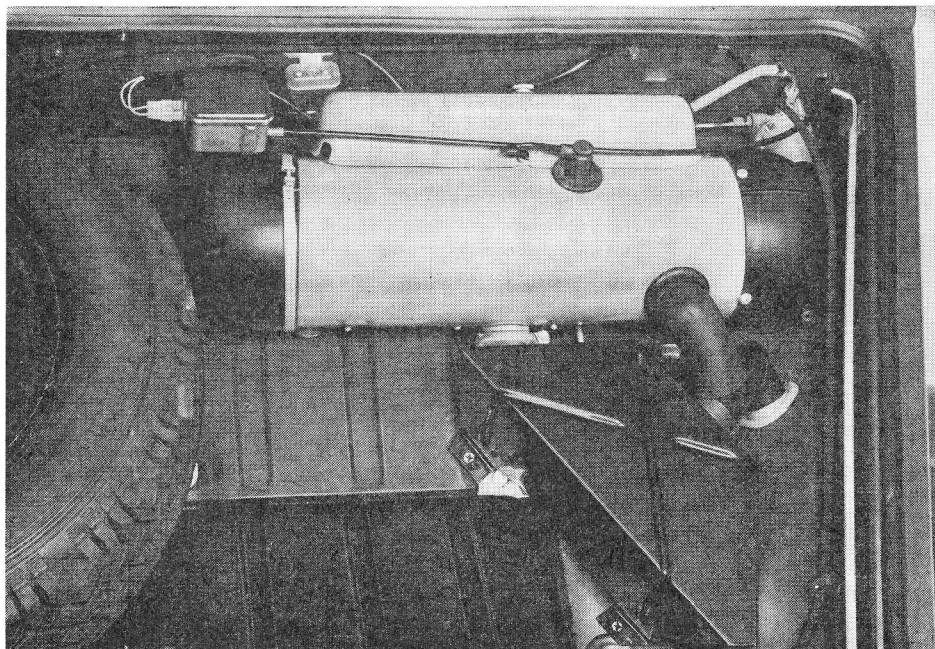


Description of Heating System **F 3.1**

Recirculating and fresh air heater BN 4 (Model 181 and Type 2)

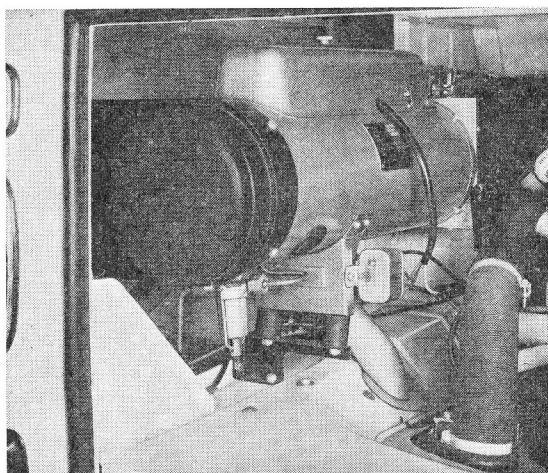
Description

The gasoline-electric recirculating heater operates independently of the vehicle engine and is installed in the front luggage compartment on the Model 181. The heater is thermostatically controlled and can be used when the vehicle engine is not running.

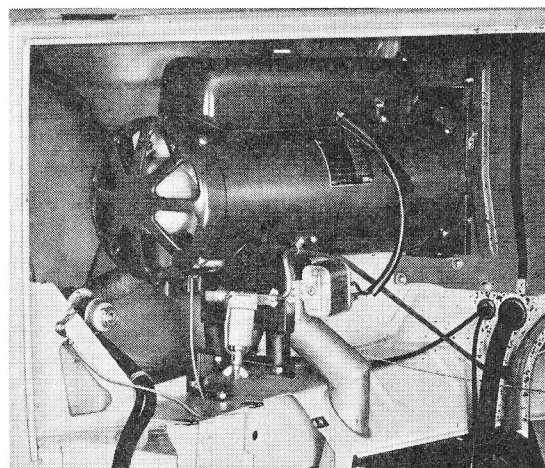


Model 181
up to October
1970

On the **Type 2** the heater is installed in the engine compartment. The heat output is regulated by a knob and the heater is supplied as a recirculating version or as a fresh air version according to model.



Recirculating heater



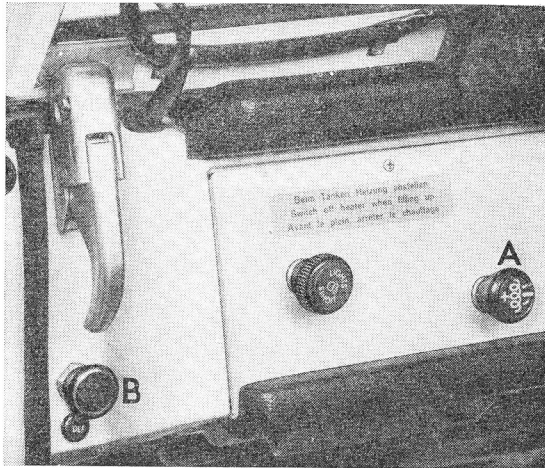
Fresh air heater

Type 2
up to July 1971

The recirculating heater uses the heat output more efficiently. On the fresh air version a thermostat operating flap (see F 3.1/2-1) is necessary to prevent cold air flowing from the engine compartment to the passenger compartment when the heater is not working.

F 3.1 Description of Heating System

Controls



Model 181

A – Time switch knob
B – Regulating switch knob

Model 181

1 – With vehicle engine running:

To switch heater on: Pull control switch knob (B) out slightly. Turn time switch knob (A) clockwise until switch engages. The green warning lamp in the knob lights up and shows that the heater is on.

To switch heater off: Turn time switch knob (A) as far as possible counter-clockwise. The warning lamp goes out and shows that the heater is switched off.

2 – With vehicle engine not running

To switch heater on: Pull regulating switch knob (B) out. Turn time switch knob (A) clockwise as far as possible. The warning lamp lights up and shows that the heater is on.

To switch heater off: The clockwork mechanism in the time switch automatically switches the heater off after about 30 minutes and the warning lamp goes out.

During these 30 minutes, the clockwork mechanism turns the time switch knob back into its original position. If the engine is started with the time switch knob in this position, the heater switches itself on again automatically and remains on until the ignition is switched off.

When the heater is used with the vehicle stationary it can be switched off at any time by turning the time switch knob counter-clockwise to the engaged position or turning it counter-clockwise as far as possible to the zero position. The clockwork mechanism then runs down without doing anything.

Regulating warm air temperature

Pull temperature regulating switch knob (B) out. The further the temperature regulating switch knob (B) is pulled out, the higher the temperature of the circulated hot air will be.



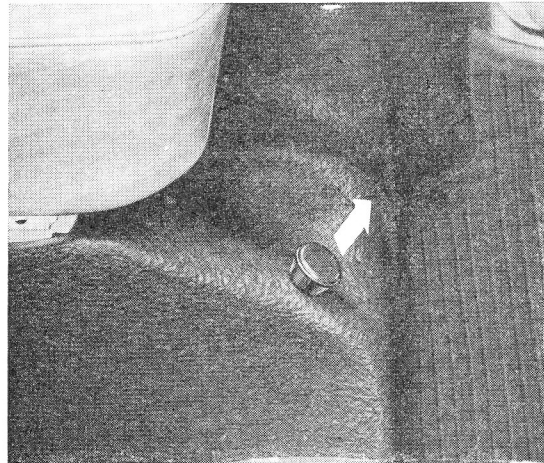
up to December 1971

Type 2

The heater is controlled with a time switch located in the instrument panel to the left of the ashtray.

A pull switch was used until July 1969 and from August 1969 a rotary switch has been used.

The heat is regulated with the knob under the seat (arrow). The heat is at its maximum when the knob is pulled out fully.



Type 2

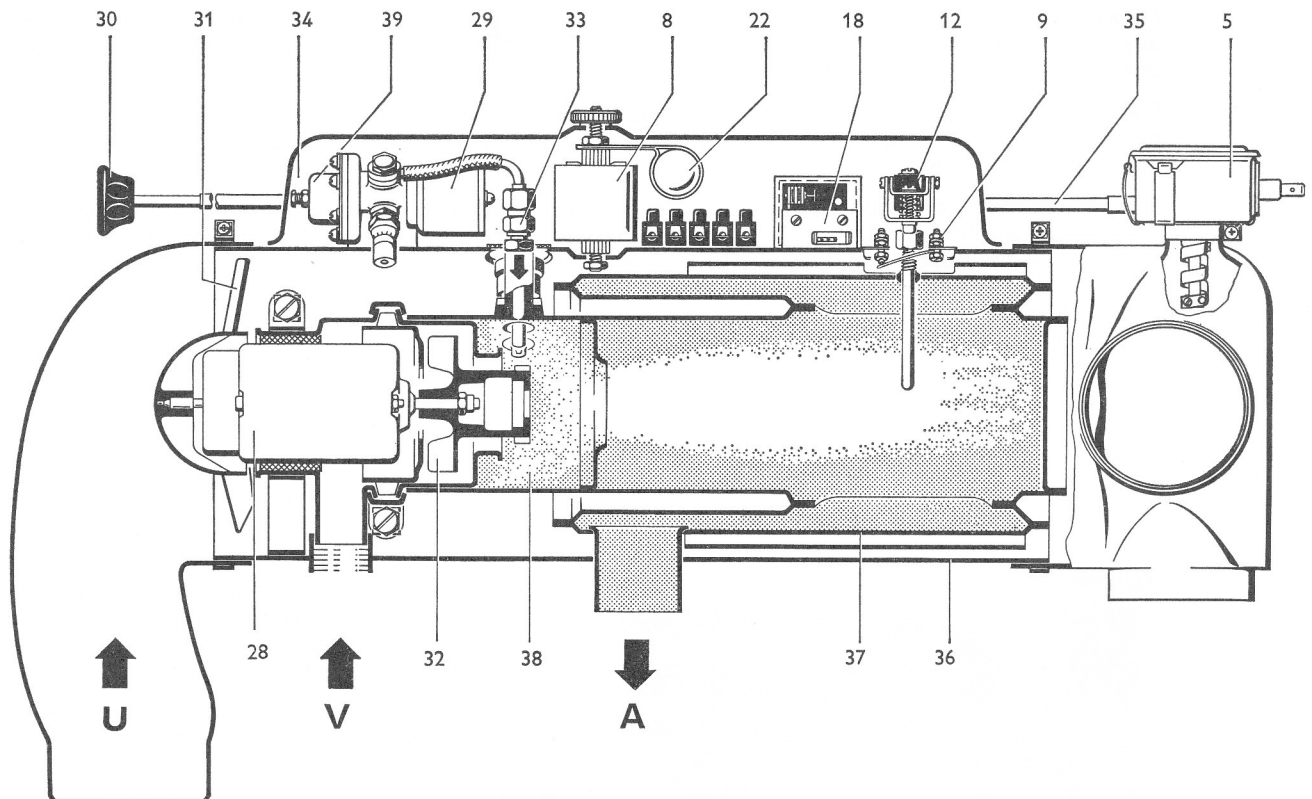
Notes: (Type 2 and Model 181)

- 1 – After the heater has been switched off, the combustion air blower continues to run (run-on) to cool down the heater.
- 2 – **The heater must be switched off before the fuel tank is filled.** The warning lamp must not be on. It is not necessary to wait until the run-on has switched off.
- 3 – To avoid running the battery down it is recommended not to switch the heater on several times in succession when the vehicle is stationary. This applies particularly when outside temperatures are very low because the full capacity of the battery is then required to start the engine.

US and Canadian versions
from August 1972

Due to official regulations in USA and Canada the lamp in the heater switch knob which formerly acted as a warning lamp to show when heater is switched on, now acts as an illuminating light. On these vehicles the lamp lights up dimly when the lights are switched on. The intensity remains unchanged when the heater is switched on. It can be regulated like the instrument lights.

Working Principles



Model 181

U – Circulating air
V – Combustion air
A – Exhaust

5 – Temperature regulating switch
8 – Ignition coil
9 – Overheating switch
12 – Thermo-switch
18 – Safety switch
22 – Condenser
28 – Combustion air blower motor
29 – Solenoid valve
30 – Knob on Bowden cable

31 – Circulating air blower
32 – Combustion air blower
33 – Jet carrier
34 – Protective cover
35 – Bowden cable
36 – Casing
37 – Heat exchanger
38 – Combustion chamber
39 – Pressure regulator

When the time switch is switched on, the combustion air blower motor operates and begins to supply air.

At the same time, the electrical fuel pump forces fuel into the combustion chamber via the diaphragm pressure regulator, the solenoid valve and the fuel jet.

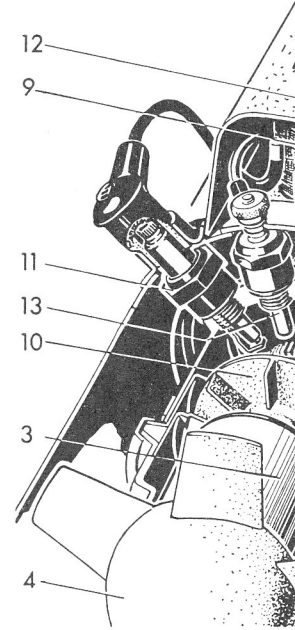
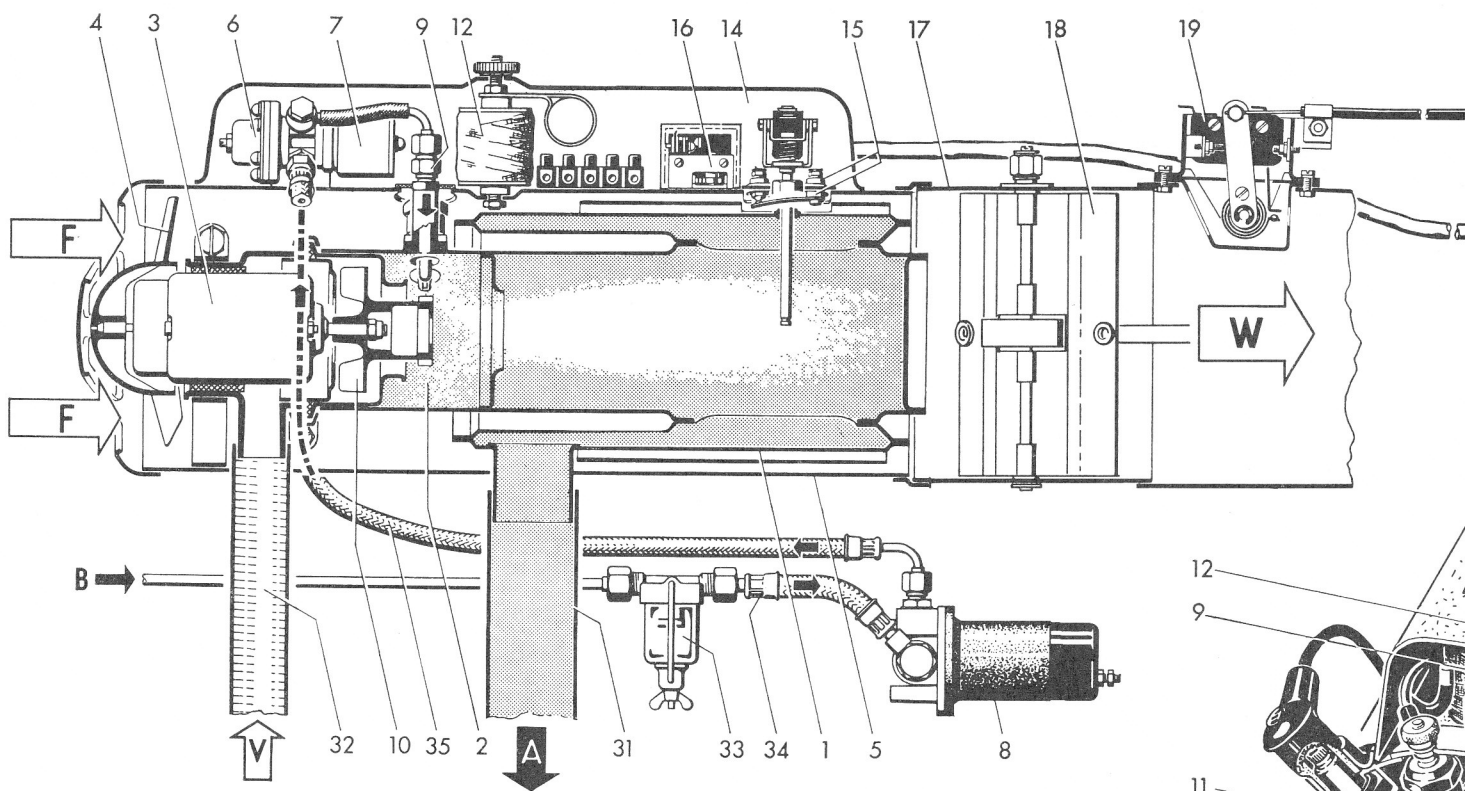
Here the fuel impinges on a toothed ring on the combustion air blower and is atomized. The combustion air, which is swirled by a housing with vanes, then mixes with the atomized fuel and forms a combustible mixture.

The glow plug is also energized and heats up the mixture so that it will easily ignite.

The spark plug is energized via the ignition coil and ignites the fuel/air mixture. The resulting flame contacts the feeler tube of the thermo-switch at the end of the heat exchanger and the thermo-switch switches the glow plug off again when operating temperature has been reached. The spark plug operates as long as the heater is on.

The air drawn in by the warm air blower is forced past the heat exchanger into the interior of the vehicle. The warm air can be distributed between windshield and footwell.

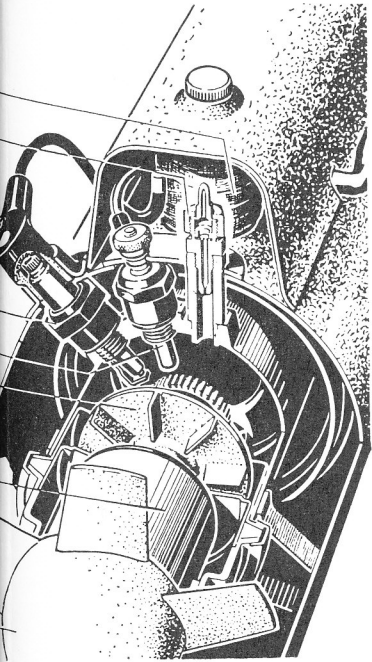
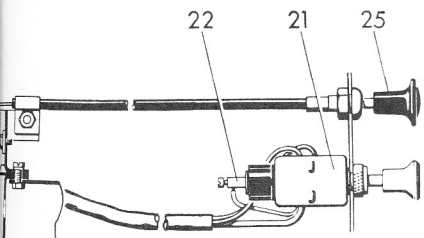
The temperature switch in the warm air pipe is adjusted by a Bowden cable and controls the exit temperature of the warm air thermostatically.



Type 2

- 1 – Heat exchanger
- 2 – Combustion chamber
- 3 – Electric motor
- 4 – Fresh air blower
- 5 – Casing
- 6 – Pressure regulator
- 7 – Solenoid valve
- 8 – Electric fuel pump
- 9 – Fuel jet
- 10 – Combustion air blower
- 11 – Spark plug, 2 pole
- 12 – Coil
- 13 – Glow plug
- 14 – Thermo-switch (Flame detector)
- 15 – Overheating switch
- 16 – Safety switch
- 17 – Warm air duct
- 18 – Control flap
(only on fresh air heater)
- 19 – Temperature regulating switch
- 21 – Heater switch
- 22 – Warning lamp terminal
- 25 – Knob for heat control switch
- 31 – Exhaust pipe
- 32 – Air intake pipe
- 33 – Fuel filter
- 34 – Suction line
- 35 – Pressure line

A – Exhaust B – Fuel F – Fresh air V – Combustion air W – Warm air

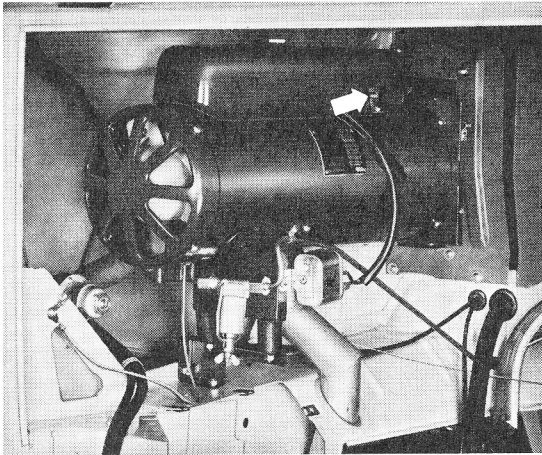


Maintenance

Deposits from the fuel can settle in the fuel lines if the heater is not used for long periods as, for example, during the warm season. To avoid trouble, it is advisable to operate the heater briefly about once a month when the heater is not in regular use.

Generally, the heater requires no special maintenance. Each year before the cold season starts, however, the glow plug and the spark plug should be checked. All electrical connections must be firm and not corroded.

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



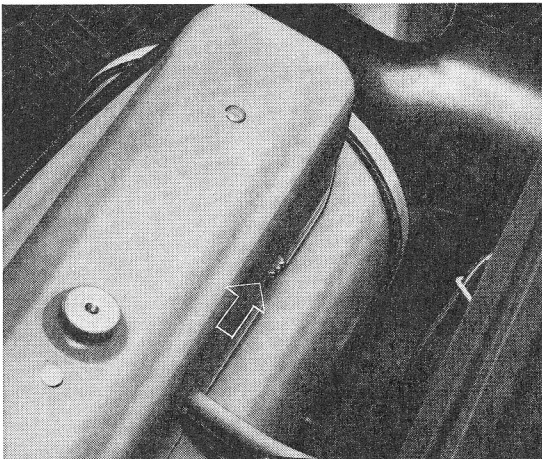
Type 2

If the heater does not begin to operate after 2–3 minutes, the safety switch has been energized. In such cases, move the lever of the safety switch (arrow) on the heater.

If the heater still does not work there is a defect in the heating system.

Technical data

Heat output, variable from	1080-4000 kcal/h
Fuel	gasoline
Fuel consumption	0.2-0.65 liters per hour
Nominal voltage	12 volts
Operating voltage	10-14 volts
Current draw	50 Watts
Current draw when starting up	110 Watts



Model 181

Heat exchanger

The heat exchanger prevents the hot gases from mixing with the hot air. It conducts the heat from the burning gas to the air flowing past the outer wall of the heat exchanger casing which is made of rustproof steel.

Description

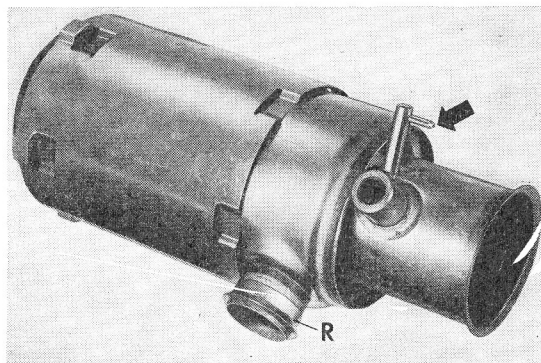
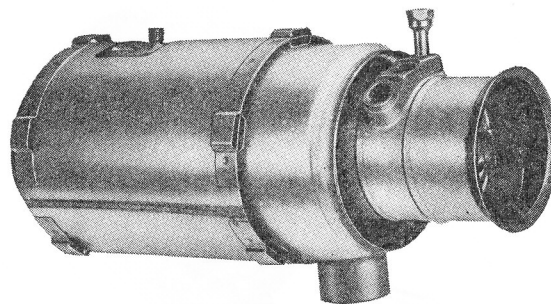
Heat exchangers for heaters with diaphragm pressure regulator have separate connections for the glow plug and the spark plug.

From 1 August 1971:

Model 181 from Chassis No. 182 2 000 007

Type 2 from Chassis No. 212 2 000 001

The new heat exchangers can be recognized by the connection for the fuel hose (arrow) and the single connection for the glow-spark plug.



R – Tapered ring with shoulder
(only for Model 181)

from 1 August 1971

Combustion air blower

- 1 – The axial blower (A) delivers hot air.
- 2 – The radial blower (B) delivers air for combustion.
- 3 – The toothed ring (L) improves mixture formation.
- 4 – A contact breaker which opens and closes once at every revolution of motor spindle is installed to supply the impulses for the ignition coil.

Model 181:

from 25 Oct. 1970,

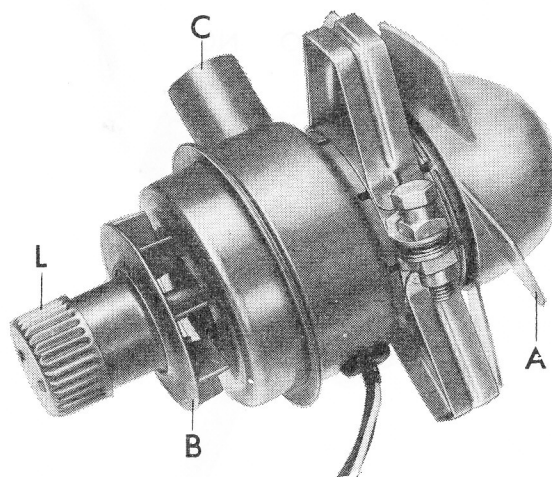
Chassis No. 181 2 251 015

Type 2:

from 1 August 1971,

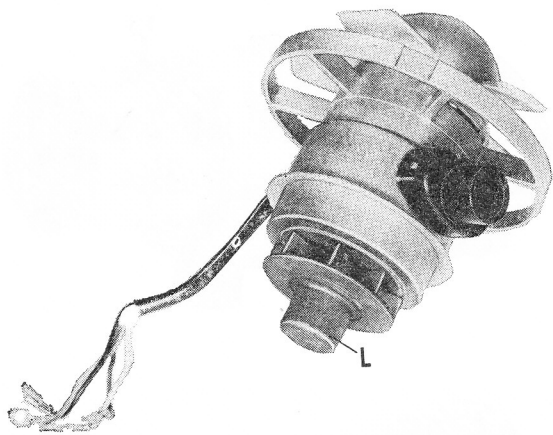
Chassis No. 212 2 000 001

- 5 – A contact breaker which open and closes once every 33 revolutions of motor spindle is installed to supply the impulses for the metering pump.



A – Axial wheel
B – Radial wheel
C – Intake pipe
L – Toothed ring
(up to July 1971)

F 3.1 Description of Heating System



Model 181; Type 2

L – Air deflector cylinder without toothed ring
(from August 1971)

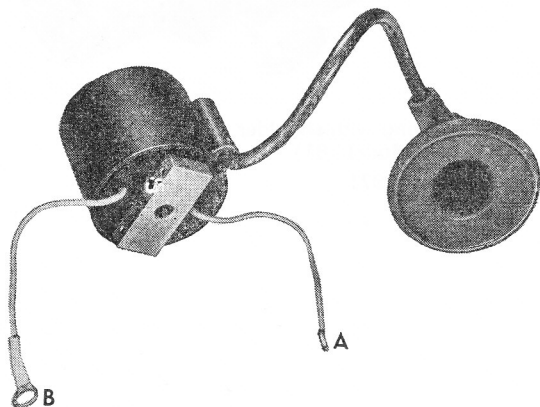
Description:

The combustion air blower for the heater with diaphragm pressure regulator has three wires.

The blower for the heater with metering pump has four wires.

Speed:

4875–5325 rpm at 12 volts.

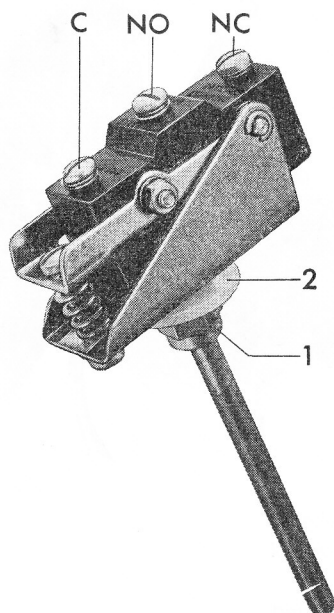


Ignition coil

The primary winding receives impulses from the contact breaker on the motor spindle and induces a high voltage in the secondary winding. This voltage passes to the plug via an ignition cable.

A – to contact breaker in combustion air blower
B – to condenser

Nominal voltage: 12 volts
High voltage: 5000 volts



Thermo-switch

1 – This switch controls the start-up time and thus the glow time of the glow-spark plug.
2 – It limits the run-on time.

Description:

NC – Continuous positive
NO – Safety switch and glow plug connection
C – Combustion air blower connection
1 – Union
2 – Sealing washer

(Double connections from August 1971)

Start-up time: Less than 45 seconds at room temperature.

Run-on time: 110–150 seconds at room temperature.

Overheating switch

If the heat exchanger gets too hot, this switch stops the supply of fuel to the heater.

Possible reasons for overheating:

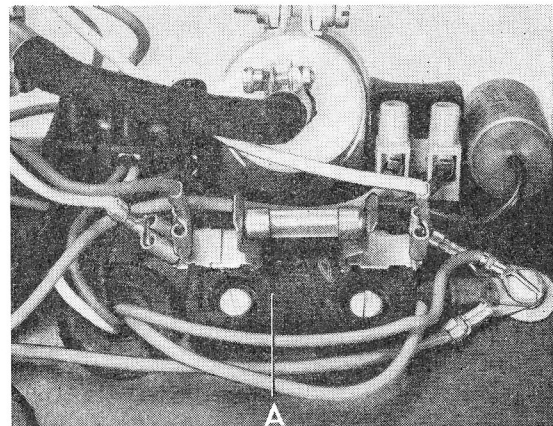
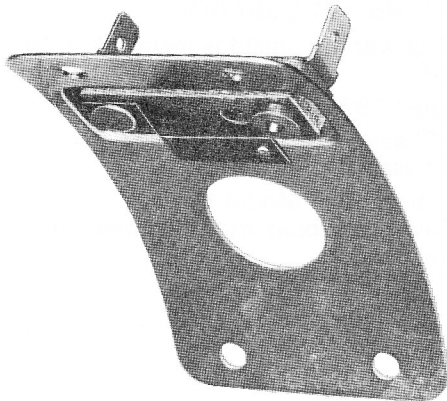
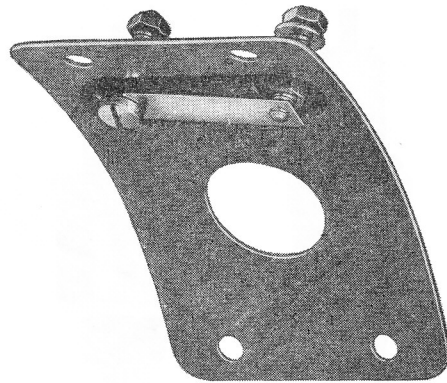
- a – Temperature regulation defective
- b – Hot air ducts blocked
- c – Excessive amount of fuel

Description:

The overheating switch on the BN 4 heater opens when heater overheats and closes when it cools down.

Model 181,
from 25 Oct. 1970,
Chassis No. 181 2 251 015

On heaters with metering pump the switch contacts close when heater overheats. This causes a fuse to blow and stops the current flow to the fuel pump (see wiring diagram).



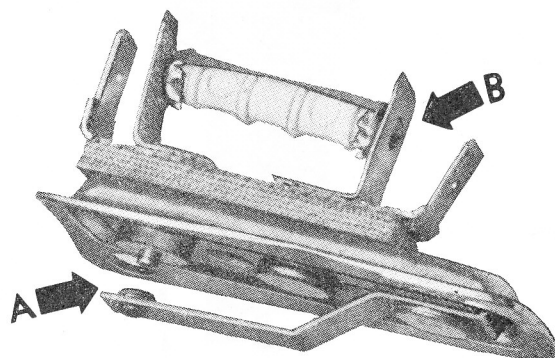
A – Overheating fuse

Model 181; from 25 October 1970

Model 181:
from 1 Aug 1971,
Chassis No. 182 2 000 007

Type 2:
from 1 Aug 1971,
Chassis No. 212 2 000 001

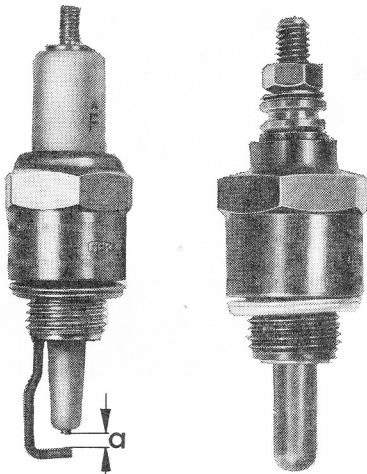
The fuse holder and overheating switch contacts were combined to form one part.



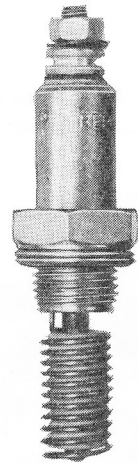
A – Overheating switch
B – Fuse holder

Model 181; Type 2, from 1 August 1971

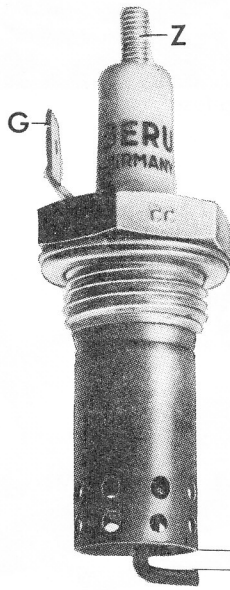
F 3.1 Description of Heating System



a = 2.5 mm



Glow plug of Model 181
from 25 October 1970



G – Low tension connection
Z – High tension connection
a = 2.5 mm

Model 181; Type 2, from August 1971

Glow plug, spark plug, glow-spark plug

The glow plug warms the fuel/air mixture and makes it readily combustible.

The spark plug ignites the mixture during the start-up period and when heater is regulating.

Description:

BN 4 heaters with diaphragm pressure regulator have a spark plug and a glow plug with glow element shield.

From 25 Oct. 1970:

Chassis No. 181 2 251 015

a glow plug without shield is installed in the Model 181.

From August 1971:

from Chassis No. 181 2 000 007
and Chassis No. 212 2 000 001

The BN 4 heaters in Model 181 and Typ 2 have a glow-spark plug with a connection for the low voltage.

Caution

The glow-spark plug from the BN 4 heater must **not** be used in the BA 4 heater because the BA 4 heater requires the special earth connection. The glow-spark plug from the BA 4 heater can, however, be used in a BN 4 heater.

Technical data:

Spark plug:

High voltage 5000 volts
Suppression resistance 5 k

Glow plug:

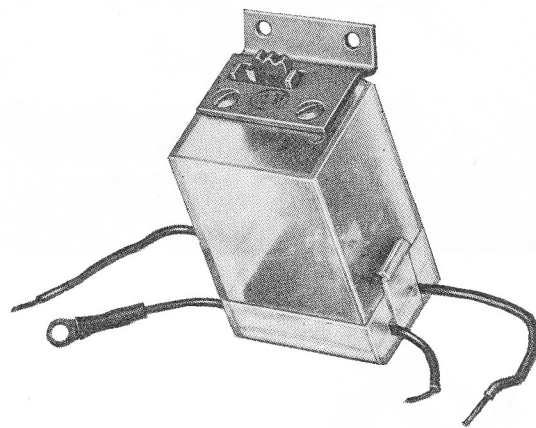
Voltage 12 volts
Resistance 2.4 Ω
Current draw 5 amp.

Glow-spark plug:

Voltage 12 volts and 5000 volts
Current draw less than 6.5 amp.
Suppression resistance 4–6 k Ω

Safety switch

This switch cuts off the current supply if, for some reason, combustion does not take place within 180 seconds of heater being switched on (no fuel, glow-spark plug defective).

**Description**

Model 181:

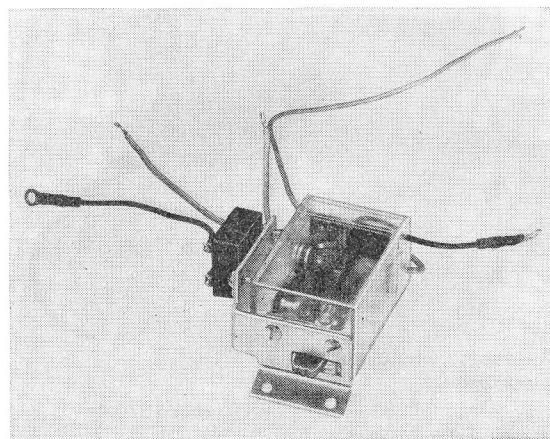
from 25 Oct 1970,
Chassis No. 181 2 251 015

Type 2:

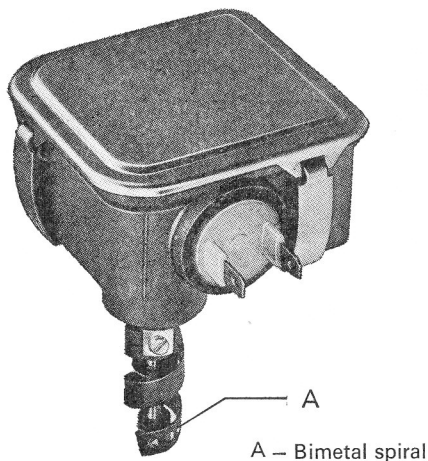
from Aug. 1971,
Chassis No. 212 2 000 001

The holder was modified and also serves as a bracket for a suppression filter.

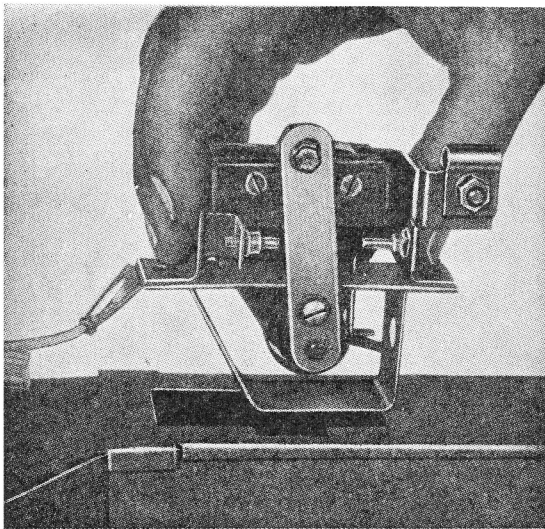
Switch response time 120–180 seconds at room temperature and 12 volts.



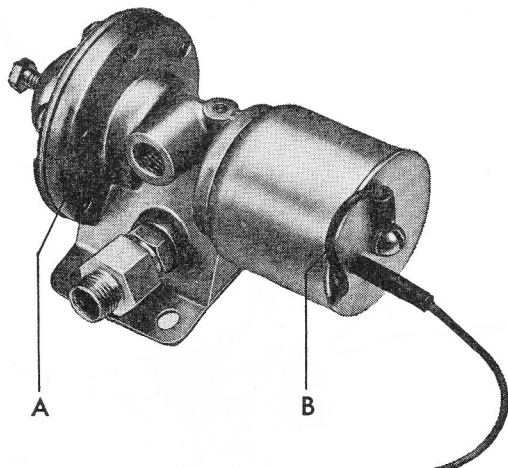
F 3.1 Description of Heating System



Model 181



Type 2



A - Pressure regulator
B - Solenoid

Model 181 - up to 25 October 1970
Type 2 - up to 1 August 1971

Temperature regulating switch

This switch keeps the selected air temperature within the switch tolerance values.

When the hot air reaches the cut-off temperature, the temperature regulating switch cuts the supply of current to the fuel pump. The air cools down by the switch tolerance value and when it reaches the cut-in temperature, the fuel pump starts to deliver fuel again.

The air temperature can be set with the knob between the lower cut-in temperature and the upper cut-off temperature.

Switch tolerance: about 20° C

Lower cut-in temperature: about 60° C

Upper cut-off temperature:

Model 181 about 110° C to 128° C

Type 2 about 120° C to 140° C

Note:

The specified temperatures can be measured roughly with electronic instruments near the temperature regulating switch.

Diaphragm pressure regulator

1 - This regulator controls the flow of fuel in conjunction with the air pressure.

The amount can be set with the adjusting screw (see F 3.3).

2 - The solenoid closes the fuel line when the pump is not delivering so that the fuel remains in the line from tank to heater.

Setting the amount delivered:

20 cm³-21 cm³ in two minutes at 12 volts (see F 3.3).

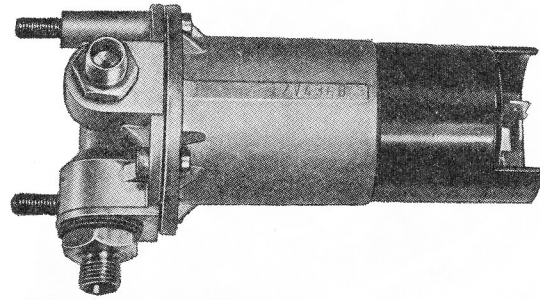
Fuel pump

Diaphragm pump

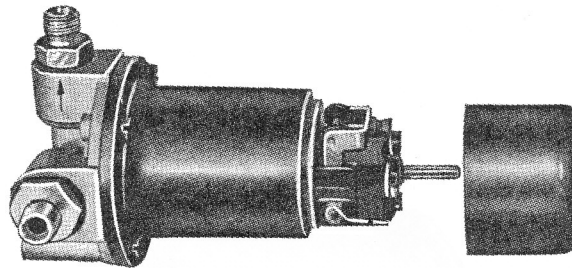
The diaphragm pump can only be installed together with the diaphragm pressure regulator.

Fitting position:

The pressure union (arrow pointing outwards) must be vertical as otherwise the valve may stick.



Model 181 – up to 25 October 1970



Type 2 – up to 1 August 1971

Metering pump

Model 181, from Chassis No. 181 2 251 015
Type 2, from Chassis No. 212 2 000 001

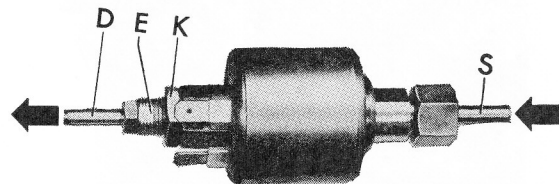
The amount delivered by the electro-magnetic metering pump depends on the speed of the combustion air blower. At every 33rd revolution of the motor spindle, the contact breaker sends an impulse to the fuel pump so that the fuel/air mixture remains constant independent of the speed of the combustion air motor.

Description:

- D – Pressure connection
- S – Suction connection
- K – Locknut
- E – Adjusting screw

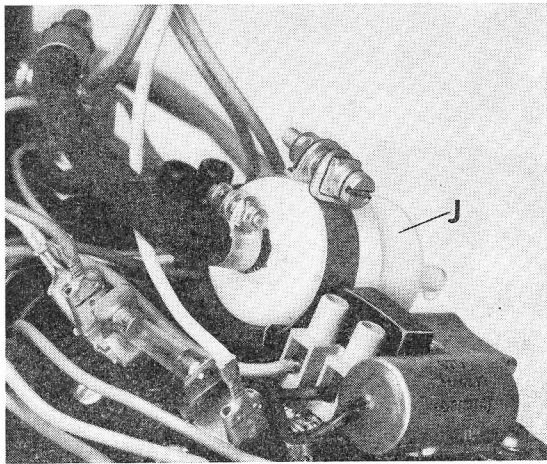
Setting fuel quantity:

200 strokes deliver 13.4 cm³–15.1 cm³ of fuel (see F 3.3).



Model 181 – from 25 October 1970
Type 2 – from 1 August 1971

F 3.1 Description of Heating System



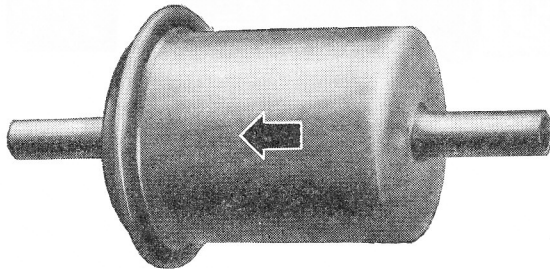
I – Impulse damper

Impulse damper (Model 181)

from 25 Oct 1970,
Chassis No. 181 2 251 015

to 30 July 1971,
Chassis No. 181 2 143 117

The impulse damper in the line between pump and fuel jet makes the fuel flow at the jet carrier more even and this in turn makes the combustion process more uniform.

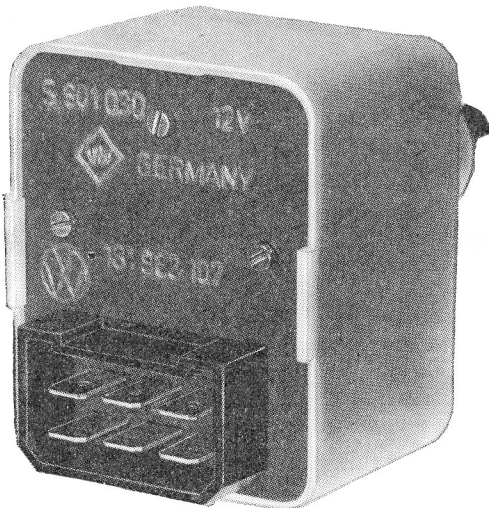


Filter

Model 181
Type 2 from August 1971

Purpose

- 1 – Dirt filter
- 2 – Water separator



Heater switch

This switch contains a clockwork mechanism which limits the time the heater stays on when vehicle is stationary and engine is not running to 25 minutes.

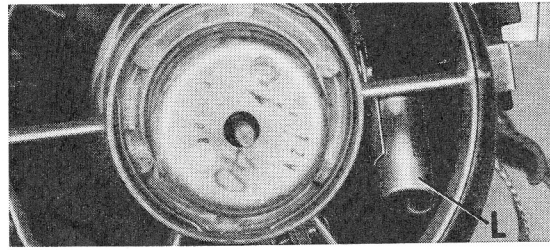
From August 1972
Model 181, from Chassis No. 183 2 000 001
Type 2, from Chassis No. 213 2 000 001

There are six connections instead of four.

Suppression parts

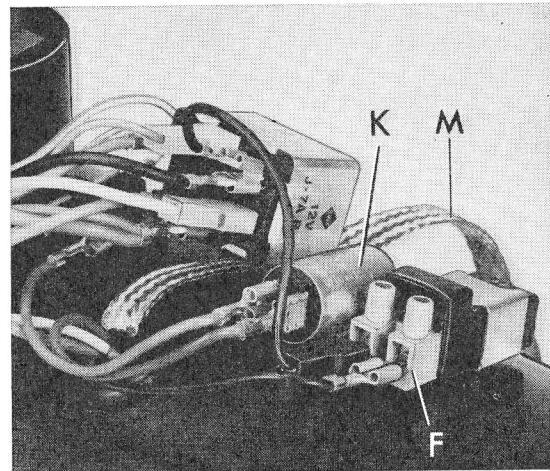
(Model 181, Type 2)

- L – Condenser on combustion air blower
Capacity 0.16 μ F
– Part No. 181 035 261 A –

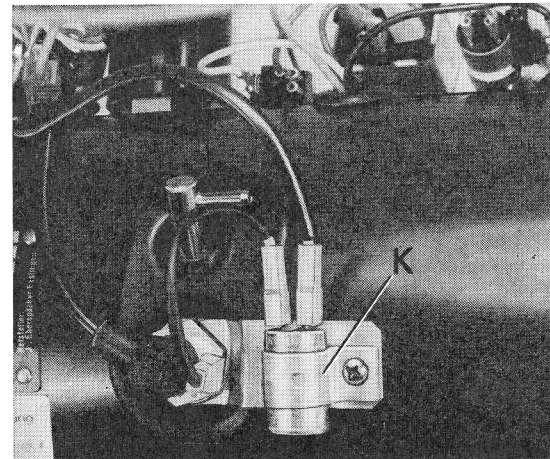


- M – Ground strap

- F – Suppression filter for combustion air blower
Capacity 1 nF / inductivity 2.5 μ H
– Part No. 181 035 253 A –

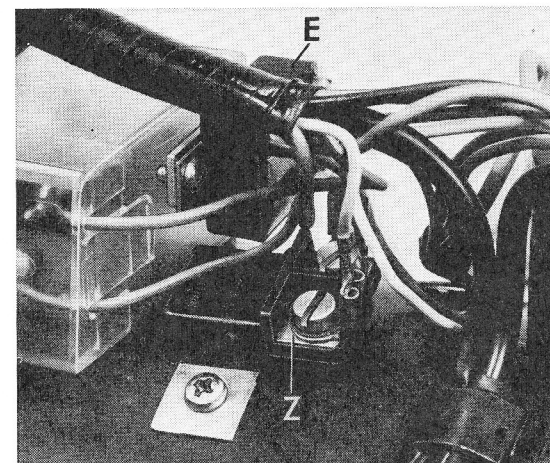


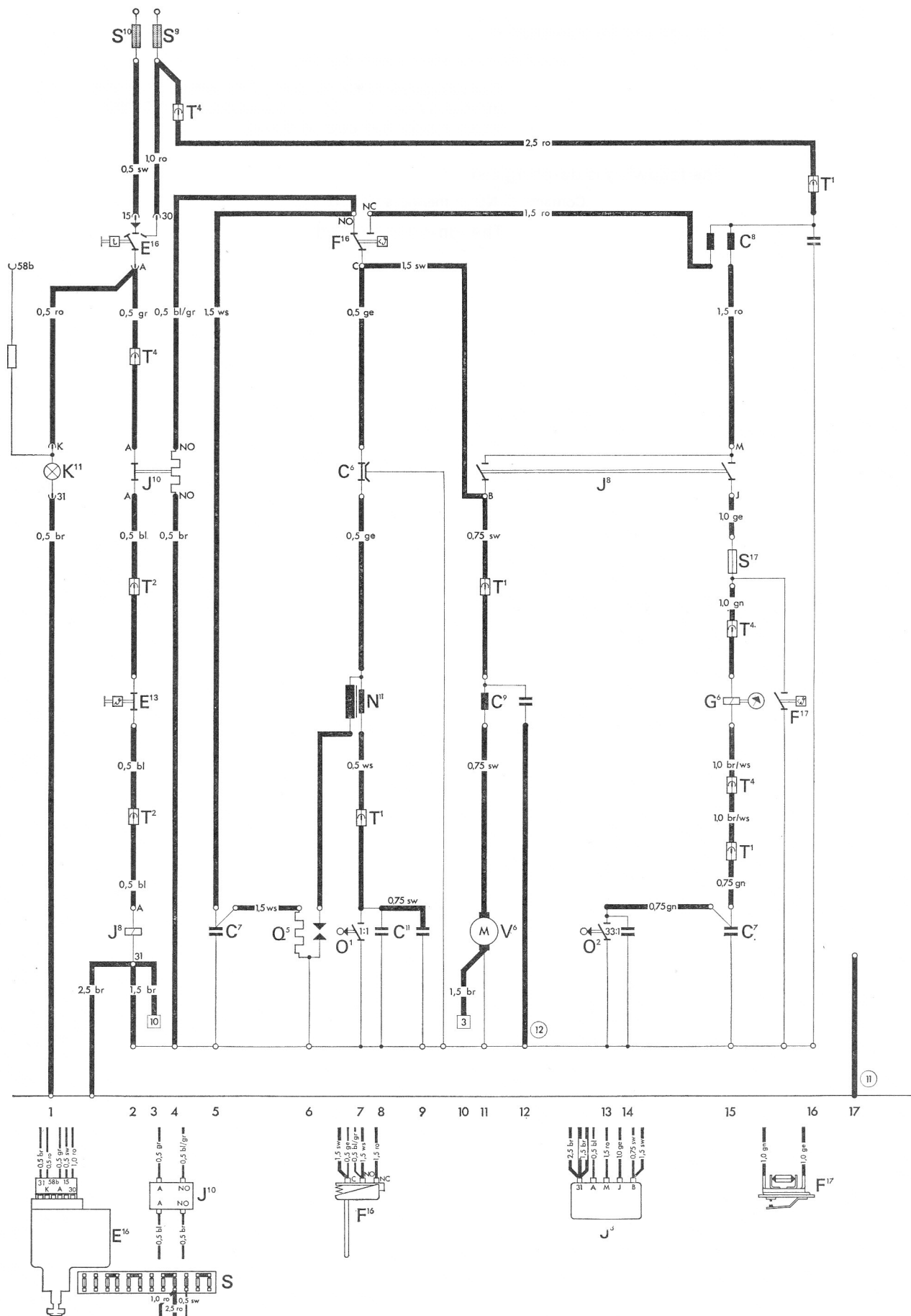
- K – Suppression condenser for glow-spark plug and heater
Capacity 2.2 μ F
– Part No. 181 035 261 B –



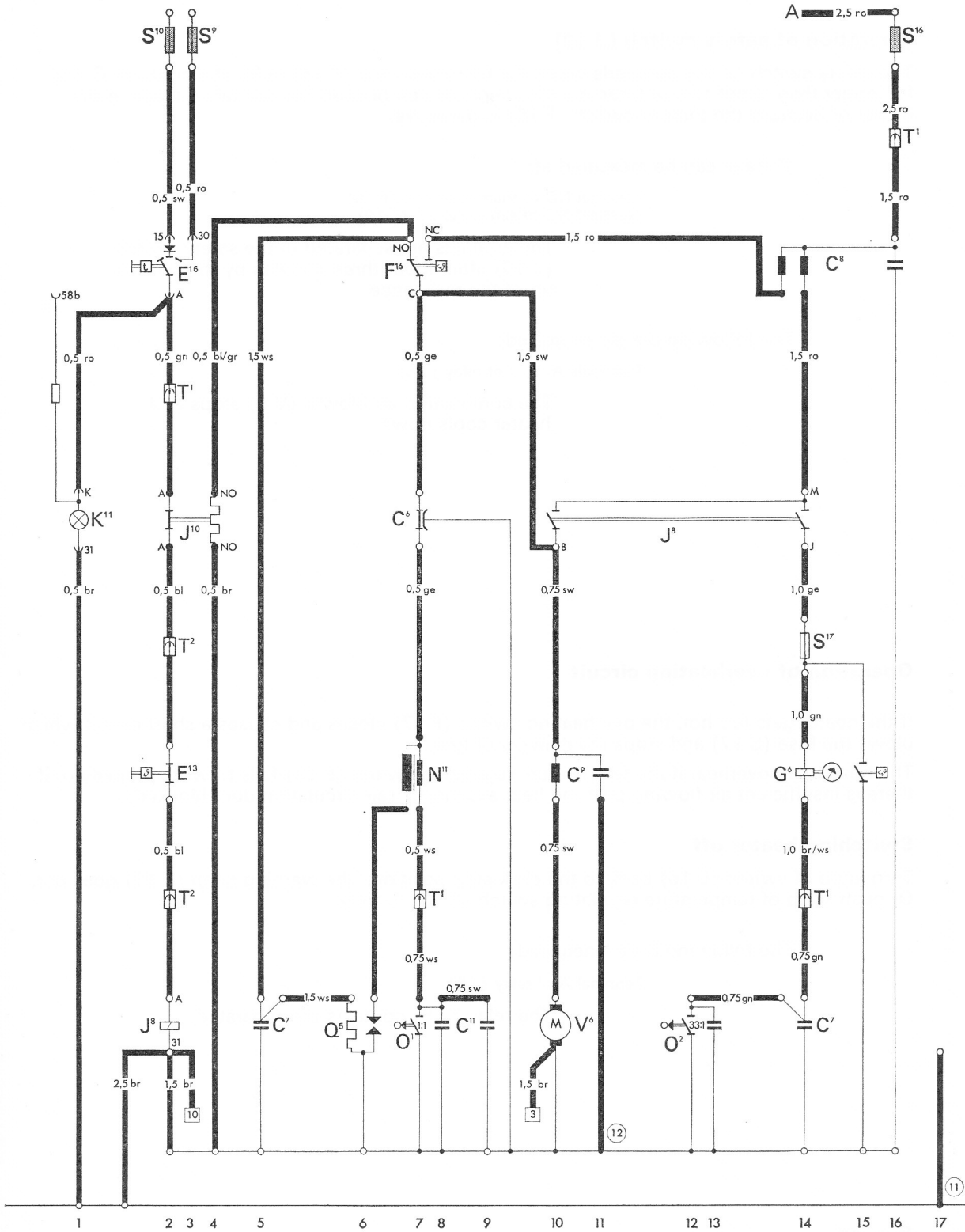
- E – Suppression filter for safety switch
Capacity 1 μ F, inductivity 2 \times 3 μ H
– Part No. 181 035 257 A –

- Z – Condenser for ignition coil (production)
Capacity 0.47 μ F





Wiring diagram and explanation – Model 181 : from August 1972, Chassis No. 183 2 000 001 4 - 9

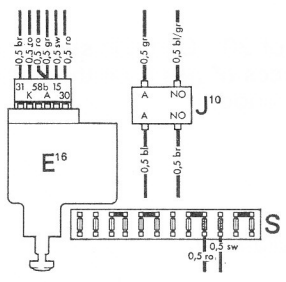


Designation

- A – Connection to 1
- C⁶ – Suppression coil
- C⁷ – Suppression coil capacity 2.2 μF
- C⁸ – Suppression filter inductivity 2×3
- C⁹ – Suppression filter inductivity 2.5
- C¹¹ – Suppression coil
- E¹³ – Temperature resistor
- E¹⁶ – Heater switch/contactor
- F¹⁶ – Thermo-switch
- F¹⁷ – Overheating switch
- G⁶ – Metering pump
- J⁸ – Relay
- J¹⁰ – Safety switch
- K¹¹ – Warning lamp, 31V
- N¹¹ – Ignition coil
- O¹ – Breaker contact (one impulse)
- O² – Breaker contact
- Q⁵ – Glow-spark plug
- S – Fuse box
- S⁹ – Fuse No. 9 in fuse box
- S¹⁰ – Fuse No. 10 in fuse box
- S¹⁶ – Separate 16 amp fuse
- S¹⁷ – Overheating fuse
- T¹ – Cable connector
- T² – Cable connector
- T³ – Cable connector
- T⁴ – Cable connector
- V⁶ – Combustion air motor
- ⓪ – Ground strap – 11
- ⓪ – Ground strap – 12

Explanation

To switch heater on
 a – Pull knob of temperature sensor
 b – Operate heater switch
 Voltage can be measured at points 10 and 11



ro = red	br = brown
sw = black	ws = white
ge = yellow	gn = green
bl = blue	gr = grey

Designation	in current track
A – Connection to terminal 30 on starter	16
C ⁶ – Suppression condenser for coil/capacity 0.47 μF	7
C ⁷ – Suppression condenser for glow-spark plug and heater/ capacity 2.2 μF	5, 14, 15
C ⁸ – Suppression filter on safety switch/capacity 1 μF/ inductivity 2×3 μH	15
C ⁹ – Suppression filter for combustion air blower/capacity 1 μF/ inductivity 2.5 μH	11
C ¹¹ – Suppression condenser on combustion air blower/capacity 0.16 μF	9
E ¹³ – Temperature regulating switch	2
E ¹⁶ – Heater switch/operating time 25 minutes	2
F ¹⁶ – Thermo-switch	7
F ¹⁷ – Overheating switch	15, 16
G ⁶ – Metering pump	14, 15
J ⁸ – Relay	2, 11, 14, 15
J ¹⁰ – Safety switch	2, 4
K ¹¹ – Warning lamp, 1.2 Watt	1
N ¹¹ – Ignition coil	7
O ¹ – Breaker contact in combustion air blower for coil (one impulse per revolution)	7
O ² – Breaker contact in combustion air blower for fuel pump	13
Q ⁵ – Glow-spark plug	6
S – Fuse box	2,3
S ⁹ – Fuse No. 9 in fuse box – terminal 30	3
S ¹⁰ – Fuse No. 10 in fuse box – terminal X	2
S ¹⁶ – Separate 16 amp fuse	16
S ¹⁷ – Overheating fuse/8 amp	14, 15
T ¹ – Cable connector, single	
T ² – Cable connector, double	
T ³ – Cable connector, 3 pin	
T ⁴ – Cable connector, 4 pin	
V ⁶ – Combustion air blower	10, 11
⑪ – Ground strap – Combustion air blower to body	17
⑫ – Ground strap – Suppression filter to heater casing	11, 12

Explanation

To switch heater on

- a – Pull knob of temperature regulating cable (E 13).
b – Operate heater switch (E 16).

Voltage can be measured at:

Terminals 15, 30, A on heater switch (E 16)

Warning lamp (K 11) lights up.

Start-up

The heater ignites within 45 seconds if the air being drawn in is at room temperature. The start-up process is terminated by the thermo-switch (F 16).

Voltage can be measured at:

Terminal A-A of relay (J 8)

Relay (J 8) operates contacts B-M-J.

Terminals M-B of relay (J 8)

The combustion air blower (V 6) delivers warm air and combustion air.

Both contacts of overheating fuse (S 17)

The metering pump (G 6) delivers fuel.

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

The glow element of the glow-spark plug (Q 5) warms the fuel-air mixture to make it readily combustible. The spark electrodes of the plug (Q 5) then ignite the mixture.

Heating

When the heater has ignited and warmed up, the thermo-switch (F 16) operates the contacts C-NC. A uniform roaring noise should be heard at the exhaust pipe.

The following is de-energized:

Terminal NO of thermo-switch (F 16)

The glow element of glow-spark plug (Q 5) is switched off.

Regulation

The temperature regulating switch (E 13) stops the flow of fuel from the metering pump when the temperature of the hot air reaches the preset maximum.

The following are de-energized:

Terminal A of relay (J 8)

Relay (J 8) separates the contacts B-M-J.

Both contacts of overheating fuse (S 17)

The pump (G 6) stops delivering fuel. Combustion stops. When the heater has cooled down to the lower response temperature of the temperature regulating switch (F 13), the fuel pump (G 6) starts to deliver again.

Voltage can be measured at:

Terminal A of relay (J 8)

Relay (J 8) operates.
Fuel pump (G 6) delivers fuel.

Operation of safety switch

The safety switch (J 10) is operated for longer than about two seconds if the heater or because the the

Voltage can

The followin

Operation of overheating fuse

If the heater gets too hot, the fuse (S 17) and blows the fuse (S 17) and the heater can overheat if there is insufficient air flow.

Switching heater off

Turn knob of switch (E 13) to the off position.
Or push knob of temperature regulating switch (E 13) to the off position.

The followin

Run-on

The run-on lasts for about 30 seconds at lower temperatures. The heater continues to heat the exchanger and cool it down.

The followin

Operation of safety switch (J 10)

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

Voltage can be measured at:

Terminal NO of thermo-switch (F 16)
Terminal NO of safety switch (J 10)

The contacts are separated in the safety switch (J 10) after about three minutes by the heating up of the resistance.

The following are de-energized:

Terminals A, B, J of relay (J 8)

The combustion air blower (V 6) stops and heater cools down.

Operation of overheating circuit

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

The heater can overheat if the temperature regulating switch (E 13) fails to work properly or if there is insufficient air flowing past the heat exchanger (air circulation duct blocked).

Switching heater off

Turn knob of switch (E 16) back to the click stop position. The warning lamp (K 11) goes out. Or push knob of temperature regulating switch (E 13) in fully.

The following is de-energized:

Terminal A of relay (J 8)

The relay (J 8) contacts are separated.

Run-on

The run-on lasts for about two 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 thermo-switch limits the run-on period.

The following is de-energized:

Contacts of overheating fuse (S 17)

The fuel pump (G 6) stops working.

F 3.1 Description of Heating System

Voltage can be measured at:

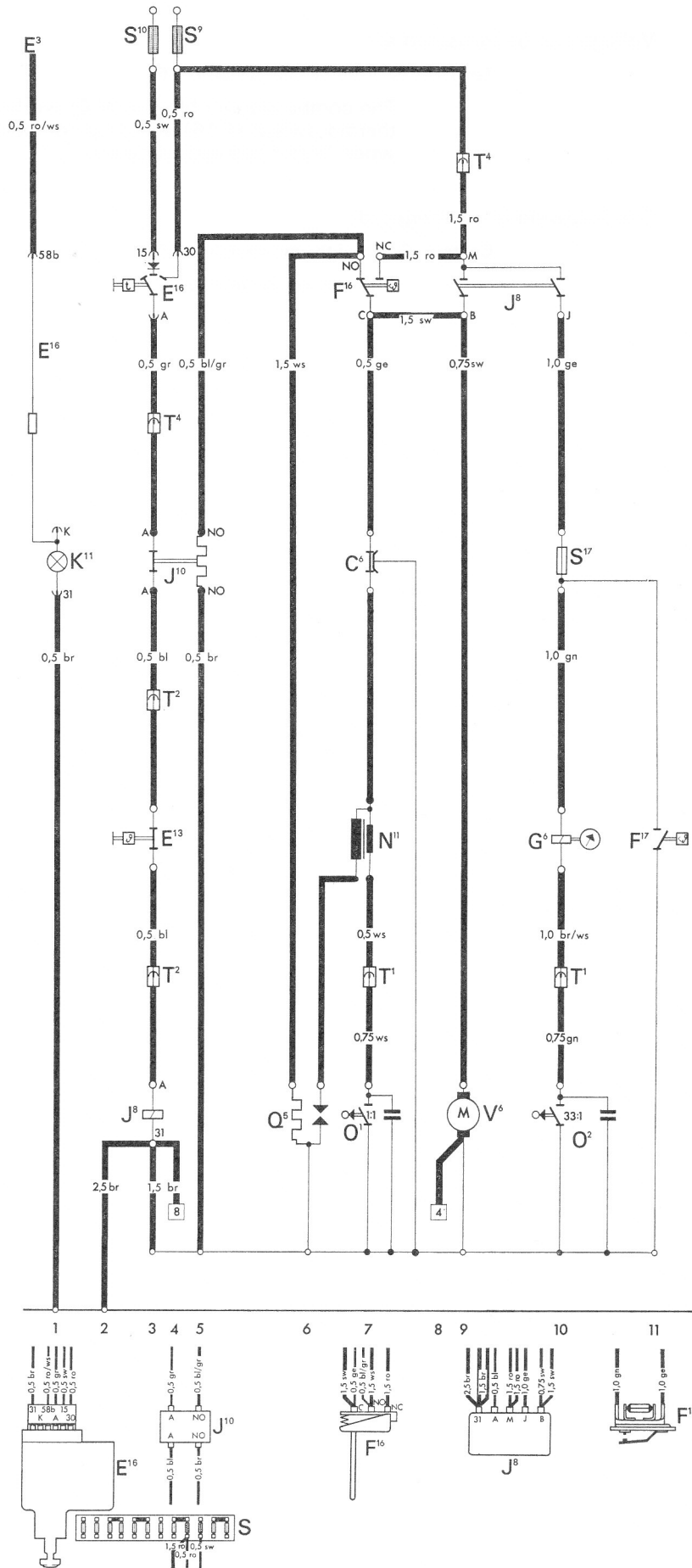
Terminal NC-C on thermo-switch (F 16)

The combustion air blower (V 6) works until the thermo-switch (F 16) switches contacts C-NO when heater has cooled down.

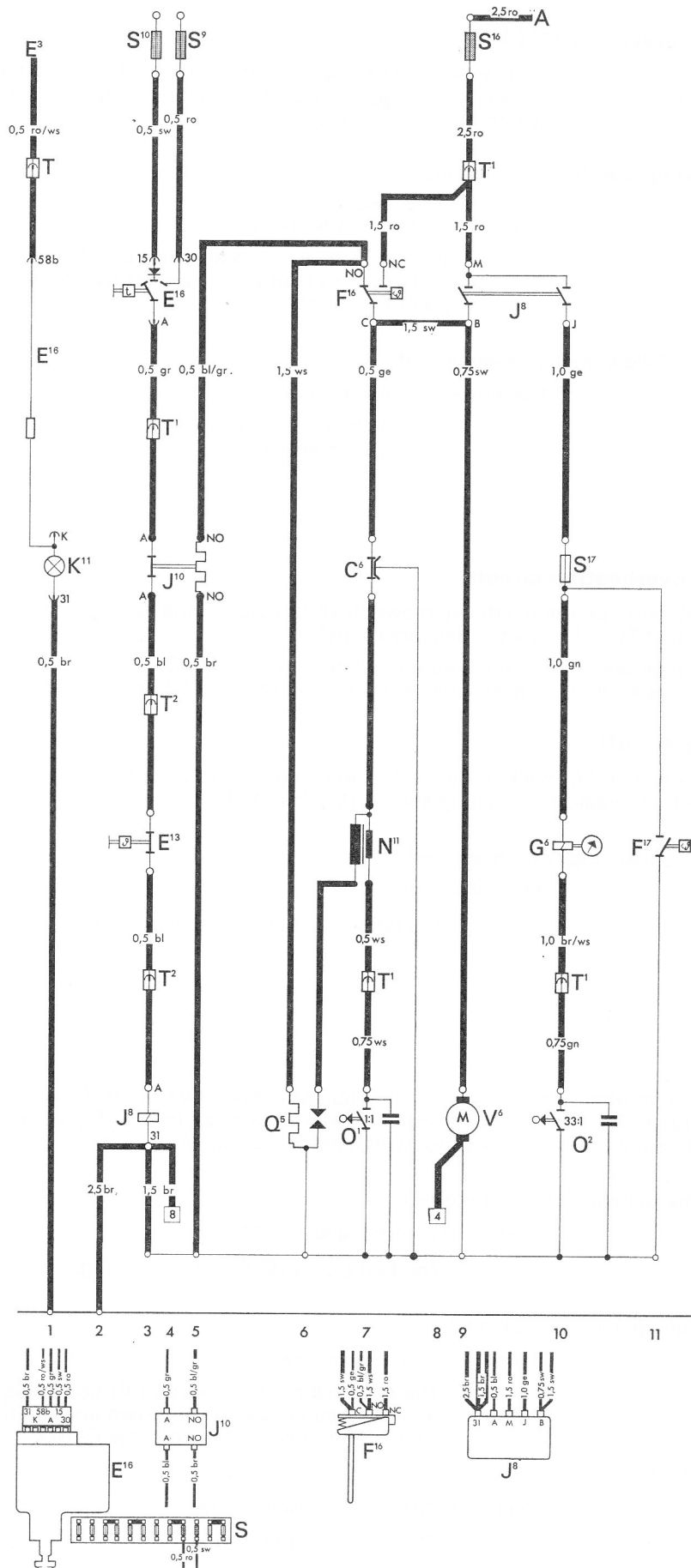
The following is de-energized:

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

The run-on is finished.



Wiring diagram and explanation—Model 181 : from August 1973, US-Canadian Version 4 - 11



Designation

- A – Connection
- C⁶ – Suppression
- E³ – to lighting s
- E¹³ – Temperature
- E¹⁶ – Heater swit
- F¹⁶ – Thermo-sw
- F¹⁷ – Overheating
- G⁶ – Metering pu
- J⁸ – Relay
- J¹⁰ – Safety swit
- K¹¹ – Warning lan
- N¹¹ – Ignition coil
- O¹ – Breaker con
- (one impuls
- O² – Breaker con
- O⁵ – Glow-spark
- S – Fuse box
- S⁹ – Fuse No. 9
- S¹⁰ – Fuse No. 10
- S¹⁶ – Separate 16
- S¹⁷ – Overheating
- T¹ – Cable conne
- T² – Cable conne
- T³ – Cable conne
- T⁴ – Cable conne
- V⁶ – Combustion

Explanation

To switch heater on

- a – Pull knob of temperat
- b – Operate heater switch

Voltage can l

ro = red	br = brown
sw = black	ws = white
ge = yellow	gn = green
bl = blue	gr = grey

Designation	in current track
A – Connection to terminal 30 on starter	9
C ⁶ – Suppression condenser for coil/capacity 0.47 μF	7
E ³ – to lighting switch – terminal 58b	1
E ¹³ – Temperature regulating switch	3
E ¹⁶ – Heater switch/operating time 25 minutes	1, 3
F ¹⁶ – Thermo-switch	7
F ¹⁷ – Overheating switch	11
G ⁶ – Metering pump	10
J ⁸ – Relay	3, 9, 10
J ¹⁰ – Safety switch	3, 5
K ¹¹ – Warning lamp, 1.2 Watt	1
N ¹¹ – Ignition coil	7
O ¹ – Breaker contact in combustion air blower for coil (one impulse per revolution)	7
O ² – Breaker contact in combustion air blower for fuel pump	10
Q ⁵ – Glow-spark plug	6
S – Fuse box	3, 4
S ⁹ – Fuse No. 9 in fuse box – terminal 30	4
S ¹⁰ – Fuse No. 10 in fuse box – terminal X	3
S ¹⁶ – Separate 16 amp. fuse	9
S ¹⁷ – Overheating fuse/8 amp.	10
T ¹ – Cable connector, single	
T ² – Cable connector, double	
T ³ – Cable connector, 3 pin	
T ⁴ – Cable connector, 4 pin	
V ⁶ – Combustion air blower	9

Explanation

To switch heater on

- a – Pull knob of temperature regulating cable (E 13).
b – Operate heater switch (E 16).

Voltage can be measured at:

Terminals 15, 30, A on heater switch (E 16)

Relay (T 8) operates and connects contact B–M–J.

Start-up

The heater ignites within 45 seconds if the air being drawn in is at room temperature. The start-up process is terminated by the thermo-switch (F 16).

Voltage can be measured at:

Terminal A-A of relay (J 8)

Relay (J 8) operates contacts B-M-J.

Terminals M-B of relay (J 8)

The combustion air blower (V 6) delivers warm air and combustion air.

Both contacts of overheating fuse (S 17)

The metering pump (G 6) delivers fuel.

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

The glow element of the glow-spark plug (Q 5) warms the fuel-air mixture to make it readily combustible. The spark electrodes of the plug (Q 5) then ignite the mixture.

Heating

When the heater has ignited and warmed up, the thermo-switch (F 16) operates the contacts C-NC. A uniform roaring noise should be heard at the exhaust pipe.

The following is de-energized:

Terminal NO of thermo-switch (F 16)

The glow elements of glow-spark plug (Q 5) is switched off.

Regulation

The temperature regulating switch (E 13) stops the flow of fuel from the metering pump when the temperature of the hot air reaches the preset maximum.

The following are de-energized:

Terminal A of relay (J 8)

Relay (J 8) separates the contacts B-M-J.

Both contacts of overheating fuse (S 17)

The pump (G 6) stops delivering fuel. Combustion stops. When the heater has cooled down to the lower response temperature of the temperature regulating switch (F 13), the fuel pump (G 6) starts to deliver again.

Voltage can be measured at:

Terminal A of relay (J 8)

Relay (J 8) operates.
Fuel pump (G 6) delivers fuel.

Operation of safety s

The safety switch (J 10) for longer than about two minutes heater or because the th

Voltage can

The followi

Operation of overhea

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

The heater can overheat there is insufficient air fl

Switching heater off

Turn knob of switch (E Or push knob of temper

The followi

Run-on

The run-on lasts for about lower temperatures. The exchanger and cool it do

The followi

Voltage can

The followi

Operation of safety switch (J 10)

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

Voltage can be measured at:

Terminal NO of thermo-switch (F 16)
Terminal NO of safety switch (J 10)

- The contacts are separated in the safety switch (J 10) after about three minutes by the heating up of the resistance.

The following are de-energized:

Terminals A, B, J of relay (J 8)

The combustion air blower (V 6) stops and heater cools down.

Operation of overheating circuit

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

The heater can overheat if the temperature regulating switch (E 13) fails to work properly or if there is insufficient air flowing past the heat exchanger (air circulation duct blocked).

Switching heater off

Turn knob of switch (E 16) back to the click stop position. The warning lamp (K 11) goes out. Or push knob of temperature regulating switch (E 13) in fully.

The following is de-energized:

Terminal A of relay (J 8)

The relay (J 8) contacts are separated.

Run-on

The run-on lasts for about two 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 thermo-switch limits the run-on period.

The following is de-energized:

Contacts of overheating fuse (S 17)

The fuel pump (G 6) stops working.

Voltage can be measured at:

Terminals NC–C of thermo-switch (F 16)

The combustion air blower (V 6) continues to work until the heater has cooled down and the thermo-switch (F 16) separates contacts C–NO.

The following are de-energized:

Contacts C–NO of thermo-switch (F 16)

The run-on is finished.

F 3.1

Description of Heating System

Voltage can be measured at:

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

The combustion air blower (V 6) works until the thermo-switch (F 16) switches contacts C-NO when heater has cooled down.

The following is de-energized:

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

The run-on is finished.

List of possible defects

It is only possible to localize a defect by testing the heating system systematically. For this reason, trouble shooting should always be carried out in the sequence given in the instructions.

Turn time switch knob clockwise as far as possible

The following conditions can be found:

- A – heater does not work (see F 3.2/1–2)
- B – heater smokes (see F 3.3/2–1)
- C – heat output insufficient (see F 3.2/2–1)
- D – heater goes out (see F 3.2/2–1)

In addition, the following can occur:

- E – run-on does not switch off (see F 3.2/2–2)
- F – heater does not work at low outside temperatures (see F 3.2/2–2)

If one of the listed defects is found, check the heating system according to the following instructions (see test chart).

F 3.2 Trouble Shooting and Testing Instructions

A – Heater does not work

Operate safety switch (see F 3.1/2–2 and F 3.3/1–3). If the heater does not work, first check whether the combustion air blower is running and the fuel pump is working (the pump ticks audibly). If these units are operating, then check the glow plug and spark plug. At the same time, check whether the pump is delivering fuel into the heater by checking at exhaust pipe for exhaust fumes.

Defective units should be repaired or replaced as necessary.

If, when carrying out these tests, the heater does not work, test it further as follows.

Operation	Possible defect	Remedy
1 – Test parts of heater and check warm air ducts as well as all electrical connections for tightness; check exhaust system for damage	a – reduction in effective cross section in exhaust pipe or in air ducts b – loose c – loose connection in electrical system	a – eliminate blockage b – tighten securing screws c – secure loose push-on connection
2 – Test 8 amp. fuse with ignition switched on	short circuit in heater electrical system	eliminate defect and replace fuse (see F 3.1/4–1 and 4–3)
3 – Test 16 amp. fuse	short circuit in electrical system	eliminate defect, replace fuse (see F 3.1/4–1 and 4–3)
4 – Test time switch for continuity with ignition switched on and off	switch contact defective	replace time switch (see F 3.5/3–3)
5 – Pull knob out as far as it will go and test temperature regulating switch (Model 181) for continuity (F 3.3/1–4)	a – bimetal strip defective b – contacts defective	a; b – replace temperature regulating control switch (see F 3.5/1–4)
6 – When breaking contact at terminal A relay must click audibly	no voltage in cable to terminal A, temperature regulating switch (Model 181) and time switch have no continuity, relay defective	replace relay (see F 3.5/2–1) test temperature regulating switch and time switch (see F 3.3/1–4 and F 3.3/2–3)

Operation	Possible defect	Remedy
7 – Test relay terminal; if there is voltage at terminal B, terminals M and I must also have voltage after switching heater on	switch contacts defective (see F 3.3/1–5)	replace relay (see F 3.5/2–1)
8 – Measure voltage at terminal 2 of terminal rail	nominal value 11.6 volts is not attained; battery is discharged too much	start vehicle engine to attain full generator voltage
9 – Test ignition coil (see F 3.3/1–3)	a – ignition coil insulation is defective b – contact breaker of blower motor defective (see F 3.3/1–6) c – short circuit on condenser on contact breaker d – short circuit in suppression condenser	a – replace ignition coil b – clean combustion air blower contacts; if short circuit in the condenser on contact breaker replace condenser (see F 3.7/1–1) c – replace condenser (see F 3.7/1–1) d – replace suppression condenser
10 – Check spark plug, but first disconnect cables from fuel pump (see F 3.3/1–5)	defective or dirty spark plug	clean spark plug; check spark plug gap (2.5 mm) (see F 3.3/1–5)
11 – Test glow plug with fuel pump disconnected	plug must glow within one minute, otherwise spiral is broken	replace glow plug (see F 3.3/1–5) (see F 3.5/2–2)
12 – Test thermo-switch	switch does not operate	adjust (see F 3.3/1–3)
13 – Check overheating switch	no continuity	replace (see F 3.5/1–1)
14 – Check filter	blocked	clean filters between fuel pump and jet (see F 3.3/2–2); filter between fuel pump and tank must be replaced if blocked (see F 3.5/2–3)
15 – Check fuel jet	blocked or damaged	clean or replace (see F 3.3/2–2)

F 3.2 Trouble Shooting and Testing Instructions

Operation	Possible defect	Remedy
16 – Test fuel pump and lines (see F 3.6/1-1)	<ul style="list-style-type: none"> a – breaker points dirty b – lines leaking at connections c – pump rattles, pressure relief valve on pressure side of pump is dry and sticks 	<p>clean breaker points and readjust. Lubricate springs and pivot points (see F 3.3/2-1)</p> <p>disconnect pump pressure line and pour several drops of gasoline into pump connection (see F 3.6/1-1)</p>
17 – Check pressure regulator an solenoid valve	incorrect adjustment	adjust pressure regulator (see F 3.3/2-2)
18 – Combustion air blower motor (listen to determine if motor is running) (see F 3.7/1-1)	<ul style="list-style-type: none"> a – bearing and winding defects b – axial wheel contacts casing c – radial wheel is damaged and has jammed in housing with vanes d – too little combustion air, voltage too low (nominal value 11.6 volts) e – combustion air blower motor does not attain prescribed speed (nominal value 5000 rpm at nominal voltage) 	<ul style="list-style-type: none"> a – replace combustion air blower; disassembly not permissible as combustion air blower and motor are balanced together (see F 3.7/1-1) b – remove casing and tighten securing clamp of combustion air blower; shortening vanes is not permissible (see F 3.5/1-2) c – replace complete combustion air blower (see F 3.5/1-2) d – check ground cable and test battery e – replace complete combustion air blower (see F 3.5/1-2)

B – Heater smokes

Operation	Possible defect	Remedy
1 – Excess fuel	a – pressure regulator incorrectly adjusted	a – adjust pressure regulator (see F 3.3/2–2)
	b – fuel jet damaged	b – replace fuel jet
2 – Combustion air motor: measure speed (see F 3.3/1–3)	a – voltage too low (nominal value 11.6 volts); lack of combustion air	a – check cables and test battery
	b – blower motor defective	b – replace complete combustion air blower (see F 3.5/1–2)

C – Heat output insufficient

Operation	Possible defect	Remedy
1 – Check delivery quantity of fuel pump	a – delivery quantity too small	a – adjust pressure regulator (see F 3.3/2–2)
	b – filter blocked	b – clean or adjust (see F 3.5/3–2 and F 3.3/2–2)
2 – Test temperature regulating switch	bimetal strip damaged (switching temperature altered)	replace (see F 3.5/1–3) adjust (see F 3.3/1–4)

D – Heater goes out

Operation	Possible defect	Remedy
1 – Check electrical system	loose contacts	secure
2 – Overheating switch defective	a – contact dirty	a – clean
	b – fatigue in bimetal strip	b – replace (see F 3.5/1–1)
3 – Check exhaust pipe for obstructions	dirty	clean (see F 3.4/1–1)
4 – Cut-in time of glow plug too short	thermo-switch incorrectly adjusted	adjust (see F 3.3/1–3)
5 – Check delivery quantity of fuel pump	filter dirty, valve blocked, jet blocked	clean or replace (see F 3.3/2–2)
6 – Overheating switch actuated	hot air ducting blocked	eliminate blockage (see F 3.4/1–1)

F 3.2 Trouble Shooting and Testing Instructions

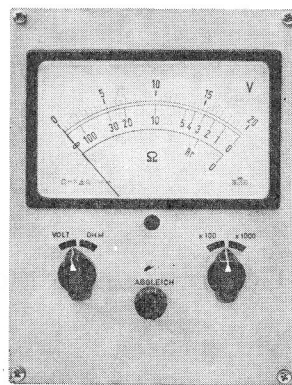
E – Run-on does not switch off

Operation	Possible defect	Remedy
1 – Check thermo-switch	thermo-switch is incorrectly adjusted	readjust (see F 3.3/1–3)
2 – Quartz rod of thermo-switch broken		replace quartz rod and readjust thermo-switch (see F 3.3/1–3)

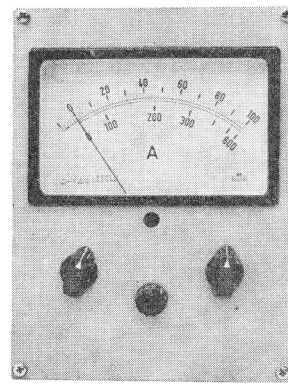
F – Heater does not work at low outside temperatures

Operation	Possible defect	Remedy
1 – Check battery voltage		if necessary, charge battery
2 – Check delivery quantity of diaphragm pressure regulator (see F 3.3/2–2)	delivery quantity too low because a – maladjustment b – filter dirty c – strainer blocked d – valve guide dirty e – diaphragm pressure regulator maladjusted	a – correct adjustment b – replace filter c – clean strainer d – replace pressure regulator e – adjust diaphragm pressure regulator
3 a – Remove glow plug and check glow spiral b – check spark plug (see F 3.3/1–5)	a – glow spiral broken b – no circuit in suppression resistor electrode gap too large	replace glow plug (see F 3.5/2–2) replace spark plug (see F 3.5/2–2)
4 – Check thermo-switch	thermo-switch defective (cut-in time too short)	replace thermo-switch (see F 3.5/2–2)

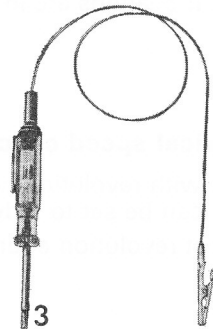
Checking and Adjusting Parts **F 3.3**



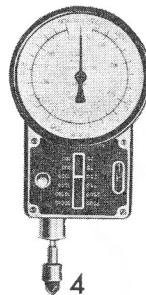
1



2



3



4



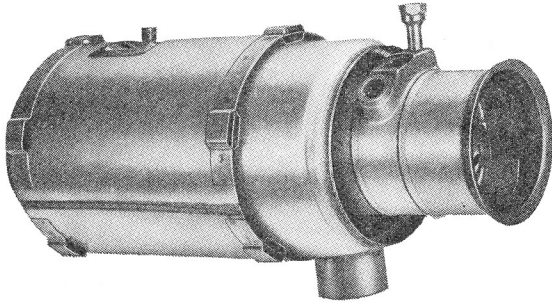
5

No.	Designation	Special tool	Remarks
1	Ohmmeter/voltmeter		Range 0–20 volts
2	Ammeter		Range 0–20 amps.
3	Test lamp		12 volts
4	Tachometer		0–8000 rpm
5	Stop watch		
	Special key	674/2	Local manufacture

F 3.3

Checking Parts and Adjusting

Heat exchanger



Visual check

Check if heat exchanger shows signs of overheating (color of sheet metal casing). Sheet metal which has been heated excessively is usually distorted. Distorted heat exchangers must be replaced.

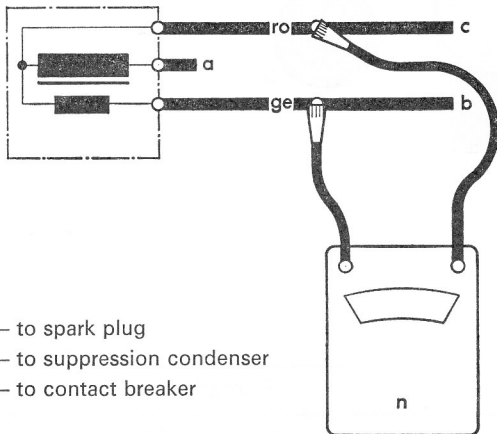
Check if heat exchanger is badly sooted up. Badly sooted heat exchanger are unserviceable. (Do **not** attempt to burn out.)

Combustion air blower

Visual check

Check if blower appears to have been damaged by heat.

Check if bearings are in order.



- a – to spark plug
- b – to suppression condenser
- c – to contact breaker

Electrical speed check

Check with revolution counter with a range which can be set to a dwell angle of 180°.

Connect revolution counter as shown here.

Counting revolutions

The breaker contacts for the metering pump which are fitted in the combustion air motor supply an impulse every 33 revolutions of the motor. This impulse actuates the fuel pump which makes one audible stroke.

$$\text{Pump strokes per minute} \times 33 = \text{motor rpm}$$

The speed with 12 volts after running for 10 minutes should be: 4875–5325 rpm

Thermo-switch

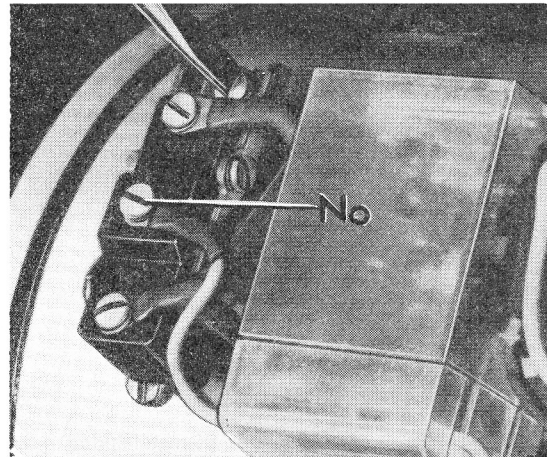
Voltage check

The thermo-switch responds in less than 45 seconds if ignition takes place and a uniform roaring noise can be heard at heater exhaust pipe.

The thermo-switch is in order if no voltage reading is obtained between terminal NO and earth within 45 seconds.

If it switches later it must be adjusted.

If it does not switch at all, the thermo-switch must be replaced.



Model 181

Adjustment

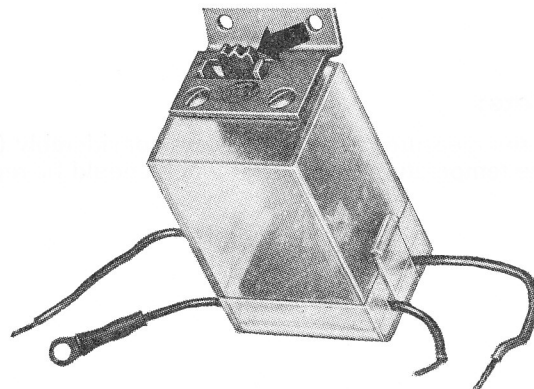
The start-up time will be correct when the run-on is set as follows:

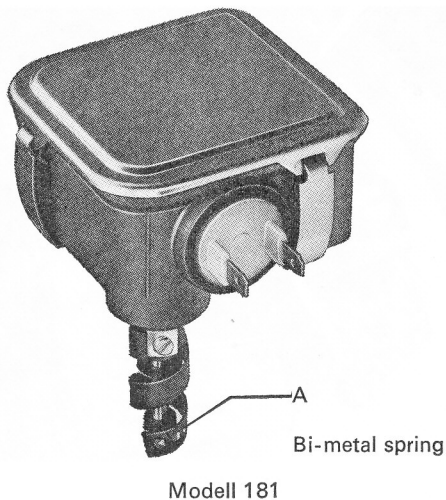
- 1 – Turn heater on. Pull temperature regulator switch all the way out. Let heater run for five minutes.
- 2 – Turn time switch knob back until warning light goes out. Start stop watch.
- 3 – The combustion air blower fan, controlled by the thermo-switch, must continue running 110–150 seconds. This run-on time is based on a nominal voltage of 12 volts and an outside temperature of about 20° C. At lower temperatures the run-on time is shorter.
If proper shut off time is not attained, the thermo-switch must be adjusted (if run-on is too long, turn adjusting screw clockwise; if run-on is too short, turn screw counterclockwise).

Checking safety switch

Measuring response time

- 1 – Disconnect wires at pump so that fuel pump does not operate.
- 2 – Turn heater on. After 120–180 seconds (at nominal voltage and at about 20° C ambient temperature) the safety switch interrupts the heating system circuit.
- 3 – If the safety switch has operated within the specified time, the switch is in order. Press lever on safety switch in direction of arrow.





Temperature regulating switch

Visual check (Model 181)

Check if the special heat-resistant oil on the regulating linkage is dirty. Thick dirty oil interferes with the regulation.

Note

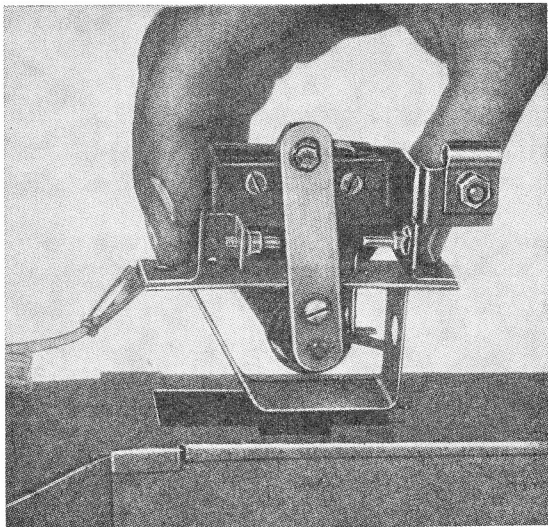
Do not touch regulating linkage with dirty fingers.

Temperature response measurement (Model 181, Type 2):

The response temperatures can be measured approximately with an electronic instrument (a normal mercury thermometer reacts far too slowly). The measuring probe should be held near the bi-metal spring of the temperature regulating switch.

Sequence:

- 1 – Switch heater on and wait for three regulating cycles to occur.
- 2 – Pull knob of temperature regulating switch cable out fully and check upper cut-off temperature.
Specified value for Model 181 :
approx. 110° C–130° C
Specified value for Type 2:
approx. 120° C–140° C
- 3 – Push knob in to halfway position and check temperature difference during a regulating cycle.
Specified value: approx. 20° C
- 4 – Push knob right in and check cut in temperature.
Specified value: approx. 60° C



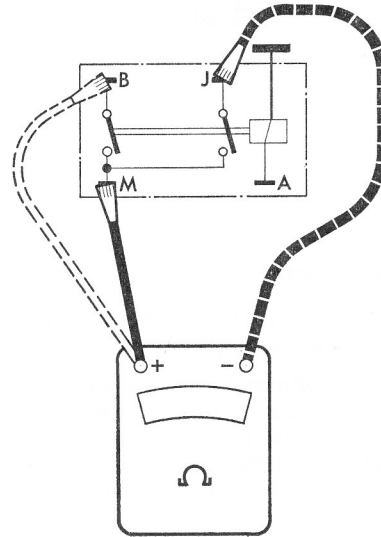
Type 2

Note:

If the measured readings deviate considerably (more than 20° C) from the specified values, the temperature regulating switch should be replaced.

Checking relay

- 1 – Disconnect cables from terminals I, B and M at relay and switch heater booster on.
- 2 – Disconnect cable from terminal A. When doing this the relay armature de-energizes audibly. If this is not the case, measure voltage between ground and plug. If there is potential at this point, measure between relay housing and terminal A with an ohmmeter. If the ohmmeter shows 0 ohm the relay winding is defective.
- 3 – If the relay armature de-energized audibly when disconnecting terminal A, connect ohmmeter between terminals I–M and B–M.
Nominal value: ∞ ohm, otherwise replace relay.
- 4 – Reconnect cable to terminal A. If the relay armature energizes audibly, check whether there is continuity from terminal I to terminal B. If there is no continuity with the relay switched on (∞ ohm), the relay must be replaced.

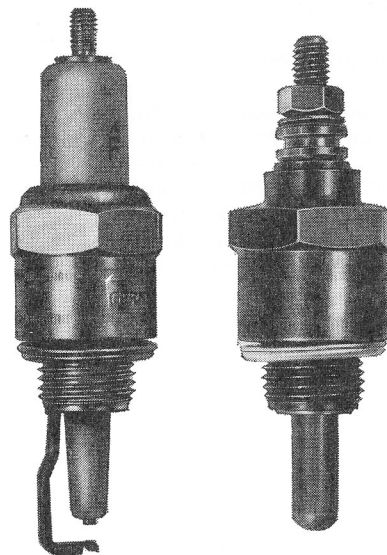


Checking glow plug and spark plug

The glow plug has a spiral protected by a metal casing. Soot can be carefully removed with a wire brush. The glow plug is serviceable if it glows bright red after one minute when connected to a 12 volt supply, otherwise the glow plug must be replaced.

The spark plug can be cleaned by rubbing the eroded locations with a wire brush. Check electrode gap (nominal value: .098 in./2.5 mm).

There is a 5 K Ω resistor installed in the spark plug. The resistor can be measured with an ohmmeter (connect terminals of ohmmeter between center electrode and ignition cable connection). If the ohmmeter shows more than 10 K Ω , the spark plug must be replaced.



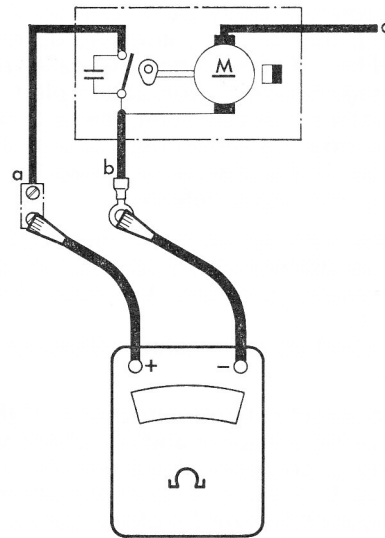
Spark plug and glow plug

F 3.3 Checking Parts and Adjusting If Necessary

Testing contact breaker

The contact breaker can be tested with an ohmmeter with the heater booster switched off.

- 1 – Unscrew intake pipe.
- 2 – Disconnect cable connector between contact breaker and ignition coil.
- 3 – Connect ohmmeter to cable connector and to ground cable, turning the fan by hand. Contact must be made and broken once for one revolution of the motor (the ohmmeter must deflect between 0 and ∞).



a – to ignition coil
b – ground
c – to terminal 1

Possible defect	Ohmmeter shows
Short circuit in condensor	0 Ω
Contact breaker points burnt. Short circuit commencing in condensor	Deflection between $\infty \Omega$ and a fixed resistance value (e.g. 10 Ω)
Open circuit in contact circuit (e.g.: connecting cable broken, contact breaker gap too large)	$\infty \Omega$ only

The contact breaker part of the combustion air blower can be repaired (see F 3.7/1–1).

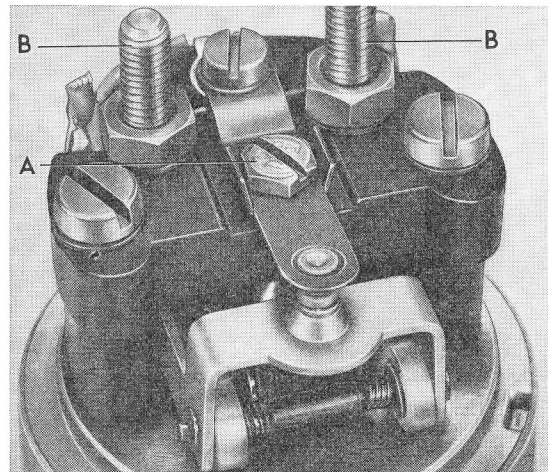
Diaphragm pump

- 1 – Remove pump
- 2 – Remove nuts from connecting screws and remove cover. Check contact breaker points and lubricate moving parts and springs sparingly if necessary (use bone oil).

Note:

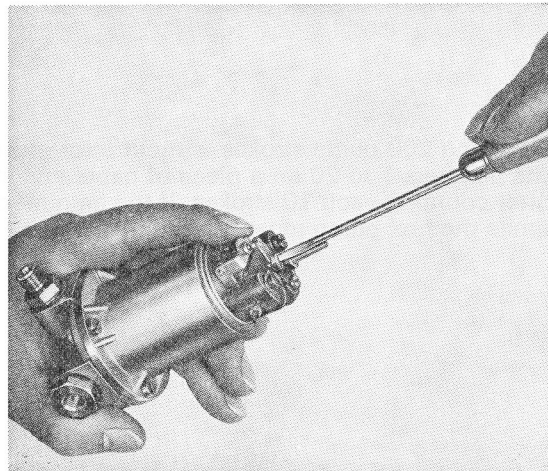
The contact breaker gap should be 1 mm (press lower contact breaker arm against housing). Correct with adjusting screw.

- 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.
- 4 – When reinstalling, first screw diaphragm bracket in clockwise as far as it will go then back off $2\frac{1}{2}$ turns counter-clockwise. The delivery quantity of the fuel pump is then adjusted correctly (see F 3.6/1–2, part 10).
- 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 3.6/1–1).



Model 181

- A – Adjusting screw
 B – Contact screws (the Type 2 pump has only one screw)



Type 2

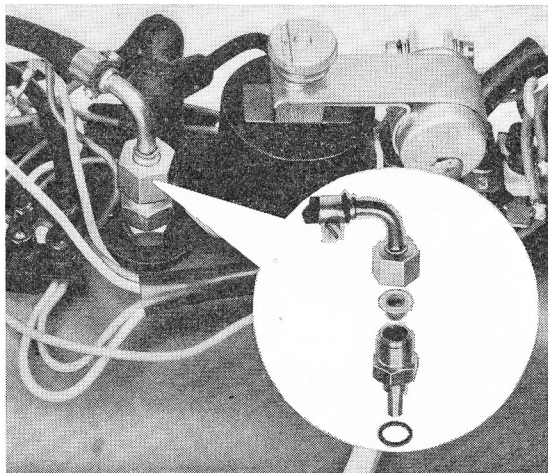
Note:

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 3.6/1–1.)

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 3.6/1–1).

F 3.3

Checking Parts and Adjusting



from Chassis No. 181 2 251 015
to Chassis No. 182 2 000 007

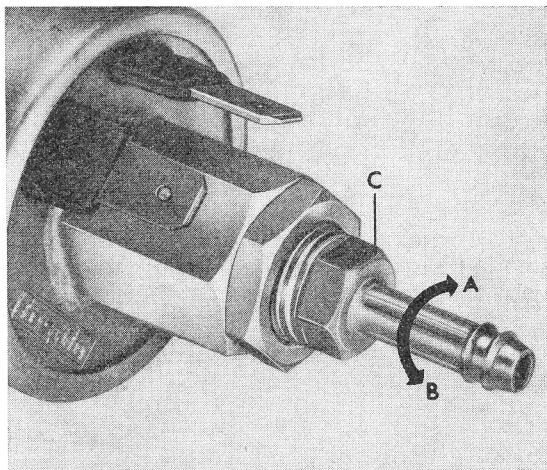
Metering pump

Checking

- 1 – Clean filter on jet carrier and hold measuring glass (capacity 25 cm³) underneath with the jet removed or pull hose off connection on heater.
- 2 – Disconnect the electric lines to the glow and spark plugs, for safety reasons.
- 3 – Switch on the heater.
- 4 – Two hundred strokes of the metering fuel pump (audible clicking) supply the required 13.4 to 15.1 cm³ capacity for the new BN 4 heater.

Note:

Counting 200 pump strokes without error present difficulties. It is advisable therefore, to write the numbers 1 to 20 on a piece of paper and strike the numbers through one after the other after counting each 10 strokes. If the amount of fuel delivered is not within the laid down limits the fuel pump must be readjusted.



Adjusting:

To increase consumption

- Turn valve guide C to left (arrow B)

To reduce consumption

- Turn valve guide C to right (arrow A)

Tighten the lock nut again afterwards and lock it with paint.

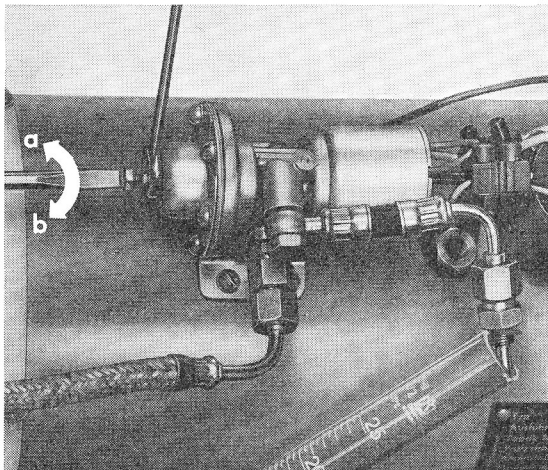
Pressure regulator and solenoid valve

Adjusting:

Note:

The fuel delivery quantity can only be set accurately by measuring the 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	(see F 3.5/)
Screen	diaphragm pressure regulator input end	clean
Screen	between union nut and jet	clean



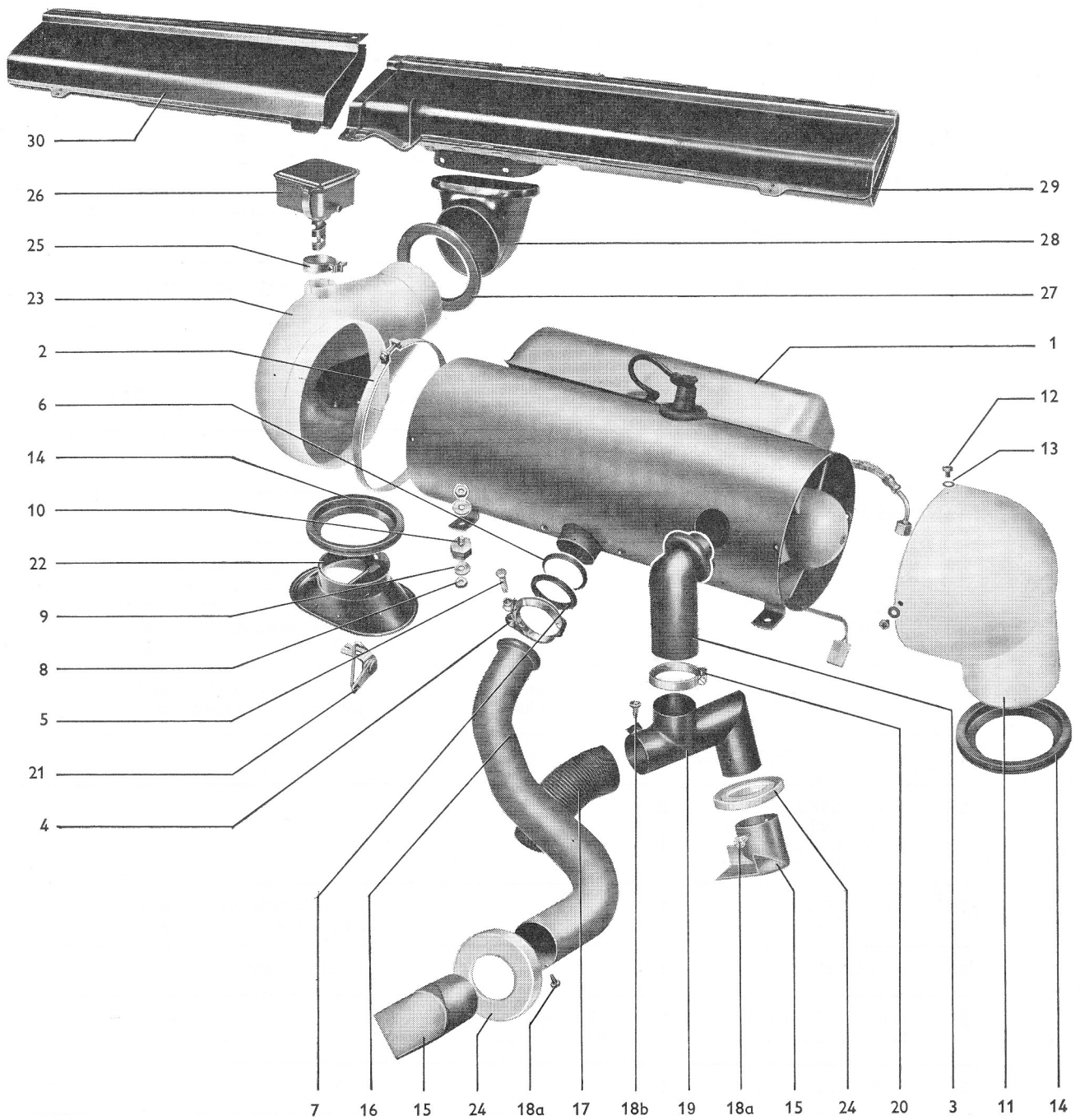
- a – Turning counter-clockwise:
decreases fuel quantity delivered
- b – Turning clockwise:
increases fuel quantity delivered

- 1 – Disconnect glow plug and spark plug. Bridge temperature regulating switch connections.
- 2 – Unscrew union nut from jet carrier.
- 3 – Unscrew jet from jet carrier and clean filter.
- 4 – Screw jet and screen to fuel hose again and hold at the same height as when jet is installed (see illustration).
- 5 – Switch heater on. Fuel emitted is collected in a measuring glass for two minutes and should be 20–21 cc in two minutes.
- 6 – If a correction is necessary, the hexagon head screw on the base of the cap must be screwed in clockwise to increase fuel quantity and backed off to decrease it (see illustration).

Note:

If, after carrying out these operations, the fuel delivery quantity is still insufficient, the valve screen (No. 10 on page F 3.8/1–2) is blocked.

Removing and installing heater booster



F 3.4 Heater Booster and Warm Air Duct

No.	Designation	Qty.	When		Special instructions see
			removing	installing	
1	Heater booster	1	remove hexagon nut and spring washers under luggage pan	axial wheel must not contact heater booster casing	F 3.5/1-2
2	B 9×154 clamp	1		ensure clamp is tight	
3	Combustion air pipe elbow	1	can be pulled out	the shoulder must seal the casing hole sufficiently	
4	Exhaust pipe clamp	1		ensure clamp is tight	
5	M 6×35 hexagon head screw	1	use solvent to loosen if necessary		
6	Conical seal	1			
7	Exhaust pipe seal	1	replace damaged seals	ensure good sealing	
8	M 6 hexagon nut	8			
9	B 6 spring washer	8			
10	Bonded rubber mounting	4		ensure that thread is tight in rubber	
11	Circulating air pipe	1	after removing heater booster, detach intake pipe	the intake pipe is secured before installing the heater booster; the intake pipe must be vertical and face downward	
12	AM 5×11 fillister head screw	4			
13	A 5.3 spring washer	4			
14	Seal	2		the groove is pressed into the luggage pan (lip downward)	
15	Intake pipe	2		before installing, check seal in luggage pan for tightness	
16	Exhaust pipe	1	check for damage and blockage	before installing, check seal for damage and tightness	
17	Combustion air pipe hose	1			
18	a – BZ 3.9×6.5 fillister head screw	2			
	b – BZ 4.8×9.5 fillister head screw	1			
19	Combustion air intake pipe	1		before installing, check seal for damage and tightness	
20	A 9×4.8 clamp	1		check for tightness	
21	Operating lever with knob and linkage	1	disconnect linkage in warm air pipe		
22	Outlet for footwell	1			

1-2 Removing and installing

No.	Designation	Qty.	Note when		Special instructions see
			removing	installing	
23	Warm air pipe	1	first disconnect linkage (21), then lift out warm air pipe	push into seal	
24	Seal for exhaust pipe and intake pipe	2	check for damage	press in from wheel housing	
25	B 9×30 clamp	1			
26	Temperature control switch	1	lift out vertically		
27	Warm air pipe seal	1			
28	Elbow	1			
29	Warm air duct, left	1			
30	Warm air duct, right	1			

Removing

- 1 – Disconnect battery ground strap.
- 2 – Remove protective cover.
- 3 – Disconnect cables from heater booster, temperature control switch and fuel pump. Unscrew ground cable.
- 4 – Use Phillips screwdriver to loosen clamp (25) for temperature control switch on warm air pipe (23). The temperature control linkage can easily be damaged. For this reason the temperature control switch (26) must be lifted out vertically very carefully (See F 3.5). Lift tensioning springs with a screwdriver and take off cover. Remove two screws with a Phillips screwdriver and disconnect switch from Bowden cable.
- 5 – Hold locknut with 14 mm open-end wrench and unscrew union nut from fuel hose.
- 6 – From vehicle interior, remove four M 6 nuts (8) underneath luggage pan (held by B 6 lock washers).
- 7 – With a Phillips screwdriver, open clamp (2) on warm air pipe (23).
- 8 – With Phillips screwdriver, open clamp (4) on exhaust pipe (16). Pull exhaust pipe out and disconnect combustion air pipe elbow (3).
- 9 – Lift heater booster (1) out.

Installing

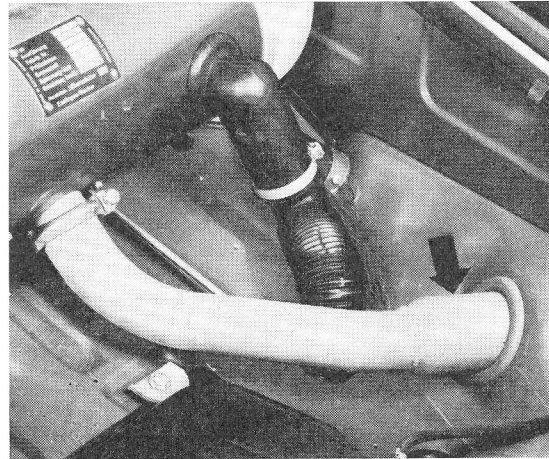
- 1 – Push heater booster (1) into warm air pipe (23) then push four bonded rubber mounting studs (10) of heater booster (1) through luggage pan. When doing this, ensure that circulating air pipe (11) is pushed through seal (14) of luggage pan.
- 2 – Secure fuel hose to fuel pump, using 14 mm open-end wrench.
- 3 – Connect cables according to wiring diagram (see F 3.1).
- 4 – Push exhaust pipe (larger diameter pipe see F 3.4/1–4) and seal (7) and conical seal (6) in as far as possible and secure with clamp (4). Push combustion air pipe elbow (3) on.
- 5 – Connect battery ground cable and check operation of heater booster.

F 3.4 Heater and Warm Air Ducts

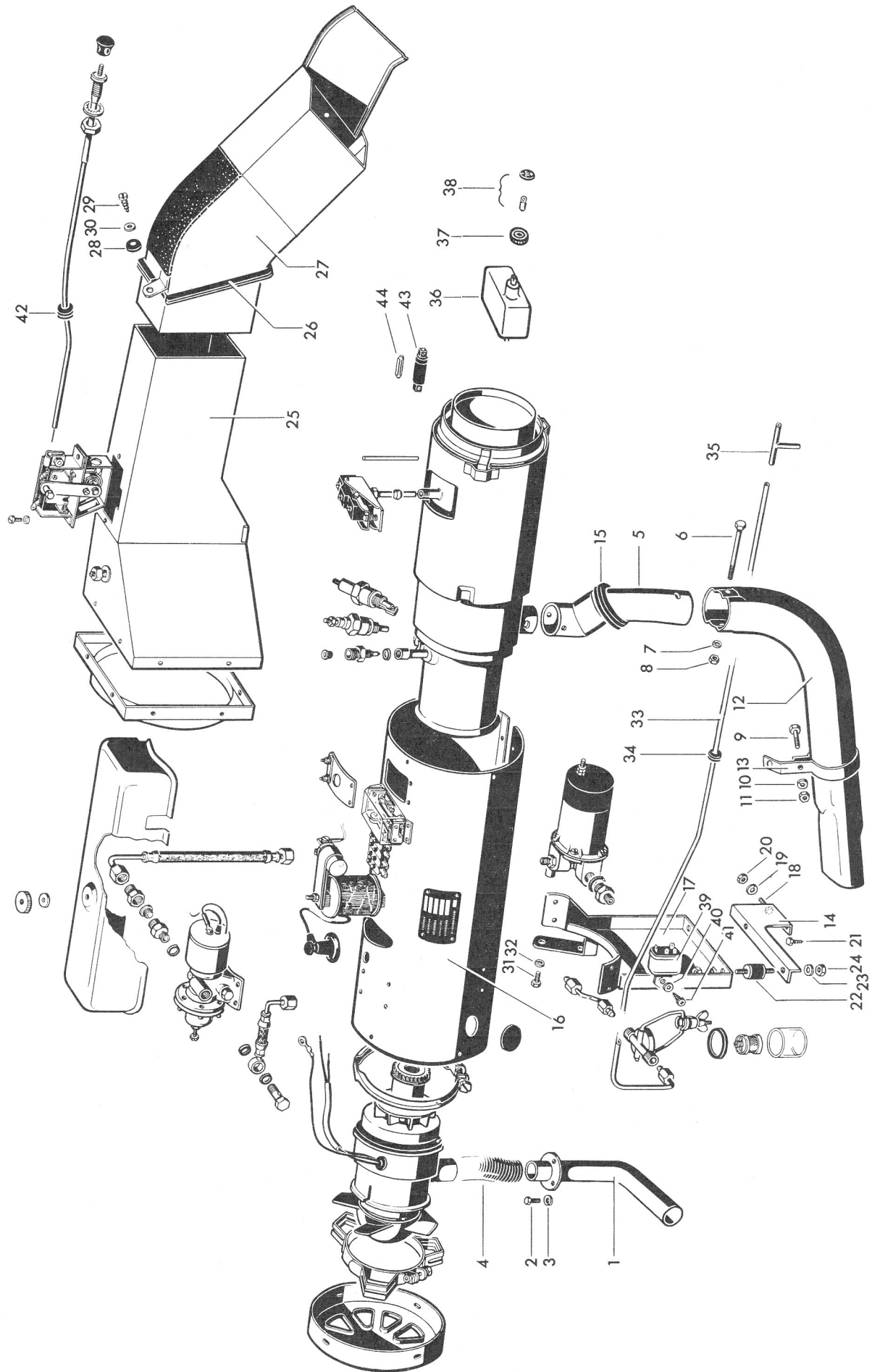
Larger diameter exhaust pipe

(from 1 Oct. 1970, Chassis No. 181 2 177 988)

The dimensions of the connection for the exhaust pipe remain the same, thereby allowing the new exhaust pipe to be installed in older vehicles. The following points should be observed when installing:



- 1 – The hole in the wheel housing must be enlarged to 63 mm dia. Ensure that the hole centre remains true.
- 2 – Install a new gasket. The larger rim should be towards the wheel housing.
- 3 – Smear the exhaust pipe and gasket with a lubricant (glycerine or talcum).
- 4 – Guide the exhaust pipe from the wheel housing and connect it to the heater.



F 3.4 Heater and Warm Air Duct

No.	Description	Qty.	Note when		Special instructions see
			removing	installing	
1	Combustion air pipe	1	clean	angled part must be toward vehicle engine	
2	Bolt M 4×15	3			
3	Lock washer	3			
4	Hose for combustion air pipe	1		install firmly	
5	Exhaust pipe	1	clean		
6	Bolt BM 5×50	1			
7	Lock washer B 5	1			
8	Nut M 5	1			
9	Bolt M 6×15	1			
10	Lock washer B 6	1			
11	Nut M 6	1			
12	Exhaust tail pipe	1			
13	Bracket for tail pipe	1			
14	Bracket for heater	1			
15	Seal for exhaust pipe	1			
16	Heater	1			
17	Support for housing	1			
18	Bolt	1			
19	Lock washer	1			
20	Nut	1			
21	Self tapping screw	1			
22	Bonded rubber mounting for support	2		install free of tension	
23	Lock washer	4			
24	Nut	4			
25	Hot air duct with flap and temperature regulating switch	1		adjust temperature regulating switch	F 3.1/2-1
26	Gasket for outlet	1			
27	Outlet	1			
28	Grommet	1			
29	Self tapping screw B 4.8×13	2			
30	Washer	1			
31	Bolt M 6×15	2			
32	Lock washer B 6	2			
33	Fuel line	1			

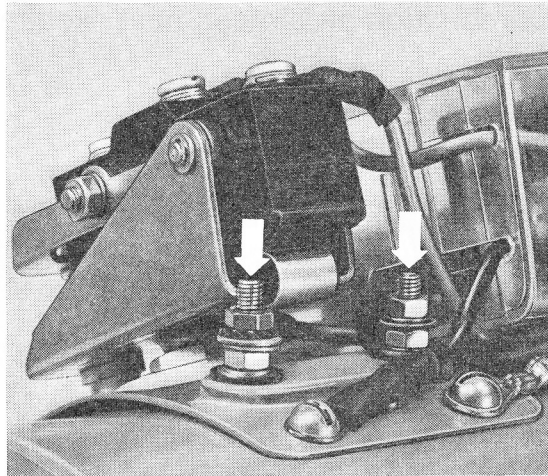
No.	Description	Qty.	Note when		Special instructions see
			removing	installing	
34	Grommet	1			
35	T connector	1			
36	Time switch	1			F 3.5/3-3
37	Knob	1			
38	Bulb and lens	1			
39	Relay	1			
40	Washer	1			
41	Self tapping screw	1			

Overheating switch

Model 181 –
up to Chassis No. 181 2 251 015

Type 2 –
up to Chassis No. 211 2 276 560

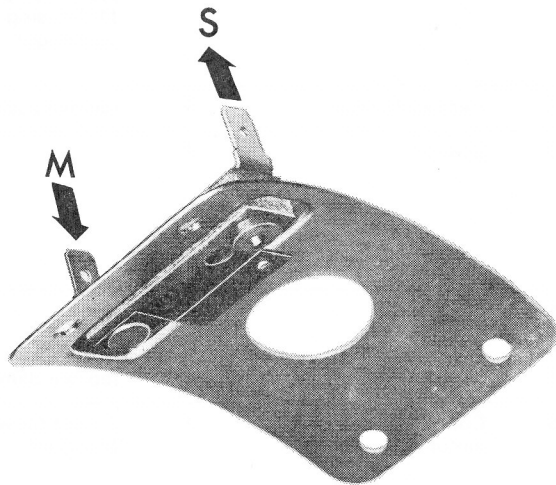
The wires on the overheating switch may be interchanged.



Model 181 –
from Chassis No. 181 2 251 015
up to Chassis No. 181 3 143 118

The wires must not be interchanged

M – Ground connection
S – to overheating fuse
(terminal on adjusting screw)

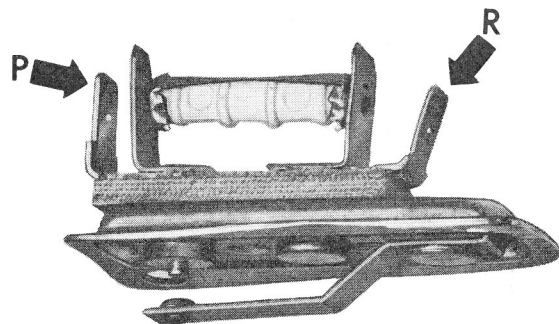


Model 181 –
from Chassis No. 182 2 000 007

Type 2 –
from Chassis No. 212 2 000 001

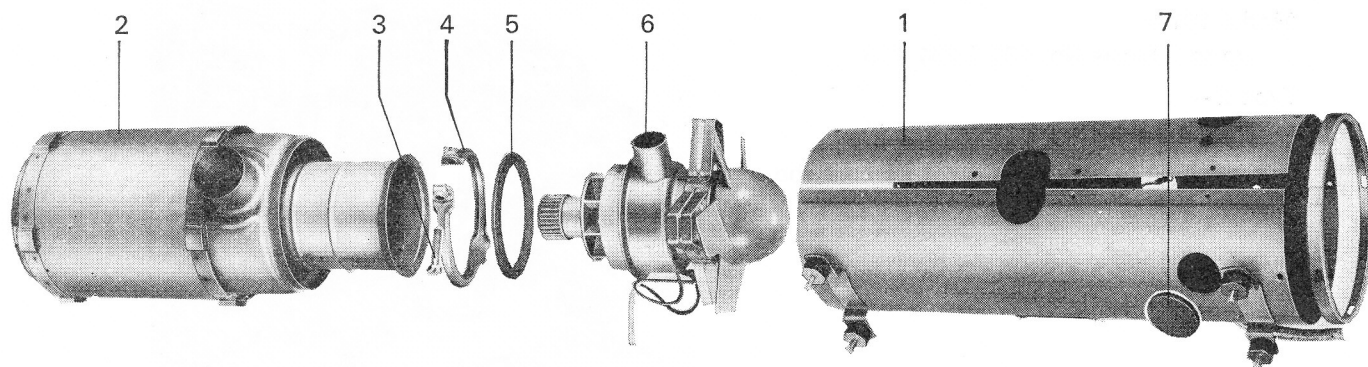
The wires must not be interchanged

P – to metering pump
(terminal on adjusting screw)
R – to relay



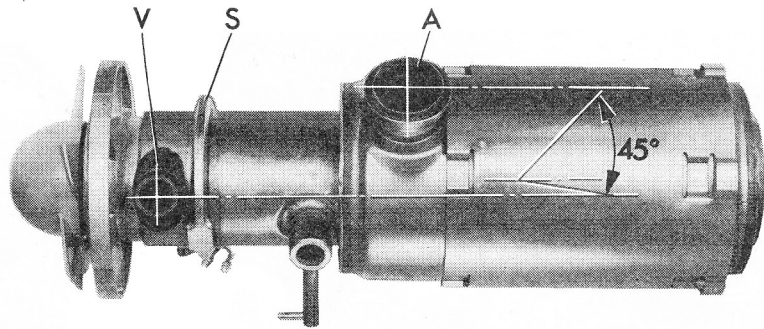
F 3.5 Removing and Installing Parts

Combustion air blower, heat exchanger



No.	Designation	Qty.	Note when	
			removing	installing
1	Housing	1	pull housing apart, stand heater on end and lift housing off heat exchanger	pull combustion air blower cables through hole in housing; pull housing apart and slide over heat exchanger; ensure that fan does not rub on housing; tighten four round head screws
2	Heat exchanger	1	remove deposits	
3	Screw	1		screw must not be tightened until heater is assembled; first secure housing to heat exchanger then insert screwdriver through hole with grommet and tighten screw; due to this work sequence, screw seal must face combustion air intake pipe
4	Clamp	1		jaws of clamp must align with exhaust pipe connection
5	Seal	1	replace damaged seal	
6	Combustion air blower motor	1	do not tilt when lifting off	combustion air blower motor must be able to be turned in the heat exchanger until combustion air intake pipe is aligned with housing hole by turning
7	Plug	1		after tightening clamp, plug hole

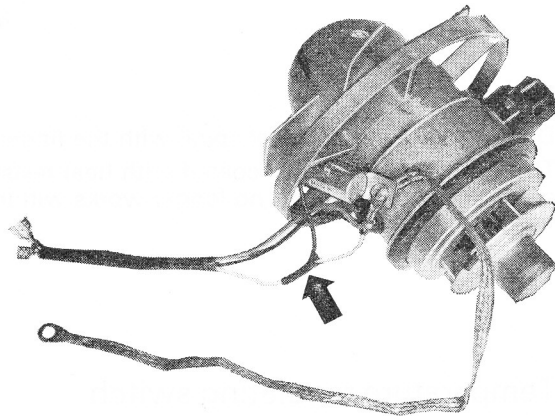
Assembly instructions:



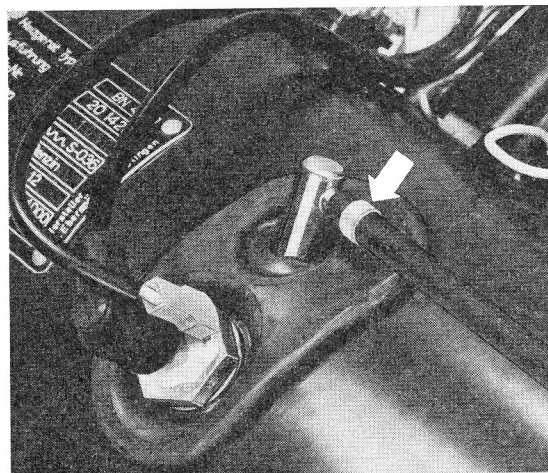
a – The combustion air blower must be fitted in the heat exchanger with the air intake (V) offset 45° from the exhaust outlet (A) (see illustration).

V – Combustion air intake
 S – Clip
 A – Exhaust outlet

b – Replacement combustion air blowers are supplied without the suppression condenser. If the blower is installed in a suppressed heater, the black wire of the condenser – Part No. 181 035 261 A – must be soldered to the white wire as shown. The soldered joint must be wrapped with insulating tape.



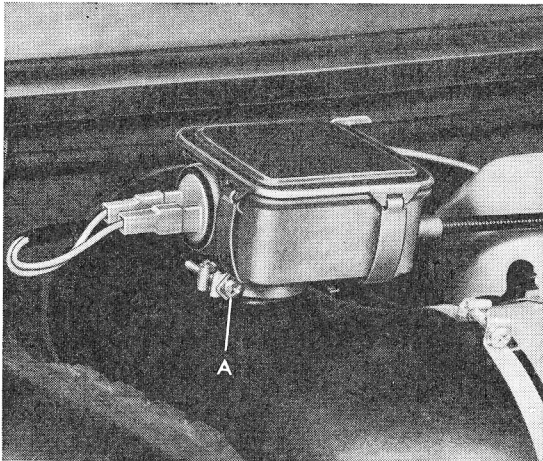
c – The fuel hose must be secured with a clip (see arrow).



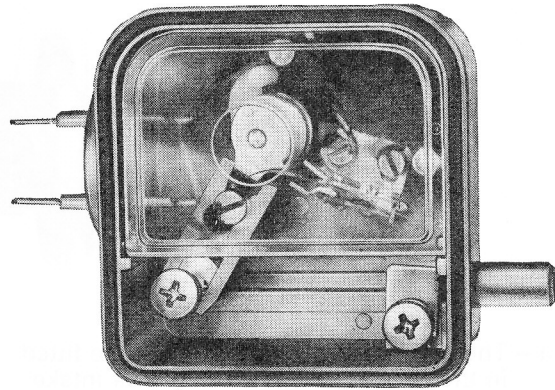
F 3.5 Removing and Installing Parts

Temperature regulating switch

Model 181



A – Clip



A – Locking screw
B – Securing screw

Model 181

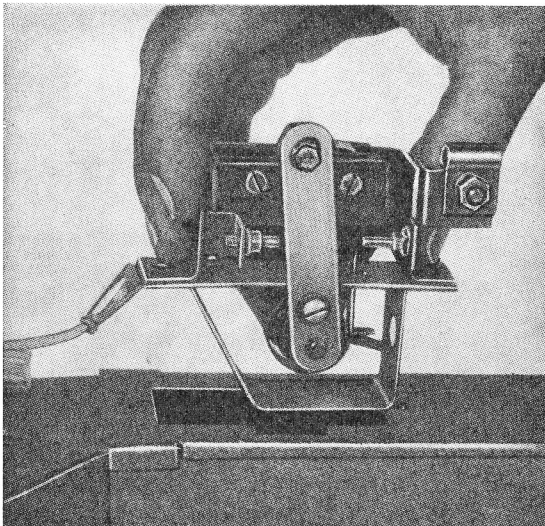
Note:

Do not touch the bi-metal spiral with the fingers.

The regulating linkage is coated with heat resistant special oil. Dirt affects the viscosity of the oil so that a dirty switch no longer works within the specified tolerances.

Temperature regulating switch

Type 2



Type 2

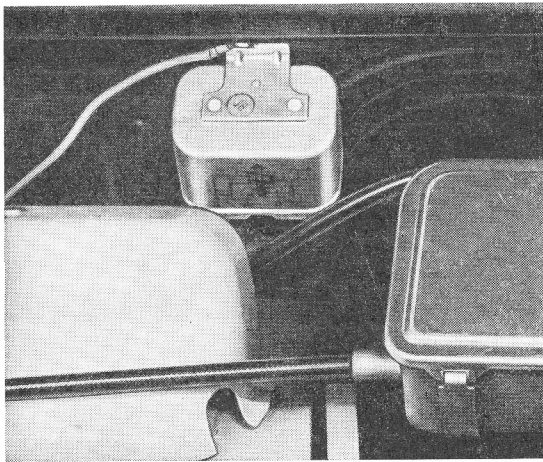
The switch is accessible when the heater is removed complete with warm air duct.

Relay

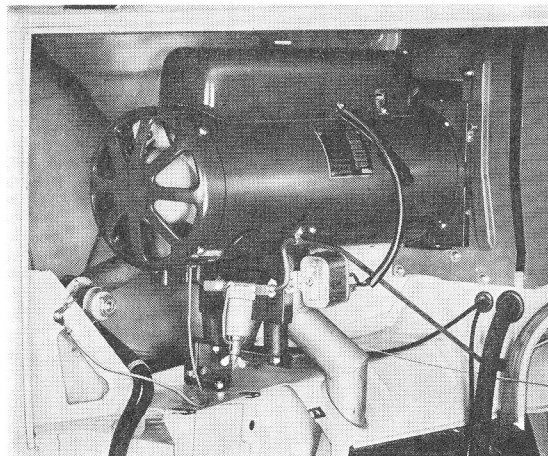
(Model 181; Type 2)

Removing

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



Model 181



Type 2

Installing

Ensure that cables are connected according to wiring diagram (see F 3.1/4.1; F 3.1/4-3).

Safety switch

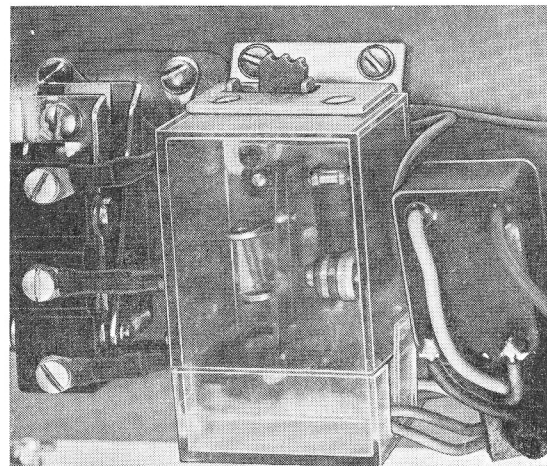
(Model 181; Type 2)

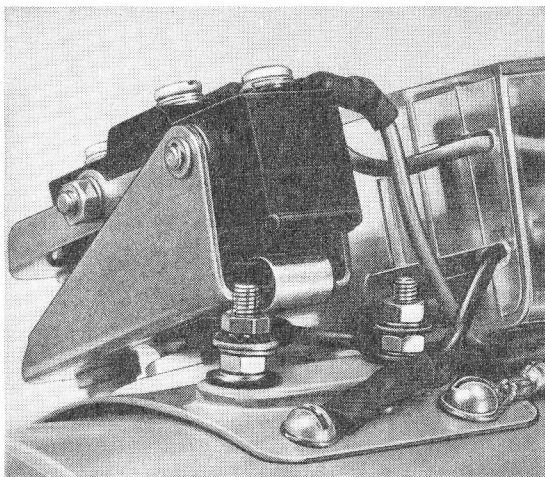
Removing

- 1 – Disconnect battery ground strap.
- 2 – Detach heater and swing slightly toward front.
- 3 – Remove two round head screws holding the switch.

Installing

- 1 – Connect wires according to wiring diagram (see F 3.1/4-1; F 3.1/4-3).
- 2 – Install heater.
- 3 – Connect battery ground strap and check operation of heater.





Thermo-switch (Flame detector) (Model 181; Type 2)

Removing

- 1 – Disconnect battery ground strap.
- 2 – Remove heater (see F 3.4/1-1 and F 3.4/2-1).
- 3 – Disconnect three wire leads, each locked with two lock washers.
- 4 – Back off flame detector switch union nut with 12 mm open-end wrench, then turn switch to pull it out vertically (if necessary use solvent).

Installing

- 1 – Carefully insert flame detector switch into combustion chamber and tighten union nut. The hole in the heater housing is covered with the plug.
- 2 – Connect wires according to wiring diagram (see F 3.1/4-1; F 3.1/4-3).
- 3 – Install heater (see F 3.4/1-1 and F 3.4/2-1).
- 4 – Connect battery ground strap and check operation of heater.

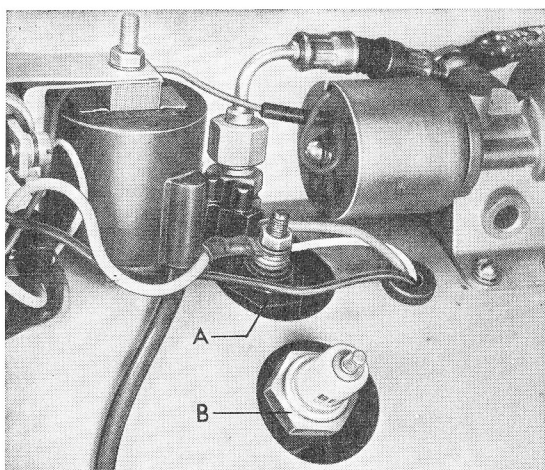
Glow plug, spark plug (Model 181; Type 2)

Removing

- 1 – Disconnect spark plug connector from spark plug. Remove glow plug terminal nut using an 8 mm open-end wrench.
- 2 – Remove spark plug and glow plug with a 21 mm socket wrench.

Installing

Install plugs. Make sure that two lock washers are used for glow plug.



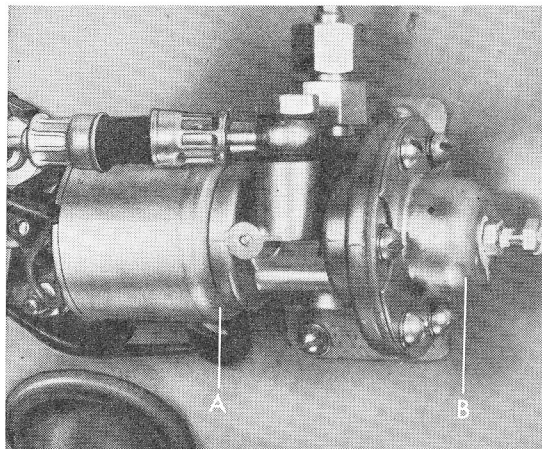
A – Glow plug
B – Spark plug

- 3 – Push fuel hose onto filter and screw 14 mm union nut onto pressure connection while counter-holding with open-end wrench.
- 4 – Connect battery ground strap and check operation of heater booster.

Diaphragm pressure regulator and solenoid valve

Removing

- 1 – Disconnect battery ground strap.
- 2 – Disconnect cable of solenoid valve from terminal 5.
- 3 – Disconnect fuel hose between jet and diaphragm pressure regulator at regulator. The gland nut can be backed off with a 12 mm open-end wrench.
- 4 – Fuel hose between pump and diaphragm pressure regulator is disconnected at fuel pump while counterholding with a 14 mm open-end wrench. Catch escaping fuel in a cloth.
- 5 – Remove four round head screws and washers. Take solenoid valve and diaphragm pressure regulator off heater booster casing. The ground cable shoe is secured by two round head screws.



A – Solenoid valve
B – Diaphragm pressure regulator

Installing

- 1 – Secure diaphragm pressure regulator and solenoid valve with four round head screws and washers. Use two of the screws for securing the ground cable shoe.
- 2 – Connect fuel hoses. Counterhold locknut on fuel pump with a 14 mm open-end wrench.
- 3 – Connect solenoid valve cable to terminal 5. Connect battery ground strap and check operation of heater booster.

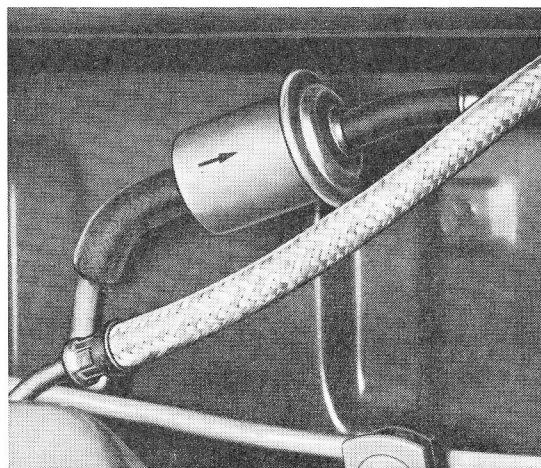
Filter

Removing

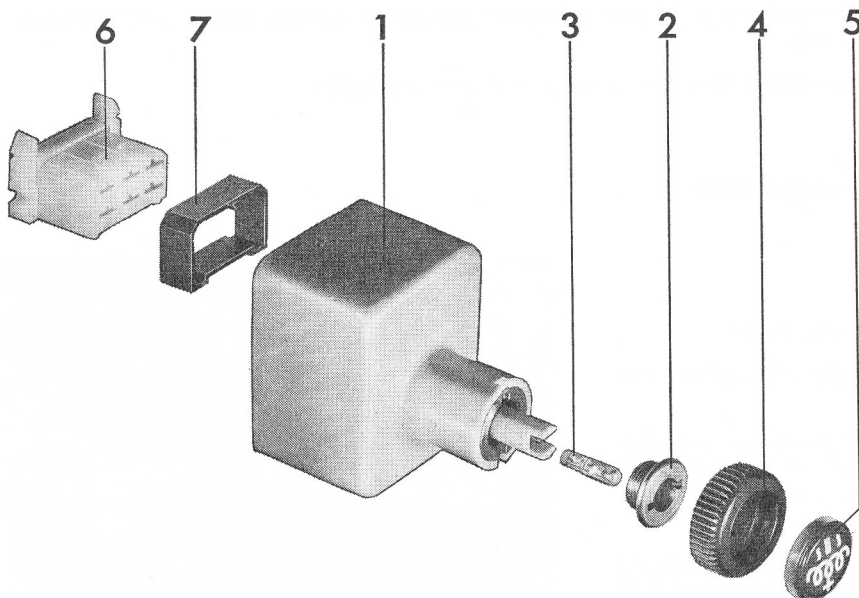
- 1 – Disconnect fuel hose between filter and tank.
- 2 – Disconnect fuel hose from filter to pump, then plug. Catch any escaping fuel.

Installing

Note that the arrow showing direction of fuel flow faces pump.



F 3.5 Removing and Installing Parts



- 1 – Time switch
- 2 – Escutcheon
- 3 – Warning lamp
- 4 – Switch knob
- 5 – Knob lens
- 6 – Plug
- 7 – Plug frame

Time switch

Removing

- 1 – Disconnect battery ground strap.
- 2 – Pull time switch knob off and take out bulb.
- 3 – Remove tapping screw in instrument panel insert and open insert.
- 4 – Disconnect cables at switch.
- 5 – Unscrew escutcheon with special wrench VW 674/1 and pull switch out.

Installing

- 1 – Secure escutcheon to time switch in instrument panel insert with special wrench VW 674/1.
- 2 – Connect cables according to wiring diagram (see F 3.1/3–5).
- 3 – Connect battery ground strap and check operation of heater booster.

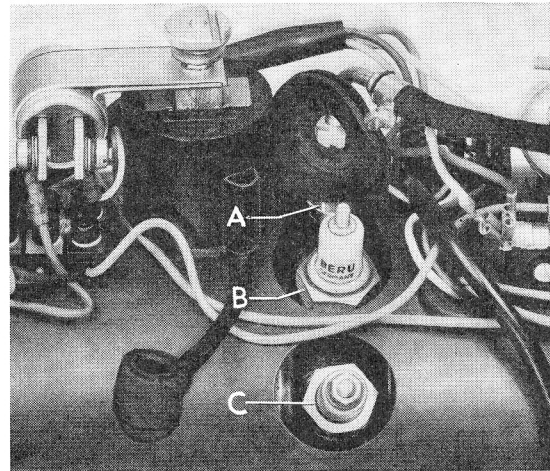
from Chassis No. 181 2 251 015
to Chassis No. 181 3 143 118

The layout of the holes for the glow and spark plugs is different to the former BN 4 heaters.

- A – Hole for jet
- B – Hole for spark plug
- C – Hole for glow plug

Note:

If the spark and glow plugs are interchanged, ignition trouble will occur on the heater at low temperatures.

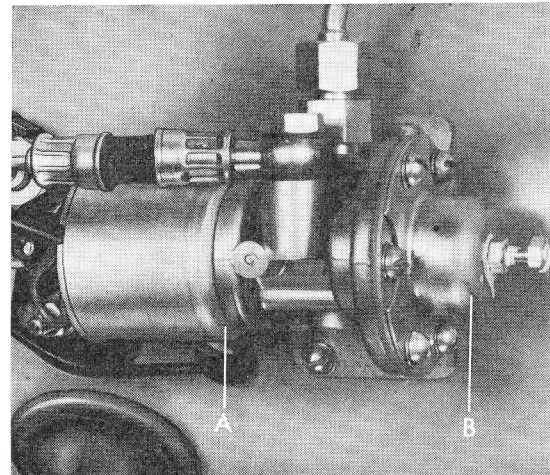


Diaphragm pressure regulator and solenoid valve

(Model 181, Type 2)

Removing

- 1 – Disconnect battery ground strap.
- 2 – Disconnect cable of solenoid valve from terminal 5.
- 3 – Disconnect fuel hose between jet and diaphragm pressure regulator at regulator. The gland nut can be backed off with a 12 mm open-end wrench.
- 4 – Fuel hose between pump and diaphragm pressure regulator is disconnected at fuel pump while counterholding with a 14 mm open-end wrench. Catch escaping fuel in a cloth.
- 5 – Remove four round head screws and washers. Take solenoid valve and diaphragm pressure regulator off heater booster casing.
The ground cable shoe is secured by two round head screws.

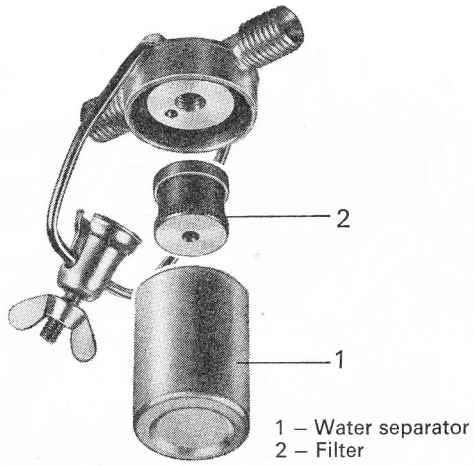


A – Solenoid valve
B – Diaphragm pressure regulator

Installing

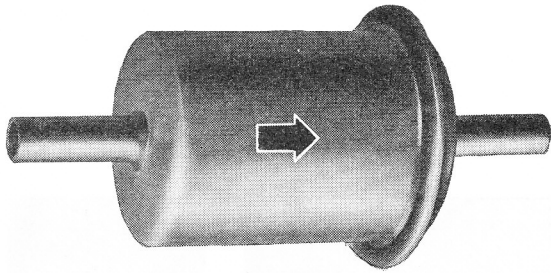
- 1 – Secure diaphragm pressure regulator and solenoid valve with four round head screws and washers. Use two of the screws to secure the ground cable shoe.
- 2 – Connect fuel hoses. Hold locknut on fuel pump with a 14 mm open-end wrench.
- 3 – Connect wires as shown in wiring diagram. Connect battery ground strap and check operation of heater booster.

F 3.5 Removing and Installing Parts

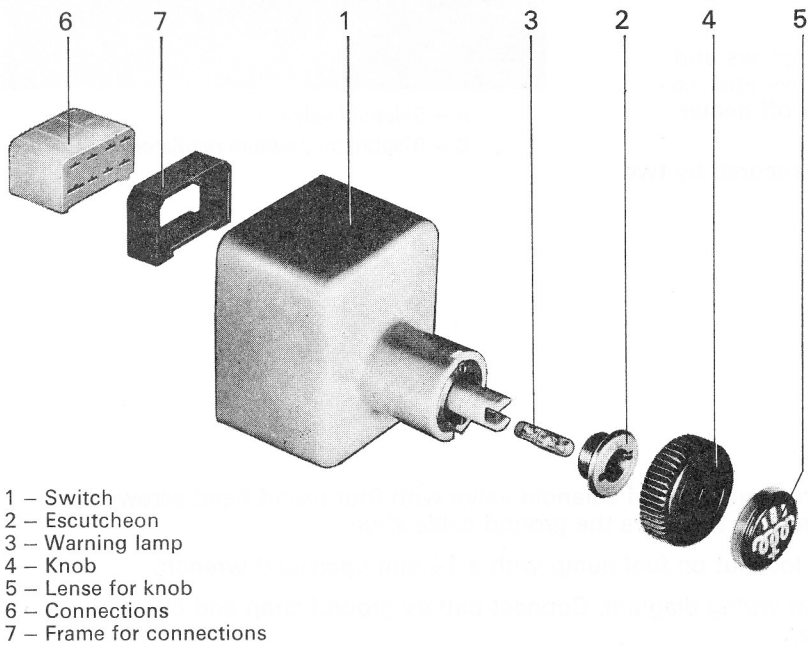


Filter

Ensure that the arrow showing the fuel flow direction is pointing towards the pump.

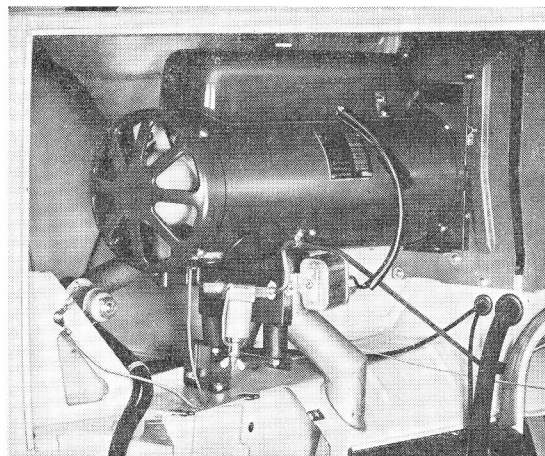


Heater switch

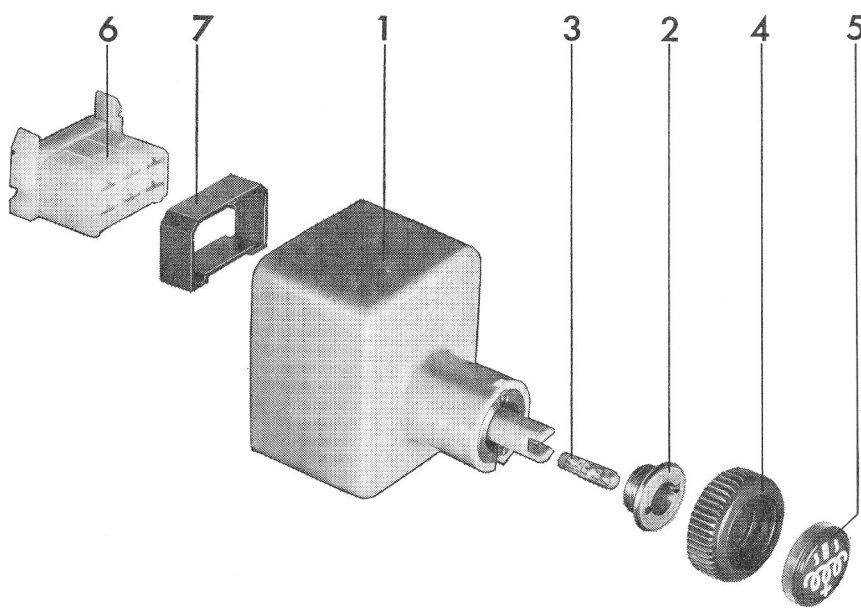


Fuel filter (Type 2)

When installing, ensure that arrow showing flow direction points toward pump.



Time switch (Model 181; Type 2)



- 1 – Time switch
- 2 – Escutcheon
- 3 – Warning light
- 4 – Knob
- 5 – Lens
- 6 – Plug
- 7 – Plug frame

Removing

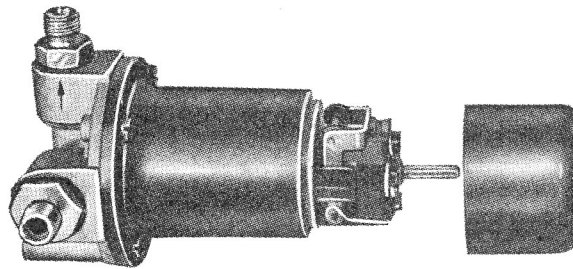
- 1 – Pull knob off and take out bulb.
- 2 – Remove self tapping screw in instrument panel insert and open the insert.
- 3 – Disconnect wires at switch.
- 4 – Unscrew escutcheon with special wrench VW 674/1 and pull switch out.

Installing

- 1 – Secure escutcheon to time switch in instrument panel insert with special wrench VW 674/1.
- 2 – Connect wires according to wiring diagram (see F 3.1/3).
- 3 – Connect battery ground strap and check operation of heater.

Diaphragm pump

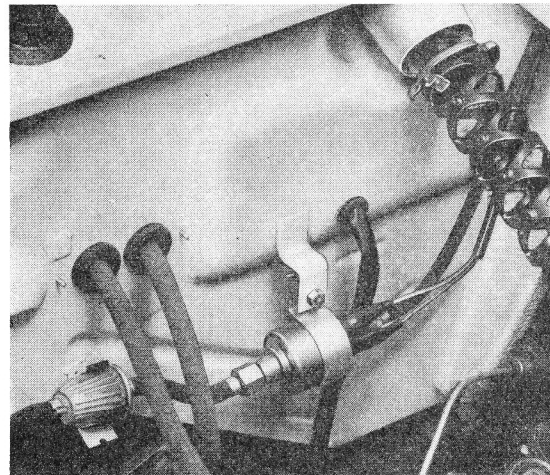
The pump must be fitted so that the pressure union is vertical as shown by arrow.
If necessary, bleed fuel lines after connecting pump. Bleed pressure union and moisten pressure valve with a few drops of fuel.



(for Type 2)

Metering pump

This pump must be installed horizontally under the fuel tank as otherwise the delivery capacity will be altered.

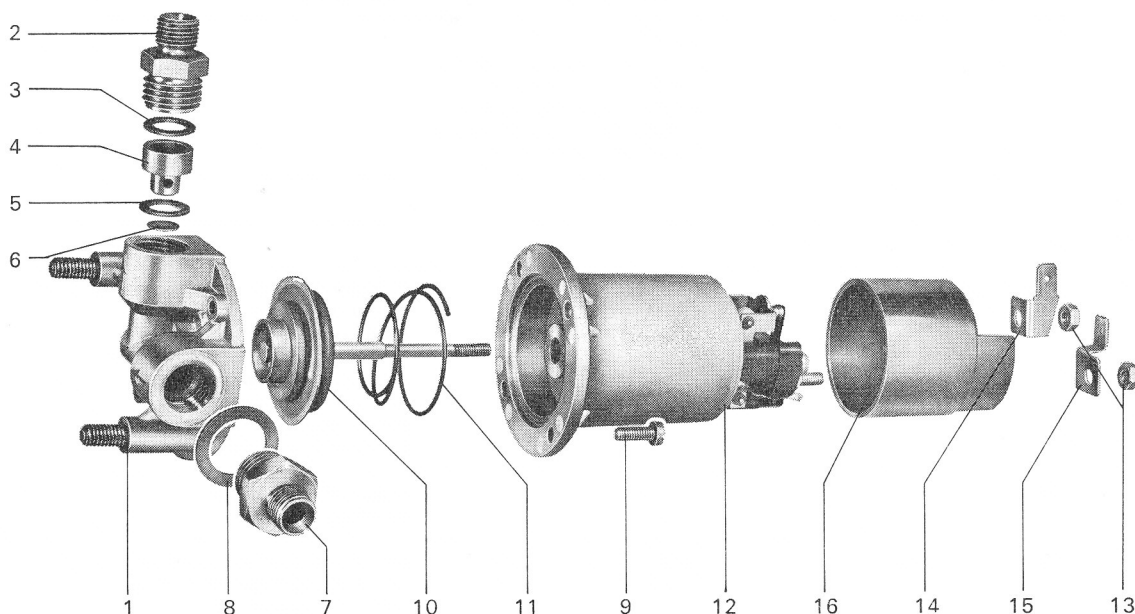


(installation in Model 181)

Disassembling and Assembling Fuel Pump **F 3.6**

Fuel pump

Model 181



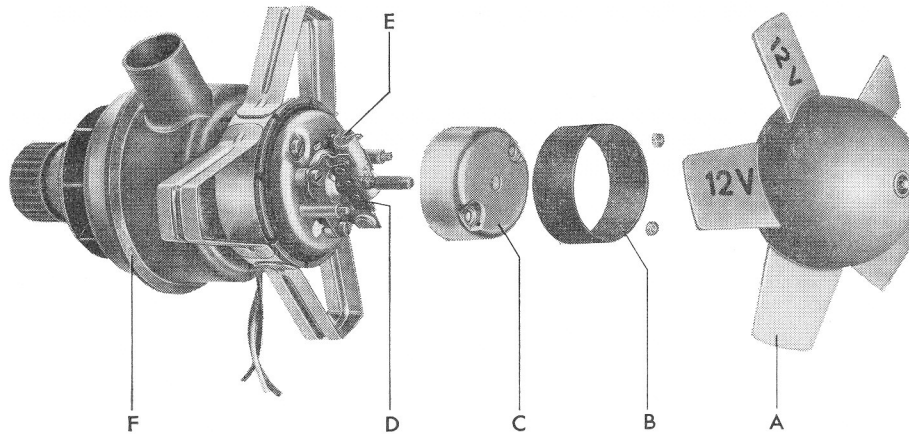
No.	Designation	Qty.	Note when		Special instructions see
			disassembling	assembling	
1	Pump body	1		pump must be installed in vehicle with pressure union at top (arrow points outward)	F 3.5/3-1
2	Outlet union (pressure side)	1	12 mm wrench; look for damage; spherical surface must be smooth; outlet union 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 3.3/2-1
3	Washer	1			
4	Pressure valve	1	make sure valve is not dirty		
5	Washer	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 3.3/2-1

F 3.6 Disassembling and Assembling Fuel Pump

No.	Designation	Qty.	Note when		Special instructions see
			disassembling	assembling	
7	Intake union	1	17 mm wrench; look for damage; spherical surface must be smooth; intake union has larger drilling and is larger across flats than outlet union		
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 3.3/2-1
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 3.3/2-1
13	Nut	2	Type 2 pump has only one nut		
14	Terminal (+)	1	note pole designation on bakelite cap		
15	Terminal (—)	1	Type 2 pump has no ground connection	note pole designation on bakelite cap	
16	Bakelite cap	1	Type 2 cap is brown		

Disassembling and assembling combustion air blower

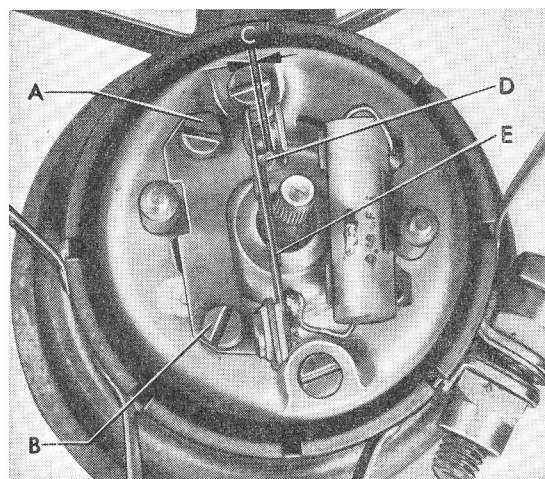
The contact breaker in the combustion air blower is replaceable. If damaged, the complete blower does not have to be replaced.



A – Axial wheel
C – Cover
E – Condenser

B – Seal
D – Contact breaker
F – Blower motor

- 1 – Screw an M 4 screw into hole in center of axial wheel and press wheel off.
- 2 – Remove seal and take cover off.
- 3 – Unsolder condenser and cable to ignition coil at contact breaker.
- 4 – Remove securing screw and clamp screw and take contact breaker out.
- 5 – Install new contact breaker so that projection in contact carrier is pretensioned against end plate.
- 6 – Turn cam on motor shaft against insulating strip and set breaker point gap to 0.35–0.5 mm. Tighten securing screw and clamping screw and seal with paint. The contact pressure should be about 180 grams.



A – Securing screw
B – Clamping screw
C – Gap of 0.35–0.5 mm
D – Projection on contact carrier
E – Cam and insulating strip

F 3.7 Combustion Air Blower

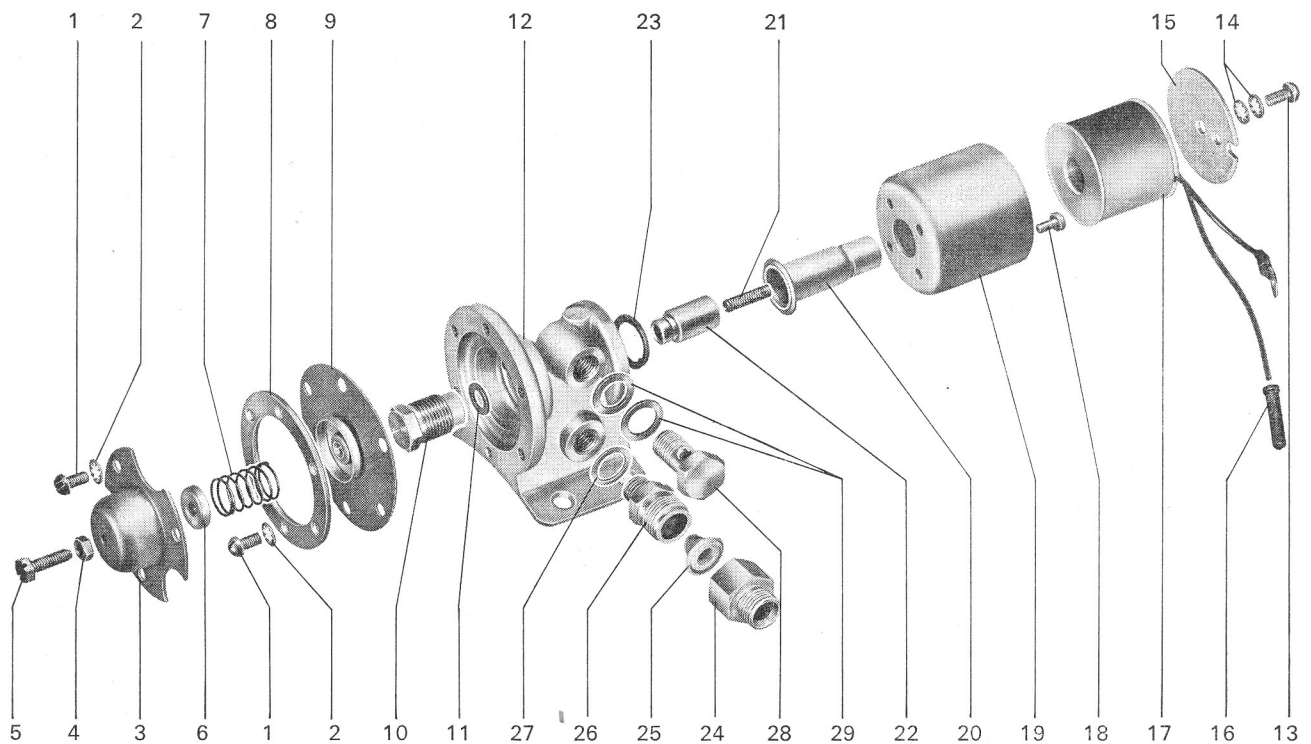
- 7 – Lubricate cam and insulating strip with multi-purpose grease. Grease must not contact the breaker point surfaces.
- 8 – Solder condenser and cable to ignition coil on. The connecting cable between condenser and contact breaker must have a gap of at least 2 mm between end plate, condenser clamp and cover. It is advisable to also replace the condenser when replacing the breaker points.
- 9 – When assembling, ensure that the seal covers the joint between cover and motor.

Testing:

Insert a screw into spark plug connector and hold screw about 7 mm from ground at a motor speed of 5 000 rpm. A continuous spark must jump across. When carrying out this test, switch off fuel pump and glow plug (see F 3.3/1–2 and 1–6).

Pressure Regulator and Solenoid Valve **F 3.8**

Pressure regulator and solenoid valve



No.	Designation	Qty.	Note when		Special instructions see
			disassembling	assembling	
1	AM 4×6 round head screw	6			
2	Toothed washer	6			
3	Cap	1	vent hole must not be blocked	vent hole must face downward	
4	M 4 Nut	1		after setting fuel delivery quantity, seal with paint	F 3.3/2-2
5	M 4 Bolt	1		after setting fuel delivery quantity, seal with paint	F 3.3/2-2
6	Spring plate	1		bolt (5) must be inserted through hole	
7	Spring	1		spring must be held by spring plate and diaphragm cover	

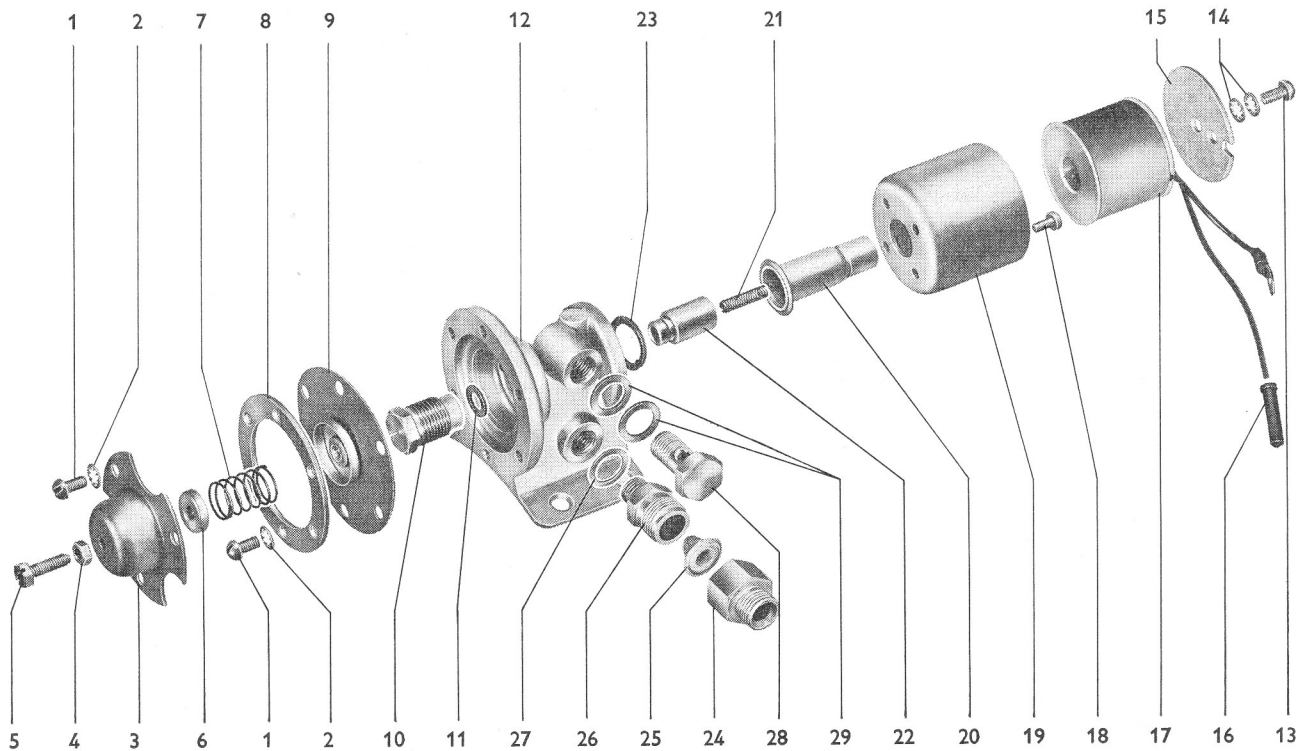
F 3.8 Pressure Regulator and Solenoid Valve

No.	Designation	Qty.	Note when		Special instructions see
			disassembling	assembling	
8	Flange	1	lift carefully		
9	Diaphragm	1	after removal, place diaphragm in fuel	only install diaphragms soaked in fuel (this warrants constant mechanical properties after adjustment)	
10	Valve filter	1		clean filter	
11	Washer	1			
12	Pressure regulator housing	1		clean with compressed air	
13	AM 4×6 round head screw	1			
14	Toothed washer	2		secure cable shoe with toothed washer on each side	
15	Cover	1			
16	Rubber sleeve	1			
17	Winding	1			
18	AM 3×6 K round head Phillips screw	4			
19	Winding housing	1			
20	Guide sleeve	1			
21	Spring	1			
22	Valve	1			
23	Seal	p			
24	Union	1			
25	Screen	1		clean	
26	Union	1			
27	Washer	1			
28	Gland nut	1			
29	Washer	2			

Pressure regulator and solenoid valve are installed in one housing. The solenoid valve is open if an audible click can be heard when energizing it (about 12 volts). If it cannot be heard to operate, replace winding.

Diaphragm Pressure Regulator and Solenoid Valve **F 3.8**

Diaphragm pressure regulator and solenoid valve



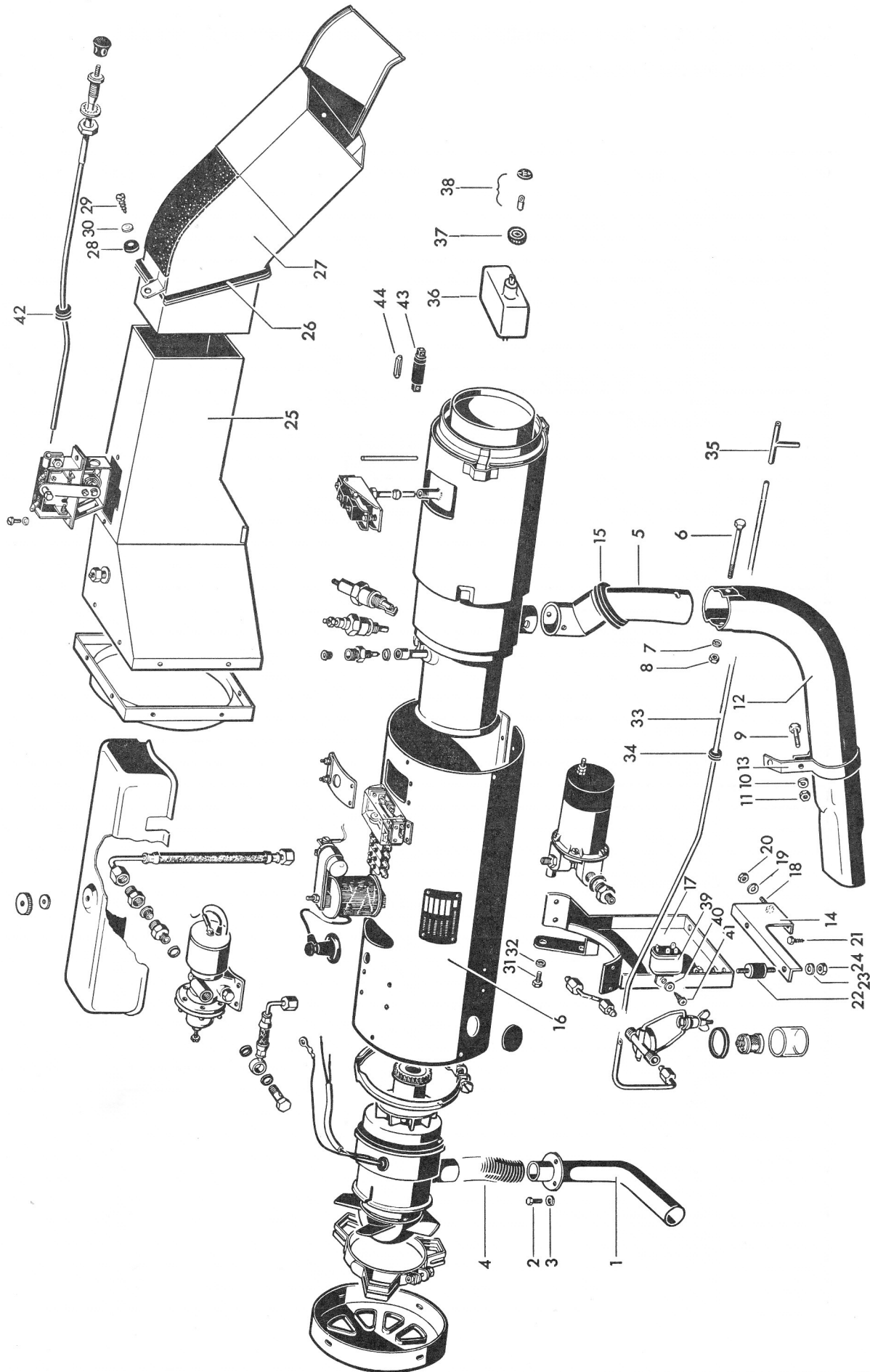
No.	Designation	Qty.	When		Special instructions see
			disassembling	assembling	
1	AM 4×6 round head screw	6			
2	Toothed washer	6			
3	Cap	1	vent hole must not be blocked	vent hole must face downward	
4	M 4 hexagon nut	1		after setting fuel delivery quantity, seal with paint	F 3.3/2-4
5	M 4 hexagon head screw	1		after setting fuel delivery quantity, seal with paint	F 3.3/2-4
6	Spring plate	1		hexagon head screw (5) must be inserted through hole	
7	Spring	1		spring must be held by spring plate and diaphragm cover	

F 3.8 Diaphragm Pressure Regulator and Solenoid Valve

No.	Designation	Qty.	When		Special instructions see
			disassembling	assembling	
8	Flange	1	lift carefully		
9	Diaphragm	1	after removal, place diaphragm in fuel	only install diaphragms soaked in fuel (this warrants constant mechanical properties after adjustment)	
10	Valve filter	1		clean filter	
11	Seal	1			
12	Pressure regulator housing	1		clean with compressed air	
13	AM 4×6 round head screw	1			
14	Toothed washer	2		secure cable shoe with toothed washer on each side	
15	Cover	1			
16	Rubber sleeve	1			
17	Winding	1			
18	AM 3×6 K round head Phillips screw	4			
19	Winding housing	1			
20	Guide sleeve	1			
21	Spring	1			
22	Valve	1			
23	Seal	1			
24	Union	1			
25	Screen	1		clean	
26	Union	1			
27	A 8×12 seal	1			
28	Gland nut	1			
29	A 8×12 seal	2			

Diaphragm pressure regulator and solenoid valve are installed in one housing. The solenoid valve is open when an audible click can be heard when energizing it (about 12 volts). If it cannot be heard to operate, replace winding.

Installing instructions for Type 2; Models 211-244



F 3.20 Service Installation

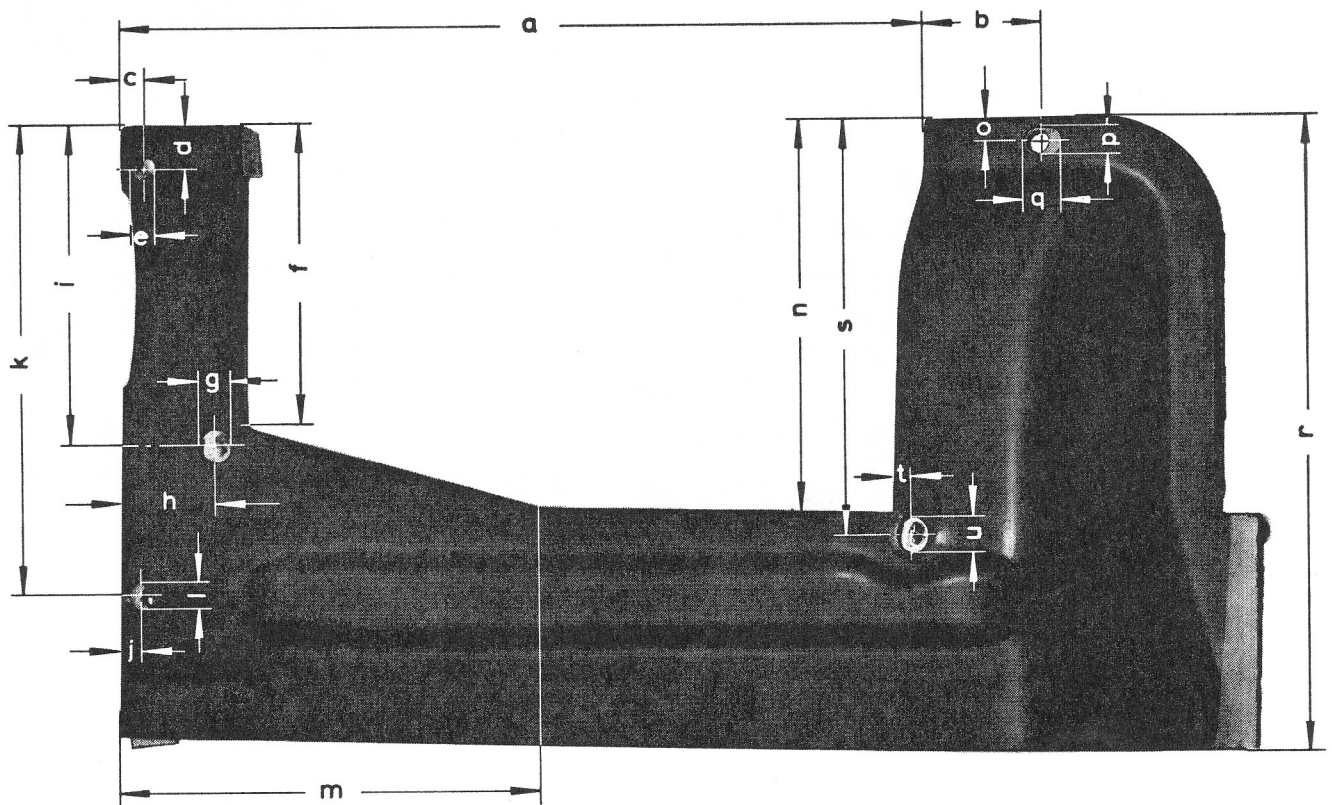
The Eberspächer BN 4 heater is installed in the engine compartment on the left side.

The kit contains the following parts:

Qty.	Designation	Remarks	No.
1	Heater		16
1	Combustion air pipe		1
1	Hose	210 mm	4
1	Exhaust		5
1	End pipe		12
1	Bracket	exhaust pipe	13
2	Bracket	heater	17, 14
1	Seal	exhaust pipe	15
2	Bonded rubber mounting		22
1	Seal	hot air outlet	—
1	Hot air outlet		25, 27
1	Seal	partition	26
1	Seal	side panel	—
1	Fuel line		33
1	Bowden cable	regulator switch	—
1	Sticker		—
1	Hose	500 mm long	—
1	T piece		35
2	Hose	80 mm long	—
3	Grommet		34, 42
6	Retaining strap		—
1	Connector		—
1	Knob	Bowden cable	—
1	Time switch		36
1	Escutcheon		—
1	Switch knob		37, 38
1	Relay		39
1	Plug		—
1	Cable	connector	—
1	Cable harness	heater	—
1	Cable harness	time switch	—
1	Cable adaptor		—
1	Fuse	16 Amp	44, 43
3	Bolt	M 4×10	2
2	Bolt	M 6×15	18, 9, 31
2	Bolt	BM 5×50	6
2	Nut	M 5	8
6	Nut	M 6	11, 24
1	Nut	M 10×1	—
2	Tapping screw	B 4.8×13	—
4	Washer	A 5.2	30
3	Spring washer	B 4	3
2	Spring washer	B 5	7
6	Spring washer	B 6	19, 10, 23, 32
1	Lock washer	J 10.5	—
1	Lock washer	A 5.1	—
1	Hex. head tapping screw	B 6.3×13	21
2	Tapping screw	B 4.8×13	29
1	Tapping screw	B 4.8×9.5	—
1	Bulb	JG 12 V 1.2 W	38
1	Union nut	M 12×1.5	33

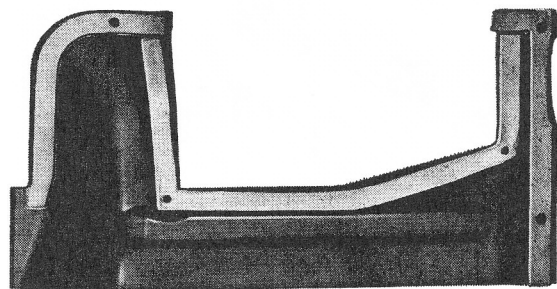
- 1 – Remove engine.
- 2 – Remove rear partition and shorten it 165 mm (r).

2 a – Reshape cut off part as shown in drawing.



a = 227 mm	g = 10 mm	m = 130 mm	r = 165 mm
b = 32 mm	h = 27 mm	n = 105 mm	s = 115 mm
c = 7 mm	i = 85 mm	o = 7 mm	t = 7 mm
d = 10 mm	j = 7 mm	p = 7 mm	u = 10 mm
e = 8 mm	k = 127 mm	q = 10 mm	
f = 80 mm	l = 8 mm		

- 3 – Stick seal for partition on to cut off part as shown in illustration.



F 3.20 Service Installation

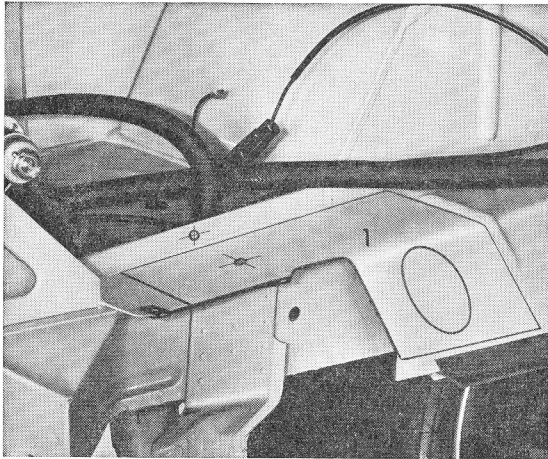
4 – The following holes are made in the engine compartment:

Note:

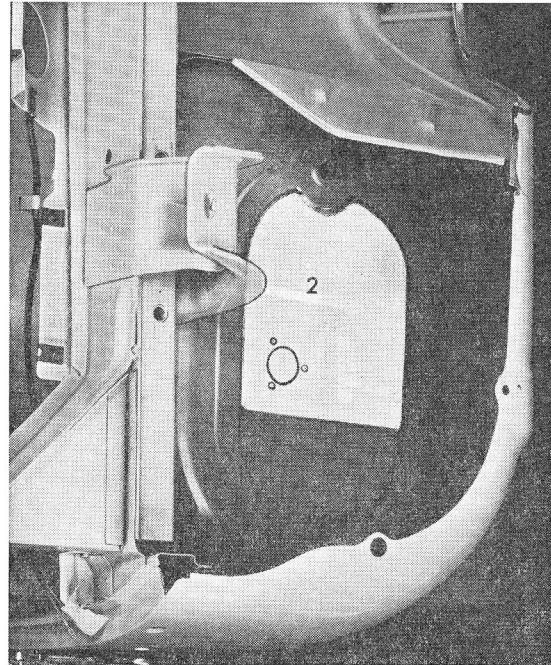
Templates made of thin cardboard are included with the installing instructions supplied with the kit. It is advisable to use these templates once only.

Dealers who install a lot of heaters are advised to make new templates of more durable material. The drawing on page F 3.20/1-12 gives all the necessary measurements.

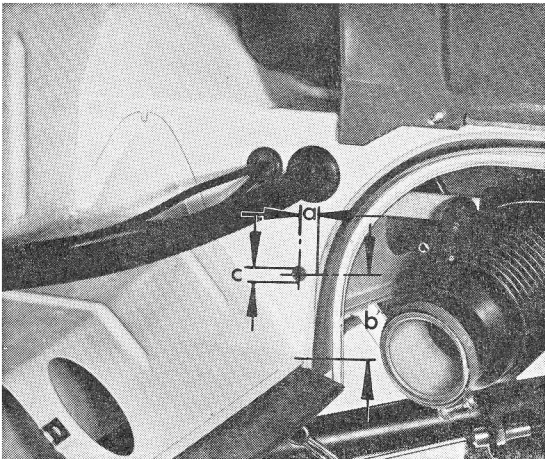
The contacting edges of the templates are marked. These edges must be placed exactly against the rib or cut-out concerned in order to ensure that the holes and drilling are located accurately.



A = Holes for heater brackets
B = Hole for exhaust pipe



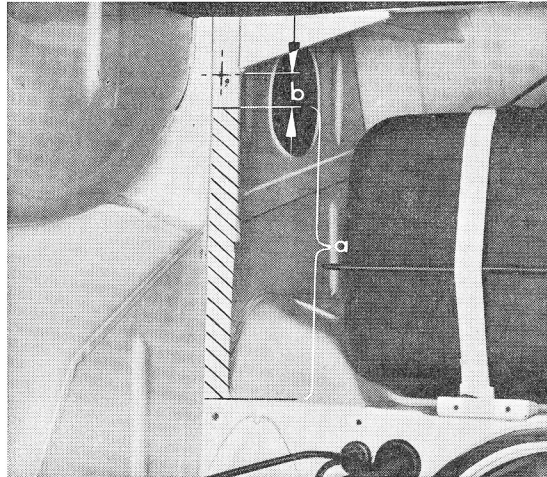
Holes for combustion air pipe and
securing screws



5 – Drill hole for fuel line

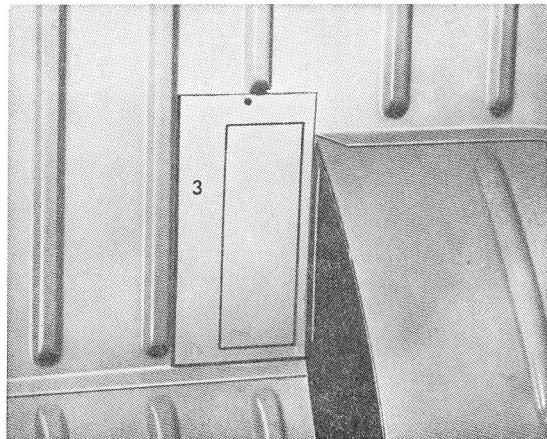
a = 13 mm
b = 65 mm
c = 10 mm dia.

- 6 – Shorten bracket for engine cover plate left (see illustration).

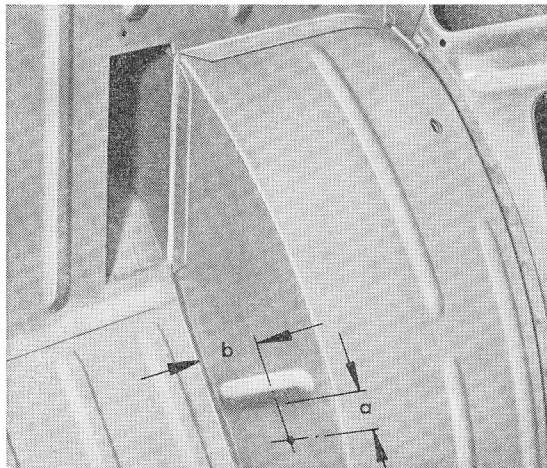


a = remove
b = 20 mm

- 7 – Take rear seat out and remove carpet if fitted.
8 – Mark off and cut hole for hot air outlet from inside body.

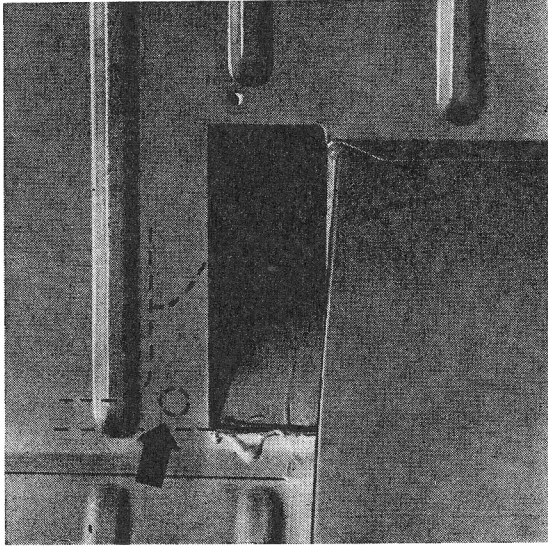


- 9 – Drill second hole for hot air outlet securing screws.



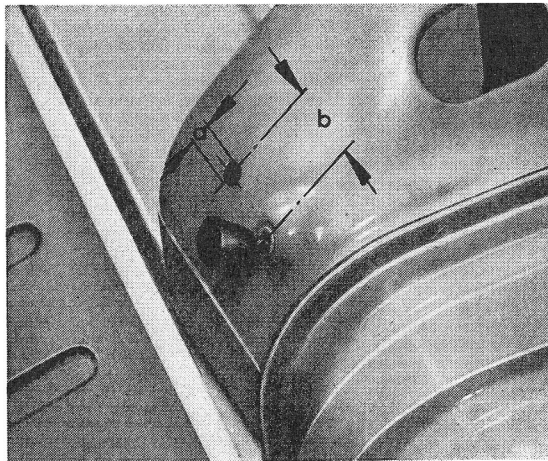
a = 28 mm
b = 63 mm

F 3.20 Service Installation



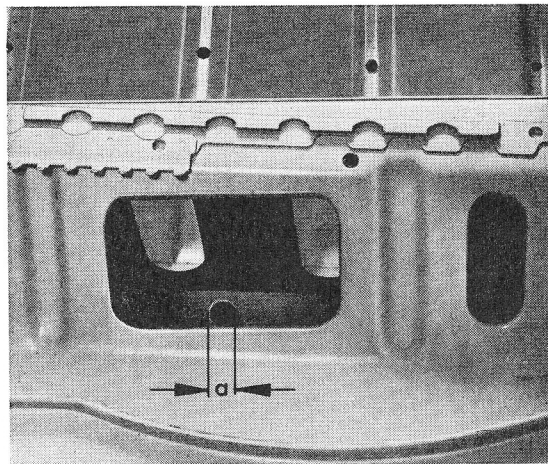
10 – Drill hole for Bowden cable (with an angle drill). The hole is drilled 12 mm to left and rear of the left edge of the hot air outlet hole. The illustration on the left shows the location of this hole.

11 – Take driver's seat out.



12 – Drill securing hole for Bowden cable.

a = 10 mm dia.
b = 45 mm



13 – Drill hole for Bowden cable under the seat box.

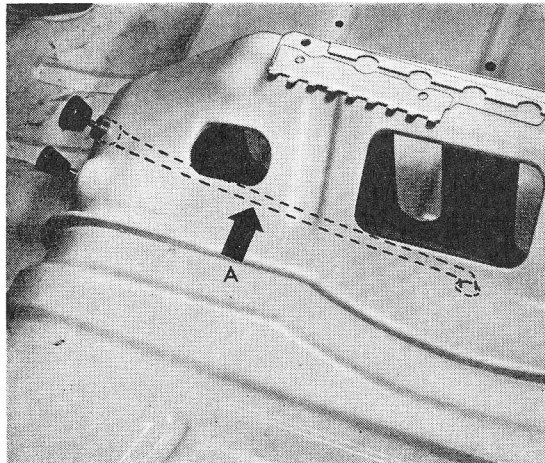
Caution!

Parts of the brake system are below this location so do not drill deeper than 30 mm.

a = 17 mm dia.

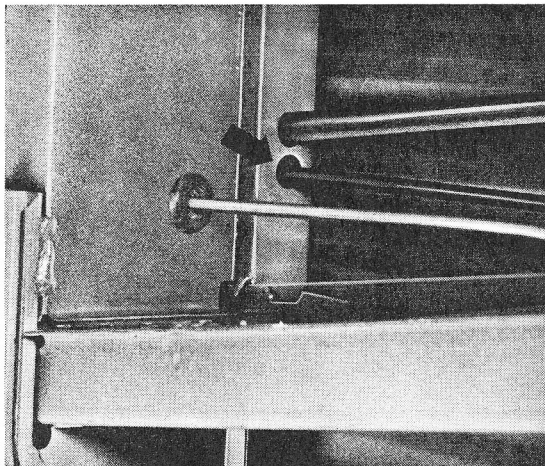
Installing

- 1 – Install Bowden cable.
The cable is passed through the hole under the driver's seat first. Do not forget the grommet. Secure Bowden cable and install knob.



A = Bowden cable

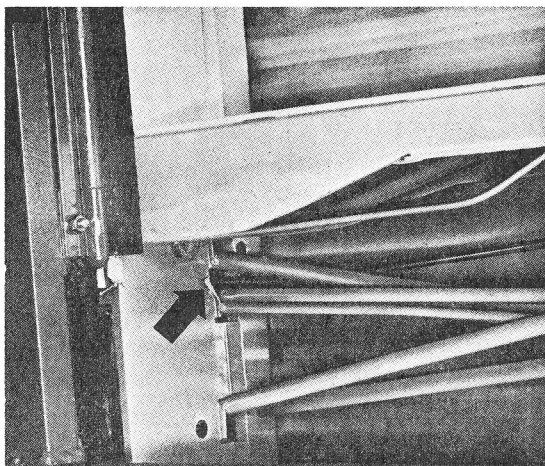
- 2 – Pass the Bowden cable through the holes in the frame cross members.



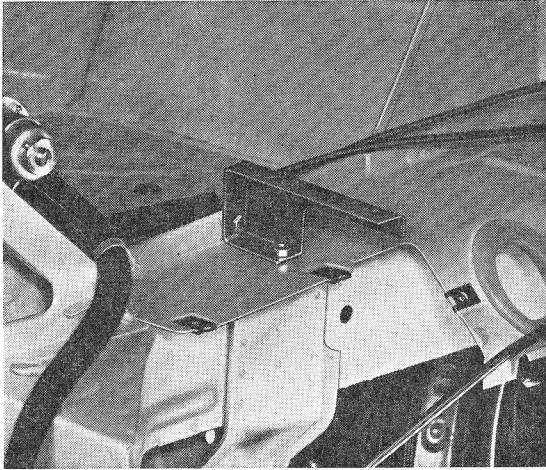
Note:

Vehicles with a sliding roof have reinforcement plates welded in between the cross members but the holes mentioned above are still accessible. To pull the cable through it is advisable to pass a thin copper tube through the holes first and then attach the cable to the tube and pull it through.

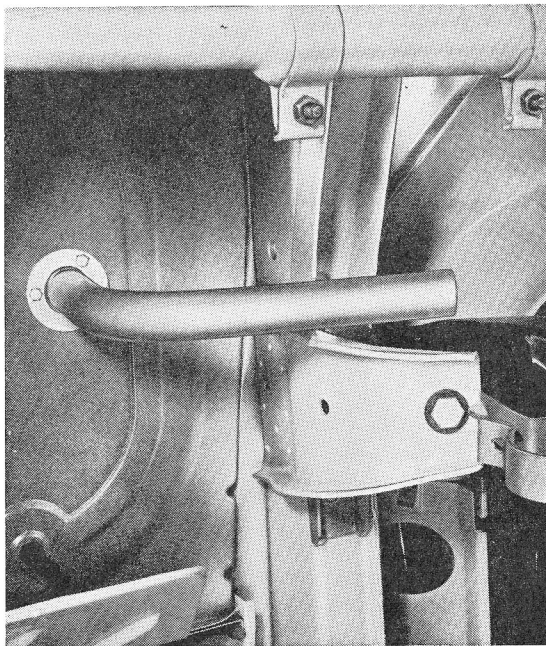
- 3 – Pass cable through the hole near the hot air outlet into the engine compartment.



F 3.20 Service Installation



4 – Install heater brackets in engine compartment.



5 – Install lower part of combustion air intake pipe. The lower opening in the pipe must be towards the engine.

6 – Install right part of partition.

7 – Install time switch about 45 mm to left of ashtray.

8 – Install cable harness for heater.

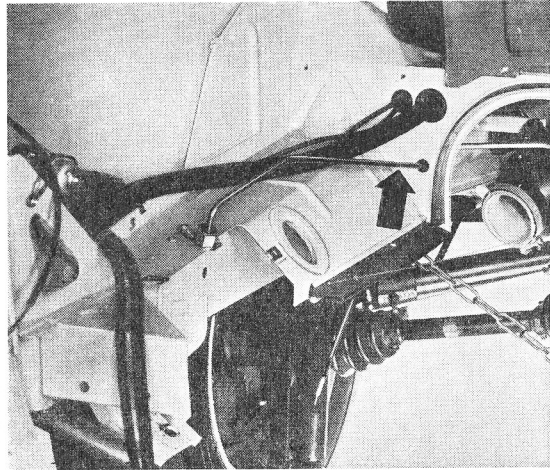
The cable from time switch to heater is routed parallel with the main harness as far as the engine compartment and then parallel with the engine harness to the heater.

Install a 2.5 mm² red cable in insulation sleeving from starter terminal 30 to heater (connector with fuse) parallel with engine harness.

9 – Cut fuel line to engine 120 mm from the end and install a T piece. Do not forget hose clips.

10 – Install silicon sealing for exhaust pipe.

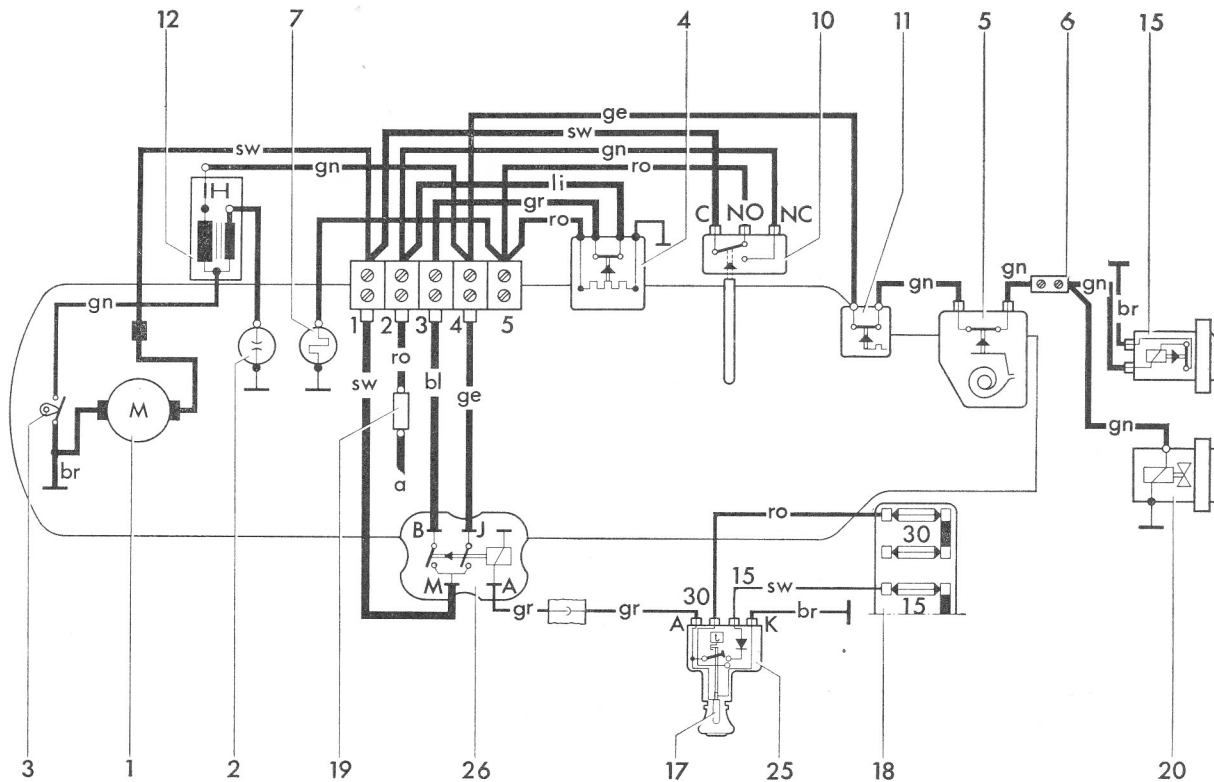
- 11 – Install fuel line to heater. Do not forget grommet.



- 12 – Install heater provisionally but leave it so far back that the temperature regulating lever is easily accessible.
- 13 – Push Bowden cable right in (at knob on cable under driver's seat).
- 14 – Press temperature regulating lever on to stop on heater and install Bowden cable free of tension.
- 15 – Push heater in to stop and engage the lower pins of the two bonded rubber mountings in the holes in the heater brackets.
- 16 – Install the left, cut-out part of partition (3 tapping screws). Seal the joint between the two parts of the partition.
- 17 – Install hot air outlet from inside vehicle but do not secure it.
- 18 – Insert two heater securing screws (tapping screws with washers) from the engine compartment through the cut-off part of the partition.

F 3.20 Service Installation

- 19 – Secure the hot air outlet.
- 20 – Connect the heater fuel line. Connect cables according to wiring diagram.
- 21 – Connect hose for combustion air intake pipe.



- 1 – Motor
- 2 – Spark plug
- 3 – Breaker contacts
- 4 – Safety switch
- 5 – Regulating switch
- 7 – Glow plug
- 10 – Thermoswitch
- 11 – Overheating switch
- 12 – Coil

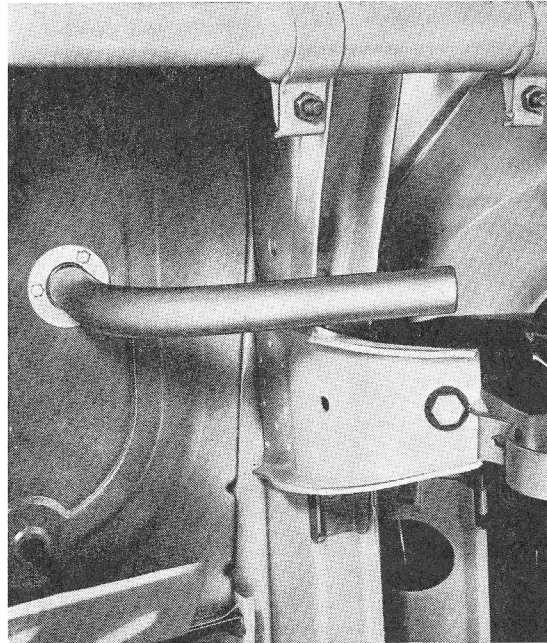
- 14 – Fuel pump
- 17 – Warning lamp
- 18 – Fuse box
- 19 – Fuse 16 amp.
- 20 – Fuel solenoid valve
- 25 – Time switch
- 26 – Relay

a = to starter terminal 30

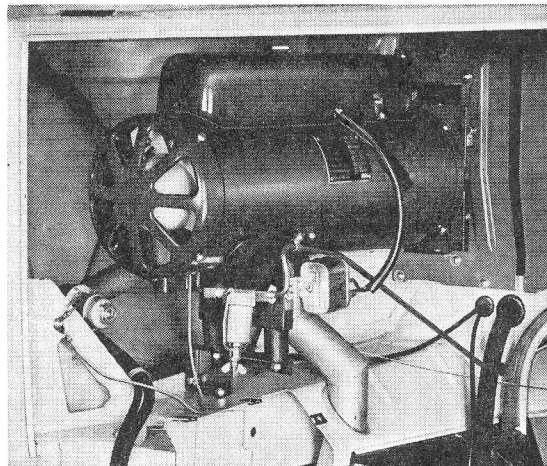
ro = red	br = brown	gn = green
sw = black	gr = grey	li = lilac
ge = yellow	ws = white	

- 22 – Install engine.

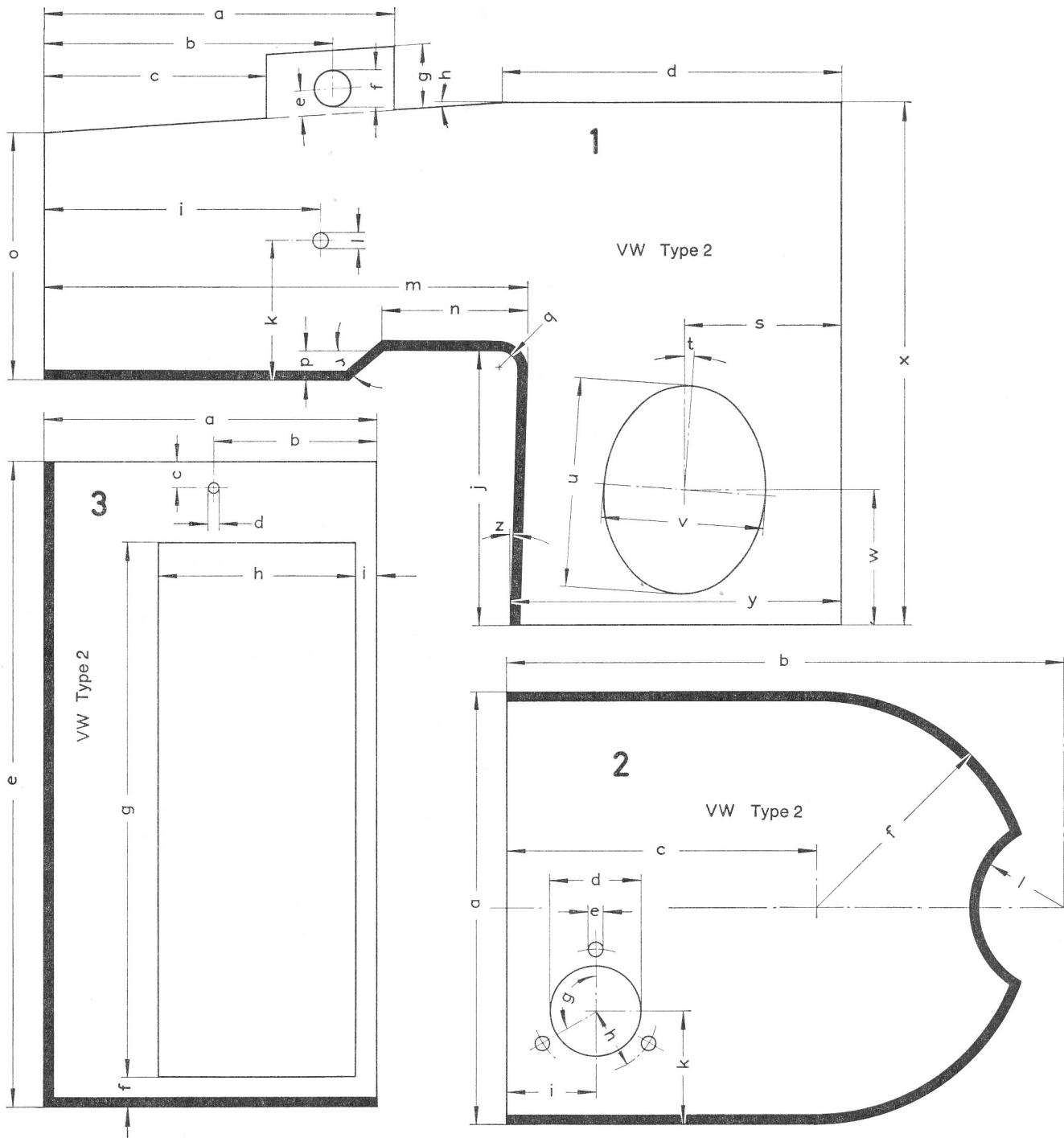
- 23 – When inserting the left engine mounting bolt into engine carrier, attach the clip for the exhaust pipe as well.
- 24 – Insert exhaust pipe from below and secure it.



- 25 – Connect battery and check operation of heater. It may be necessary to switch over the safety switch if it has operated in transit.
- 26 – Install driver's seat and rear seat.



F 3.20 Service Installation



Template 1

a = 115 mm	o = 80 mm
b = 95 mm	p = 10 mm
c = 73 mm	q = 5 mm
e = 8.5 mm	r = 41°
f = 12 mm ∅	s = 51 mm
g = 21 mm	t = 4°
h = 5°	u = 69 mm
i = 90 mm	v = 54 mm
j = 90 mm	w = 45 mm
k = 46 mm	x = 172 mm
l = 5 mm ∅	y = 109 mm
m = 158 mm	z = 2°
n = 48 mm	

Template 2

a = 143 mm	g = 120°
b = 183 mm	h = 20 mm
c = 102 mm	i = 30 mm
d = 30 mm ∅	k = 20 mm
e = 5 mm ∅	l = 28 mm
f = 71 mm	

Template 3

a = 110 mm	f = 10 mm
b = 53 mm	g = 176 mm
c = 9 mm	h = 65 mm
d = 4 mm ∅	i = 7 mm
e = 213 mm	