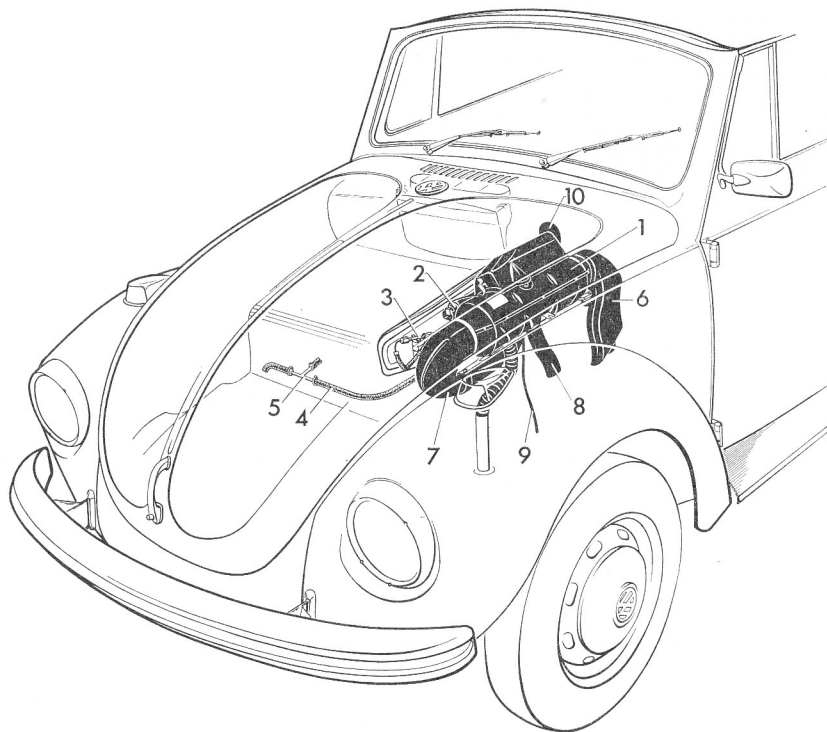


Description

The BN 2 heater is a gasoline burning unit which works independently of the vehicle engine. It is installed in the front luggage compartment.



Type 1, Model 1302

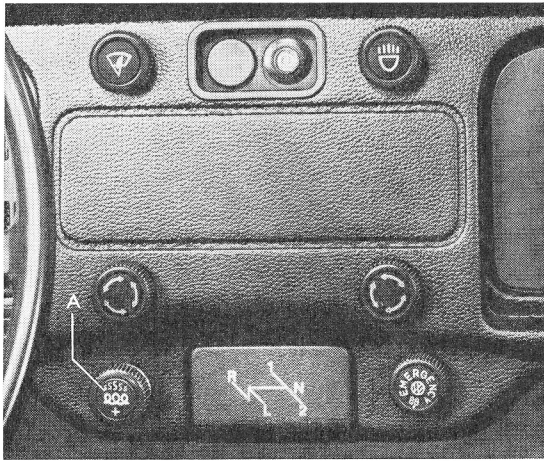
- | | |
|--------------------|---------------------------------|
| 1 – BN 2 heater | 7 – Air recirculation pipe |
| 2 – Fuel pump | 8 – Exhaust pipe |
| 3 – Filter | 9 – Overflow hose |
| 4 – Fuel hose | 10 – Combustion air intake pipe |
| 5 – T piece | |
| 6 – Hot air outlet | |

Note:

Some countries receive vehicles with heaters which do not have the overflow pipe and overflow hose.

F 4.1 Description of Heating System

Operation



A – Knob of heater switch

To switch heater on :

Pull knob A out.
The warning lamp lights up and shows that the heater is working.

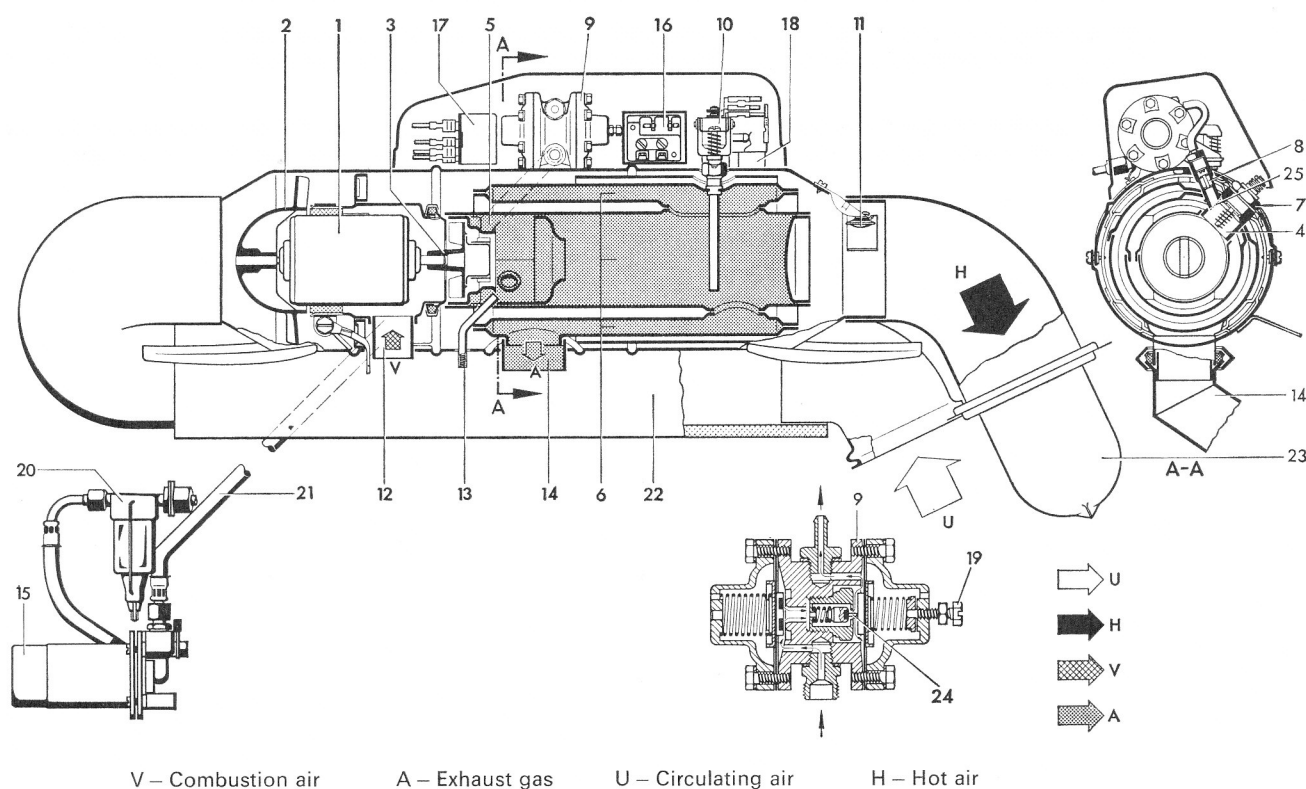
To switch heater off :

Push knob A in.
Warning lamp goes out.

Notes :

- 1 – When the heater is switched off, the 3 minute run-on period starts. In this period the combustion flame goes out, the combustion chamber is cleared of gas and the complete heater cooled down. At the end of the period the current circuit is broken by the thermostat and the blower stops turning.
- 2 – The heater must be switched off when filling the fuel tank. The warning lamp must be out but it is not necessary to wait until the run-on period has ended.
- 3 – To avoid running the battery down do not leave the heater on for hours at a time without starting the engine up in the meantime to charge the battery. This applies particularly when it is cold because the full battery capacity is then required to start the engine.
- 4 – When it is very cold it is advisable to manage without preheating the vehicle interior and not to switch the heater on until the vehicle engine is running.

Working principles



V – Combustion air

A – Exhaust gas

U – Circulating air

H – Hot air

- 1 – Electric motor
- 2 – Hot air blower
- 3 – Combustion air blower
- 4 – Antechamber
- 5 – Combustion chamber
- 6 – Heat exchanger
- 7 – Glow plug
- 8 – Fuel jet
- 9 – Pressure regulator
- 10 – Thermostats
- 11 – Overheating switch
- 12 – Combustion air intake pipe
- 13 – Overflow pipe

- 14 – Exhaust pipe
- 15 – Fuel pump
- 16 – Safety switch
- 17 – Relay
- 18 – Fuse holder with 8 Amp. fuse
- 19 – Adjusting screw
- 20 – Fuel filter
- 21 – Fuel line
- 22 – Air circulation pipe
- 23 – Hot air outlet
- 24 – Regulating valve
- 25 – Strainer

The heater is switched on by pulling out the switch.

The electric motor for the hot air and combustion air blowers, the glow plug (via the thermo-switch) and the electric fuel pump are then energized.

The combustion air blower starts delivering air and this mixes with the fuel which is supplied by the fuel pump via the pressure regulator and is injected into the antechamber.

The glow plug warms the combustible fuel/air mixture in the antechamber and ignites the mixture. Combustion then extends to the combustion chamber and starts to heat the heat exchanger. When the flame has heated the feeler tube of the thermo-switch to a certain point, the current flow from the thermo-switch to the glow plug is interrupted and the mixture continues to burn automatically.

The hot air blower draws air from the vehicle interior and forces it past the heat exchanger where it is heated up to about 90° C above the intake temperature.

Due to the larger size of the hot air blower, the pressure on the hot air side of the heat exchanger is higher than the combustion pressure. This ensures that no exhaust gases can get into the hot air and thus into the vehicle interior even if the heat exchanger is leaking.

F 4.1

Description of Heating System

The heater is switched off by pushing the switch in again. This stops the current flow to the fuel pump so that combustion ceases.

The motor for the hot air and combustion air blowers, however, continues to run and this cools the heater down evenly and blows all traces of gas out of the combustion chamber.

The warning lamp is out during the run-on period and after about 3 minutes the thermo-switch cuts off the current supply to the motor. The run-on is then finished and the heater completely out of operation.

The heater has an overheating switch which cuts the current supply to the fuel pump by shorting the 8 ampere fuse and stopping combustion if the heater gets excessively hot for any reason.

Maintenance

Deposits from the fuel tend to settle in the fuel system of the heater when it is not used for long periods. To avoid trouble, it is advisable to operate the heater briefly about once a month when the heater is not in regular use.

Every year before starting to use the heater:

Check heater plug for burning and fit new if necessary.

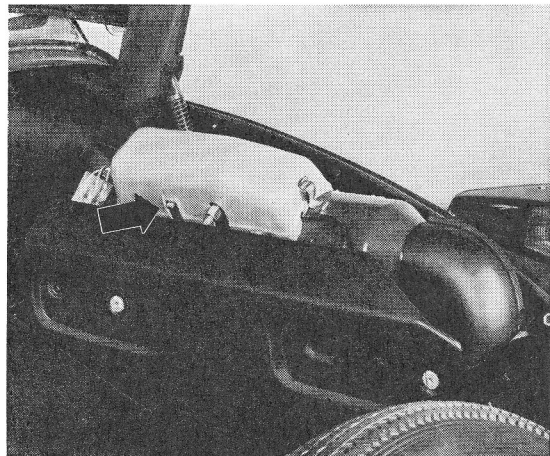
Clean fuel jet and fuel filter (see F 4.3/2–2).

Check security of electrical connections.

Check security of all nuts and bolts on the heater.

During the winter and when driving over poor roads, mud or snow may tend to accumulate in the exhaust or combustion air intake pipes. Have these pipes checked for blockage from time to time so that the heater can always work properly.

If the heater does not work when it has been switched on, the safety switch may have operated. The lever of the safety switch on the heater (arrow) should be moved. If the heater does not start then, there is a defect in the system.



Technical Data

Heat output	2000 kcal/h
Fuel	Gasoline
Fuel consumption	0.32–0.38 liters per hour
Current consumption (in working condition)	36 Watts
Current consumption (when heating)	about 200 Watts
Voltage	12 Volt
Voltage range at 20° C	10 Volt–14 Volt

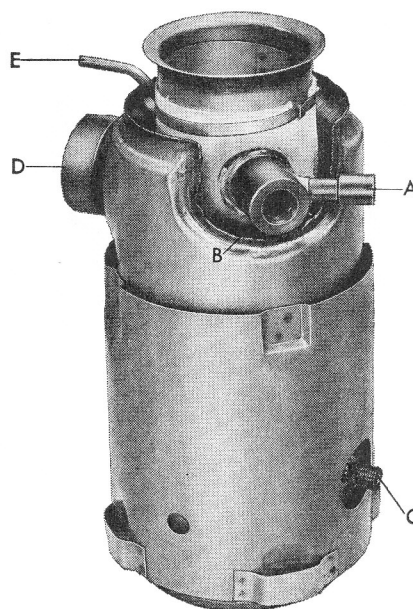
Description of parts

Heat exchanger

The heat exchanger is made of anti-corrosion sheet steel. The cylindrical combustion chamber and the two annular chambers of the heat exchanger are connected by two openings (see sectional view, F 4.1/2-1).

The combustion air blower is secured to the housing with vanes at the end of the combustion chamber. Glow plug, thermo-switch and fuel jet are screwed into the heat exchanger.

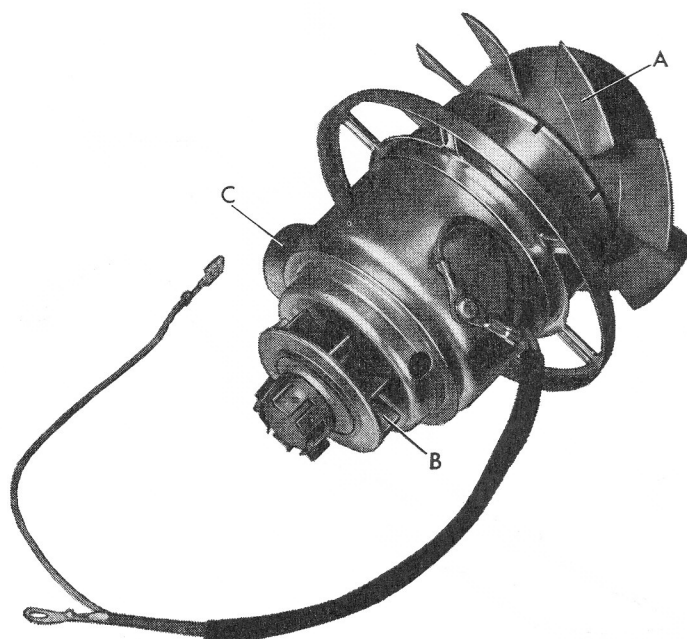
- A – Adapter for fuel jet
- B – Adapter for glow plug
- C – Adapter for thermost switch
- D – Adapter for exhaust pipe
- E – Overflow pipe (see note F 4.1/1-1)



Combustion air blower

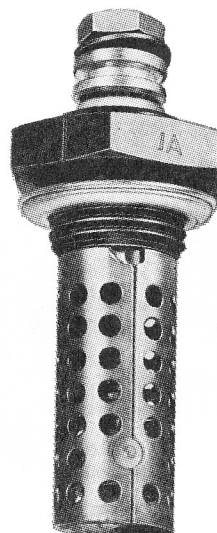
There are two blowers secured to the shaft of the combustion air blower. The axial blower (A) delivers the warm air and the radial blower (B) draws the combustion air in through the air intake (C). The teeth on the radial blower atomize the fuel.

- A – axial blower
- B – radial blower
- C – air intake

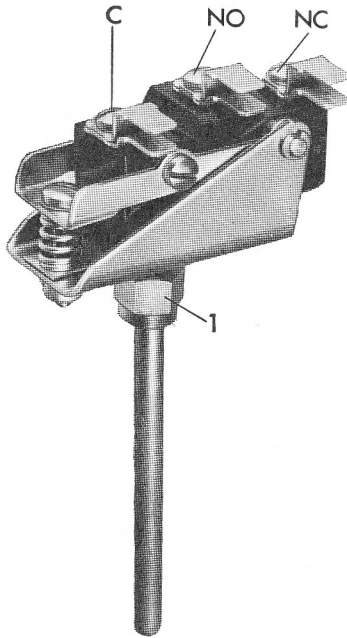


Glow plug

The glow plug protrudes into the combustion chamber. The glow plug works only for a brief period after switching on the heater booster and is then switched off by the thermost switch.



F 4.1 Description of Heating System



Thermo-switch

The thermo-switch is secured to a thread on the heat exchanger by a union nut. The feeler tube protrudes into the combustion chamber. The thermo-switch controls the cut-in time of the glow plug, the heater resistor of the safety switch and the run-on.

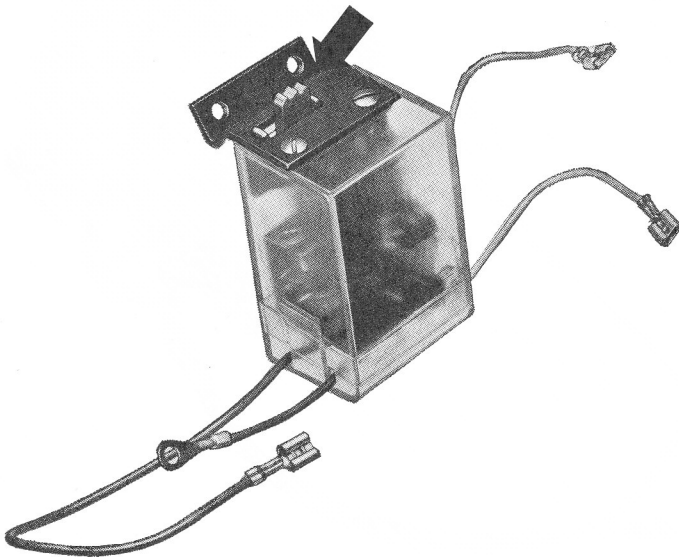
(Run-on time 100–180 seconds)

NC – normally closed

NO – normally open, safety switch, relay and glow plug

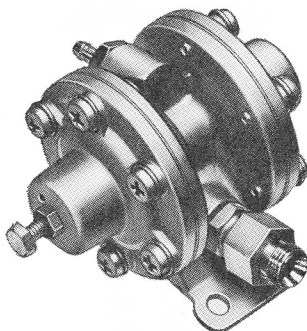
C – Common, combustion air blower

1 – Union nut



Safety switch

The safety switch, secured to the heater casing, interrupts the flow of current to the heating system if ignition has not taken place within four minutes after switching the heater booster on or combustion fails for some other reason. The heater resistor in the safety switch controls a bimetal strip so that after more than three minutes the contact in the form of a leaf spring jumps out of its normal position due to the increase in temperature and cuts off the heating system.

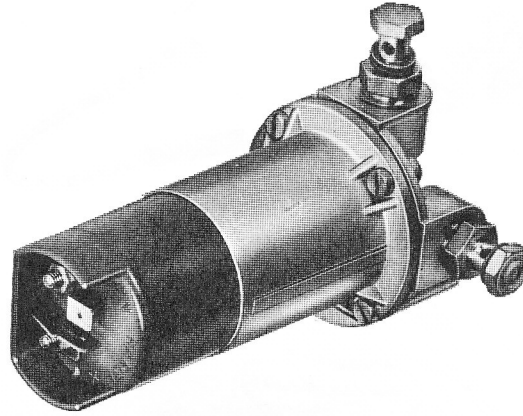


Pressure regulator

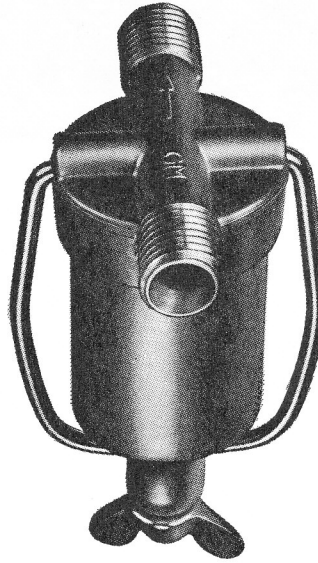
The diaphragm pressure regulator is secured to the heater casing. The pressure regulator keeps the fuel pressure constant.

Fuel pump

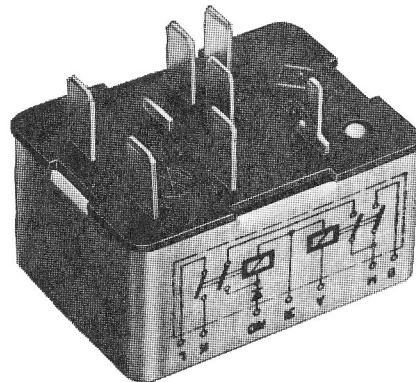
The fuel pump is secured to the heater casing. This diaphragm pump delivers fuel to the combustion chamber via the pressure regulator independently of the combustion air blower motor speed.

**Filter**

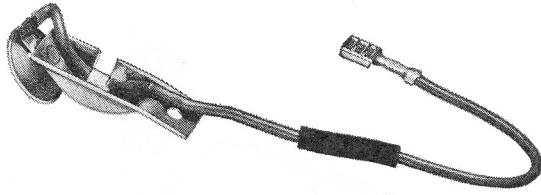
Between the T piece and the fuel pump is a filter. It is attached to the cover plate with a clip.

**Relay**

The relay is attached to the heater under the protective cap.

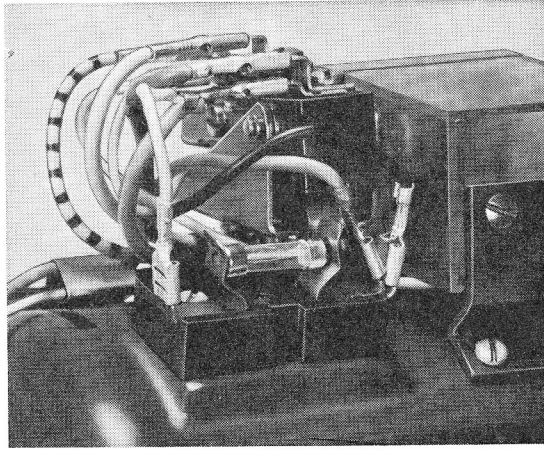


F 4.1 Description of Heating System

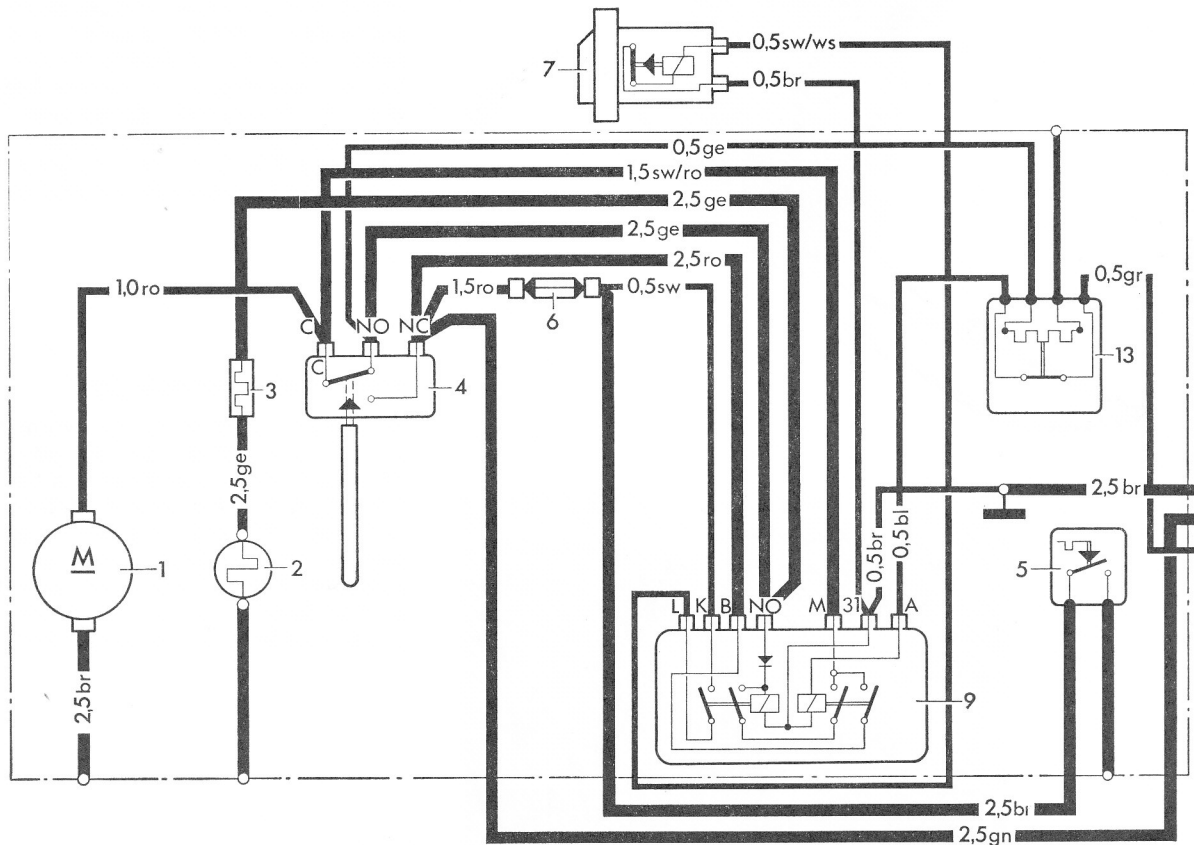


Overheating switch

The overheating switch is installed in the hot air outlet. If the temperature rises above 180–240° C, the switch closes. This shorts the circuit through the overheating switch and the fuse (see illustration). The sudden surge of current blows the fuse and the fuel pump stops delivering fuel.



8 ampere fuse



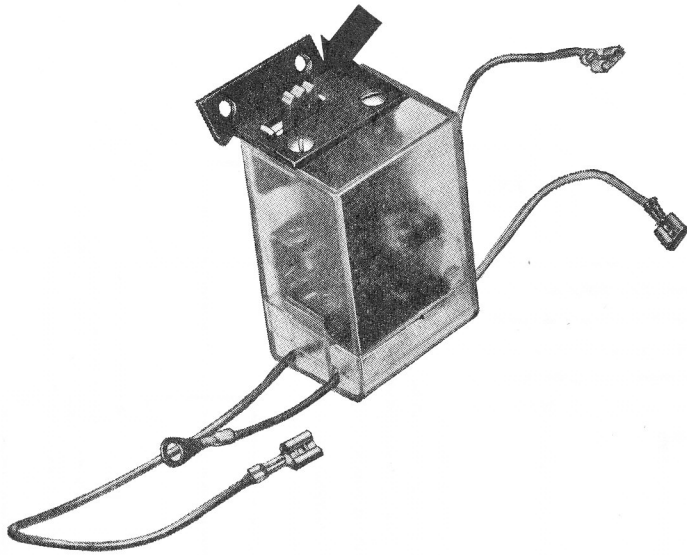
Explanation of wiring diagram

The switching times quoted are for 12 volts and an ambient temperature of 20° C (68° F). At lower temperatures the run-on time will be shorter and the response time of the safety switch longer.

When the heater is switched on, current flows to terminal A of relay (9) from terminal 30 of the fuse holder (10) via the switch (11) and the safety switch (13).

Current also flows continuously from terminal 30 of fuse holder (10) via fuse (6) to terminal K of the relay (9). From fuse (6) current also flows via NC terminal of thermo-switch (4) to terminal B of relay (9) so that terminals B, A and K on relay (9) are now all energized.

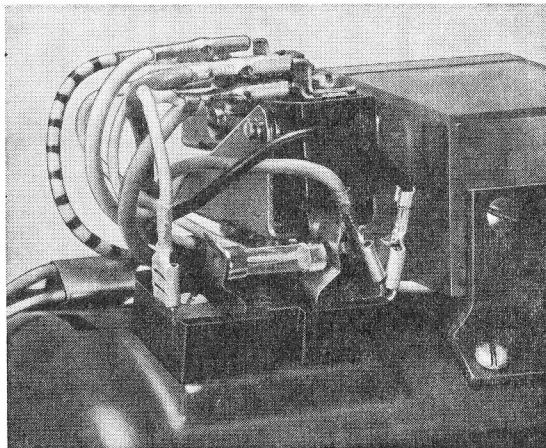
F 4.1 Description of Heating System



Note:

Safety switch (13)

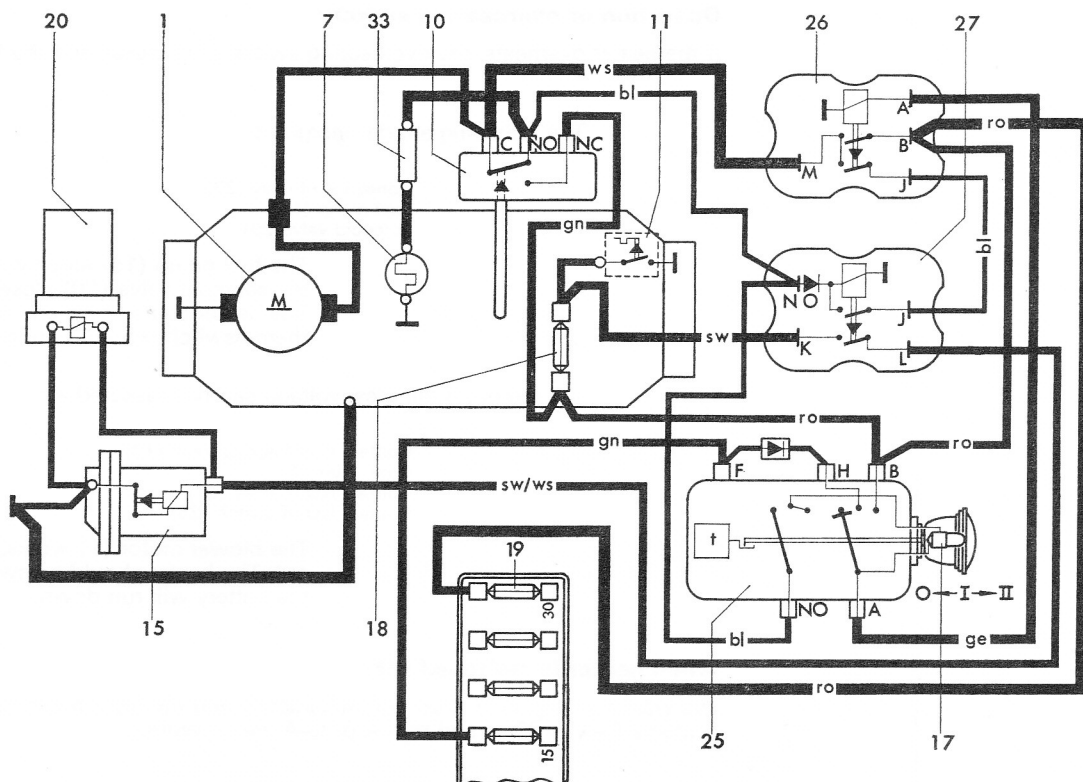
If the glow plug is defective, if no fuel is delivered or if combustion does not take place for some other reason, the safety switch (response time 3–4 minutes) interrupts the current flow to the dual relay. To switch the heater on again, press the lever on the safety switch in direction shown by arrow (it springs back to its original position). The lever must only be moved when the defect has been found and rectified.



8 ampere fuse

Overheating switch (5)

If the blower stops or the warm air ducts are blocked so that no air can pass through the heat exchanger and there is a danger of overheating, the overheating switch (response temperature 180–240° C) interrupts the current supply to the fuel pump by causing the 8 ampere fuse to blow (see illustration). Before a new fuse is put in the connector (6), the fault must be found and rectified.



Explanation of wiring diagram (with ignition off)

To switch heater on:

Operate switch. The clockwork runs and the heater starts up. The contacts B-A/30-A and NO-A/K-A in the switch are closed.

Start up:

The heater must ignite within a period of 45 seconds. The start-up period is controlled by the thermostatic switch (10).

Voltage can be measured at:

Terminal 30
 Contact B of relay (26)
 Contacts B-A of time switch (25)
 Contact A of relay (26)

The relay (26) operates.

Contacts B-M of relay (26)
 Contact C of thermostatic switch (10)

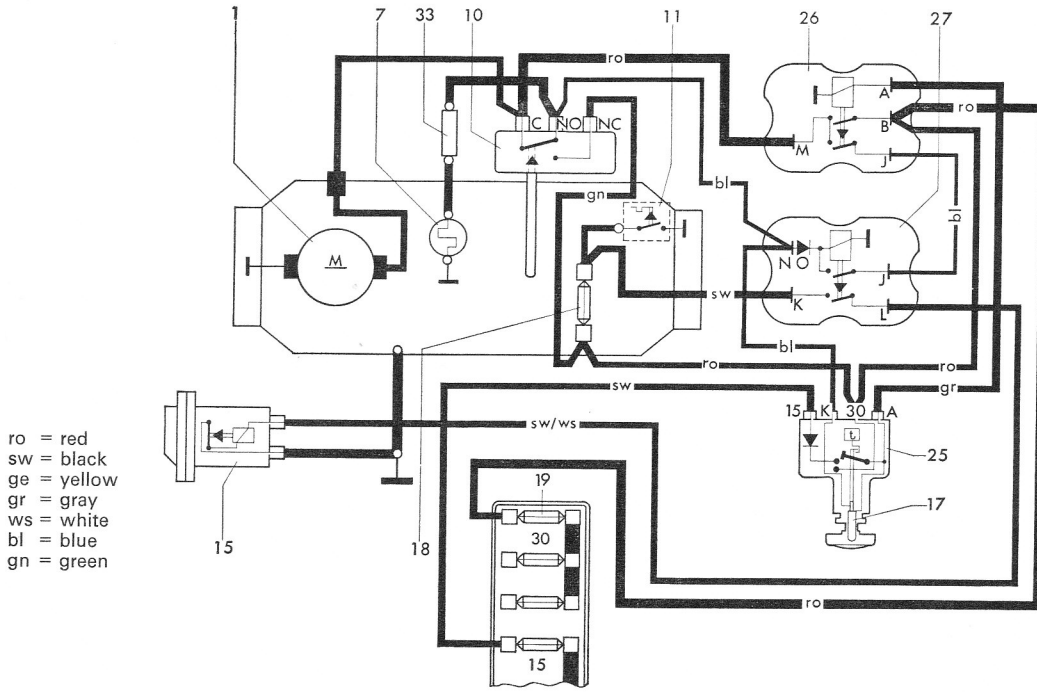
The blower motor (1) starts running.
 The glow plug (7) heats up and ignites the mixture.

Contact NO of relay (27)

The relay (27) operates.

Contacts K, L, I of relay (27)

The fuel pump delivers (15).
 Solenoid valve (20) opens.



ro = red
 sw = black
 ge = yellow
 gr = gray
 ws = white
 bl = blue
 gn = green

- 0 – Heater off
- I – Heater on (engine running)
- II – Heater on (engine not running, clockwork to limit time)
- 1 – Blower motor
- 7 – Glow plug
- 10 – Thermoswitch
- 11 – Overheating switch
- 15 – Fuel pump
- 17 – Warning lamp
- 18 – Fuse 8 amp.
- 19 – Main fuse 16 amp.
- 20 – Filter with solenoid valve
- 25 – Time switch
- 26 – Relay I
- 27 – Relay II
- 33 – Series resistance

Heating time:

When heater is burning the thermoswitch (10) changes over to contacts C–NC and warning lamp (17).

No voltage can be measured at:

- Contact NO of thermoswitch (10)
 The glow plug (7) is switched off.
- Contact NO of relay (27)
- Contact NO of switch (25)
 The contact NO or K of switch (25) has the ground potential via the glow plug (7).

Voltage can be measured at:

- Contact A of switch (25)
 The warning lamp (17) lights up.

Operation of overheating switch:

If the heater overheats, the overheating switch (11) closes and the fuse (18) blows.

The following are de-energized:

Contact K of relay (27)
Fuel pump (15)
Solenoid valve (20)

The fuel pump (15) stops working.
the solenoid valve (20) closes.
The heater cools down and after 3 minutes the
thermoswitch switches contact C-NO.

After about 3 minutes, voltage can be measured at:

Contact C of thermoswitch (10)
Glow plug (7)
Contact NO of relay (27)
Contact NO of switch (25)

The blower motor (1) works, the warning lamp (17) goes
out. The heater should be switched off as otherwise
the battery will run down.

When heater is switched off:

The warning lamp (17) goes out immediately and the run-on commences. The switch (25)
contacts B-A or 30-A and NO-A or K-A are separated.

Run-on:

At a temperature of 20° C this lasts about 3 minutes. At lower temperatures it is correspondingly
shorter. The run-on is necessary to blow all traces of gas out of heat exchanger and to cool
it down.

The following are de-energized:

Contact A of switch (25)
Contact A of relay (26)

The relay (26) is de-energized.

Contact 1 of relay (26)
Contact 1 of relay (27)

The relay (27) is de-energized.

Contact L of relay (27)

Fuel pump (15) stops working.
Solenoid valve (20) closes.

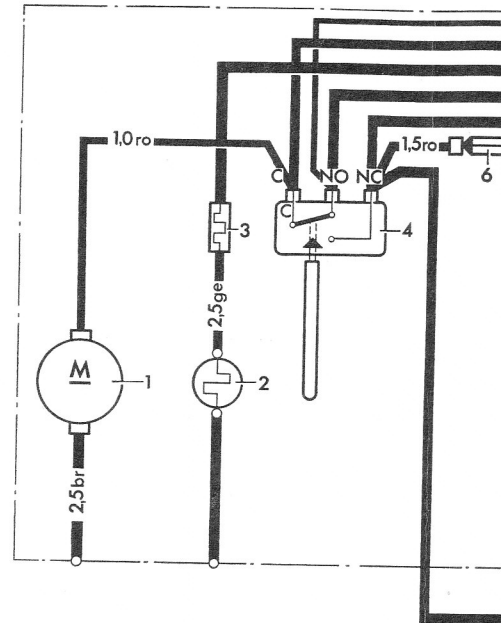
Voltage can be measured at:

Terminal 30
Contact B of relay (26)
Contact B of switch (25)
Contact NC of thermoswitch (10)
Contact C of thermoswitch (10)
Blower motor (1)

Blower motor (1) continues running.
After 2 to 3 minutes, when the heat exchanger
has cooled down, the thermoswitch (10) operates
contacts C-NO and the blower stops working.

- 1 – Combustion air blower motor
- 2 – Glow plug
- 3 – Series resistance (installed under upper cover)
- 4 – Thermoswitch
- 5 – Overheating switch
- 6 – Fuse for overheating switch (8 amp.)
- 7 – Fuel pump
- 8 – Connector
- 9 – Relay
- 10 – Fuse box
- 11 – Switch
- 12 – 1.2 watt bulb
- 13 – Safety switch
(Response time approx. 3 minutes)
- 14 – Connector
- 15 – Fuse 16 amp.

a – to starter-ignition switch – terminal 30
b – to lighting switch – terminal 30



Explanation of wiring diagram

To switch heater on:

Pull switch out. The heater starts up. The warning lamp (12) lights up and switch contacts 30-A are closed.

Start up:

Within 45 seconds the heater should ignite. The start up period is controlled by the thermostatic switch (4).

Voltage can be measured at:

- Fuse box (10) – input side
- Fuse (15)
- Contacts 30-A of switch (11)
- Contact A of safety switch (13)
- Contact A of relay (9)

The relay (9) operates contacts M-B.

- Contact NC of thermostatic switch (4)
- Contact B of relay (9)
- Contact M of relay (9)
- Contact C of thermostatic switch (4)

The blower motor (1) starts.

- Contact NO of thermostatic switch (4)
- Contact NO relay (9)

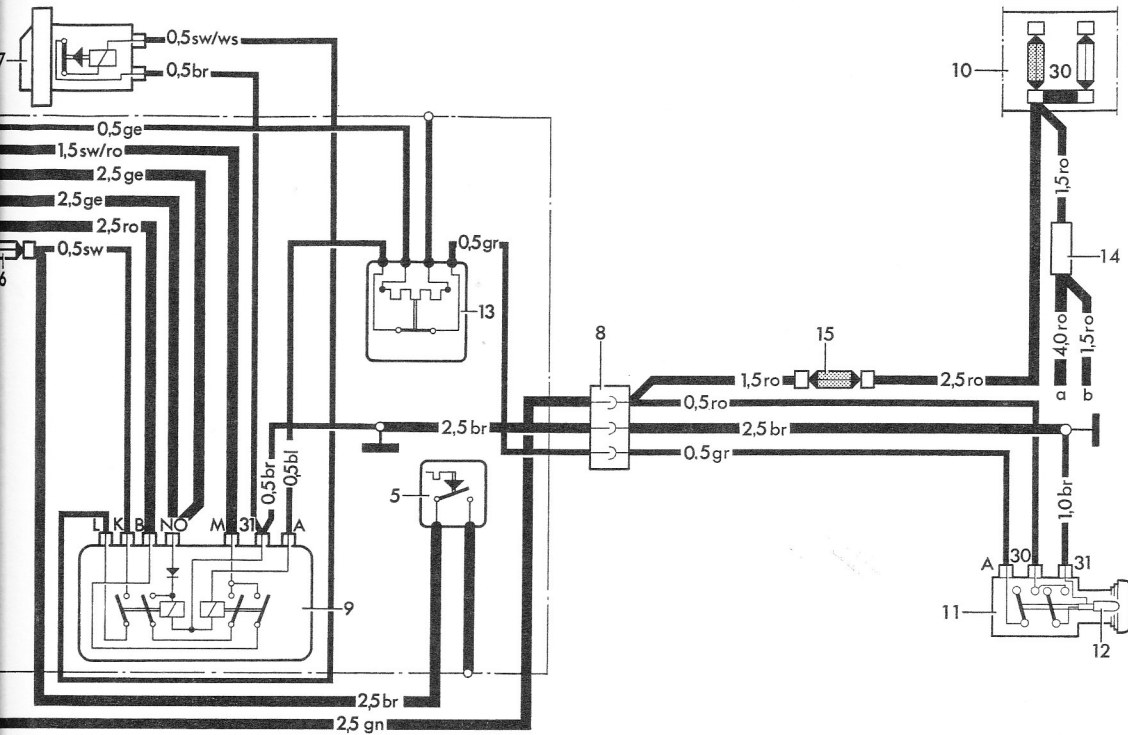
The relay (9) operates contacts K-L, NO-M.

- 8 amp. fuse (6)
- Contact K-L of relay (9)
- Fuel pump (7)

The fuel pump (7) starts to deliver fuel.

- Series resistance (3)
- Glow plug (2)

The glow plug (2) heats up and ignites the fuel-air mixture.



gr = grey
ws = white
gr = green

ro = red
sw = black
ge = yellow
br = brown

Heating time:

When the mixture has ignited and the heater warms up, the thermoswitch (4) switches the contacts C-NC.

The following are then de-energized:

- Contact NO of thermoswitch (4)
- Contact NO of relay (9)
- Series resistance (3)

The current supply to the glow plug (2) is cut off.

Operation of overheating switch:

If the heater overheats, the overheating switch (5) closes and causes a short circuit which blows fuse (6).

The following are de-energized:

- Contacts K, L of relay (9)

The fuel pump (7) stops working. The combustion air blower (1) continues to supply air which cools down the heat exchanger and blows out all traces of gas.

After about 3 minutes the thermoswitch (4) switches contacts C-NO.

Voltage can be measured at:

Contact C of thermostat (4)
Contact NO of thermostat (4)
Contact NO of safety switch (13)

The element of the safety switch (13) heats for more than 3 minutes and then the connection between switch contact A and relay contact A is broken. The relay (9) breaks connection between contacts M-B.

The following are de-energized:

Contact M of relay (9)
Contacts C-NO of thermostat (4)

Blower motor (1) and glow plug (2) are switched off.

Operation of safety switch (13):

The safety switch (13) responds if the thermostat (4) holds the contacts C-NO longer than about 3 minutes because combustion has not taken place in the heater or because the quartz rod in the thermostat (4) is broken.

Voltage can be measured at:

Contacts C-NO of thermostat (4)
Contact NO of safety switch (13)

The element of the safety switch (13) heats for more than 3 minutes and then the connection between switch contact A and relay switch A is broken. The relay (9) breaks the connection between contacts M-B.

The following are de-energized:

Contact M of relay (9)
Contacts C-NO of thermostat (4)

Blower motor (1) and glow plug are switched off.

To switch heater off:

Press switch (11) in. The warning lamp (12) goes out, switch contacts A-30 are separated and run-on begins.

Run-on:

The run-on lasts about 3 minutes at a temperature of 20° C and is shorter at lower temperatures. The run-on is necessary to cool the heat exchanger down and blow out all traces of gas.

The following are de-energized:

Contact A of safety switch (13)
Contact A of relay (9)

All contacts in relay (9) are separated.

Contact L of relay (9)

The fuel pump stops working.

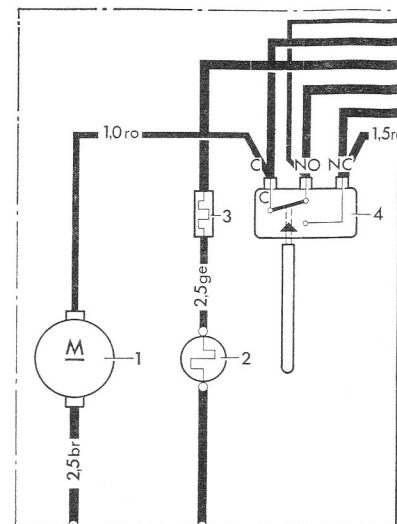
Voltage can be measured at:

Contacts NC-C of thermostat (4)

When the heat exchanger has cooled down, the thermostat (4) switches contacts C-NO. The blower motor stops working.

a – to fan switch
 b – to instrument harness
 c – to lighting switch –
 terminal 30
 d – to starter-ignition switch –
 terminal 30

1 – Combustion air blower motor
 2 – Glow plug
 3 – Series resistance (installed under top cover)
 4 – Thermostwitch
 5 – Overheating switch
 6 – Fuse for overheating switch – 8 amp.
 7 – Fuel pump
 8 – Connector
 9 – Relay
 10 – Fuse box
 11 – Switch
 12 – 1.2 watt bulb
 13 – Safety switch
 14 – Timing clock
 15 – Fuse, 8 amp., for fan motor
 16 – Connector
 17 – Fuse for heater, 16 amp.



Wiring diagram for BN 2 heater with timing clock (time switch in clock)

(The operation of the heater is described on page F 4.1/6–3.)

To switch heater on without using timing clock (14)

Switch ignition on and pull knob of switch (11). Contacts X–A are closed.

Voltage can be measured at:

Connector (16)
 Contacts X–A of switch (11)

The warning lamp (12) lights up.

Contact A of safety switch (13)
 Contact A of relay (9)

The relay (9) operates and heater starts up.
 (The process which follows and the voltage
 checking points are described on page F 4.1/6–3.)

To switch heater off – Timing clock (14) not ready to work

Switch ignition off or push switch knob (11) in.

The following are de-energized:

Contact A of switch (11)
 Contact A of safety switch (13)
 Contact A of relay (9)

The relay (9) is de-energized and run-on begins.
 (The process which follows and the voltage
 checking points are described on page F 4.1/6–3.)

F 4.1 Description of Heating System

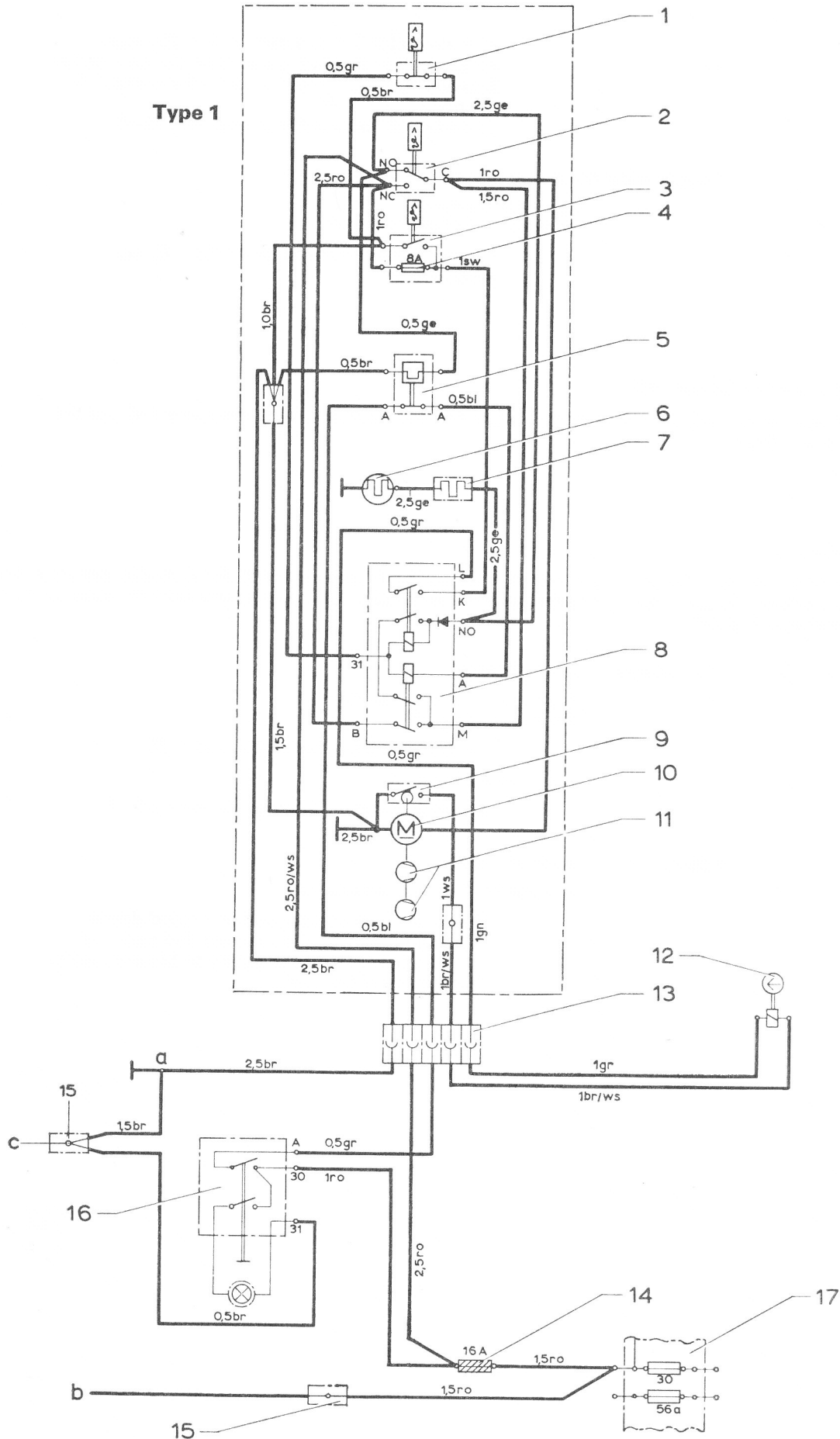
Heater is switched off automatically 15 minutes after being switched on by timing clock (14):

Contacts 30-Z in clock (14) are opened.

The following are de-energized:

- Contact Z in clock (14)
- Contact Z-A in switch (11)
- Contact A-A in safety switch (13)
- Contact A in relay (9)

The relay (9) is de-energized and run-on begins.
The process which follows and the voltage checking points are described on page F 4.1/6-3)



Explanation

(Testing should always be carried out with the engine running at a fast idle.)

To switch heater on

Pull switch knob out. The heater starts up and the warning light comes on. Switch contacts 30-A are closed.

Start-up

The heater ignites within about 40 seconds. The start-up process is terminated by the thermo-switch (2).

Voltage can be measured at:

- Fuse box (17) – unfused side
- Separate fuse (14)
- Terminals 30-A of switch (16)
- Terminal 1 of safety switch (5)
- Terminal A of relay (8)

The relay (8) operates contacts M-B.

- Terminal NC of thermo-switch (2)
- Terminals B-M of relay (8)
- Terminal C of thermo-switch (2)

The blower motor (10) starts to run.

- Terminal NO of thermo-switch (2)
- Terminal NO of relay (8)

The relay (8) operates contacts K-L, NO-M.

- 8 amp fuse (4)
- Terminals K-L of relay (8)
- Metering pump (12)

The metering pump (12) starts to deliver fuel.

- Series resistance (7)
- Glow plug (6)

The glow plug (6) warms and ignites the fuel-air mixture.

Heating

When the heater has ignited and warmed up, the thermo-switch (2) operates the contacts C-NC and this stops the start-up process.

The following are de-energized:

- Terminal NO of thermo-switch (2)
- Terminal NO of relay (3)
- Series resistance (7)

The glow plug (6) is switched off.

Temperature regulation

Before the air being delivered becomes too hot because the ambient temperature near the vehicle is not particularly low, the temperature limiting switch (1) opens and the heater runs on until the thermo-switch responds again.

When the temperature limiting

The following

After about two to three minutes the temperature limiting switch (1) has closed.

Operation of overheating

If the heater gets too hot, the thermo-switch (2) blows the fuse (4).

The following

Voltage can be

The following

Operation of safety switch

The safety switch (5) responds after about 3 minutes because the thermo-switch (2) is defective.

Voltage can be

When the temperature limiting switch (1) opens, the relay (8) breaks the contacts.

The following is de-energized:

Terminal L on relay (8)

The fuel pump (12) stops delivering.
The heater starts to cool down.

After about two to three minutes the thermo-switch (2) operates contacts C-NO. The temperature limiting switch (1) has closed in the meantime and the heater starts up again.

Operation of overheating switch

If the heater gets too hot, the overheating switch (3) closes and causes a short circuit which blows the fuse (4).

The following are de-energized:

Terminals K and L in relay (8)

The pump (12) stops delivering fuel. The combustion air blower (10) continues to run to cool down the heater and blow out all traces of gas.
After about 3 minutes, the thermo-switch (2) operates contacts C-NO

Voltage can be measured at:

Terminal C of thermo-switch (2)
Terminal NO of thermo-switch (2)
Terminal NO of safety switch (5)

The glow element of safety switch (5) warms for more than 3 minutes and then the connection between switch contact A and relay contact A is broken.
The relay (8) breaks the connection M-B.

The following are de-energized:

Terminal M of relay (8)
Terminal C-NO of thermo-switch (2)

Blower motor (10) and glow plug (6) are switched off.

Operation of safety switch (5)

The safety switch (5) responds when the thermo-switch (2) holds the contacts C-NO longer than about 3 minutes because combustion has not taken place in the heater or because the thermo-switch (2) is defective.

Voltage can be measured at:

Terminals C-NO of thermo-switch (2)
Terminal NO of safety switch (5)

To swi

Press sv
run-on

Run-on

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F 4.1 Description of Heating System

The glow element of safety switch (5) warms for more than 3 minutes and then the connection between switch contact A and relay contact A is broken.

The relay (8) breaks the connection M-B.

The following are de-energized:

Terminal M of relay (8)
Terminal C-NO of thermo-switch (2)

Blower motor (10) and glow plug (6) are switched off.

To switch heater off

Press switch (16) in. The warning lamp goes out, contacts A-30 are separated and the run-on begins.

Run-on

The run-on lasts for about 3 minutes at an ambient temperature of 20° C and is shorter at lower temperatures. The run-on is necessary in order to clear all traces of gas from the heat exchanger and cool it down.

The following are de-energized:

Terminal A of safety switch (5)
Terminal A of relay (8)

All contacts are separated in relay (8)

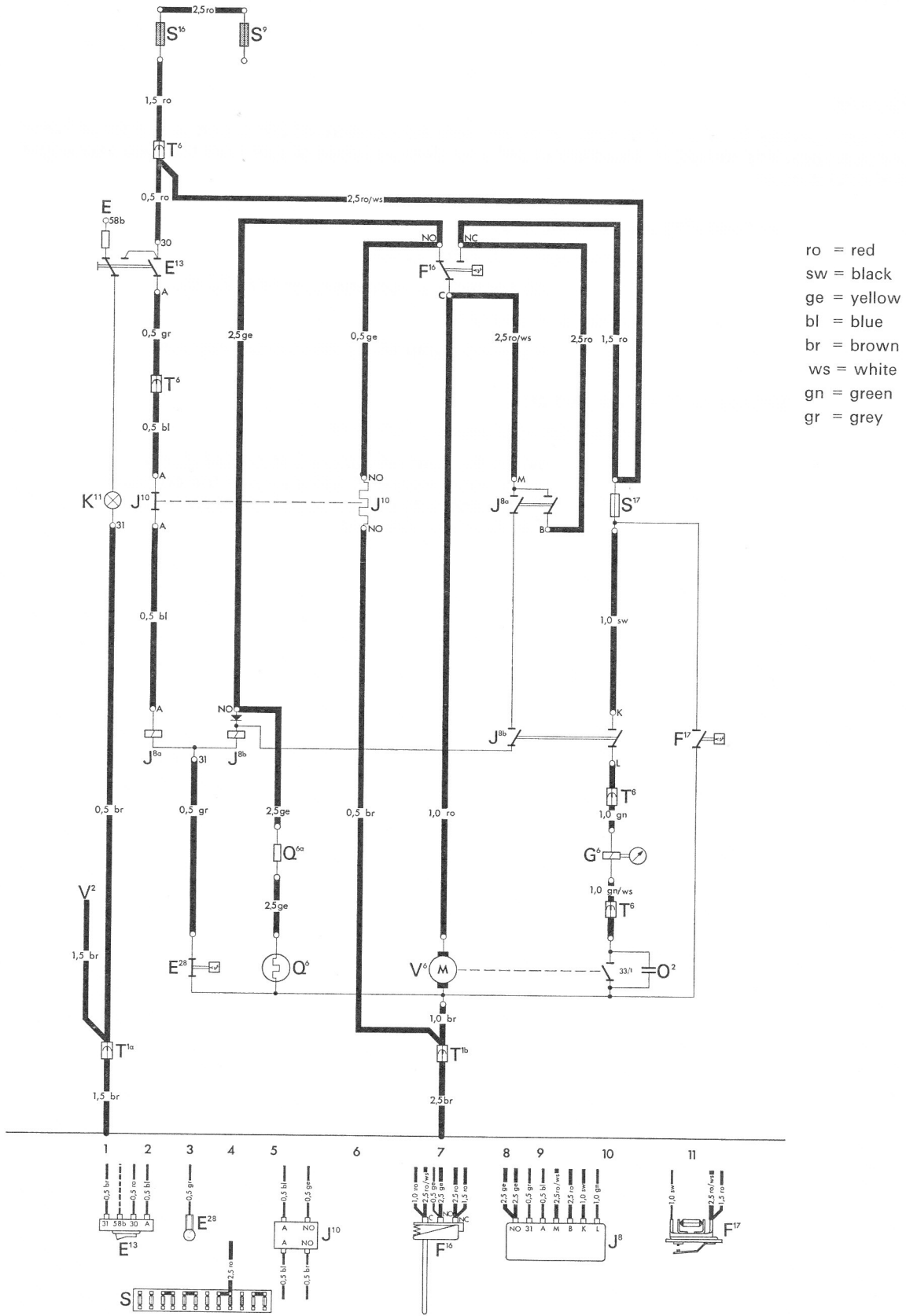
Terminal L of relay (8)

Metering pump (12) stops delivering fuel.

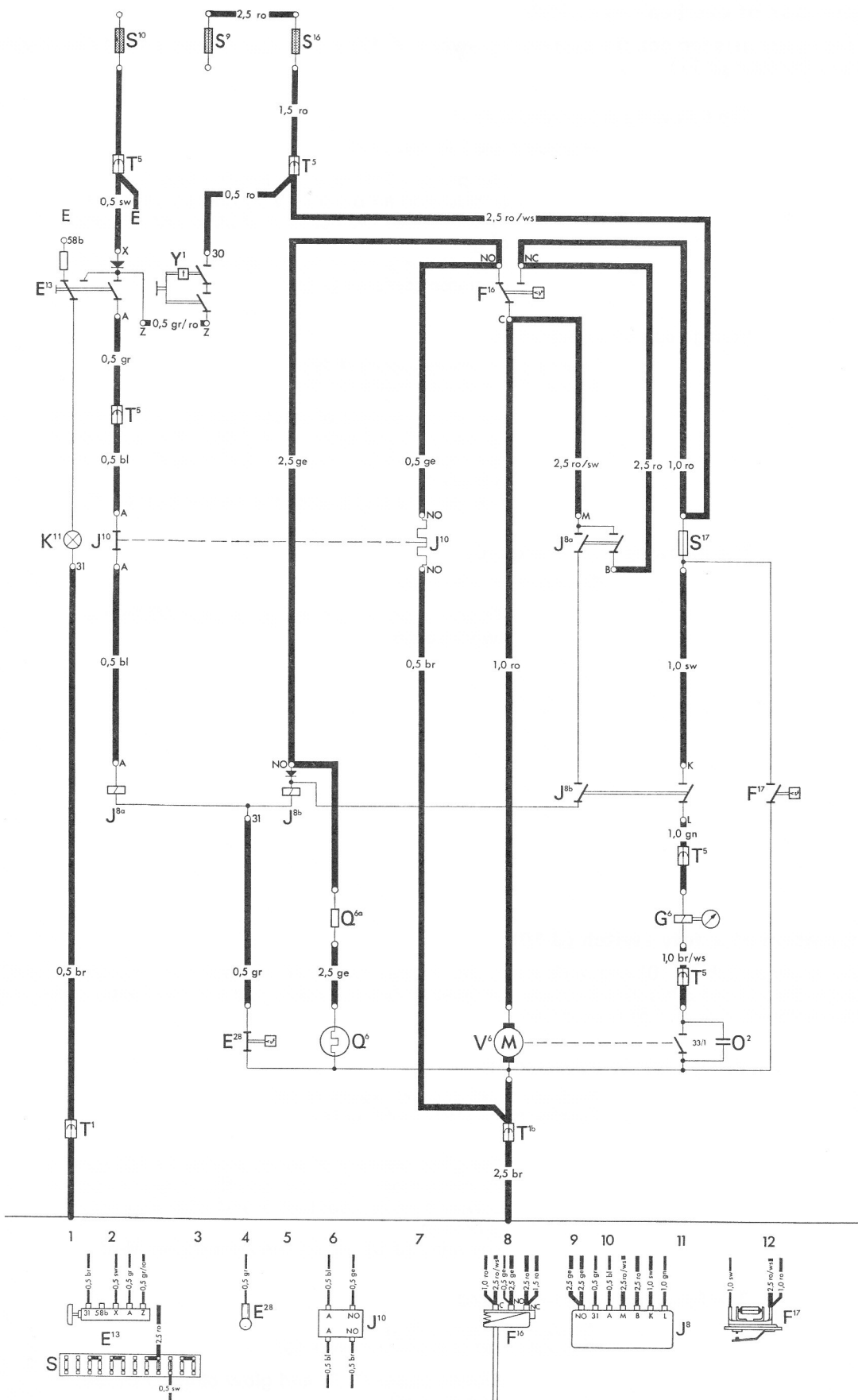
Voltage can be measured at:

Terminal NC-C of thermo-switch (2)

When the heat exchanger has cooled down the thermo-switch (2) operates the contacts C-NO and cuts current supply to blower motor. The run-on is finished.



**Wiring diagram and explanation (from August 1972)
 Type 1 from Chassis No. 113 2 000 001
 Type 3 from Chassis No. 313 2 000 001**



Designation

- E – to wiper sw
- E^{58b} – to lighting Canadian v
- E¹³ – Switch with
- E²⁸ – Temperatur
- F¹⁶ – Thermo-sw
- F¹⁷ – Overheating
- G⁶ – Metering p
- J⁸ – Relay
- J¹⁰ – Safety swit
- K¹¹ – Warning lar
- Q² – Breaker con
- Q⁶ – Glow plug
- Q^{6a} – Series resis
- S⁹ – Fuse No. 9
- S¹⁰ – Fuse No. 1
- S¹⁶ – Separate fu
- S¹⁷ – Overheating
- T¹ – Single conn
- T^{1a} – Single conn
- T^{1b} – Single conn
- T⁶ – Connector
- V² – to fan mot
- V⁶ – Blower mo
- Y – Clock with

Explanation of wiring

(Testing should always be done with the power off.)

To switch heater on:

Pull switch out. The heater will start.

Start up:

Within 40 seconds the heater switch (F 16) will close.

Voltage can be checked at the motor terminals.

Description of Heating System **F 4.1**

Designation	in current track
E – to wiper switch	1
E ^{58b} – to lighting switch – terminal 58b – only used in US-Canadian vehicles	1
E ¹³ – Switch with warning lamp 1.2 watt	2
E ²⁸ – Temperature limiting switch	3/4
F ¹⁶ – Thermo-switch	7/8
F ¹⁷ – Overheating switch	11/12
G ⁶ – Metering pump	10/11
J ⁸ – Relay	2, 4, 5, 8, 9, 10
J ¹⁰ – Safety switch	2, 6, 7
K ¹¹ – Warning lamp 1.2 watt	1
O ² – Breaker contact for metering pump impulse	10/11
Q ⁶ – Glow plug	5/6
Q ^{6a} – Series resistance	5/6
S ⁹ – Fuse No. 9 in fuse box – terminal 30	4/5
S ¹⁰ – Fuse No. 10 in fuse box – terminal 15	2
S ¹⁶ – Separate fuse – 16 amp.	2
S ¹⁷ – Overheating fuse – 8 amp.	10/11
T ¹ – Single connector	1
T ^{1a} – Single connector – on fan motor ground	1
T ^{1b} – Single connector – under protective cap	7/8
T ⁶ – Connector – 6 pin	1, 10, 11
V ² – to fan motor	1
V ⁶ – Blower motor	7/8
Y – Clock with time switch	3

Explanation of wiring diagram

(Testing should always be carried out with engine running at a fast idle.)

To switch heater on:

Pull switch out. The heater starts up. The switch contacts 30–A are closed.

Start up:

Within 40 seconds the heater should ignite. The start up period is controlled by the thermo-switch (F 16).

Voltage can be measured at:

- Fuse box (S 9) – input side
- Contacts A–A of safety switch (J 10)

The relay (J 8a) operates contacts M–B.

Terminal NC of thermo-switch (F 16)
Terminal C of thermo-switch (F 16)

The blower motor (V 6) starts to run.

Terminal NO of thermo-switch (F 16)

The relay (J 8 b) operates contacts K-L, NO-M.

8 amp fuse (S 17)
Terminals K-L of relay (J 8 b)

The metering pump (G 6) starts to deliver fuel.

Series resistance (Q 6 a)

The glow plug (Q 6) warms and ignites
the fuel-air mixture.

Heating

When the heater has ignited and warmed up, the thermo-switch (F 16) operates the contacts C-NC and this stops the start-up process.

The following are de-energized:

Terminal NO of thermo-switch (F 16)

The glow plug (Q 6) is switched off.

Temperature regulation

Before the air being delivered becomes too hot, the temperature limiting switch (E 28) opens and the heater runs on until the thermo-switch responds again.

When the temperature limiting switch (E 28) opens, the relay (J 8) breaks the contacts.

The following is de-energized:

Terminal L on relay (J 8 b)

The fuel pump (G 6) stops delivering.
The heater starts to cool down.

After about two to three minutes the thermo-switch (F 16) operates contacts C-NO. The temperature limiting switch (E 28) has closed in the meantime and the heater starts up again.

Operation of overheat

If the heater gets too hot
blows the fuse (S 17).

The following

Voltage can

The following

Operation of safety s

The safety switch (J 10)
longer than about 3 min
the thermo-switch (F 16

Voltage can

The following

Operation of overheating switch

If the heater gets too hot, the overheating switch (F 17) closes and causes a short circuit which blows the fuse (S 17).

The following are de-energized:

Terminals K and L in relay (J 8b)

The pump (G 6) stops delivering fuel. The combustion air blower (V 6) continues to run to cool down the heater and blow out all traces of gas.

After about 3 minutes, the thermo-switch (F 16) operates contacts C-NO

Voltage can be measured at:

Terminal C of thermo-switch (F 16)

Terminal NO of thermo-switch (F 16)

The glow element of safety switch (J 10) warms for more than 3 minutes and then the connection between switch contact A and relay contact A is broken.

The relay (J 8a) breaks the connection M-B.

The following is de-energized:

Terminal M of relay (J 8a)

Blower motor (V 6) and glow plug (Q 6) are switched off.

Operation of safety switch (J 10)

The safety switch (J 10) responds when the thermo-switch (F 16) holds the contacts C-NO longer than about 3 minutes because combustion has not taken place in the heater or because the thermo-switch (F 16) is defective.

Voltage can be measured at:

Terminals C-NO of thermo-switch (F 16)

Terminal NO of safety switch (J 10)

The glow element of safety switch (J 10) warms for more than 3 minutes and then the connection between switch contact A and relay contact A is broken.

The relay (J 8) breaks the connection M-B.

The following are de-energized:

Terminal M of relay (J 8a)

Terminal C-NO of thermo-switch (F 16)

Blower motor (V 6) and glow plug (Q 6) are switched off.

To switch

Press swit
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Run-on

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and cool i

F 4.1 Description of Heating System

To switch heater off

Press switch (E 13) in. The contacts A-30 are separated and the run-on begins.

Run-on

The run-on lasts for about 3 minutes at an ambient temperature of 20° C and is shorter at lower temperatures. The run-on is necessary in order to clear all traces of gas from the heat exchanger and cool it down.

The following are de-energized:

Terminal A of safety switch (J 10)

All contacts are separated in relay (J 8).

Terminal L of relay (J 8)

Metering pump (G 6) stops delivering fuel.

Voltage can be measured at:

Terminal NC-C of thermo-switch (F 16)

When the heat exchanger has cooled down the thermo-switch (F 16) operates the contacts C-NO and cuts current supply to blower motor. The run-on is finished.

Trouble shooting with heater installed

It is only possible to localize a defect by subjecting the heater to a systematic test. For this reason, trouble shooting should always be carried out in the sequence given here.

Switch heater on

The following conditions may be found:

- A – Heater does not work (see F 4.2/1–2)
- B – Heater smokes (see F 4.2/1–4)
- C – Heater goes out (see F 4.2/1–4)

If one of these conditions is found, the heater must be checked as explained on the following pages.

F 4.2 Trouble Shooting

A – Heater does not work

Check	Possible fault	Remedy
1 – Current supply interrupted, 16 ampere fuse blown	Short circuit in system	Check for wiring fault (see wiring diagram on page F 4.1/5-1) or short circuit. Rectify defect and install new 16 amp. in holder
2 – Safety switch has switched heater off (see wiring diagram, page F 4.1/5-1, item 13)	a – Thermostwitch has not operated b – Mixture has not ignited because glow plug is defective	a – Check switch and replace or adjust (see F 4.3/1-2) b – Replace glow plug (see F 4.5/1-2)
3 – 8 amp. fuse has blown (see F 4.1/5-2)	Heater has overheated and overheating switch has operated. a – Hot air short circuit – the hot air from heater is drawn in again because the outlet is directing the hot air into the intake elbow b – Air ducts blocked	a – Turn the hot air outlet b – Clear the ducts
4 – Voltage drop	Battery voltage low	Start engine so that generator voltage is available. If necessary, remove and charge battery
5 – Glow plug (see F 4.3/1-2)	Glow coil broken	Replace glow plug (see F 4.5/1-2)
6 – Fuel	Tank empty	Fill tank
7 – a – Filter b – Strainer in pressure regulator (see F 4.8/2-1) c – Jet	a – Filter bowl full of water or strainer dirty b – Strainer blocked c – Jet blocked	a – Empty the bowl and clean with compressed air (see F 4.3/2-2) b – Clean strainer c – Clean jet with compressed air

Check	Possible fault	Remedy
8 – Fuel pump (see F 4.6/1–1)	<p>a – Pump drawing in air (pump works unevenly or too fast) (see F 4.6/1–1).</p> <p>b – Pump not working (short circuited or contacts burnt) (see F 4.3/1–4).</p> <p>c – Valves in pump housing sticking</p>	<p>a – Check pipe from tank to pump for leakage</p> <p>b – Check contacts, clean and adjust. Replace pump if necessary. Check 8 amp. fuse (see F 4.1/5–2)</p> <p>c – Clean valves (see F 4.6/1–1)</p>
9 – Thermostat	<p>a – Thermostat not working in the specified period</p> <p>b – Thermostat not working</p>	<p>a – Adjust thermostat (see F 4.3/1–2)</p> <p>b – Replace thermostat (see F 4.5/1–2)</p>
10 – Relay	<p>a – Contacts defective</p> <p>b – Diode defective (see F 4.3/1–3)</p>	<p>a; b – Replace relay (see F 4.5/1–4)</p>
11 – Blower motor	<p>a – Motor does not attain prescribed speed</p> <p>b – Motor not working (see F 4.3/1–2)</p>	<p>a; b – Check motor, replace if necessary (see F 4.5/1–1 and F 4.3/1–2)</p>
12 – Shortage of combustion air	<p>a – Intake pipe blocked</p> <p>b – Exhaust pipe blocked</p>	<p>a; b – Clean (see F 4.4/1–1)</p>

F 4.2 Trouble Shooting

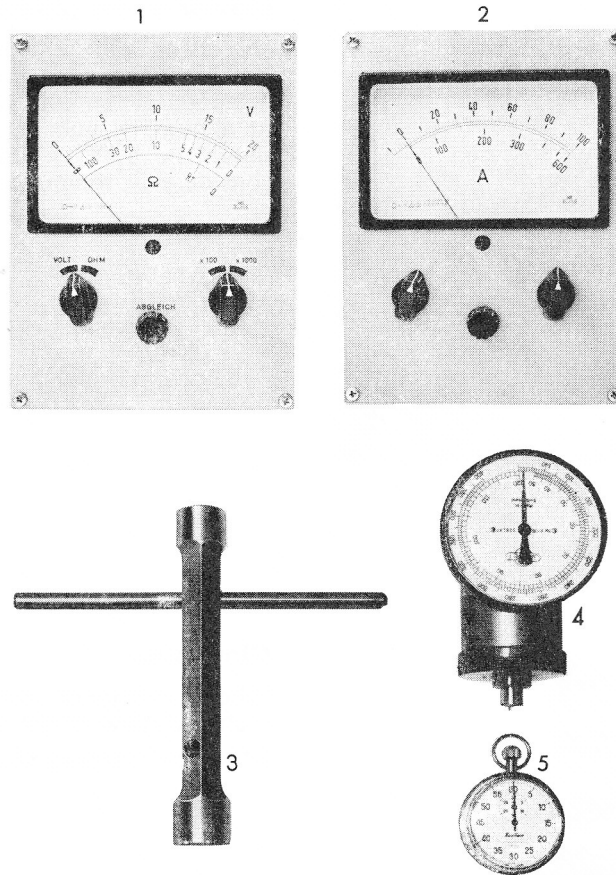
B – Heater smokes

Check	Possible fault	Remedy
1 – Combustion air intake pipe or exhaust pipe blocked (see F 4.2/1–3)		
2 – Pressure regulator	a – Defective b – Incorrectly adjusted	a – Replace (see F 4.5/1–3) b – Check and adjust (see F 4.3/1–4)
3 – Fuel pump	Incorrectly adjusted	Adjust correctly (see F 4.3/1–4)

C – Heater goes out

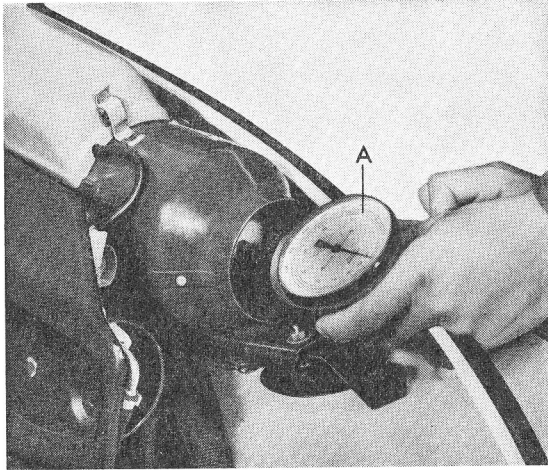
Check	Possible fault	Remedy
1 – Heater not getting sufficient fuel (see F 4.2/1–3, point 7)		
2 – Shortage of combustion air (see F 4.2/1–3, point 12)		
3 – Overheating switch has operated – 8 amp. fuse blown (see F 4.2/1–2, point 3)		

Checking and Adjusting Parts of Heater **F 4.3**



No.	Designation	Special Tool No.	Remarks
1	Ohmmeter/voltmeter		range 0–20 volts
2	Ammeter		range 0–20 amps.
3	Box wrench		20 mm A/F
4	Revolution counter		0–8000 rpm.
5	Stop watch		

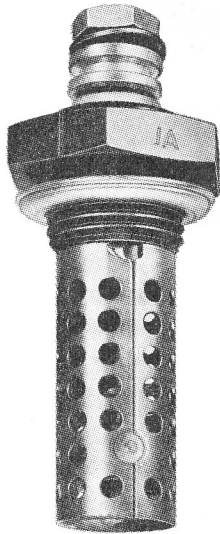
F 4.3 Checking and Adjusting Parts of Heater



A – Revolution counter

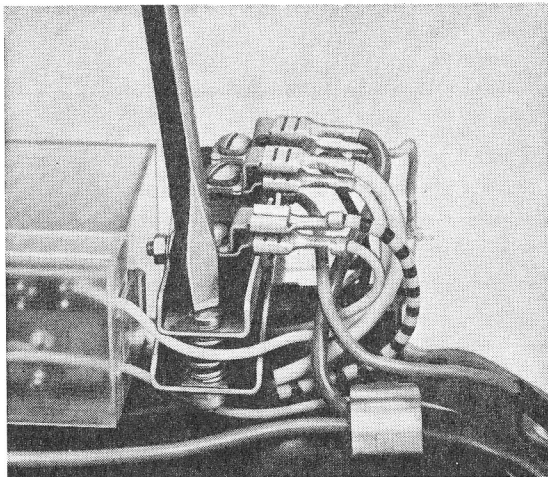
Blower motor (checking speed)

The speed can be measured with the motor installed. The supply cable to the motor is detached at terminal C on the thermostwitch. At a nominal voltage of 12 volts the speed should be $5700 \pm 5\%$. If the speed deviates considerably, the motor should be replaced.



Glow plug

When a voltage of 4 volts is applied to the plug it should glow bright red after one minute. Otherwise the plug should be replaced.



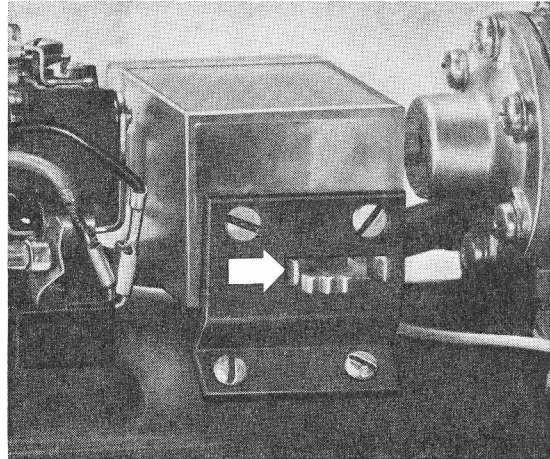
Thermostwitch

- 1 – Switch heater on and let it run for at least 5 minutes.
- 2 – Switch off and start stop watch.
- 3 – The combustion air blower, controlled by the thermostwitch, should run on for 100–180 seconds. This value is based on a nominal voltage of 12 volts and an outside temperature of 20°C . At lower temperatures the run-on time is shorter.

If the run-on time is not correct, the thermostwitch must be adjusted. If time is too long, turn adjusting screw to the right, if too short, turn screw to left. If the motor does not switch off, the quartz rod may be broken. If so, the rod must be replaced.

Checking and adjusting safety switch

- 1 – Disconnect cables from pump and glow plug.
- 2 – Switch heater on. After about 3 to 4 minutes (at nominal voltage and ambient temperature of 20° C) the switch should interrupt the circuit to the relay (contact A).
- 3 – If the switch operates within the specified time, push the switch lever in direction shown by arrow and switch heater on again.

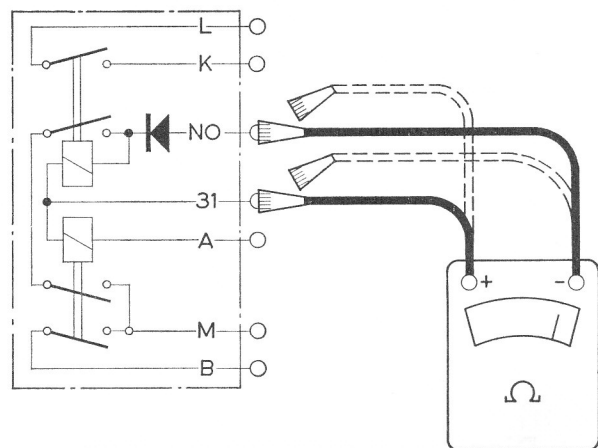


Checking dual relay

- 1 – Take 16 amp. heater fuse out of fuse box
- 2 – Disconnect all cables from relay and take relay out.
- 3 – a) Connect ohmmeter to terminals NO and 31 on relay. The meter will show a certain reading (low **or** high resistance).
b) Change test probes over (see dotted lines). If the ohmmeter shows the **same** reading as before, the diode is defective and the relay must be replaced.
- 4 – Apply a voltage of 12 volts between the terminals M (+) – 31 (–), A (+) – 31 (–), L (+) – 31 (–) continuously during the check. Apply 12 volts briefly between terminals NO (+) – 31 (–).

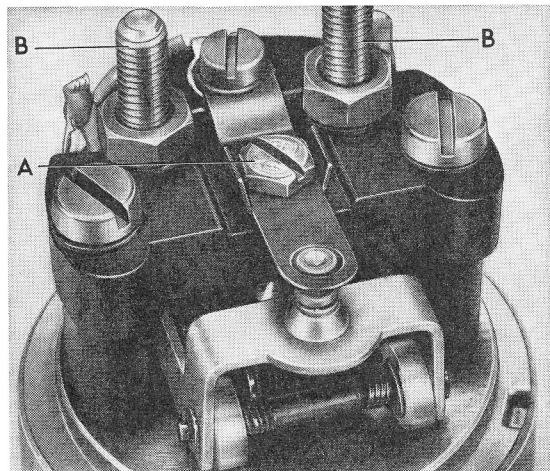
Both relays are then energized.

The voltmeter should now read 12 volts between terminal B (+) – 31 (–) and K (+) – 31 (–) but not between terminals NO (+) – 31 (–) otherwise the relay is defective and must be replaced.



F 4.3 Checking and Adjusting Parts of Heater

Fuel pump



A – Adjusting screw
B – Contact screws

- 1 – Disconnect two-pin plug from fuel pump. Disconnect suction and pressure lines.
- 2 – Remove two nuts from connecting screws and remove cover. Check contact breaker points and lubricate moving parts and springs sparingly if necessary (use bone oil).

Note:

The contact breaker gap should be .04 in./ 1 mm (press lower contact breaker arm against housing). Correct with adjusting screw.

- 3 – Remove four cheese head screws on winding housing and take pump housing off. Turn diaphragm bracket counter-clockwise to remove it and check it visually (see F 4.6/1–1).
- 4 – When reinstalling, first screw diaphragm bracket in clockwise as far as it will go then back off 2½ turns counter-clockwise. The delivery quantity of the fuel pump is then adjusted correctly (see F 4.6/1–1).

- 5 – The fuel pump must be installed on the luggage pan so that the connection on the pressure side is vertically upward as denoted by the arrow. After installation, the fuel line on the pressure side may have to be bled. After this, moisten pressure valve with a few drops of gasoline (see F 4.5/1–4).

Note:

When assembling, ensure that the diaphragm is located in the groove and the winding housing is firmly bolted to the pump housing (the pump will not deliver if air is drawn in at the side). (See F 4.6/1–2.)

There is a vent hole in the winding housing. Secure pump housing to winding housing with four cheese head screws with pressure connection opposite vent hole (see F 4.6/1–1).

Diaphragm pressure regulator

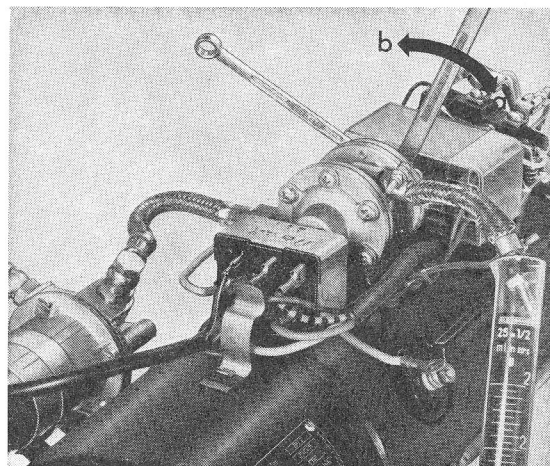
Note:

The fuel delivery quantity can only be set accurately by carrying out a measurement of consumption on the heater. The fuel quantity is measured at the fuel jet.

Before carrying out a consumption measurement or adjustment, clean the filters.

Part	Location	Remarks
Filter	between tank and fuel pump	Clean (see F 4.3/2-2)
Strainer	inlet to pressure regulator	Clean (see F 4.8/2-1)

- 1 – Disconnect glow plug
- 2 – Screw jet at off jet carrier and clean it with compressed air.
- 3 – Install jet on the fuel hose again, then hold measuring glass under the jet (see illustration).
- 4 – Switch heater on and catch the fuel being pumped out for 2 minutes. The amount pumped in this time should be 10.7–12.7 cm³.
- 5 – The amount can be corrected with the screw (No. 1 on page F 4.8/1-1) in the end cap as shown in illustration.



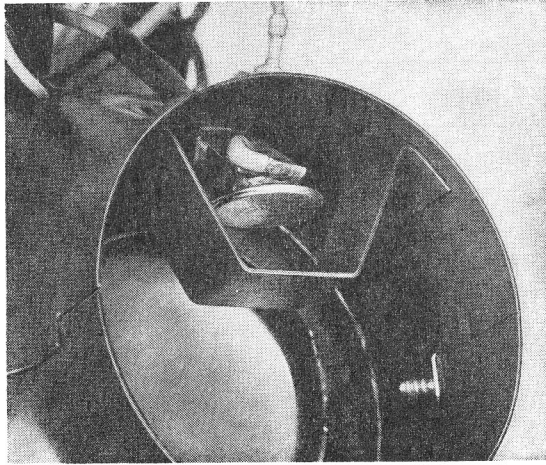
- a – Turning to left;
reduces amount of fuel
- b – Turning to right;
increases amount of fuel.

Note:

If an adequate supply of fuel cannot be attained with the adjusting screw, the filter in the pressure regulator (No. 8 on page F 4.8/2-1) is blocked or the fuel pump is not delivering sufficient fuel (see F 4.3/1-4).

F 4.3

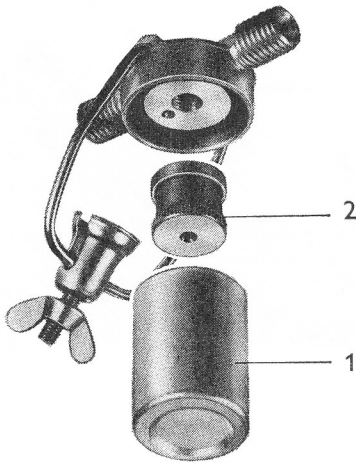
Checking and Adjusting Parts of Heater



Overheating switch

Block the outlet elbow under the instrument panel (about $\frac{2}{3}$ of cross section) and measure the switching temperature of the overheating switch. It should be $180-240^{\circ}\text{C}$.

Defective overheating switches must be replaced.



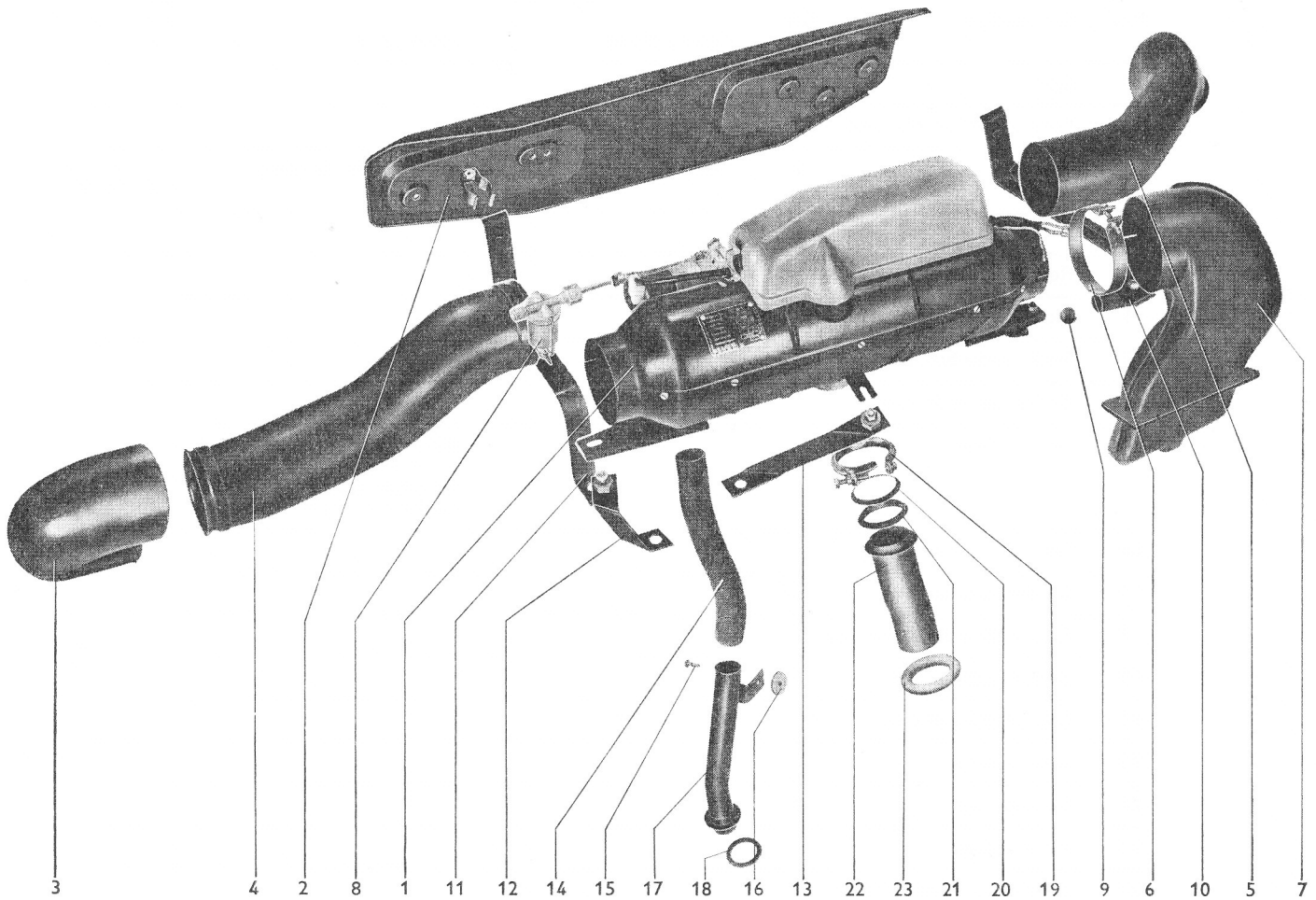
Filter

Water collects in the filter bowl (1) so it must be removed and emptied regularly (see F 4.1/3-1).

At the same time the filter element (2) should be screwed off and cleaned with compressed air.

- 1 – Water collector
- 2 – Filter element

Heater and Hot Air Ducts **F 4.4**



No.	Designation	Qty.	Note when		Special instructions see
			disassembling	assembling	
1	Heater and pump	1	The heater is supported on two brackets and a pin with a rubber bush (item 9) which fits in a tube. This pin is only on heaters installed in Type 1302 vehicles.	Place bush (9) on pin and insert in tube (10) then secure heater to the brackets (12 and 13) Attach fuel hose to filter (8) Connect cables as shown in wiring diagram	F 4.1/5-1
2	Cover plate	1			
3	Air circulating pipe	1			
4	Pipe	1			
5	Intake elbow	1		The intake elbow must engage in the hole in luggage pan	

F 4.4 Heater and Hot Air Ducts

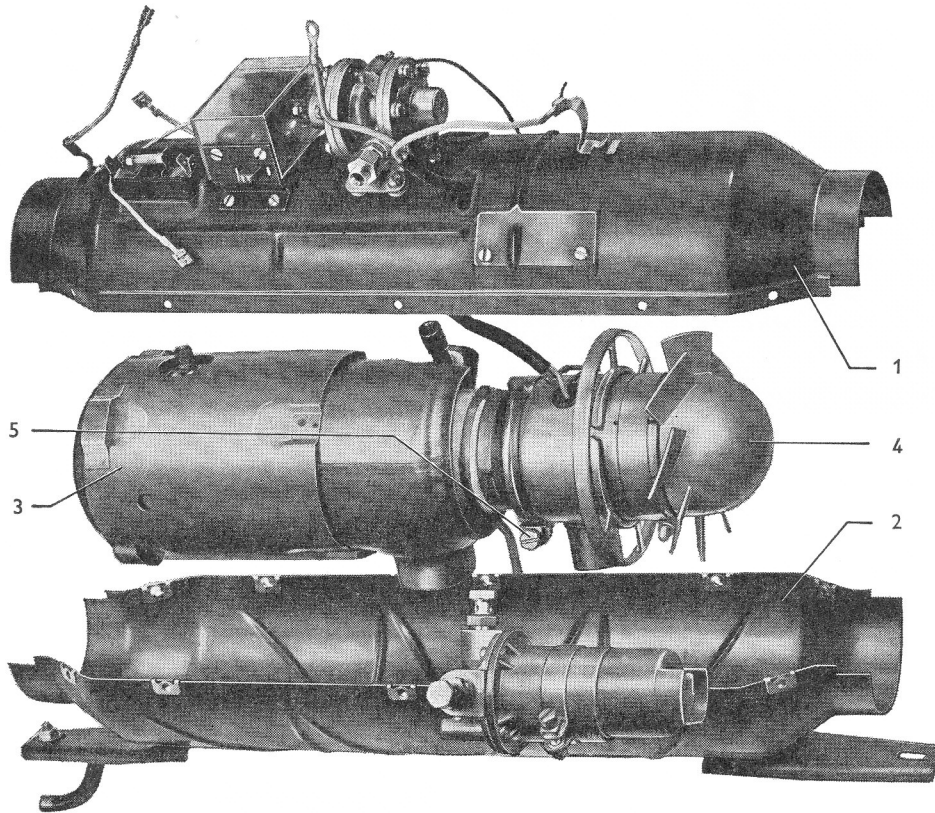
No.	Designation	Qty.	Note when		Special instructions see
			disassembling	assembling	
6	Clip	1			
7	Footwell outlet with seal	1			
8	Filter	1	clean	arrow shows fuel flow direction	F 4.20/1-7
9	Rubber bush	1			
10	Rear heater bracket	1			
11	Front cover plate bracket	1			
12	Front heater bracket	1			
13	Center heater bracket	1			
14	Flexible pipe	1		this pipe must not be kinked and must fit tightly on the intake pipe (17) and on the heater adapter	
15	Tapping screw	1			
16	Rubber washer	1			
17	Combustion air intake pipe	1			
18	Seal for intake pipe	1			
19	Clip for exhaust pipe	1			
20	Tapered ring	1			
21	Sealing ring	1			
22	Exhaust pipe	1			
23	Grommet for exhaust pipe	1			

Removing and Installing Parts of Heater **F 4.5**

Combustion air blower and heat exchanger

Removing

- 1 – Disconnect battery ground strap.
- 2 – Remove heater (see F 4.4/1-1).

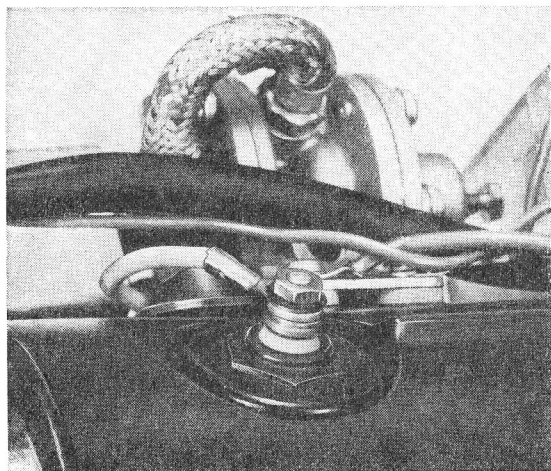


No.	Designation	Qty.	Note when		Special instructions see
			removing	installing	
1	Upper part of casing	1	remove thermoswitch	install thermoswitch and seal hole in casing with silicon washer	F 4.5/1-2
			Remove and clean jet	screw jet in and secure hose with clip	F 4.5/1-2
			remove glow plug	screw plug in and seal hole in casing with a silicon seal	
2	Lower part of casing	1	remove hose between pump and pressure regulator, remove 10 tapping screws	before installing hose, clean filter on pressure regulator	F 4.8/2-1
3+4	Heat exchanger (3) combustion air blower (4)	1 +	the blower is attached to the heat exchanger by the clip (5). Replace damaged seals	at the contact surface between heat exchanger and blower there is a sealing ring. See F 3.5/1-2, part 5	

F 4.5 Removing and Installing Parts of Heater

Installing

- 1 – Install heater (see F 4.4/1–1).
- 2 – Connect battery ground strap and check heater operation.



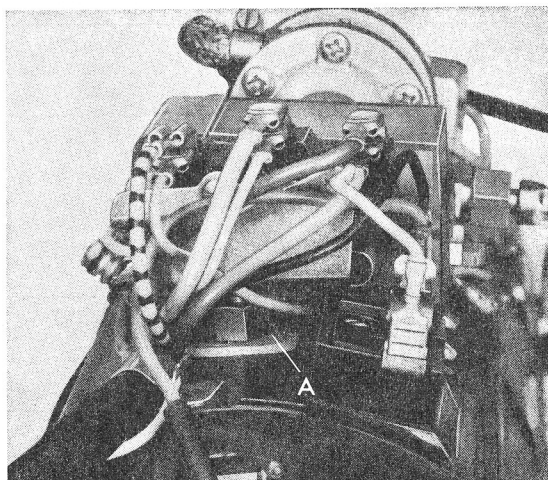
Glow plug

Removing

- 1 – Remove terminal nut (8 mm).
- 2 – Take silicon seal off.
- 3 – Screw plug out with a socket wrench (20 mm).

Installing

Screw plug in and connect cable, using the two lock washers. Press silicon seal over plug on to the casing.



A – washer

Thermoswitch

Removing

- 1 – Disconnect the battery ground strap.
- 2 – Remove heater (see F 4.4/1–1).
- 3 – Disconnect thermoswitch cables.
- 4 – Unscrew the union nut on switch with a 12 mm open-end wrench and withdraw switch vertically while turning to and fro (use solvent if necessary).

Installing

- 1 – Insert thermoswitch carefully and tighten union nut. The hole in the casing is covered with a washer.
- 2 – Connect cables as shown in wiring diagram (see F 4.1/5–1).
- 3 – Install heater (see F 4.4/1–1).
- 4 – Connect battery ground strap and check operation of heater.

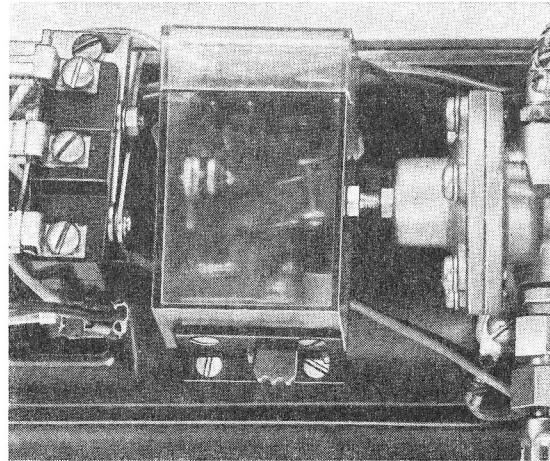
Safety switch

Removing

- 1 – Disconnect battery ground strap.
- 2 – Remove two screws holding the switch.

Installing

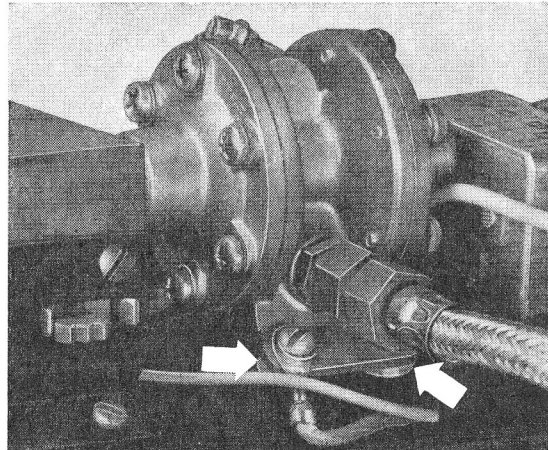
- 1 – Connect cables as shown in wiring diagram (see F 4.1/5-1).
- 2 – Connect battery ground strap and check operation of heater.



Pressure regulator

Removing

Disconnect the two hoses and remove four tapping screws.



Installing

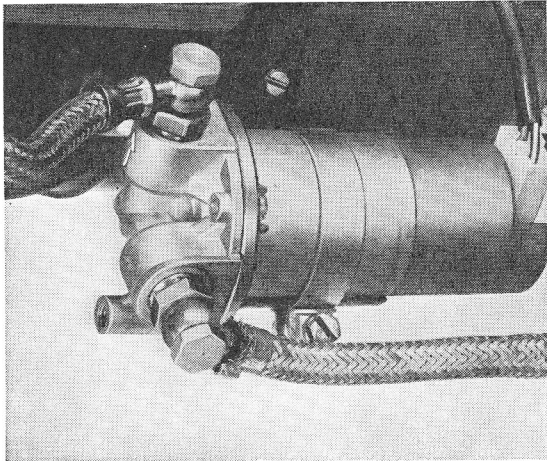
- 1 – Attach regulator with four tapping screws. Four plastic washers (see arrows) keep the regulator 4 mm away from the casing.

Note:

- The pressure regulator must not contact the casing because the heat will cause the fuel flow quantity to vary.
- 2 – The fuel hose between jet and hose connection is secured to the hose connection with a clip to prevent it from being pulled off.
- 3 – Tighten union nut on hose between pump and pressure regulator. Hold the union with a 17 mm open-end wrench.

F 4.5 Removing and Installing Parts of Heater

Fuel pump



Removing

- 1 – Pull plug out.
- 2 – Remove two union bolts.
- 3 – Loosen clip.

Installing

- 1 – Secure the pump on the bracket so that the arrow on the pump housing points upwards.
- 2 – Connect fuel hoses with the union bolts.
- 3 – Connect the plug.

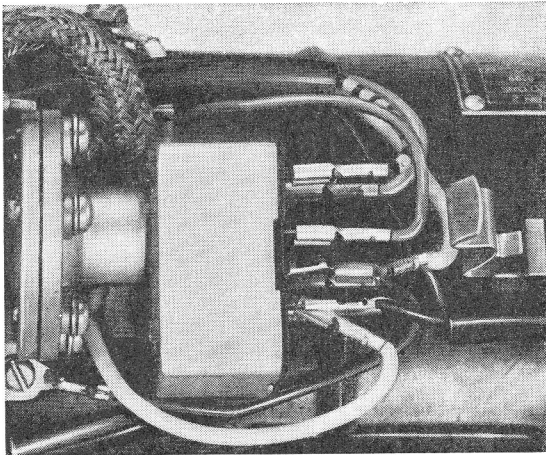
Relay

Removing

- 1 – Disconnect battery ground strap.
- 2 – Pull cables off and remove relay.

Installation

When installing the relay, ensure that the cables are connected according to wiring diagram (see F 4.1/5-1).



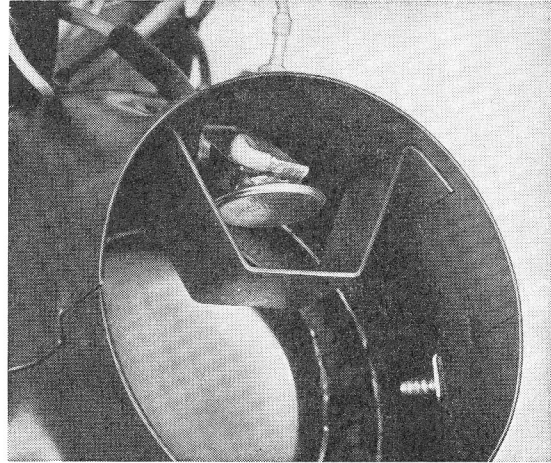
Overheating switch

Removing

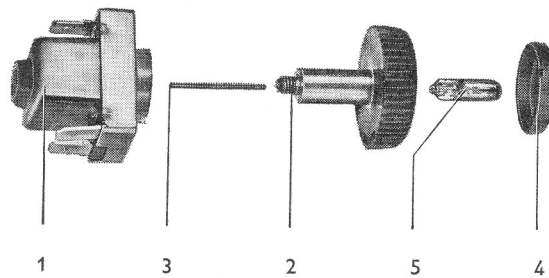
The overheating switch is attached to the heater casing with a tapping screw. When removing the switch, ensure that the silicon seal does not fall into the heater.

Installing

Secure the switch to the casing with a tapping screw and seal the hole with the silicon seal.



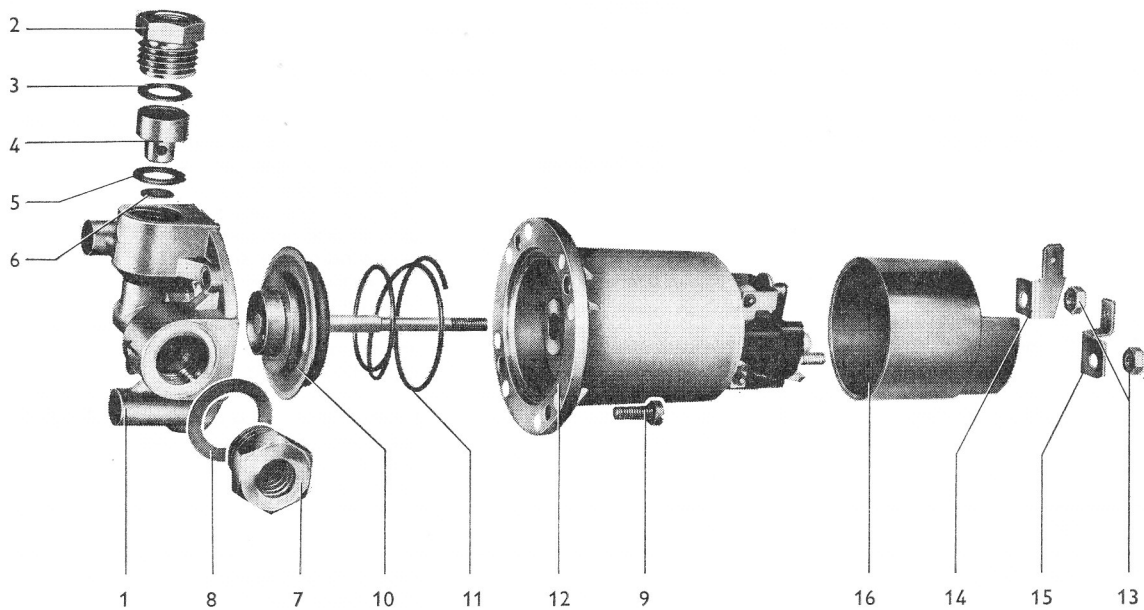
Switch



No.	Designation	Qty.	Note when		Special instructions see
			removing	installing	
1	Switch	1			
2	Knob	1	screws off		
3	Pin, 1 mm	1	used to eject the bulb		
4	Lens	1	pry out of rubber part with a screwdriver		
5	Bulb 1.2 watts	1			

Disassembling and Assembling Fuel Pump **F 4.6**

Fuel pump

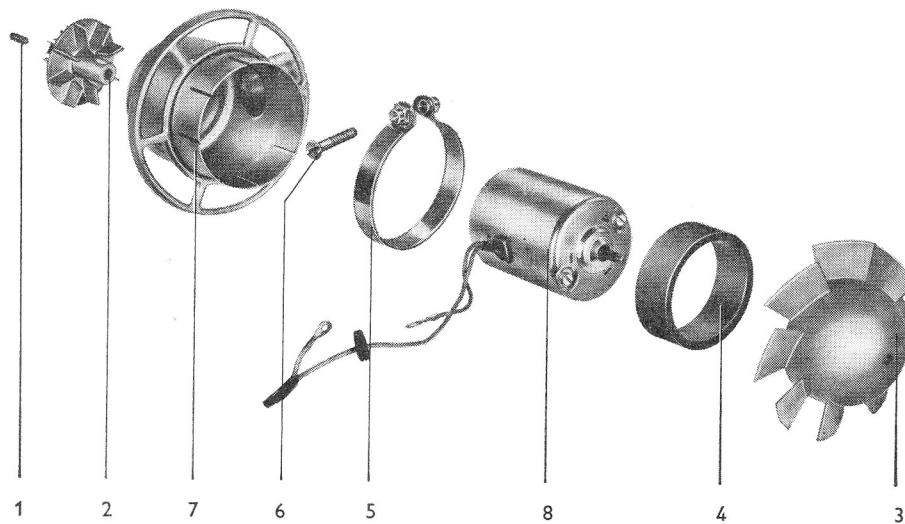


No.	Designation	Qty.	Note when		Specials instructions see
			disassembling	assembling	
1	Pump body	1		pump must be installed in vehicle with pressure union at top (arrow points outward)	F 4.5/1-4
2	Outlet union (pressure side)	1	12 mm A/F; look for damage; outlet union has smaller drilling and is smaller across flats than intake union	if pump rattles, unscrew union nut and moisten outlet union with fuel; when assembling, ensure that intake union and outlet union are not mistaken	F 4.3/1-4
3	Seal	1			
4	Pressure valve	1	make sure valve is not dirty		
5	Seal	1			
6	Suction valve	1	if pump rattles, and moistening with fuel does not remedy it, suction valve is tilted and jammed	ensure that suction valve is in correct position	F 4.3/1-4

F 4.6 Disassembling and Assembling Fuel Pump

No.	Designation	Qty.	Note when		Special instructions see
			disassembling	assembling	
7	Intake union	1	17 mm A/F; look for damage; intake union has larger drilling and is larger across flats than outlet union		F 4.6/1-1
8	Seal	1			
9	Screw	4			
10	Diaphragm unit	1	unscrew counter-clockwise	delivery quantity adjustment: screw diaphragm unit in as far as possible, then back off 2 ¹ / ₂ turns; the diaphragm also acts as seal between pump and winding housing, therefore ensure that diaphragm is correctly positioned	F 4.3/1-4
11	Spring	1		ensure that spring is correctly installed	
12	Winding housing	1	vent hole must not be blocked	pump and winding housings are screwed together so that vent hole is opposite pressure union	F 4.3/1-4
13	Nut	2			
14	Terminal (+)	1		note pole designation on bakelite cap	
15	Terminal (-)	1		note pole designation on bakelite cap	
16	Bakelite cap	1			

Combustion Air Blower **F 4.7**

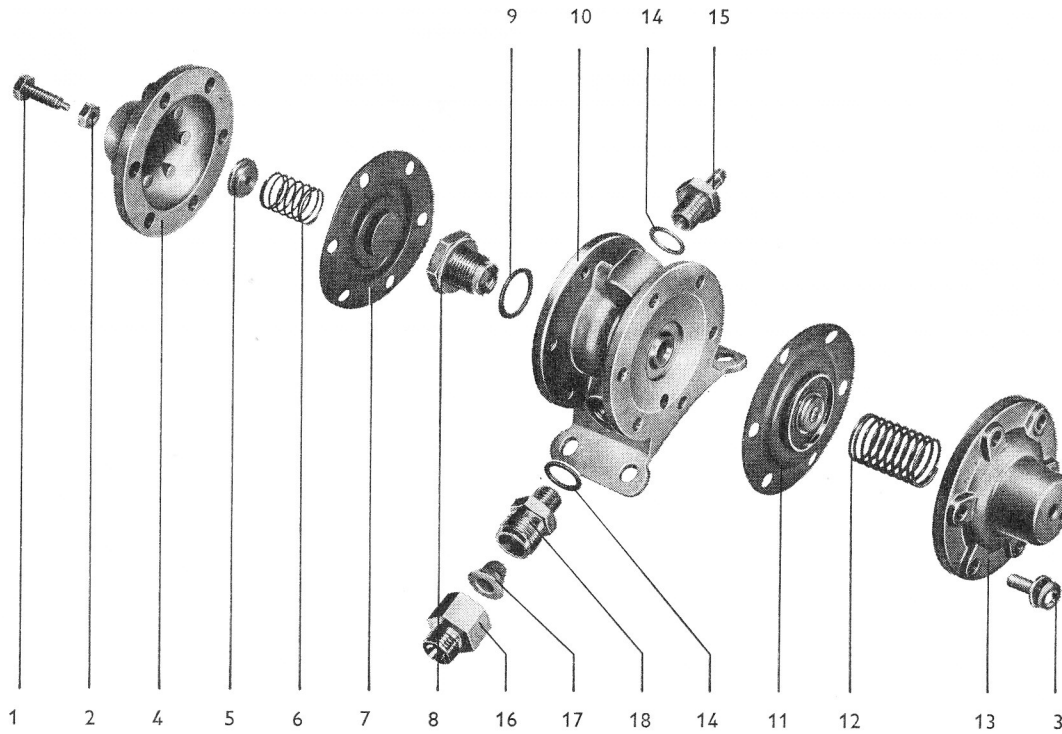


No.	Designation	Qty.	Note when		Special instructions see
			removing	installing	
1	Setscrew	1	can be unscrewed through hole in motor mounting (7)		
2	Radial wheel	1			
3	Axial wheel	1	screw a M 4 bolt into hole in wheel to press it off		
4	Seal	1			
5	Clamp	1			
6	Bolt M 6	1			
7	Motor mounting	1			
8	Motor	1			

F 4.8 Pressure regulator

No.	Designation	Qty.	Note when		Special instructions see
			removing	installing	
14	Washer	2			
15	Union	1			
16	Union nut	1			
17	Strainer	1		clean	
18	Union	1			

Pressure regulator **F 4.8**



No.	Designation	Qty.	Note when		Special instructions see
			removing	installing	
1	Bolt M 4	1		sealed with paint when delivery capacity has been set	F 4.3/1-4
2	Nut M 4	1		sealed with paint when delivery capacity has been set	F 4.3/1-4
3	Phillips screw M 4 and washer	12			
4	End cover	1		bolt (1) must be in hole in part 5	
5	Spring seat	1		must be located in spring	
6	Spring	1			
7	Regulating diaphragm, complete	1		metal washer must locate the spring	
8	Valve	1		clean filter	
9	Washer	1			
10	Regulator housing	1		clean with compressed air	
11	Closing diaphragm, complete	1		metal washer must locate the spring	
12	Closing spring	1			
13	End cover	1		do not interchange with part 4	

Installing instructions for Model 1300

The Eberspächer BN 2 heater is installed in the front luggage compartment on the left side.

Note:

These instructions are not valid for Type 1 vehicles with the long front end (Model 1302).

The kit contains the following parts:

Qty.	Designation	Remarks
1	Heater with fuel pump	Type BN 2/Model 20 13 85/20 13 86
1	Cover plate	
1	Fuel hose	5×2.5
1	Overflow hose	4×1.5 only for model 20 13 85
2	Clip	
1	T piece	
1	Filter	
1	Suction line	
1	Pressure line	
2	Sealing ring	of silicon for the exhaust pipe, of rubber for the combustion air intake pipe
4	Bracket	
1	Exhaust pipe with cap	
1	Combustion air intake pipe	
1	Flexible elbow	
1	Intake elbow	
1	Outlet elbow	
1	Circulation pipe	
1	Warm air outlet	
1	Cable harness	
1	Switch	
1	Sticker	Stick inside flap over tank filler neck

Note:

In some countries, a model 20 13 86 heater is installed which has no overflow pipe on the heat exchanger and no overflow hose (see F 4.1/2-1).

F 4.20 Service Installation

Work sequence

- 1 – Disconnect battery ground cable.
- 2 – Take spare wheel and luggage compartment lining out.
- 3 – Shorten felt padding 260 mm as shown in Figure 1.

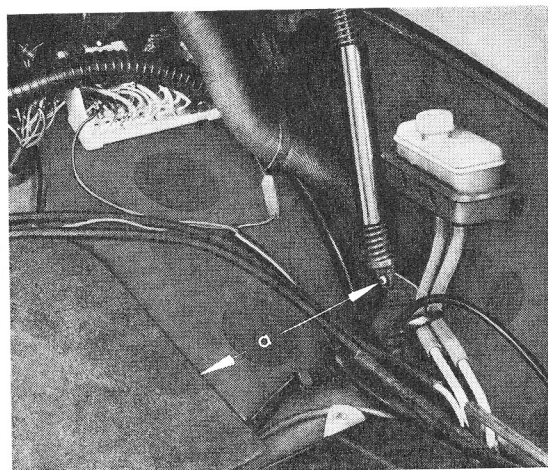


Fig. 1
a = 260 mm

Note:

Vehicles built before August 1970 have shorter brake lines which means that they pass by the position selected for the exhaust pipe hole. It is essential to lengthen the brake pipes below the fluid reservoir so that they are far enough away from the exhaust pipe. The routing of the fluid pipes is shown in Figures 1 and 2.

A clip (Part No. 111 255 487) holds the connecting hoses away from the exhaust pipe hole.

Designation	to be removed	to be installed
1 – Pipe	113 611 805 H	113 611 805 L
2 – Pipe	113 611 806 B	113 611 806 L
3 – Two hoses	211 611 801 B	N 20 366 1

- 4 – The centers of the holes are marked with a pair of dividers and marking out is done from points A, B and C (see Figure 2).

Note:

The points A and C should be center punched lightly to hold the divider point better while marking out.

- Point A – Center of fender bolt
- Point B – Center of spot weld on left bracket for hood support
- Point C – Center of tank securing bolt

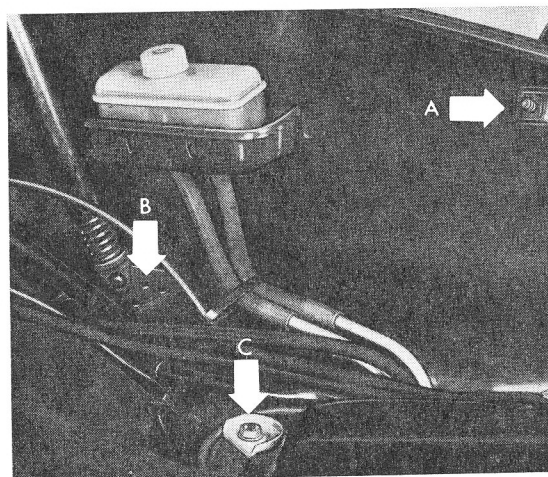
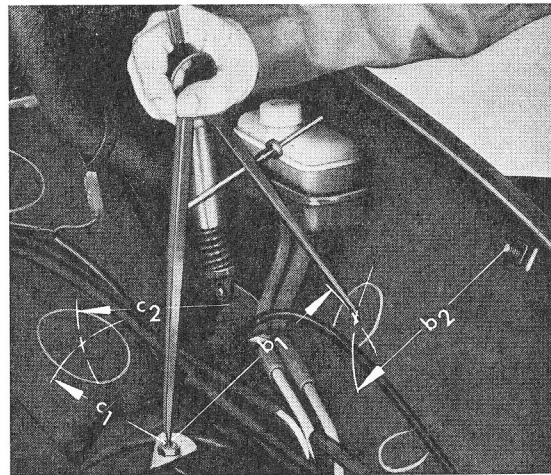


Fig. 2

Hole for exhaust pipe
 $b_1 = 182 \text{ mm}$ $b_2 = 186 \text{ mm}$
 (see note on page F 4.20/1-2)

Hole for intake elbow
 $c_1 = 130 \text{ mm}$ $c_2 = 156 \text{ mm}$

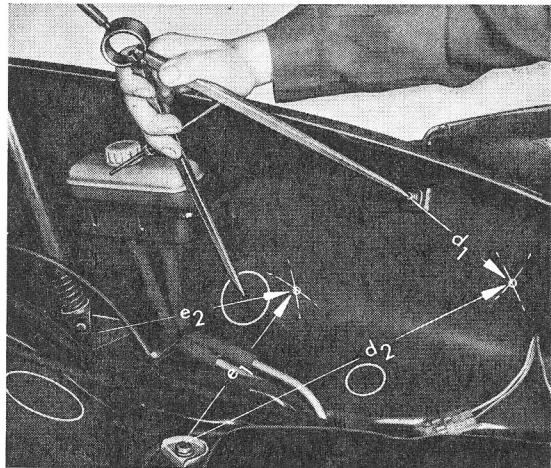
Figure 3



Hole for front bracket
 $d_1 = 113 \text{ mm}$ $d_2 = 302 \text{ mm}$

Hole for center bracket
 $e_1 = 192 \text{ mm}$ $e_2 = 194 \text{ mm}$

Figure 4

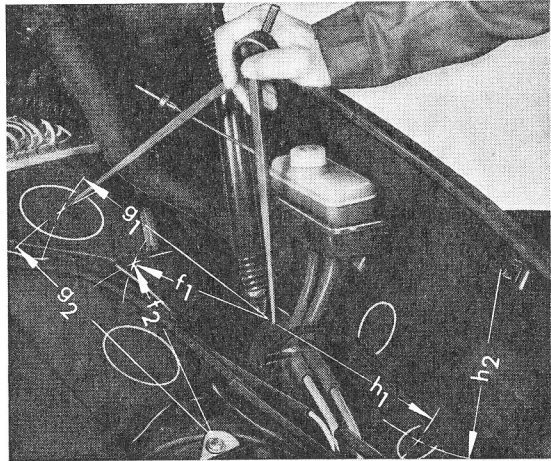


Hole for rear bracket
 $f_1 = 146 \text{ mm}$ $f_2 = 246 \text{ mm}$

Hole for outlet elbow
 $g_1 = 234 \text{ mm}$ $g_2 = 320 \text{ mm}$

Hole for combustion air intake pipe
 $h_1 = 265 \text{ mm}$ $h_2 = 160 \text{ mm}$

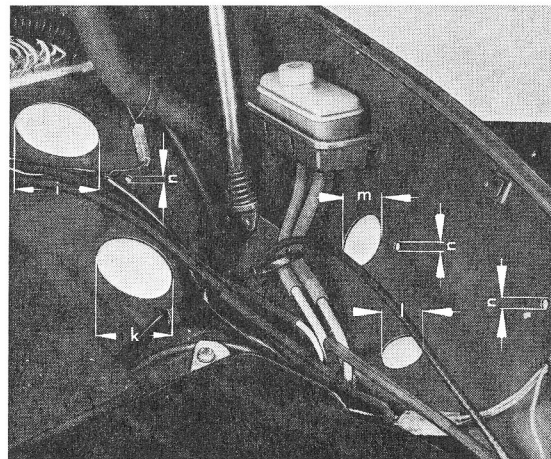
Figure 5



5 – Cut and drill holes (see figure 6)

$i = 85 \text{ mm}$
 $k = 74 \text{ mm}$
 $l = 35 \text{ mm}$
 $m = 50 \text{ mm}$
 $n = 7 \text{ mm}$

Figure 6



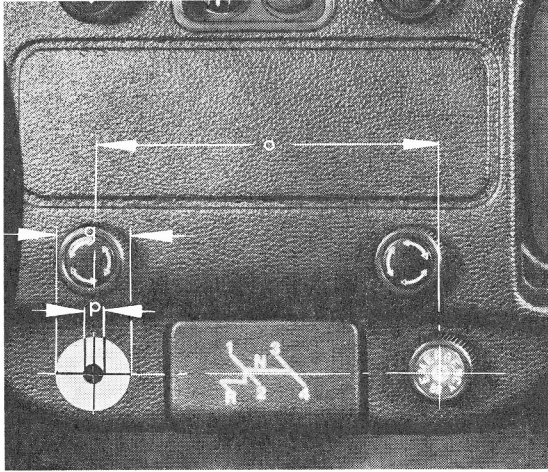


Fig. 7
o = 150 mm
p = 15 mm
q = 25 mm

- 6 – Drill a 15 mm hole in the instrument panel to the left of the ashtray for the heater switch (see Figure 7).

The heater switch is installed 150 mm away from and level with the emergency flasher switch (see Figure 7).

Note:

If the instrument panel is padded, the hole in the foam rubber must be enlarged to 25 mm so that the escutcheon can be installed properly (see Figure 7).

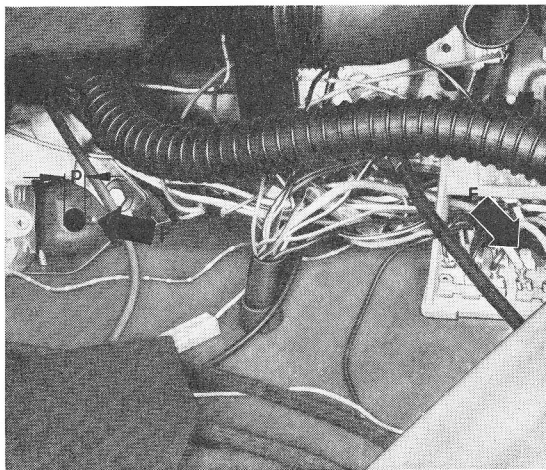


Fig. 8
P = 15 mm
E = Terminal 30
F = Slot

- 7 – Cut the switch securing slot – F – from the passenger compartment (see Figure 8).

8 – Connect cables to switch (see Figure 9 and wiring diagram F 4.1/5-1). Secure switch with escutcheon and screw in the switch knob complete with warning lamp.

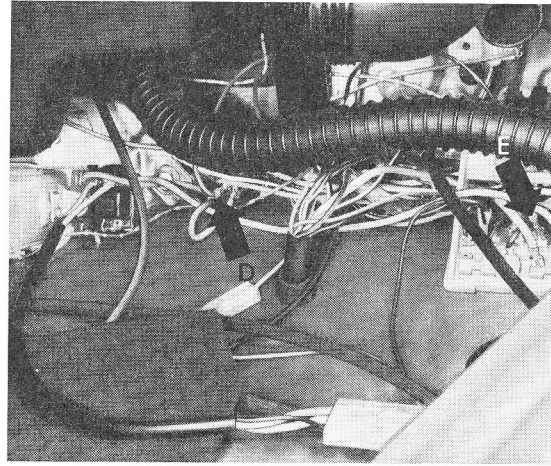


Fig. 9
D = Ground, terminal 31
E = Terminal 30

9 – Pull fuel line through hole G (see Figure 10). Place a clip on the fuel hose to the engine and cut the hose about 100 mm away from tank connection. Insert "T" piece. Secure hoses on "T" piece with clips to prevent them from slipping off.

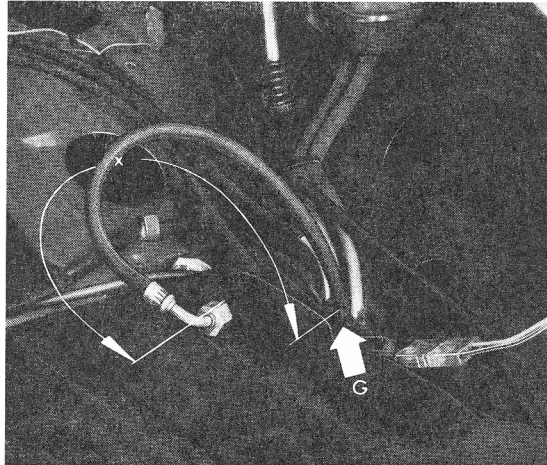


Fig. 10
G = Hole for fuel and brake fluid hoses
x = 360 mm long

10 – Drill 4 mm hole (t) to dimensions given in Figure 11 for the screw which secures the combustion air intake pipe.

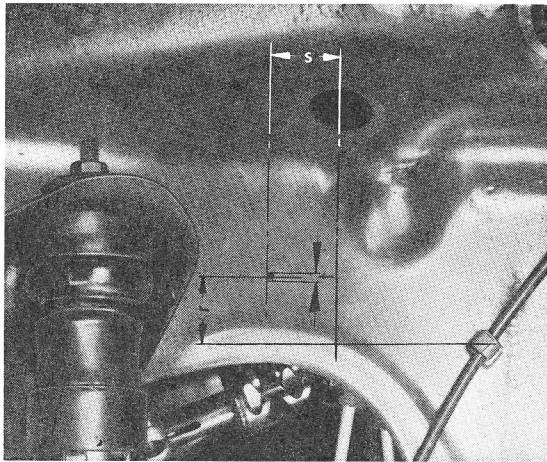


Fig. 11
r = 50 mm
s = 40 mm
t = 4

Insert rubber seal (see Figure 12)

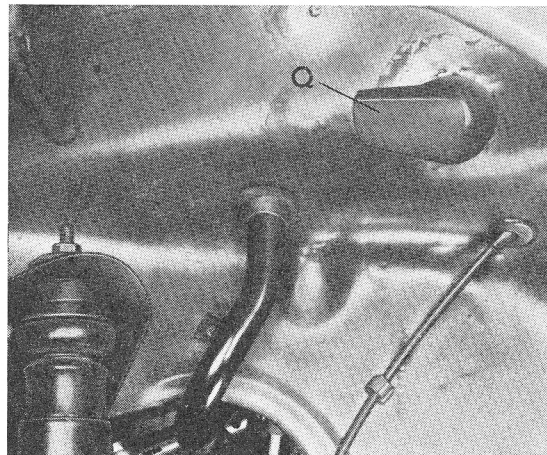
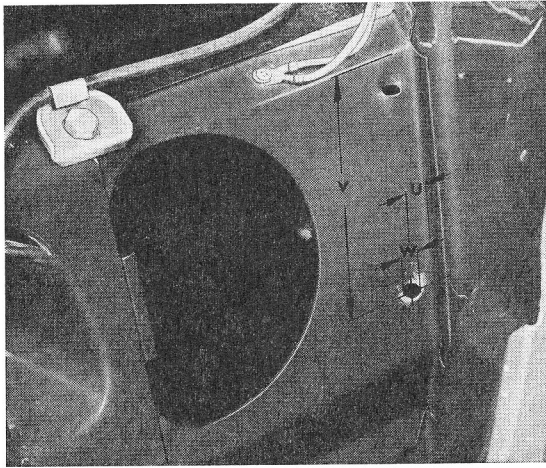
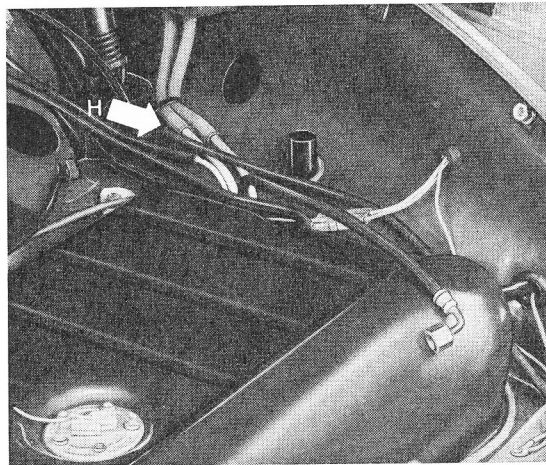


Fig. 12
Q = Exhaust elbow



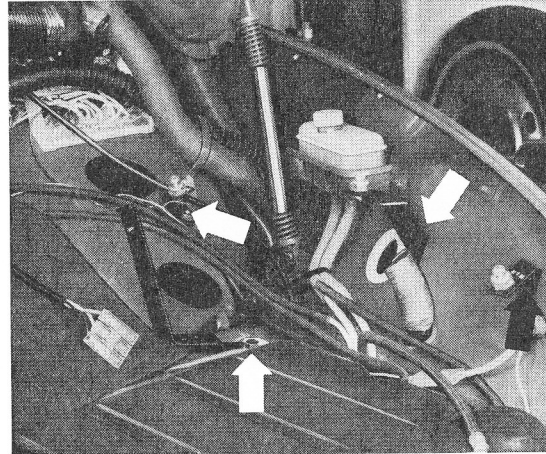
- 11 – Drill an 8 mm hole (w) on the lefthand side of the body, 10 mm (u) from the edge of the reinforcement plate (see Figure 13).
(See note on page F 4.20/1–1.)

Fig. 13
u = 10 mm
v = 120 mm
w = 8 mm



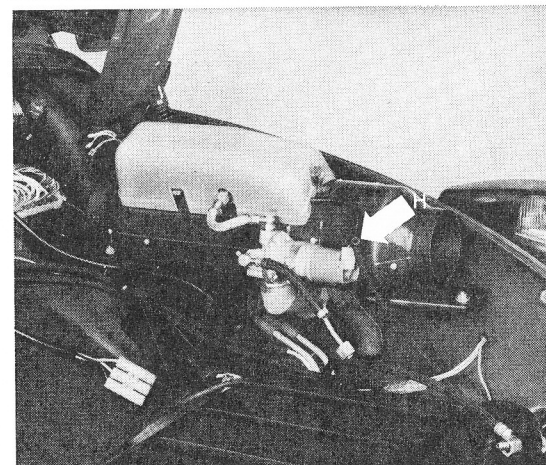
- 12 – Insert overflow hose H (see Figure 14) in the hole in the reinforcement plate (see Figure 13).
(See note on page F 4.20/1–1.)

Fig. 14
H = Overflow hose



- 13 – Install the four brackets and insert sealing ring for exhaust pipe (see Figure 15).

Fig. 15

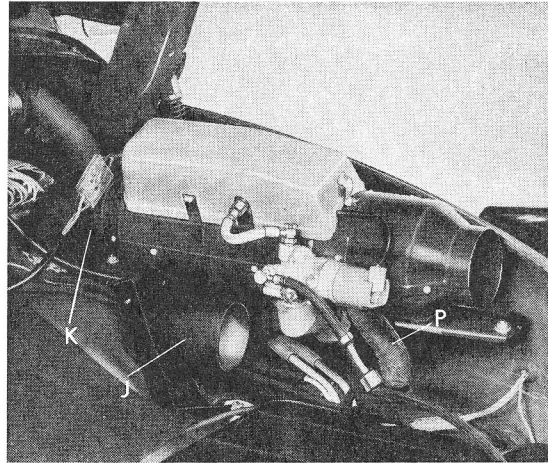


- 14 – Secure exhaust pipe on heater with clip, sealing ring and tapered ring. Attach heater to three of the brackets. Connect overflow hose H to overflow pipe (see Figure 16). The overflow pipe on the heater is between the exhaust pipe and combustion air intake connections (see page F 4.20/1–1).
- 15 – Install hose P on the combustion air pipe (see Figure 17). Secure exhaust elbow Q to exhaust pipe (see Figure 12). Connect cables as shown in wiring diagram (see Figure 17).

Fig. 16
H = Overflow hose

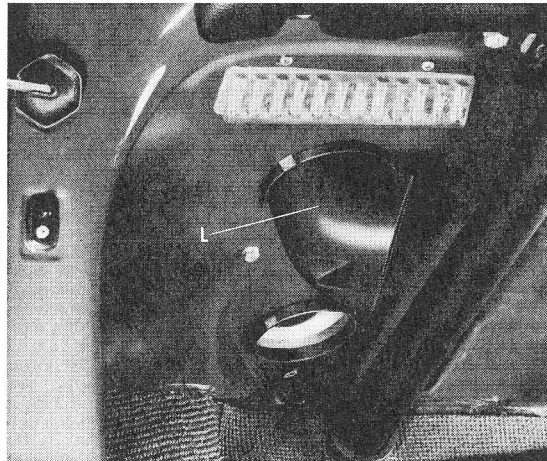
17 – Press intake elbow J and outlet elbow K into the holes until they engage (see Figure 17).

Fig. 17
J – Intake elbow
K – Outlet elbow
P – Hose



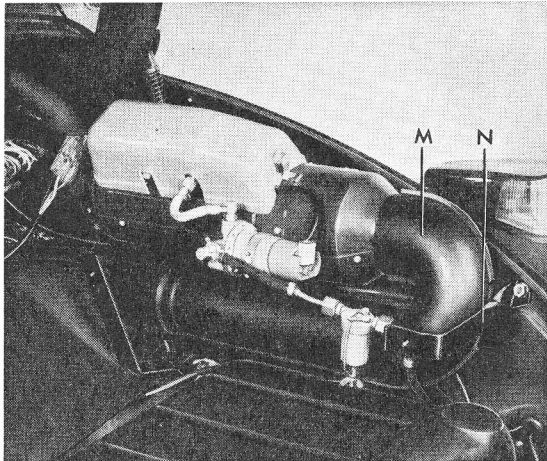
18 – Press the warm air outlet L into the outlet elbow from inside the body until it engages (see Figure 18).

Fig. 18
L – Warm air outlet



19 – Install air circulation pipe M. Secure bracket for cover plate with fender bolt (see Figure 19).

Fig. 19
M – Circulation pipe
N – Bracket

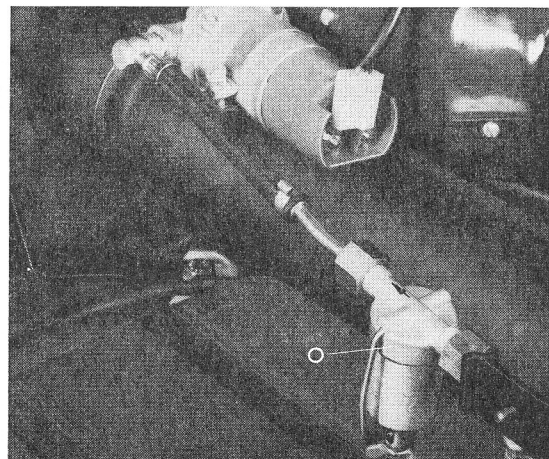


20 – Install fuel filter.

Note:

Ensure that the arrow showing the flow direction points towards the pump (see Figure 20).

Fig. 20
O – Fuel filter



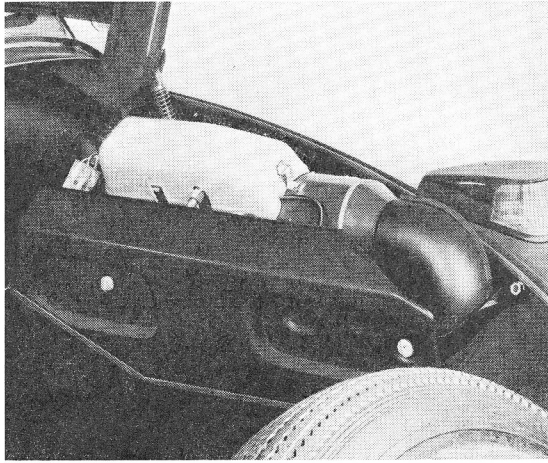


Fig. 21

- 21 – Shorten luggage compartment lining by 260 mm (a). See Figure 1. Secure cover plate (see Figure 21).
- 22 – Connect battery ground cable and check operation of heater.
- 23 – Install sticker inside flap over tank filler neck.

Installing instructions for Model 1302

The Eberspächer BN 2 heater is installed in the front luggage compartment on the left side.

Note 1:

These instructions are valid only for Type 1 vehicles with the longer front end (Model 1302).

Note 2:

In some countries, a model 201386 heater is installed which has no overflow pipe on the heat exchanger and no overflow hose (see F 4.1/2-1).

Tools

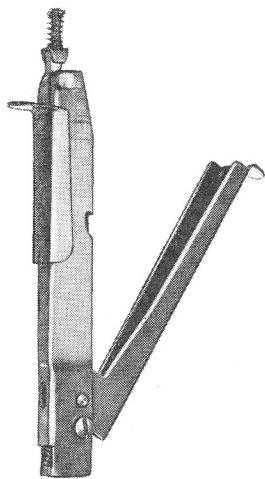


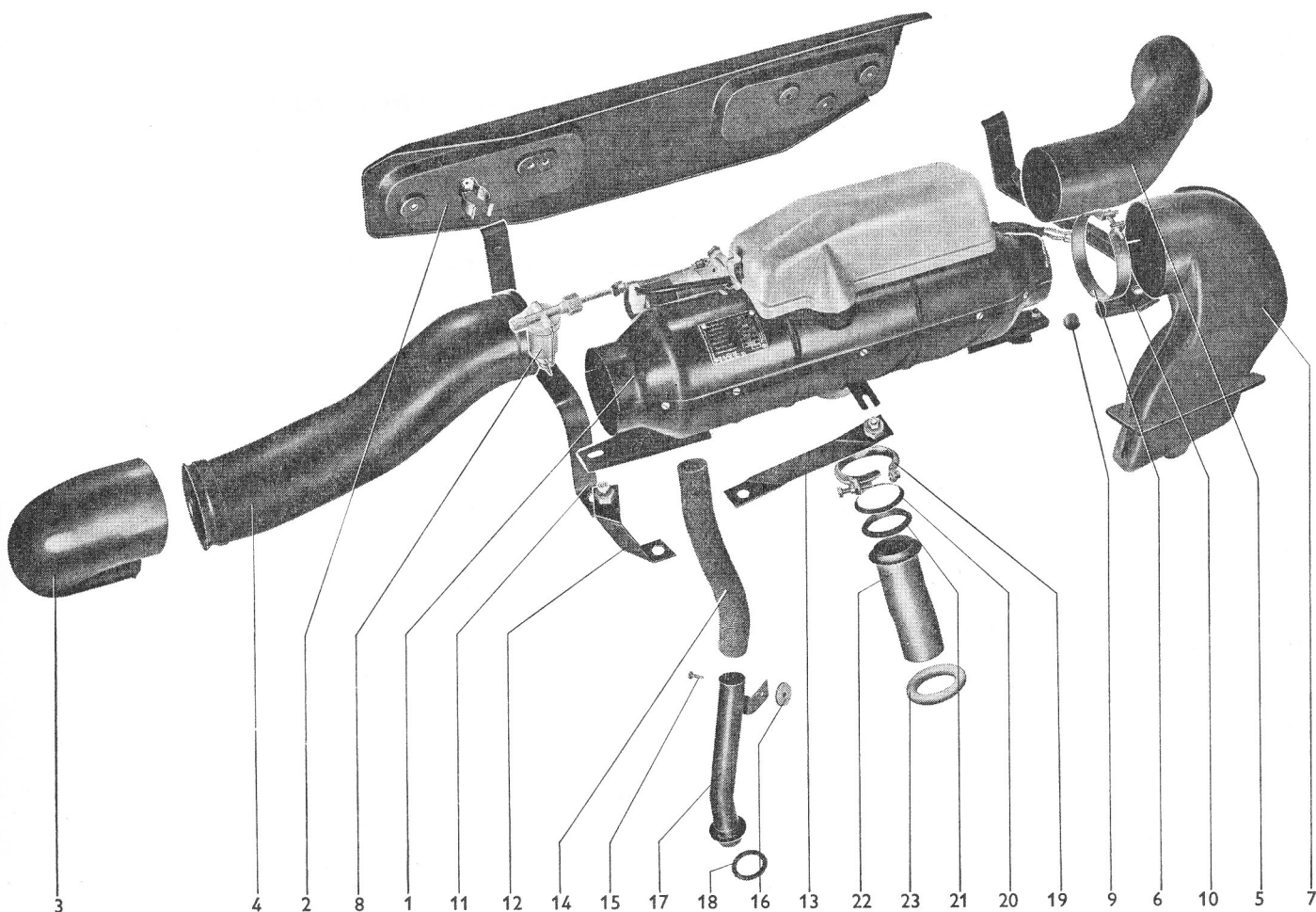
Figure 1

Sheet metal cutting tool

F 4.20 Service Installation

The kit contains the following parts:

Figure 2



No.	Designation	Qty.	Note when assembling	Special instructions see
1	Heater and fuel pump	1	Place rubber bush (9) on the pin and insert it into tube (10) before securing heater to brackets (12) and (13). Attach fuel hose to filter (8). Connect cables as shown in wiring diagram (see F 4.1/5-1)	F 4.20/2-9 F 4.20/2-9
2	Cover plate	1		
3	Circulation pipe	1		
4	Pipe	1		

No.	Designation	Qty.	Note when assembling	Special instructions see
5	Intake elbow	1	the elbow must jam in the hole in luggage pan	
6	Clip	1		
7	Footwell outlet with gasket	1		
8	Fuel filter	1	the arrow shows fuel flow direction	F 4.1/4-3
9	Rubber pad	1		
10	Rear bracket for heater and cover plate	1		
11	Front bracket for heater and cover plate	1		
12	Front bracket for heater	1		
13	Center bracket for heater	1		
14	Flexible pipe	1	the pipe must not be kinked and must be tight on combustion air intake pipe (17) and on heater	F 4.1/4-3
15	Tapping screw	1		
16	Rubber washer	1		
17	Combustion air intake pipe	1		
18	Washer	1		
19	Clip for exhaust pipe	1		
20	Tapered ring	1		
21	Seal for exhaust pipe	1		
22	Exhaust pipe	1		
23	Grommet for exhaust pipe	1		

Also included in the kit are 1 cable harness, 1 switch and 1 sticker.

Work sequence

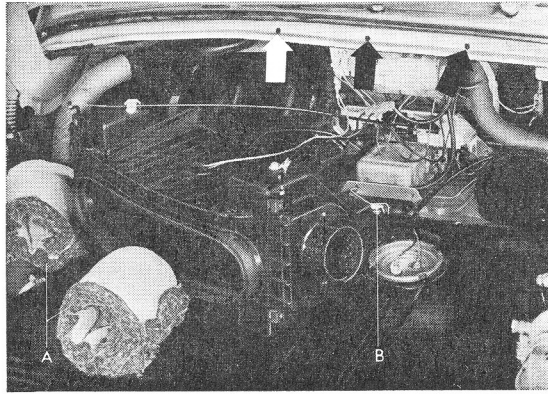


Figure 3

A = Textile hose
B = Clip

- 1 – Disconnect battery ground cable.
- 2 – Take upper and lower luggage compartment lining out.
- 3 – Remove fresh air box for blower (see Fig. 3). Take out three tapping screws (arrow) and loosen the clip (B). The textile hoses can be unbuttoned.
- 4 – Remove fuel tank.

Note:

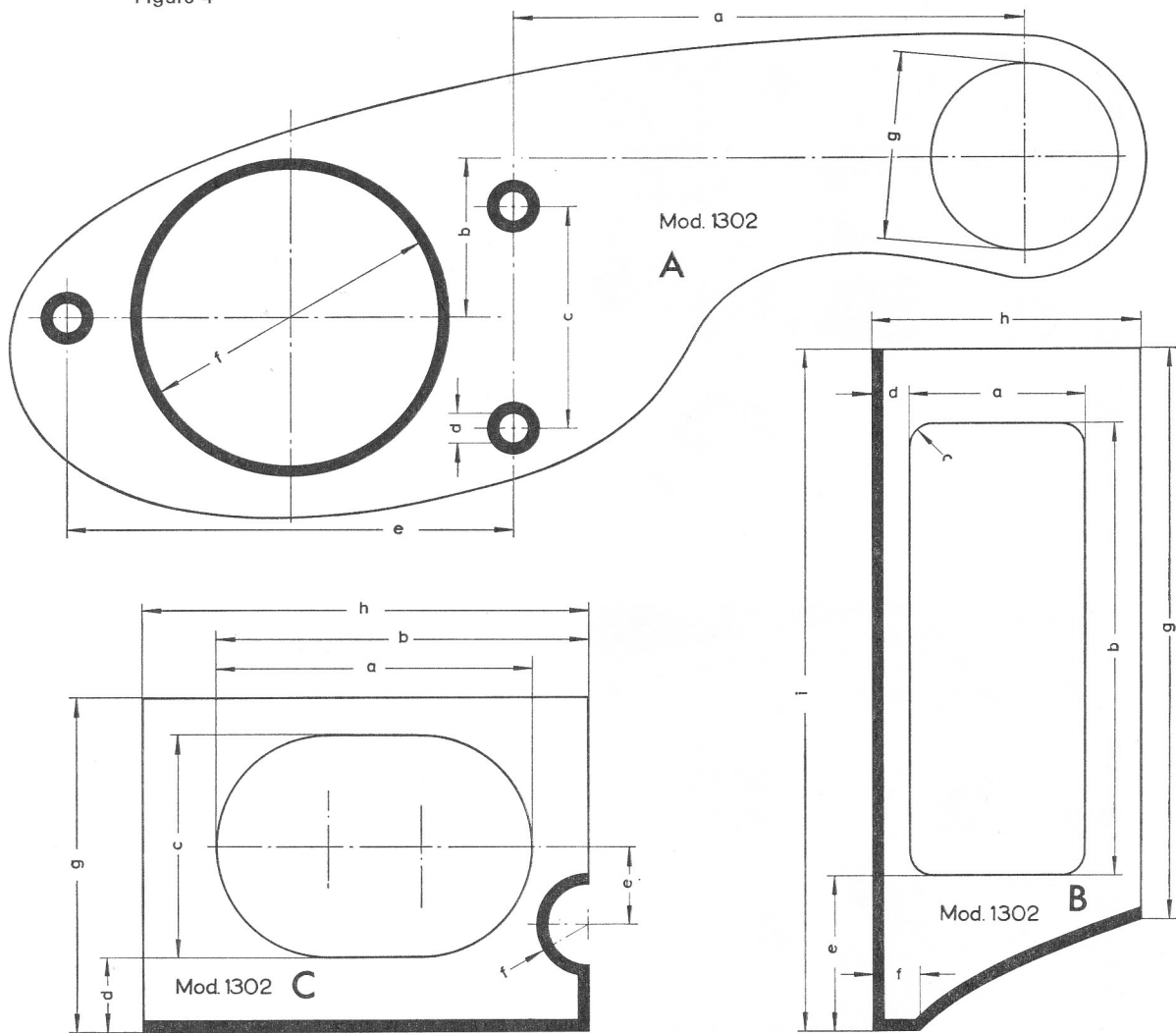
Three templates made of thin cardboard are included with the installing instructions. It is advisable to use these templates once only.

Dealers who install a lot of heaters are advised to make new templates of more durable material. The drawing on page F 4.20/2-5 gives all the necessary measurements.

The contacting edges of the templates supplied with the kit are marked with a wide black strip.

The flexible pipes for the center and left vents must be exchanged. The warm air pipe left (Part No. 113 819 723 A) and warm air pipe center (Part No. 211 255 359) are included in the kit. Both flexible pipes are shown in Figure 5.

Figure 4



A – Hole for combustion air intake pipe

- a = 138 mm
- b = 43 mm
- c = 60 mm
- d = 8 mm dia.
- e = 120 mm
- f = 80 mm dia.
- g = 50 mm dia.

- c = 6 mm
- d = 10 mm
- g = 170 mm
- h = 72 mm

B – Hole for footwell outlet

- a = 47 mm
- b = 122 mm
- e = 42 mm
- f = 12 mm

C – Hole for intake elbow

- a = 85 mm
- b = 100 mm
- c = 60 mm
- d = 20 mm
- e = 21 mm
- f = 11 mm
- g = 90 mm
- h = 120 mm

5 – Place template for footwell outlet in position, mark outline and cut hole with sheet metal cutter (see Figure 1) from inside passenger compartment (see Figure 5).

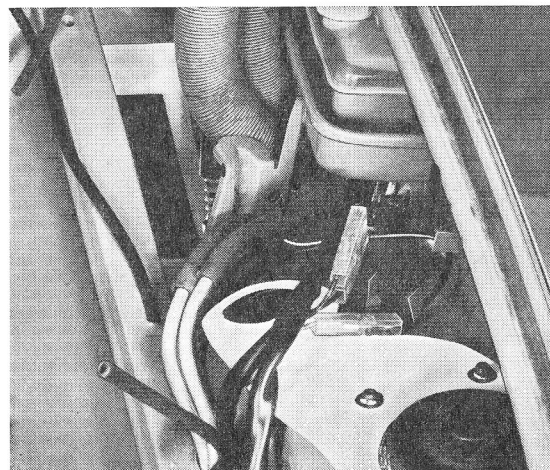


Figure5

F 4.20 Service Installation

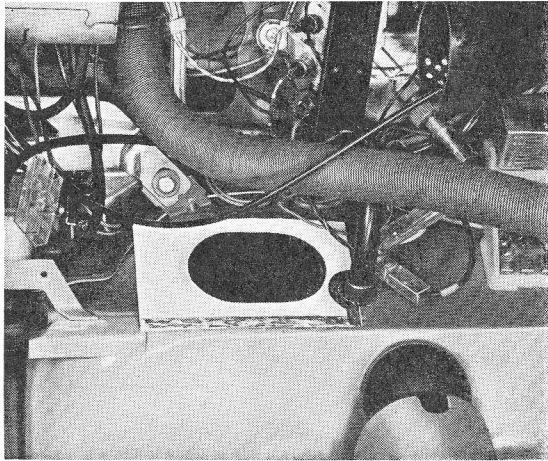


Figure 6

- 6 – Stick gasket (see Figure 2 on page F 4.20/ 2–3 Part 7) on edges of hole for footwell outlet.

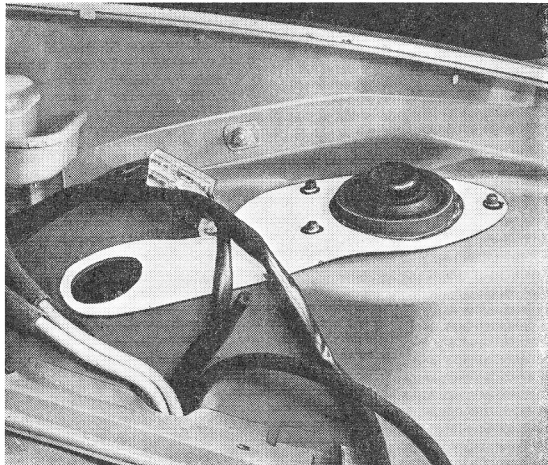


Figure 7

- 7 – Place template for intake elbow in position and mark out and cut hole (Figure 6).
- 8 – Use template and cut hole for exhaust pipe (Figure 7).

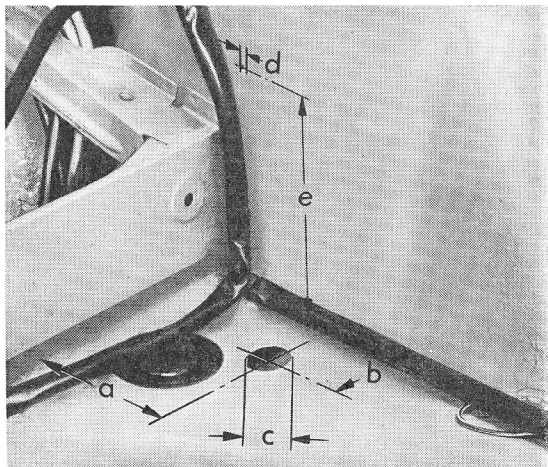


Figure 8

- a = 70 mm
- b = 50 mm
- c = 27 mm
- d = 4 mm
- e = 130 mm

- 9 – Drill holes for combustion air intake pipe and pipe securing screw (see Figure 8 for dimensions).

- 10 – When installing the combustion air intake pipe, ensure that the rubber washer (B) and the sealing washer (A) are used (see Figure 9).

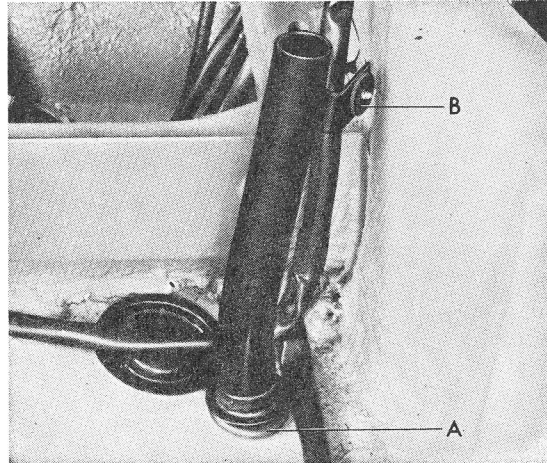


Figure 9

A = Sealing washer for combustion air intake pipe
B = Rubber washer

- 11 – Install T piece in the fuel hose 24 cm from the hole (see Figure 10) and secure with clips.

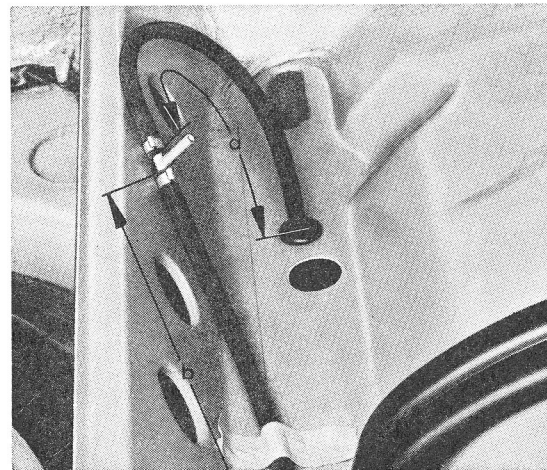


Figure 10

a = 24 cm
b = 120 cm

- 12 – Pass fuel hose 5×2.5 through hole A (see Figure 11) and secure it on T piece with clips (Figure 10).
- 13 – Pass breather hose 4×1.5 (30 cm long) through hole A (see note page F 4.20/2-1).
- 14 – Connect tank and T piece with a piece of 5×2.5 hose 18 cm long and secure with clips.
- 15 – Install tank. On the left side the tank is secured with two bolts which are also used to secure the front and rear brackets for the cover plate (see Figure 2, page F 4.20/2-2).

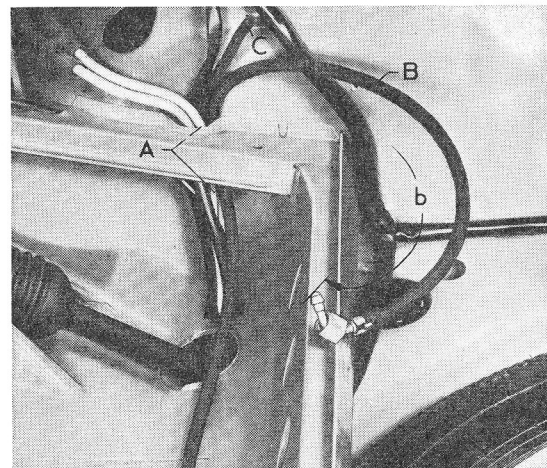


Figure 11

b = 120 cm
A – Hole
B – Fuel hose 5×2.5
C – Breather hose 4×1.5

F 4.20 Service Installation

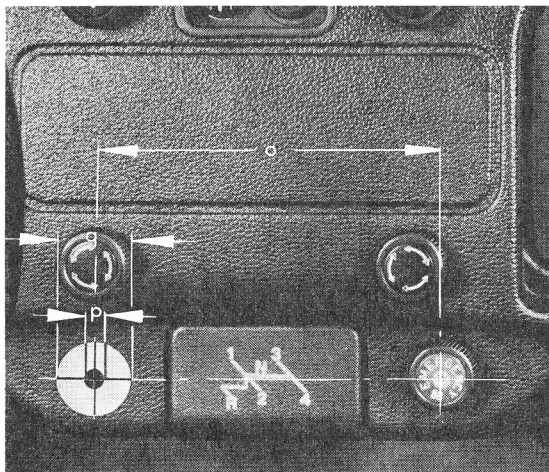


Figure 12

o = 15 mm
p = 15 mm
q = 25 mm

16 – Drill a 15 mm hole in the instrument panel to the left of the ashtray for the heater switch (see Figure 12).

The heater switch is installed 150 mm away from and level with the emergency flasher switch (see Figure 12).

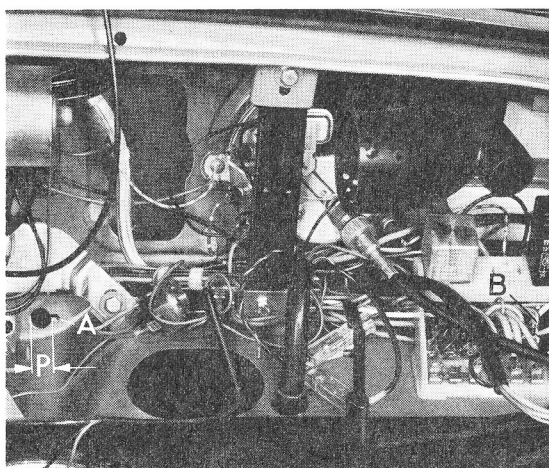


Figure 13

A – Securing slot
B – Terminal 30
P – 15 mm

17 – Cut the switch securing slot A from inside the body (see Figure 13).

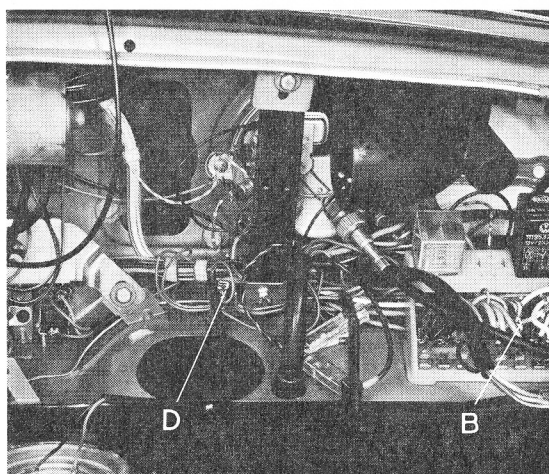


Figure 14

B – Terminal 30
D – Ground

18 – Install switch and connect cables as shown in wiring diagram (see F 4.1/5-1). (See also Figure 14.)

- 19 – Install footwell outlet (see Figure 15, part F).
- 20 – Secure front bracket (Part V in Figure 15) and center bracket (Part M in Figure 15).

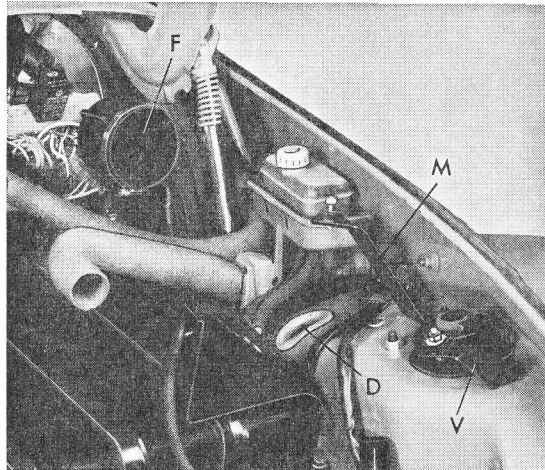


Figure 15
 D – Seal for exhaust pipe
 V – Front bracket for heater
 M – Center bracket for heater
 F – Footwell outlet with clip

- 21 – Install grommet for exhaust pipe and coat it with oil to facilitate installation of pipe (Part D, Figure 15).
- 22 – Install heater (see Figure 2 on page F 4.20/2–2).
- 23 – Push overflow hose on to overflow pipe (see Figure 16). See note 2 on page 4.20/2–1.
- 24 – Install flexible pipe on combustion air connection on heater and ensure that pipe is tight (see Figure 16).

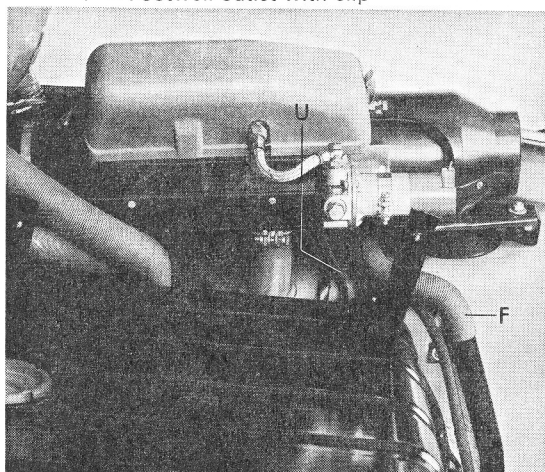


Figure 16
 U – Overflow hose (see note 2 on page F 4.20/2–1)
 F – Flexible pipe

Note:

If the flexible pipe comes off it will cause a pressure build up which will destroy the heater when it is used with vehicle in motion.

- 25 – Install fresh air control box.
- 26 – Press intake elbow in until it engages, install pipe and secure circulation pipe on heater with a clip (Figure 17).
- 27 – Install fuel filter, noting flow direction arrow. **The arrow must correspond with the fuel flow direction (Figure 17).**



Figure 17

F 4.20 Service Installation

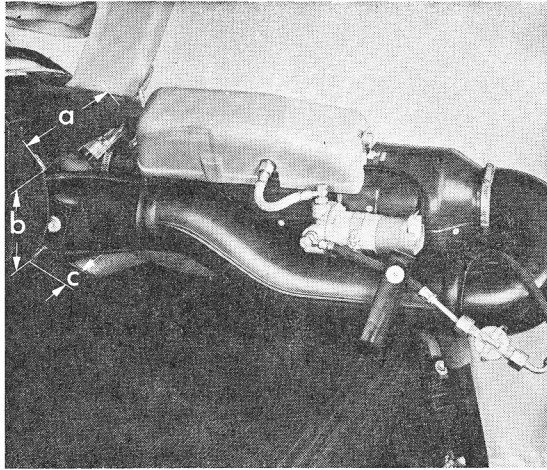


Figure 18

a = 25 cm
b = 12 cm
c = 5 cm

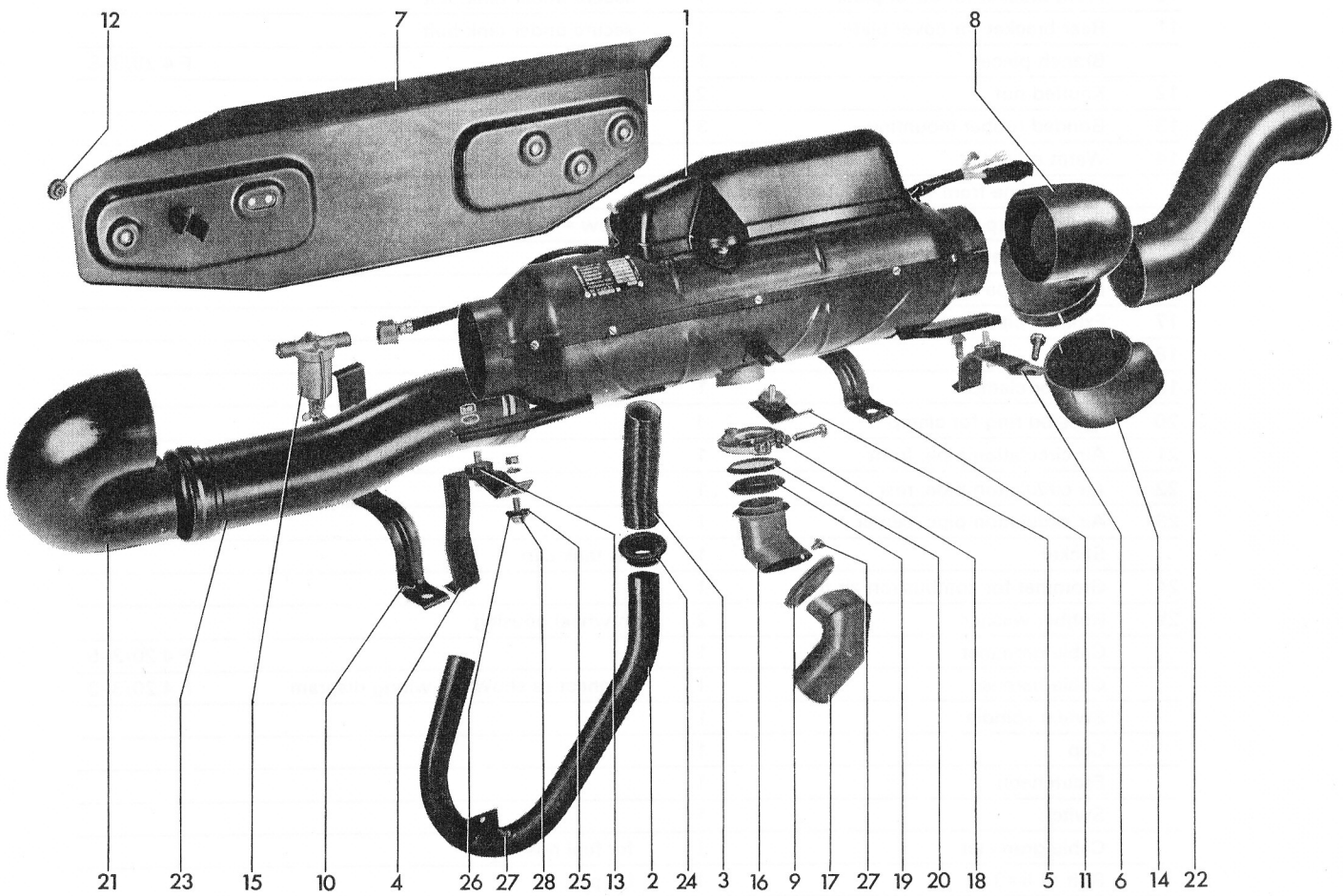
28 – Cut luggage compartment lining as shown in Figure 18.

29 – Install sticker on fuel tank cap.

30 – Connect battery ground cable and check operation of heater.

Installing instructions for Type 3 (Models 311–368)

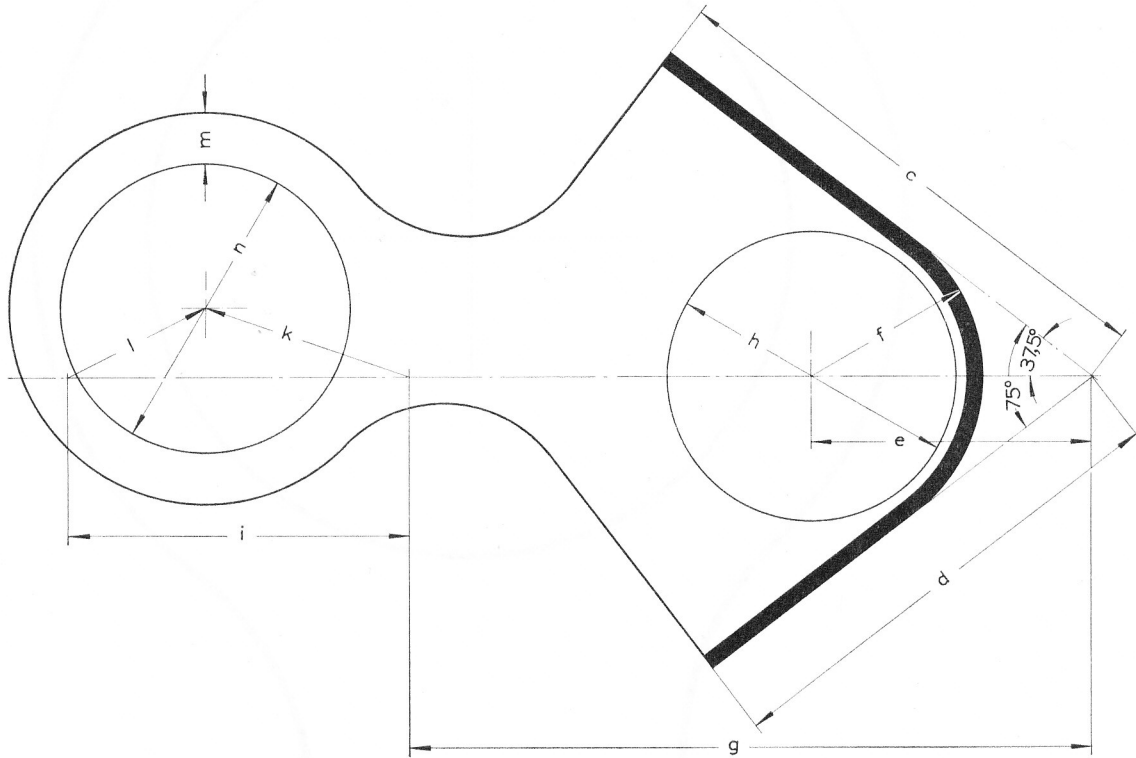
The Eberspächer BN 2 heater is installed in the front luggage compartment on the left side.



F 4.20 Service Installation

The kit consists of:

No.	Designation	Qty.	Note when assembling	See page
	Hose clip	1		
	Hose clip	4		
1	Heater	1		
2	Combustion air pipe	1		F 4.20/3-7
3	Hose for combustion air pipe	1	check security	F 4.20/3-10
4	Front bracket	1		
5	Center bracket	1		
6	Rear bracket	1		
7	Cover plate	1		
8	Warm air elbow	1		
9	Seal for exhaust pipe	1	install from wheel housing	
10	Front bracket for cover plate	1	secure under tank bolt	
11	Rear bracket for cover plate	1	secure under tank bolt	
	Branch piece	1		F 4.20/3-8
12	Knurled nut	2	secures cover plate	
13	Bonded rubber mounting	3	for brackets No. 4, 5 and 6	
14	Warm air outlet	1		
	Suction line from T piece to fuel filter	1		F 4.20/3-7
15	Fuel filter up to July 1971	1	arrow = flow direction	F 4.20/3-10
	Suction line from filter to pump	1		
16	Exhaust pipe upper	1		
17	Exhaust pipe lower	1		
18	Clamp	1		
19	Seal for clamp	1		
20	Tapered ring for clamp	1		
21	Air circulation pipe, front	1		
22	Air circulation pipe, rear	1		
23	Air circulation pipe, center	1		
	Sticker	1	for tank cap	
24	Grommet for combustion air pipe	1		
25	Rubber washer	2	in wheel housing	
	Cable grommet	1		F 4.20/3-5
	Cable harness	1	connect as shown in wiring diagram	F 4.20/3-3
	Switch spindle	1		
	Cap	1		
	Escutcheon	1		
	Switch	1		
	Cable grommet	1	for fuel hose	
	Bolt M 6×35	1	for part 18	
	Nut M 6	8	for parts 13 and 28	
26	Washer A 6.4	2	for part 28	
	Washer 6.1	8	for part 13 and 28	
	Spring washer B 6	2	for part 28	
	Washer A 8×11.5	2	for union	
	Hex. hd. tapping screw B 6.3×19	2	for part 6	
27	Tapping screw B 4.8×13	2	for parts 2, 16 and 17	
	Fuse	1	16 amp	
	Plug	1		
	Connector	1		
	Union A 2/3	1	for fuel pump	
28	Bolt M 6×15	2	for parts 4 and 5	



c = 155 mm
 d = 140 mm
 e = 82 mm
 f = 50 mm
 g = 200 mm
 h = 85 mm dia.

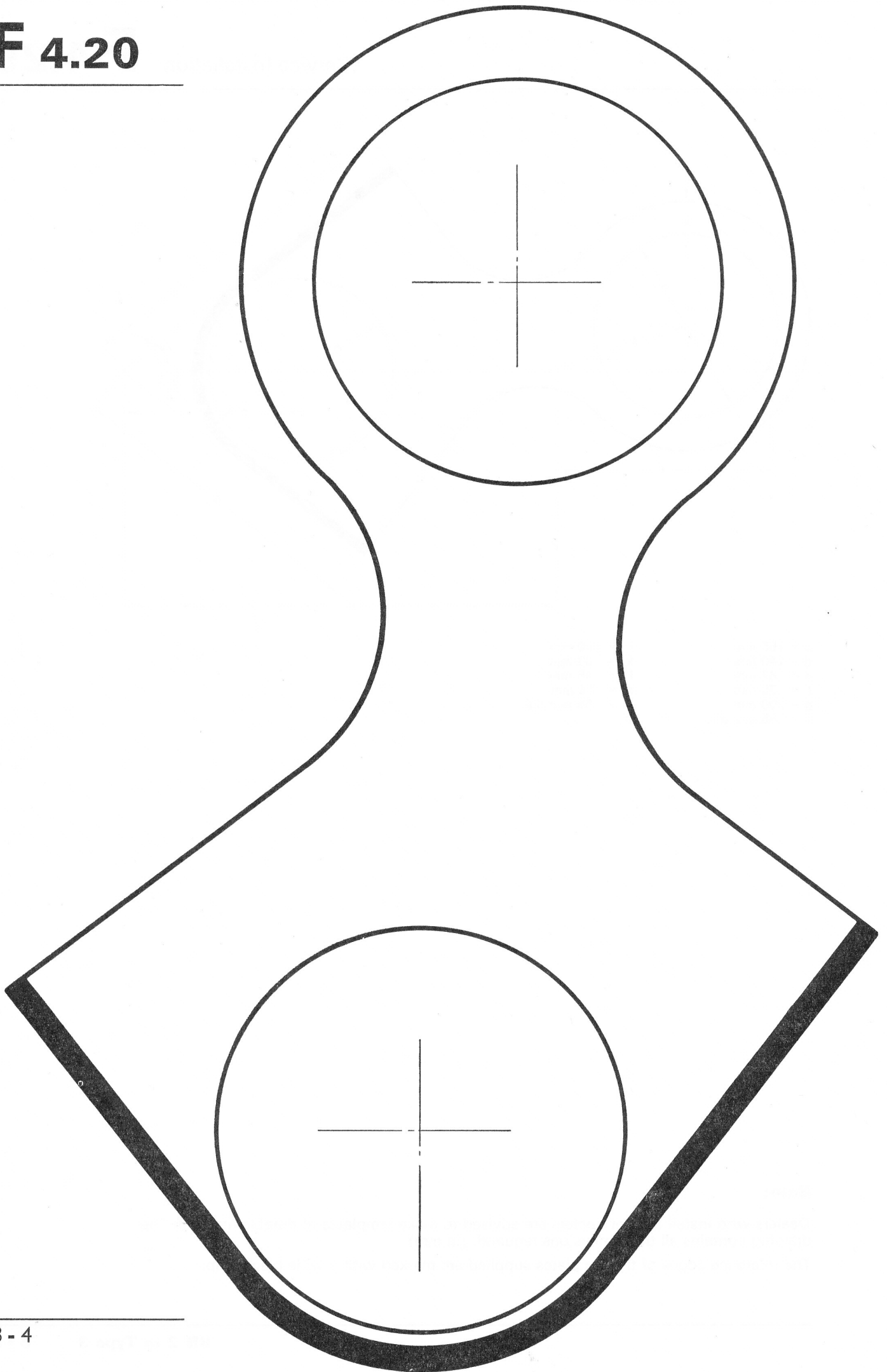
i = 100 mm
 k = 63 mm
 l = 45 mm
 m = 15 mm
 n = 55 mm dia.

Note:

Dealers who install a lot of heaters are advised to make templates of durable material. The drawing contains all the dimensions required. (in mm)

The reference edges of the templates supplied are marked with a wide black strip.

F 4.20



Installing:

- 1 – Disconnect battery ground cable.
- 2 – Take luggage compartment lining out.
- 3 – Drill 16 mm hole (b) for the cable harness and fit grommet in hole (Fig. 1).
Route cable through grommet (Fig. 1).

a = 50 mm
b = 16 mm dia.

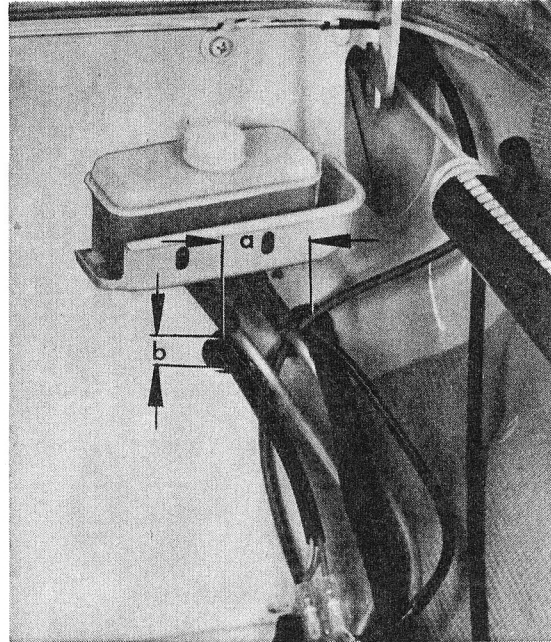


Fig. 1

- 4 – Drill a 16 mm hole (a) through the cross member for the fuel hose (Fig. 2).

a = 16 mm dia.
l = 250 mm
U = overflow hose

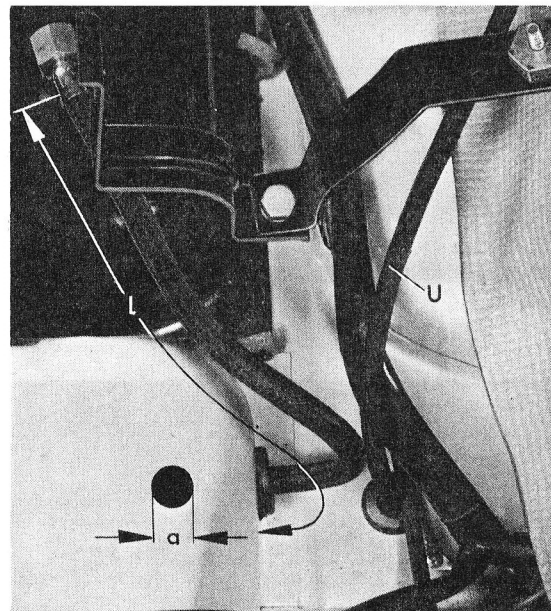
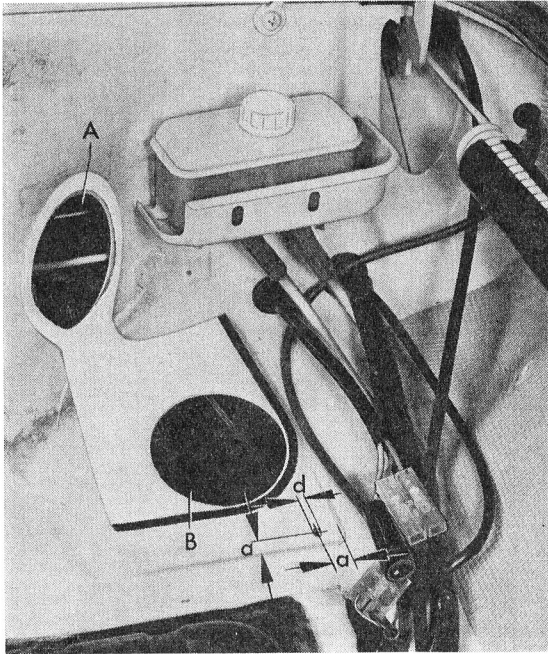


Fig. 2

Note:

In Fig. 2, the hole for the fuel hose is in the side of the cross member (factory installation). When subsequently installing the heater, the hole must be made in the top part of the cross member (Fig. 2, dimensioned hole a).

F 4.20 Service Installation



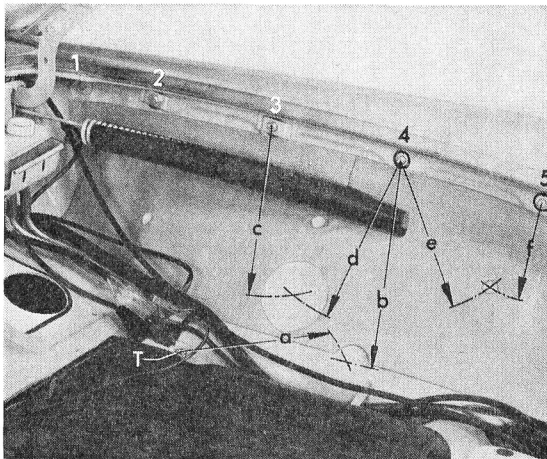
5 – Place template against upper edge of rib, mark off the hole and cut them out (Fig. 3).

A – Hole for rear part of an circulation pipe
 B – Hole for warm air elbow
 a = 10 mm d = 5.1 mm dia.

Note:
Take care when cutting hole A because the fresh air blower box is directly behind the panel.

6 – Drill hole d (5.1 mm) in the rib (Fig. 3).

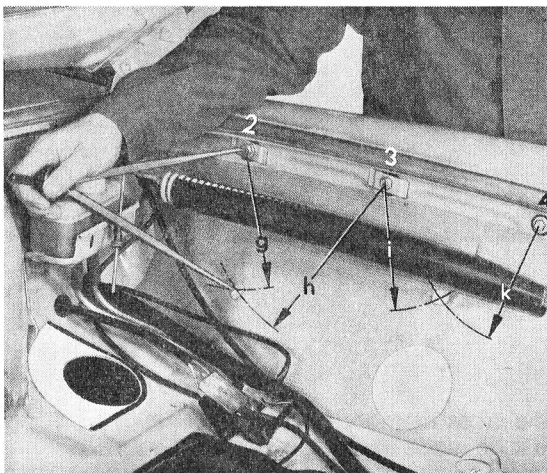
Fig. 3



7 – The centers of the holes (Figs. 4, 5 and 6) are marked with dividers from the centers of the fender bolts 2, 3, 4, 5 and tank securing bolt T.

T = Tank bolt
 a = 200 mm d = 213 mm
 b = 253 mm e = 193 mm
 c = 220 mm f = 123 mm

Fig. 4



Note:
Bolt 1 shown in Fig. 4 is not visible (the body shown is a prototype). The bolt number 4 in Fig. 4 is thus actually bolt number 3.

g = 162 mm
 h = 218 mm
 i = 136 mm
 k = 145 mm

Fig. 5

8 – Cut and drill holes (Fig. 6).

e = 7 mm dia. n = 49.8 mm dia.
m = 100 mm dia. o = 36 mm dia.

9 – The luggage compartment lining must be cut to provide a 100 mm hole (m) for the exhaust pipe (Fig. 6).

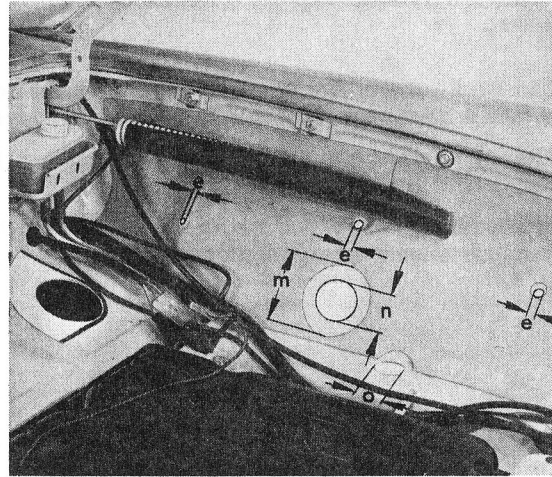


Fig. 6

10 – Install a grommet for the combustion air pipe (Fig. 10).

11 – Drill a 4 mm hole (p) for the tapping screw (Fig. 7).

p = 4 mm dia.
r = 20 mm

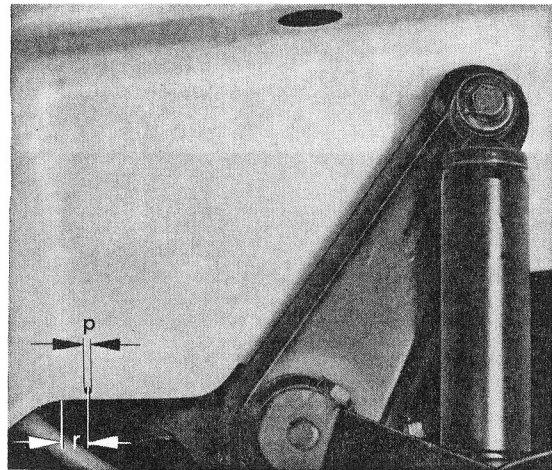


Fig. 7

12 – Install grommet in hole for fuel line and pull hose through from luggage compartment, leaving the last 250 mm (1) in compartment (see Fig. 2).

13 – Install a piece of protective sleeving over the hose below the luggage compartment (Fig. 8).

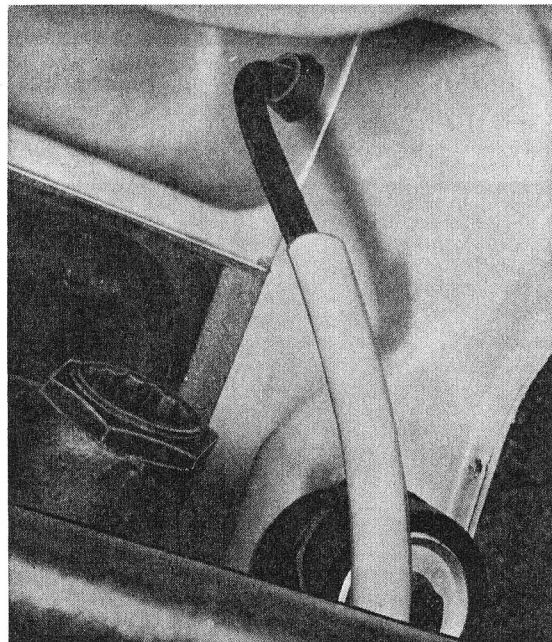


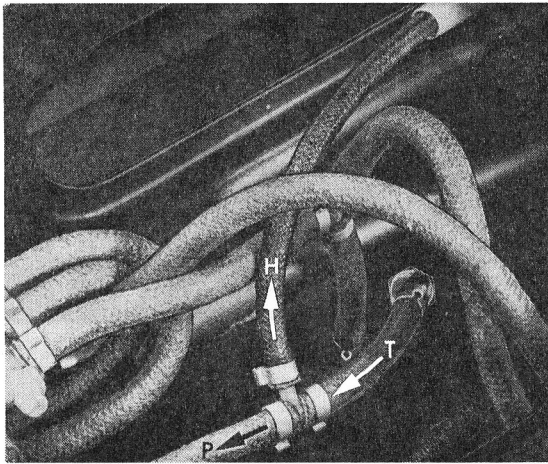
Fig. 8

Note:

The fuel supply for the heater may only be taken from the hose between tank and the fuel pump of the fuel injection system (Fig. 9).

The heater will go out if the fuel is taken from the return line of the fuel injection system because of the vapour bubbles in this line.

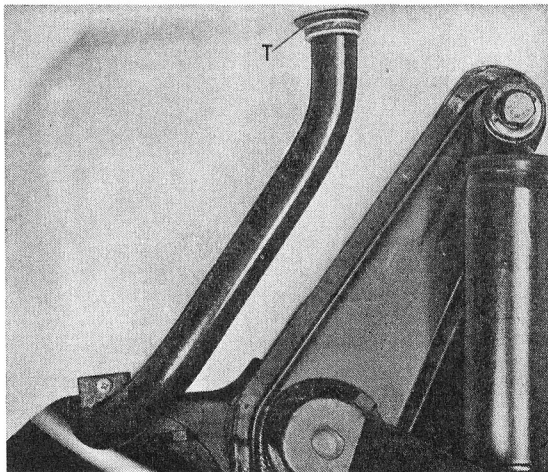
The heater will smoke if the fuel is taken from the pressure line of the fuel injection system because of excessive fuel consumption.



14 – Clip hose between tank and fuel pump (engine) and cut it (Fig. 9).

T = from tank
P = to pump of fuel injection engine
H = to heater

Fig. 9



15 – Install T piece and secure the three hoses with hose clips as shown (Fig. 9).

16 – Install combustion air pipe (Fig. 10).

Fig. 10

17 – Install exhaust pipe and seal.
(Figs. 11 and 12)

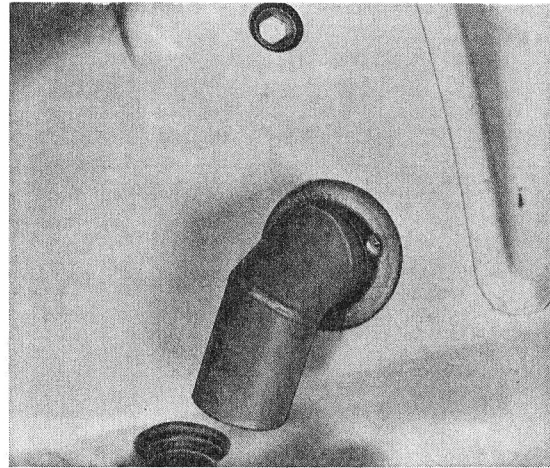


Fig. 11

18 – Install three brackets for heater (Fig. 12 and page F 4.20/3-1).

- H = Rear bracket
- M = Center bracket
- V = Front bracket
- A = Front bracket for cover plate
- B = Rear bracket for cover plate
- G = Exhaust pipe, upper part

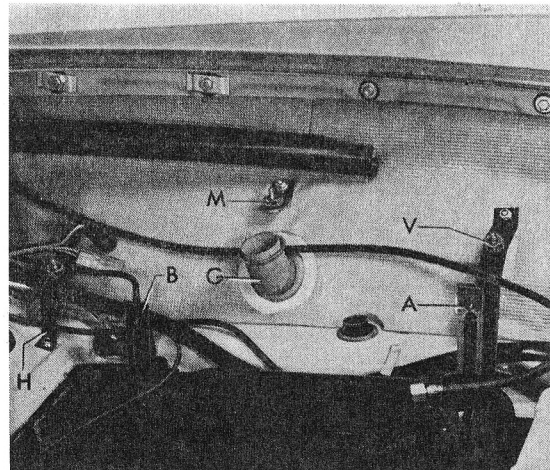


Fig. 12

19 – The cover plate brackets A and B and front heater bracket V are secured with the tank bolts (Figs. 12, 13 and page F 4.20/3-1).

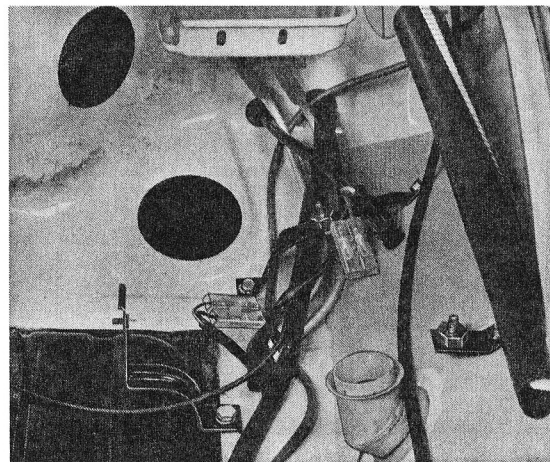


Fig. 13

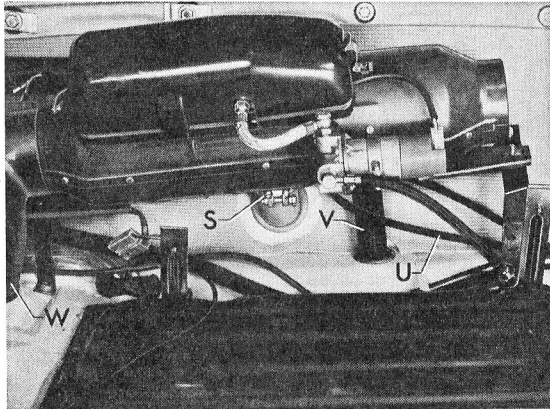


Fig. 14

U = Overflow hose
W = Warm air elbow
V = Combustion air hose
S = Clamp for exhaust pipe

- 20 – Press warm air elbow into hole until it clicks (Fig. 14).
- 21 – Secure heater to the three brackets after installing hose V for combustion air (must fit tightly). (Fig. 14)
- 22 – Secure exhaust pipe with clamp S (Fig. 14).
- 23 – Push overflow hose on to overflow pipe (see F 4.1/2–1 and Fig. 14).
See also the routing of hose in Fig. 2

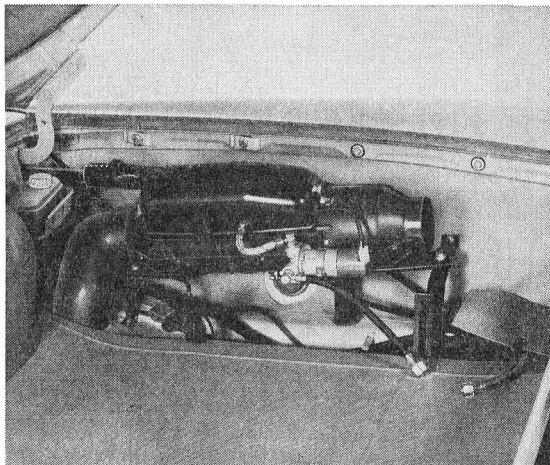


Fig. 15

- 24 – Cut luggage compartment cardboard to fit and install it (Fig. 15).

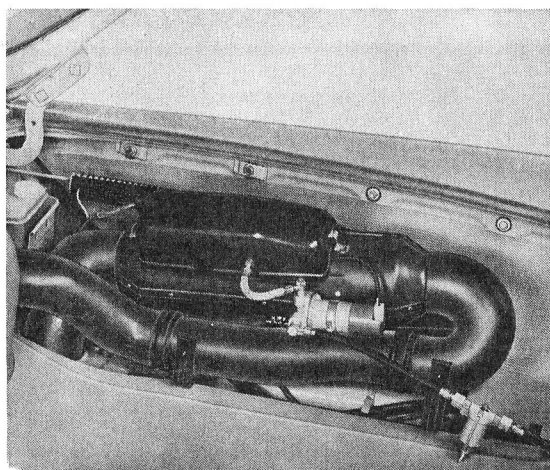


Fig. 16

- 25 – Install air circulation pipe and warm air elbow (page F 4.20/3–1 and Fig. 16).
- 26 – Install fuel filter (Fig. 17).

Note:
The arrow shows direction of flow.

- 27 – Connect switch wires as shown in wiring diagram on page F 4.1/6–5.

28 – Secure switch in one of the holes provided (Fig. 17).

29 – Connect cables to fuse box as shown by wiring diagram on page F 4.1/6–5.

Note:

There are two cables attached to terminal 30 on the bridged side of the 16 amp. fuse (feed side).

- Cable to lighting switch – 1.5 mm² red
- Cable to ignition switch – 4 mm² red

30 – Pull off cables to lighting switch and starter-ignition switch and then connect them to the connectors provided in the heater cable harness (see wiring diagram F 4.1/6–5).

31 – The red 2.5 mm² cable of the heater cable harness is connected to the 16 amp. fuse at terminal 30. (See wiring diagram on page F 4.1/6–5).

32 – Install cover plate and press filter into clip on plate (page F 4.20/3–1).

33 – Connect battery ground cable and check heater operation.

34 – Install sticker on tank filler flap.

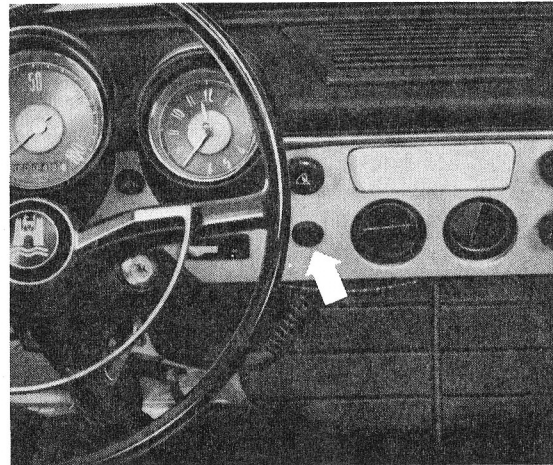


Fig. 17

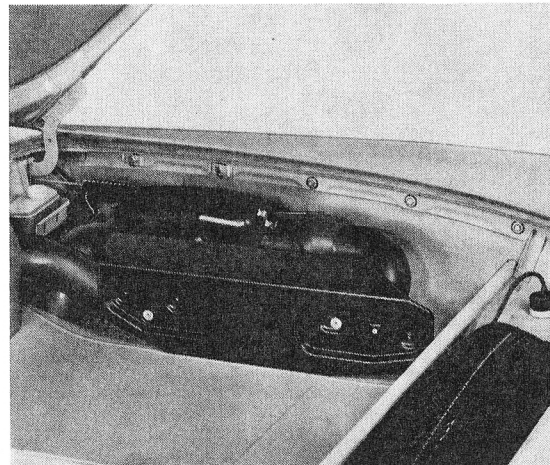


Fig. 18