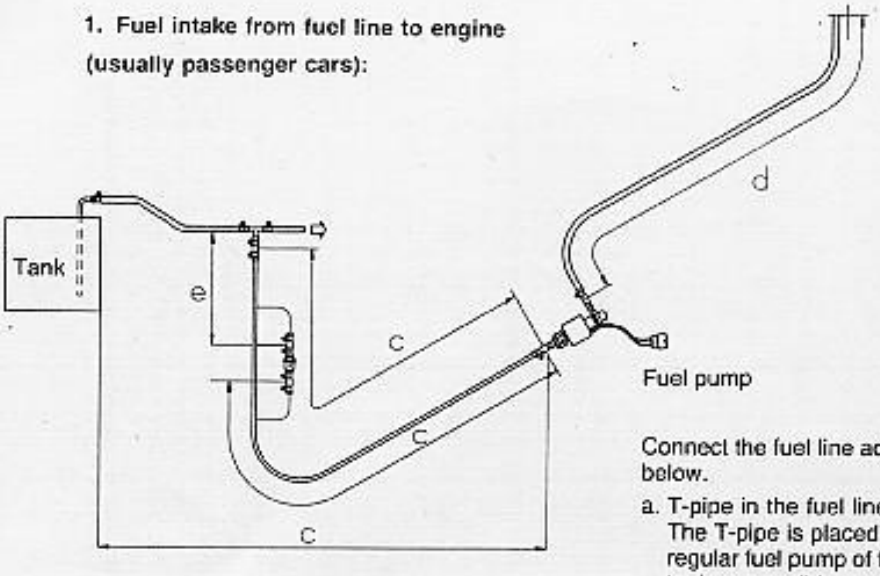


Fig. 3



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1. Fuel intake from fuel line to engine (usually passenger cars):



Max level hose length

	Petrol	Diesel
a	600 mm	1000 mm
c	3000 mm	3000 mm
d	4000 mm	6000 mm
e	50 mm	50 mm

Fuel hose: Only PA-hose (plastic)
Dimension: Suction Internal dia = 3 mm
Pressure Internal dia = 2 mm

Connect the fuel line according to one of the methods below.

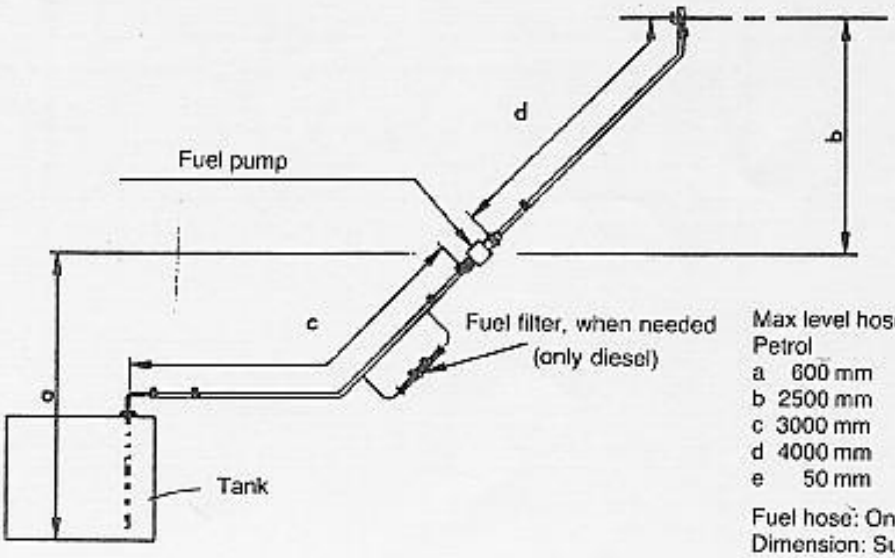
a. T-pipe in the fuel line of the vehicle.
The T-pipe is placed between the fuel tank and the regular fuel pump of the vehicle, as close to the fuel tank as possible.
The fuel outlet should be placed at the lowest possible position in the fuel system.
The T-pipe is directed downwards.

b. Special connections.
In some vehicles, separate connecting nipples for vehicle heaters are already mounted. If so, these should be used.

NOTE! In vehicles with injection engines, the T pipe is mounted on the return fuel line.
Check so that the return fuel line does not stops to high from bottom of the fuel tank.

2. Fuel intake separately from fuel tank or from separate tank (normally on trucks)

Always from the top of the fuel tank.



	Max level hose length Petrol	Suction height Diesel
a	600 mm	1000 mm
b	2500 mm	2500 mm
c	3000 mm	3000 mm
d	4000 mm	6000 mm
e	50 mm	50 mm

Fuel hose: Only PA-hose (plastic)
Dimension: Suction Internal dia = 3 mm
Pressure Internal dia = 2 mm

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Combustion air

- The combustion air must not be taken from inside the vehicle where people are present (illustration A).
- The burner unit of the heater is supplied with an intake snorkel or an intake cap, neither of which should not be removed, (illustration B).
- The combustion air should be as clean as possible, without dust and other pollutants. If this is not possible, a separate, flexible intake hose should be mounted on the air intake of the burner unit, and lead to an area free from dust, pressure, etc.
- If the heater is mounted in a closed space, for instance in a box, an opening for the combustion air must be made. This opening must not be clogged by road dirt.
- The opening for the air intake hose in the box should be at least 12 cm^2 (1.86 in^2)
- The inner diameter of the intake hose should be ∅ 26 mm (1 in) and its maximum length 1000 mm (39 in).

Exhaust system

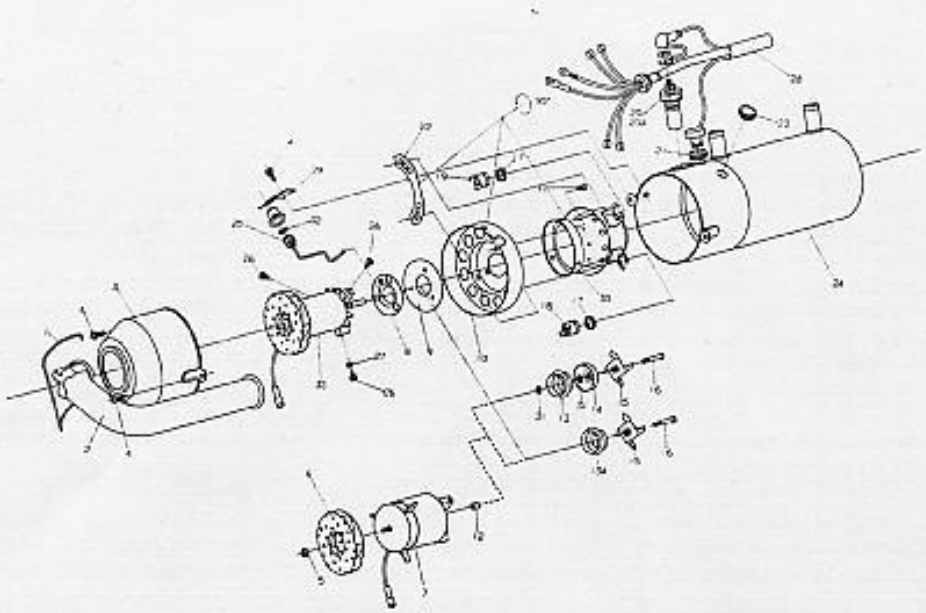
- With a flexible exhaust pipe, the inner diameter should be ∅ 28 mm. The pipe should be made of stainless steel.
- The exhaust pipe is laid so that it is not close to or touching flammable parts or other vital parts in the vehicle. It is secured with clamps in its entire length.
- The outlet is placed so that the exhaust fumes do not enter the combustion fan or the interior fan of the vehicle.
- The outlet is directed downwards or the rear of the vehicle. This is to ensure that hot exhaust fumes are kept away from vital parts of the vehicle.
- If the exhaust fumes are to flow upwards, the exhaust pipe has to be angled at the outlet to prevent rain and snow from entering.

The max length of exhaust pipe: 2000 mm

NOTE! The exhaust system may be supplied with a maximum of three 90° elbows. The pipe and the 90° bends shall be secured by clamps.

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Spare parts, explosion view



1.	Clam	3714386	13.	Fuel automizer, Petrol	3714334		
2.	Fan inlet	3716101	13a.	Fuel automizer, Diesel	3711234		
3.	Fan casing	3714201	14.	Outer cap, Petrol	3716336		
4.	Screw SW M5 x 12	949444	15.	Turbulator	3713880		
5.	Nut M4 - 4,5	3711687	16.	Screw RXAB	3714229	25.	Fuel pipe 3714220
6.	Fan	3716116	17.	Thermostat spring	3713854	26.	Screw, self-tapping 3714002
7.	Fan motor 12V type 1	3714228	18.	Overh. thermostat	3714218	27	Toothed washer 942603
7a.	Fan motor 24V type 1	3714234	19.	Oper. thermostat	3714217	28.	Cable harness, inner 3714219
8.	Sleeve	3716109	20.	Glow plug 12V	3714076	29.	Block piece/Fuel nipp 3714224
9.	Insulated washer	3714212	20a.	Glow plug 24V	3714086	30.	Burner 3714210
10.	Motor support	3714207	21.	Flame sensor bushing	3714208	31.	Sleeve, 1 = 0,7 mm 955891
11.	Screw, self-tapping	3714001	22.	Washer, guide therm	3714078	32.	O-ring 3714421
12.	Spacer sleeve 1 = 5,5	3716340	24.	Heat exchanger	3714202	33.	Fan motor (II) 12V 3714678
						33 a.	Fan motor (II) 24V 3714789

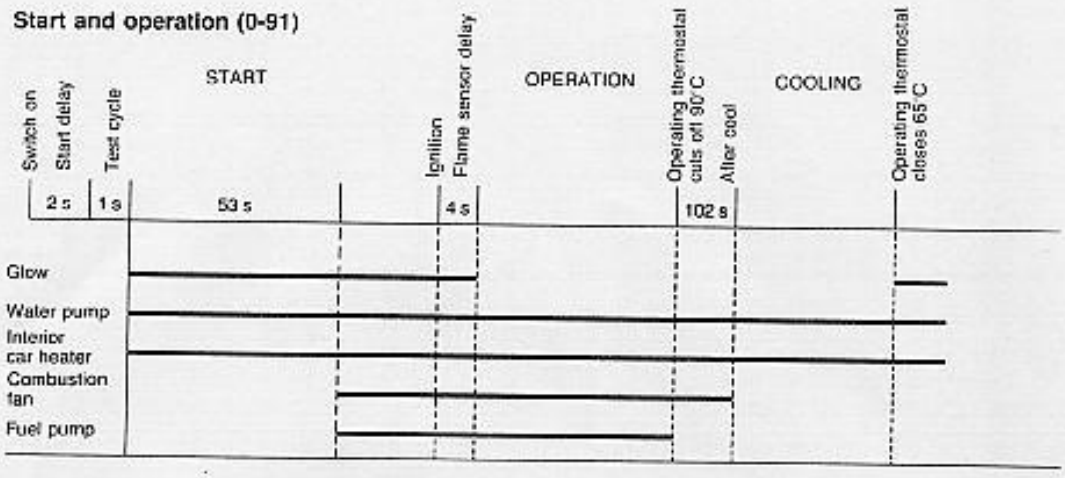
Spare parts kit 091 VFA nr 3714696

Compl	Part no	Position	Number	Name
	3712156	-	1	Plastic box
	3712157	-	1	Measuring glass
	3714697	-	1	Table of contents
	3716109	8	1	Sleeve
	3714212	9	4	Isulation washer
	3714220	25	1	Fuel pipe comp.
3714712	3714421	32	10	O-ring
	3714078	22	5	Washer, guide therm.
3714715	3714217	19	1	Control thermostat
	3713854	17	1	Thermost spring
3714716	3714218	18	1	Overheating thermostat
	3713854	17	1	Thermostat spring
	941266	23	4	Protective plug
	3716340	12	4	Spacer (1 = 5,5 mm)
3714714	955891	31	10	Sleeve (1 = 0,7 mm)
	3714229	16	2	Screw RxAB
	3714334	13	1	Fuel alomizer (petrol)
	3716336	14	1	Outer cup (only petrol)
	3713880	15	1	Turbulator
	3714076	20	3	Glow plug
	3714122	-	1	Flame sensor, order flame sensor kit
	3713045			
	3714208	21	2	Flame sensor bushing
	3714224	29	1	Block piece
	949444	4	4	Screw SW M5x12
	942603	27	3	Toothed washer
3714713	956059	26	6	Screw RxAB M4x8
	956163	11	6	Screw FX M4x10
	3711687	5	2	Nut M4x4,5

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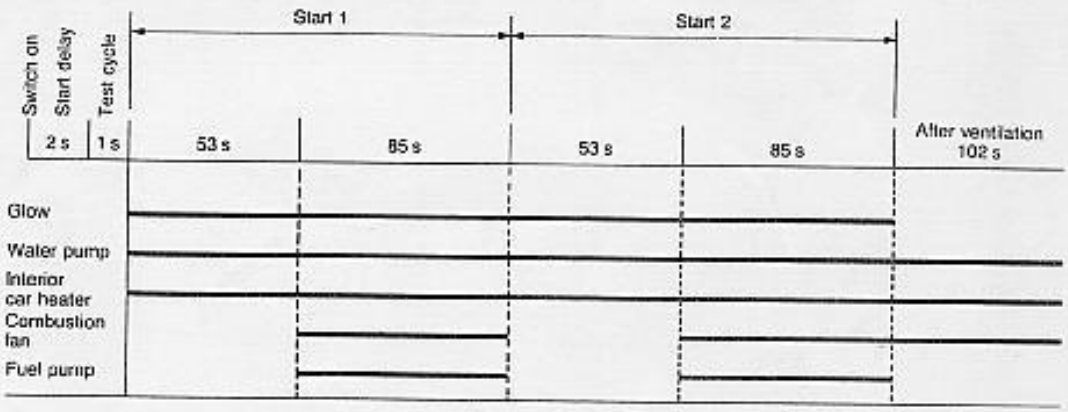
Control unit VFA 3714225 (12V) 3714226 (24V) (1 start)
3714412 (12V) 3714413 (24V) (2 starts)

Start and operation (0-91)

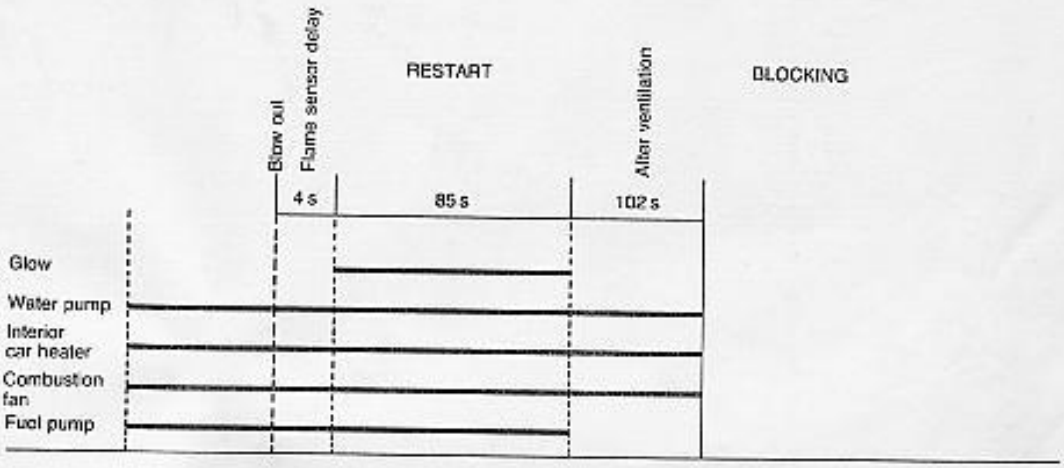


Control unit VFA 3714412 (12V) 3714413 (24V) (2 starts)

Failed start 1 and 2



Disturbance shut off



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