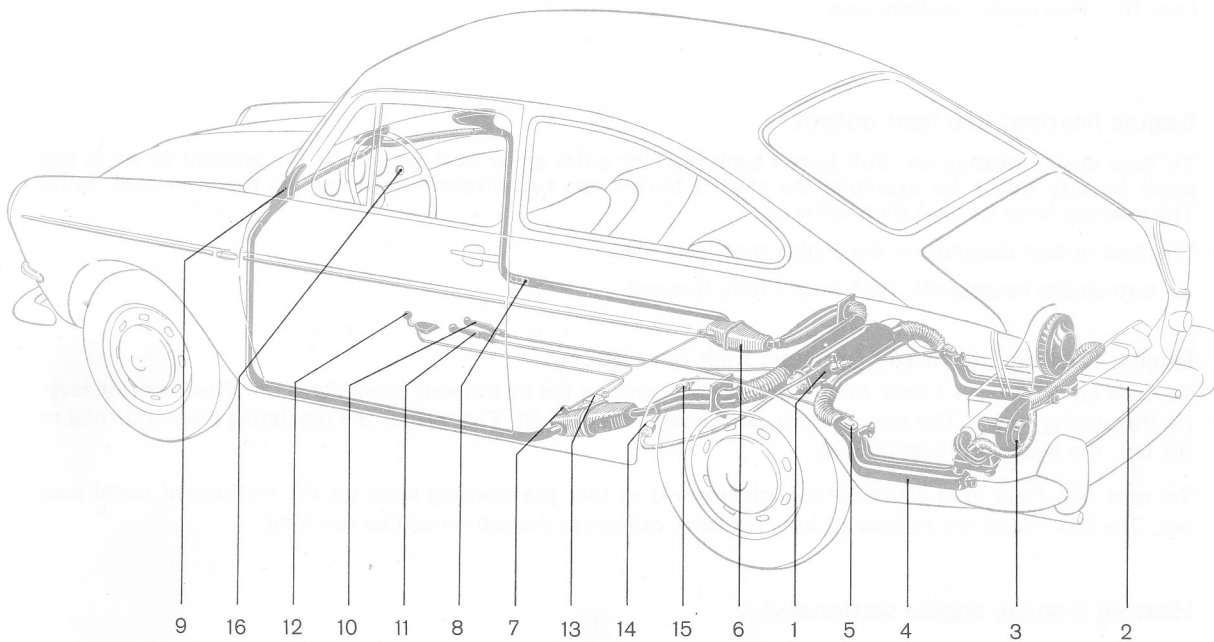


Description

The heating system is a combined engine-gasoline-fresh air system by which the fresh air is heated only by the heat given off by the engine exhaust gases or, when additional heat is required, also by the heater booster that operates independently of the vehicle engine. This thermostatically-regulated, infinitely variable heater booster is installed in the space between transmission and luggage compartment floor and can be operated also when the vehicle is stationary.

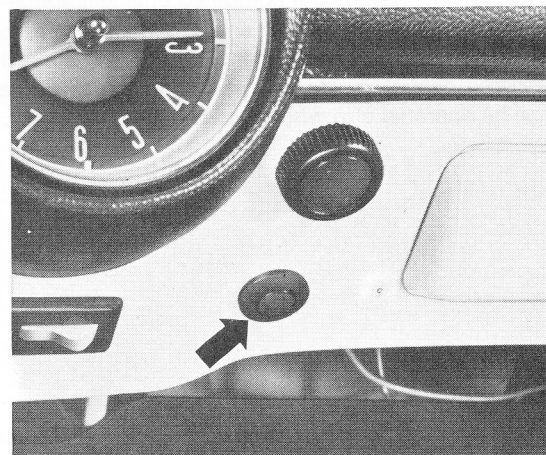
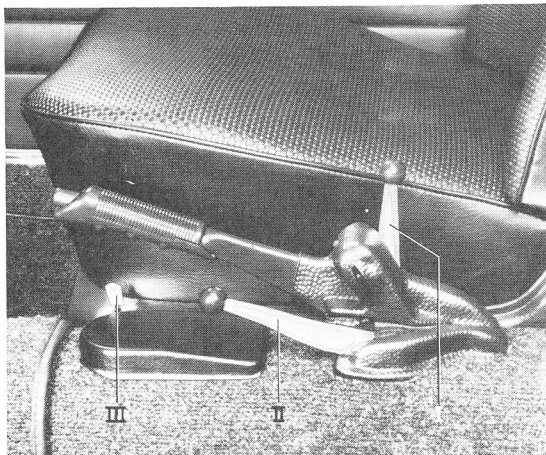


- 1 – Heater booster and combustion air blower
- 2 – Exhaust pipe
- 3 – Heater air blower
- 4 – Engine heat exchanger
- 5 – Heater flaps
- 6 – Muffler
- 7 – Outlets in rear footwell
- 8 – Outlets in front footwell

- 9 – Warm air vents in instrument panel
- 10 – Heater flap lever
- 11 – Regulating lever for rear footwell
- 12 – Heat output regulating lever
- 13 – Temperature control switch
- 14 – Fuel pump
- 15 – Fuel filter
- 16 – Warning lamp

F 2.1 Description of Heating System

Controls



- Lever I — Heater flap operation
- Lever II — Regulating levers for rear footwell
- Lever III — Heat output regulating lever

Engine heating: low heat output

To turn engine heating on: Pull lever I back but not quite as far as it will go. If the amount of air is too small (in city traffic for example) the electric blower can be switched on by pulling the lever back fully. The warning lamp (arrow) then lights up.

The heat output depends on the engine speed and load.

To turn engine heating off: Push lever I fully forward.

Engine heating and heater booster: high heat output

To turn on: Pull lever I back fully. The warning lamp on the instrument panel lights up. Then operate lever III (regulating lever). The temperature can be regulated at will. The farther the regulating lever is turned to the left, the higher the heat output.

To turn off: Push lever I just far enough forward so that the warning lamp on the instrument panel goes out. The lever must not be pushed fully forward, otherwise the run-on will be too long.

Heating (vehicle engine stationary)

To turn heating on: First pull lever I right back. The warning lamp on the instrument panel lights up. Then move lever II to regulate required degree of heating.

To turn heating off: Push lever I forward until the warning lamp on the instrument panel goes out. The lever must not be pushed fully forward, otherwise the run-on will be too long.

Note:

When the heating is switched off, the heater air blower and the combustion air blower continue to run until the heater cools down and all traces of exhaust gases have been emitted from the combustion chamber.

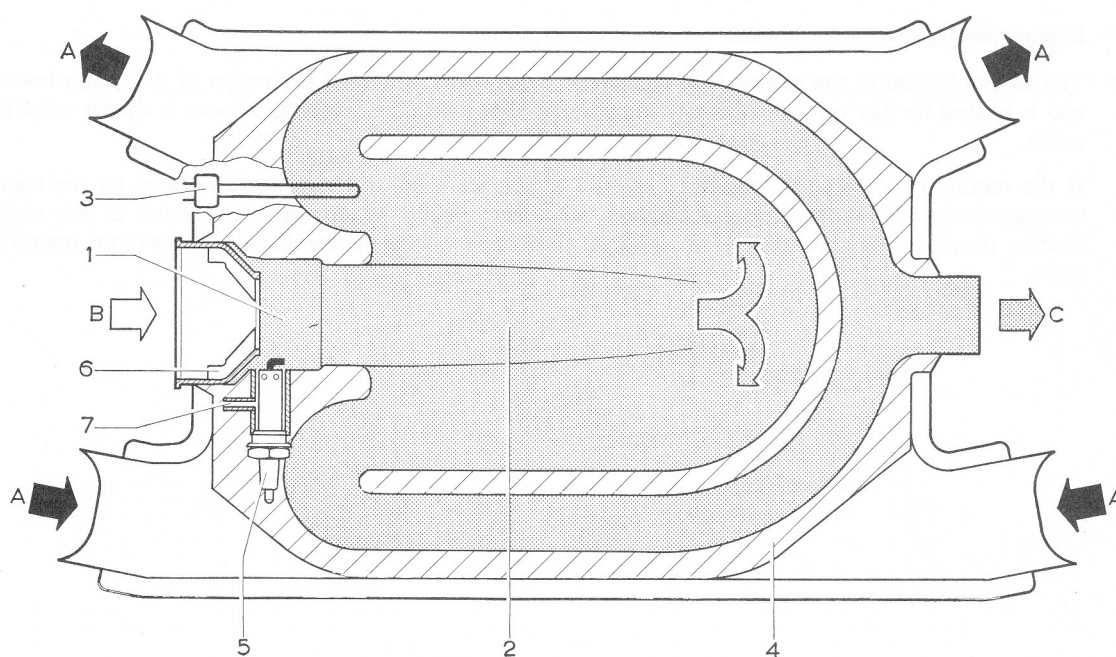
When temperatures are extremely low, the full battery capacity is required for starting the engine. To avoid starting difficulties under such conditions the heater booster should be switched on only after the engine has been started.

Operation

1 – Heating (vehicle engine stationary)

All the heater functions are controlled by the heater flap lever in conjunction with the regulating lever. The warning lamp in the instrument panel lights up.

Fuel is drawn through the vehicle engine fuel line and forced through a filter and into the heater combustion chamber by a fuel metering pump. On vehicles with electronically-controlled fuel injection system, the fuel is drawn through the fuel return line of the vehicle engine via a de-aerator. The air from the combustion air blower is swirled by a housing with vanes in front of the combustion chamber and the air and fuel then form a combustible mixture. The glow-spark plug, switched on at the same time as the fuel pump and the combustion air blower, ignites the air/fuel mixture. A flame is produced that heats the walls of the heat exchanger. The exhaust gases flow through an exhaust pipe to the atmosphere.



1 – Combustion chamber
2 – Heat chamber
3 – Thermo-switch
4 – Heat exchanger

5 – Glow-spark plug
6 – Housing with vanes
7 – Fuel line connection

A – Warm air
B – Combustion air
C – Exhaust gases

The air flowing from the heater air blower via the engine heat exchangers and the open heater flaps passes through the heater. The heat exchanger, heated by the combustion of the fuel, transfers its heat to the air passing through it and the hot air is then transferred through two hoses into the warm air ducts and to the outlets in the footwell and the instrument panel on both sides of the vehicle.

The temperature control switch, installed in the left-hand muffler, is operated by a bowden cable connected to the regulating lever and regulates the exit temperature of the air thermostatically.

To switch the heating off, the heater flap lever is pushed forward until the warning lamp on the instrument panel goes out. The heater air blower and the combustion air blower continue to run, however, until the heater cools down and all traces of exhaust gases have been emitted from the combustion chamber (run-on).

2 – Engine heating only

When the engine is running, the exhaust gases on each side of the engine are led to the muffler through pipes and into the heat exchangers. Fresh air is continually blown round the hot exhaust pipes and heated. If the engine heat exchanger flaps are open, the heated air flows via the heater and the warm air ducts to the vehicle interior.

If the heater flap lever is pulled back fully, the heater air blower is also switched on and the amount of air increased. The warning lamp on the instrument panel lights up.

Depending on the driving conditions, the larger amount of air is produced either by the engine cooling fan (motorways) or by the electrically-operated blower (city traffic).

3 – Engine heating and heater booster (vehicle engine running)

The air pre-heated in the engine heat exchanger flows round the heat exchanger of the heater booster and is heated further until the pre-set temperature is reached. The heater air blower is always on at this point.

If the required temperature, regulated by the temperature control switch, is attained by the engine heating alone, the heater booster is turned off automatically. When the temperature of the engine heating drops below the pre-set temperature, the heater booster automatically comes into operation again.

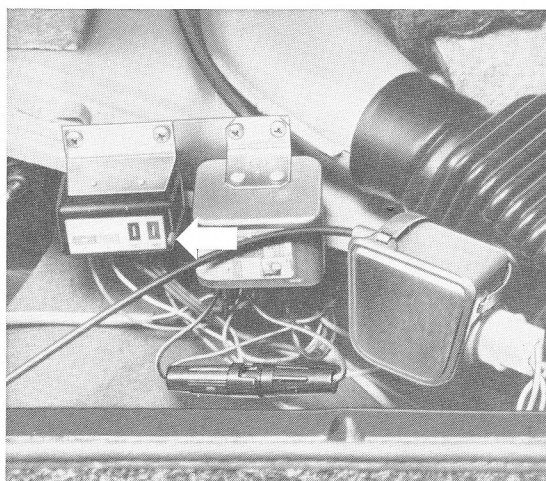
Maintenance

The following operations should be carried out regularly during the maintenance services:

- 1 – Start vehicle engine.
- 2 – Pull heater flap lever back fully. Warning lamp on instrument panel must light up.
- 3 – Adjust regulating lever to half heat output.
- 4 – After about two minutes, check whether warm air flows from warm air vents equally on both sides in vehicle interior. Turn heating off. To do this, push heater flap lever forward until warning lamp goes out. As soon as the lamp has gone out, check that the heater air blower and the combustion air blower run-on for 120–240 seconds, to cool the heater and emit all traces of exhaust gases from the combustion chamber.

Note:

If the heater booster is not used over a long period (during the summer for example), rubber-like deposits from the fuel may adhere to the fuel lines. Operational defects that could be caused by this can be avoided if the heating is switched on briefly with the vehicle engine **cold** about once a month during the summer. If, after about two minutes, the heating does not start to operate, the fuel in the pressure line between fuel pump and heater has probably evaporated. The time taken for the fuel pump to pump fuel into the combustion chamber in this case and for the fuel to ignite is too long and the safety switch has cut-in. The regulating lever should therefore be moved to the off position. After five minutes, operate the lever on the safety switch (arrow) in the space on the left under the rear seat, then switch the heater booster on again. If the heater booster still does not operate, there is a defect in the heating system.



Heater booster – technical data

Heat output, infinitely variable	1000–3400 kcal/h	
Fuel	Gasoline	
Fuel consumption	0.2–0.6 liter/h	(.42–1.3 US pt./h) (.35–1 Imp. pt./h)
Nominal voltage	12 volts	
Current input	130 watts	

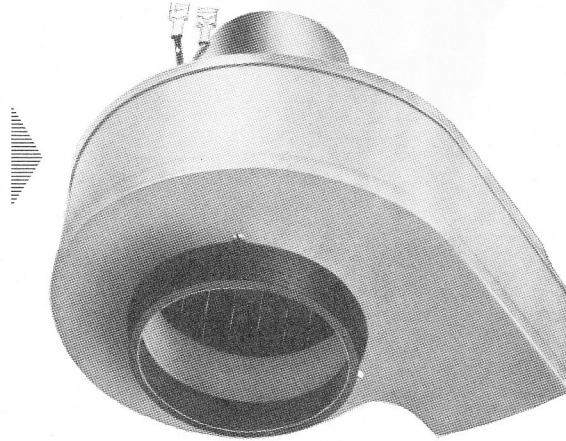
Description of parts

Note:

Individual parts not described in this section are the same as the units on pages F 1.1/4-1 through 4-4.

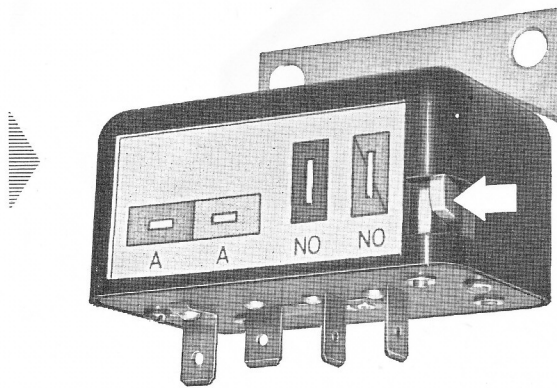
Heater air blower

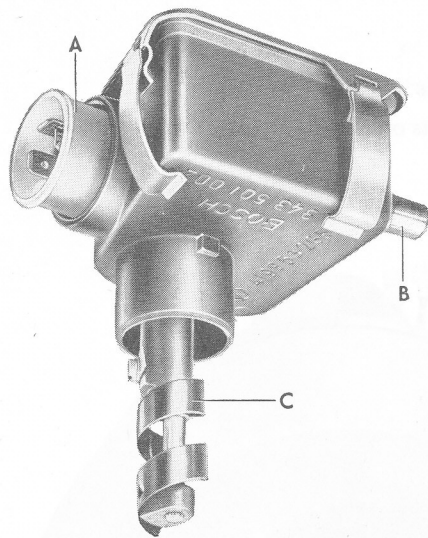
The heater air blower is mounted on the left-hand side of the rear air deflector plate. This blower forces air automatically, alternating with the engine cooling fan, through the engine heat exchangers and the heat exchanger of the heater into the vehicle interior. If the engine cooling fan produces more air (high engine speeds), the non-return flaps in the elbows between fan housing and exhaust muffler are opened. If the electric blower produces more air (low engine speeds), the flaps close automatically to prevent the air from escaping through the engine cooling air intake.



Safety switch

This switch cuts off the current to the heater (dual relay opens circuit) should, for some reason, the combustion system become defective (fuel supply cut off, glow-spark plug defective).

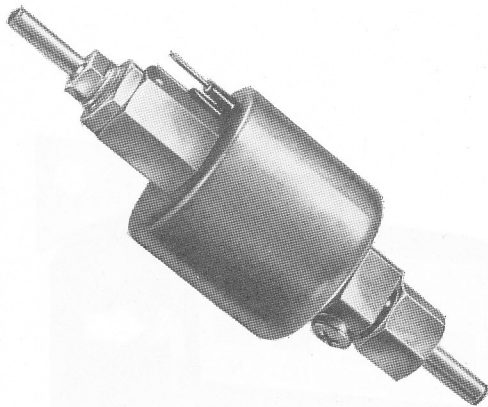




Temperature control switch

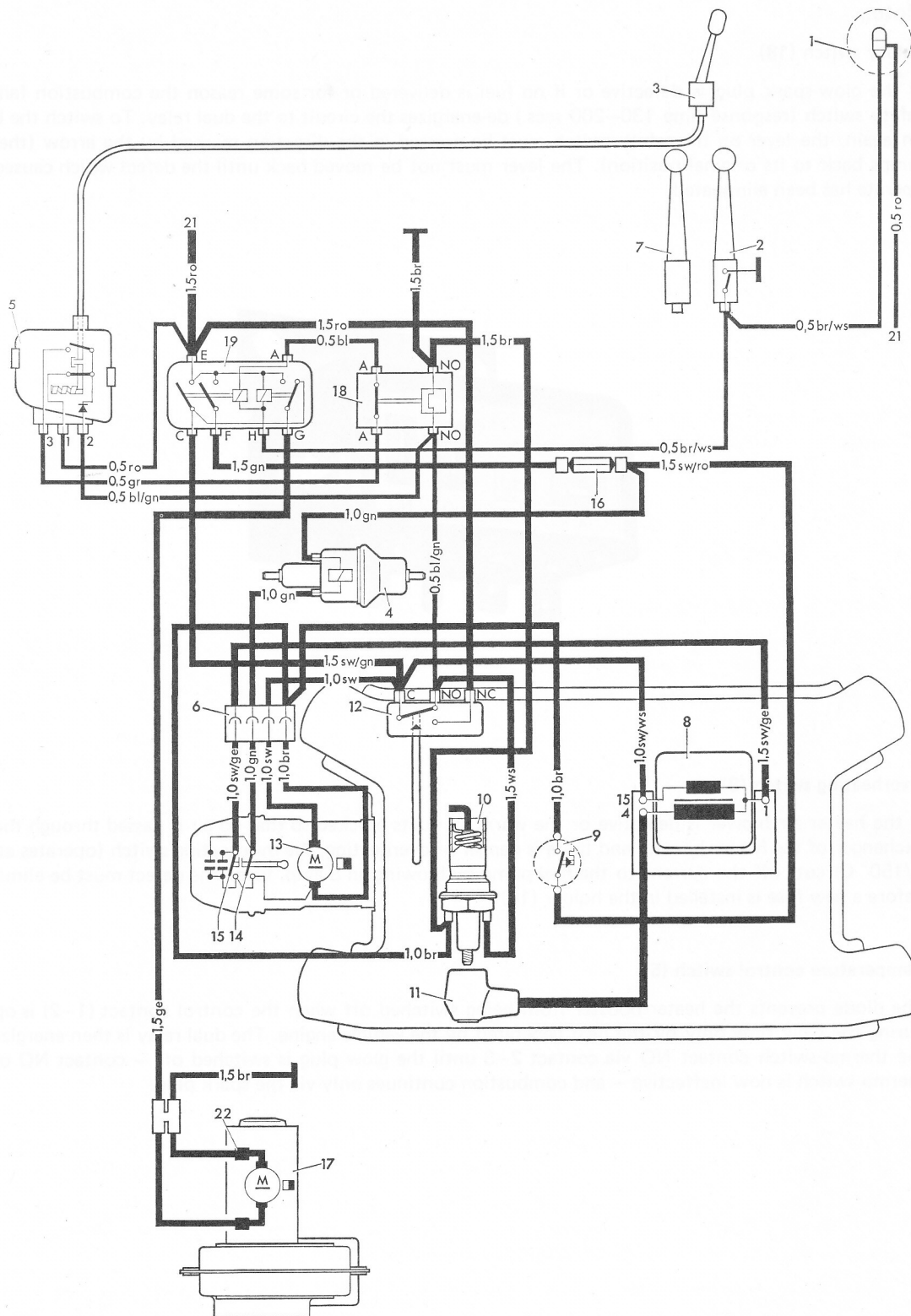
The bimetal spiral of the control switch protrudes into the muffler on the left under the rear seat and operates a contact via a cam when the temperature changes. This contact switches the fuel pump on and off via a relay depending on the pre-set temperature. The control range is variable between 95° and 257° F (35° and 125° C) and is dependent on the position of the thermostat control linkage. The linkage is operated by the heat output regulating lever via a bowden cable. The regulating lever also closes the cut-in contact of the operating relay at the same time.

- A — Electrical cable connections
- B — Bowden cable attachment
- C — Bimetal spiral



Fuel pump

The quantity of fuel delivered by the electromagnetically operated fuel pump depends solely on the speed of the combustion air blower. At every 33rd revolution of the blower shaft the fuel pump is given an impulse from a contact breaker so that the air/fuel mixture always remains constant irrespective of changes in combustion air blower speed.



Cable colors:

- | | | |
|-------------|------------|------------|
| ro – red | bl – blue | ws – white |
| sw – black | br – brown | gn – green |
| ge – yellow | gr – gray | |

-
- | | |
|--|--|
| 1 – Warning lamp | 11 – Angled connector and ignition cable |
| 2 – Main switch (heater flap lever) | 12 – Thermo-switch (run-on time 120–240 secs.) |
| 3 – Heat output regulating lever | 13 – Combustion air blower |
| 4 – Fuel pump | 14 – Contact breaker for pump |
| 5 – Temperature control switch
(range 95–257° F / 35–125° C) | 15 – Contact breaker for ignition |
| 6 – Push-on connection | 16 – 8 amp. overheating fuse |
| 7 – Lever for rear footwell | 17 – Heater air blower |
| 8 – Ignition coil | 18 – Safety switch (response time 130–200 secs.) |
| 9 – Overheating switch
(cut-in temperature approx. 302° F / 150° C) | 19 – Dual relay |
| 10 – Glow-spark plug | 21 – to terminal 30 of fuse box (16 amp. fuse). Some vehicles
have a 16 amp. fuse located on the left under the rear seat |
| | 23 – Suppression choke 4 μ H |

Note:

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

Explanation of wiring diagram

When lever (3) is operated and at the same time the contact in lever (2) closed, the dual relay (19) is energized via contact 1–3 of the temperature control switch (5) and contact A–A of the safety switch (18). The warning lamp (1) on the instrument panel immediately lights up (energized by the contact in lever 2).

The heater air and combustion air blowers (17 and 13), switched on via relay contacts E–G and E–C, begin to operate. The electrical fuel pump (4) is provided with voltage via relay contact E–F and via the short circuit fuse (16) and begins to pump fuel into the combustion chamber controlled by contact breaker (14) of the combustion air blower. The combustion air is swirled by the housing with vanes and forms a combustible mixture with the fuel. The glow element in the glow-spark plug (10) is provided with voltage via relay contact E–C and via the thermo-switch (12) – contact C–NO. The element heats up and pre-heats the air/fuel mixture.

At the same time as the glow-spark plug is energized, the ignition coil (8) also cuts in. The contact breaker (15) then breaks the primary circuit, as on the vehicle engine. The high tension of about 5000 volts induced in the secondary winding by this means passes to the glow-spark plug via an ignition cable with angled connector (11) and ignites the air/fuel mixture.

When the flame has sufficiently heated the feeler tube of the thermo-switch, contact C–NO of the thermo-switch opens, contact is then in position C–NC, and switches the glow-element off. The ignition system, however, continues to function.

When the temperature pre-set by the temperature control switch is attained, contact 1–2–3 cuts off the current to the relay. The relay is ineffective, the fuel pump is de-energized and combustion ceases.

The heater air blower remains in operation via contact E–G, as the relay winding E–H has not yet been de-energized. The combustion air blower remains in operation, energized via thermo-switch contact NC–C. In addition, the ignition system is also still supplied with voltage.

When the bimetal spiral of the temperature control switch cools down to below the pre-set temperature, the relay is energized again via contact 1–2–3 of the control switch and via contact A–A of the safety switch and closes. The fuel pump begins to operate and combustion recommences.

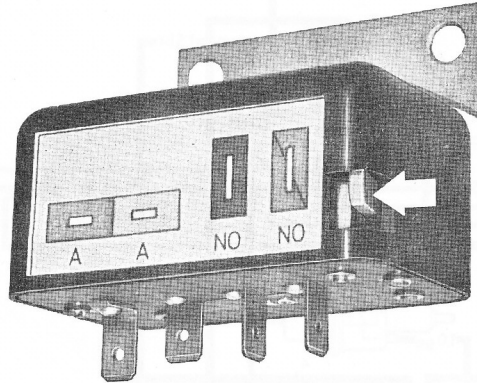
The heater remains on until the holding current of the relay is switched off by the contact in lever 2 (lever 2 far enough forward so that warning lamp goes out).

The heater air and combustion air blowers still receive voltage via thermo-switch contact NC–C and continue to run until the heater has cooled down and all traces of exhaust gas are emitted. (The contact in the thermo-switch is then in position C–NO again.)

Note:

Safety switch (18)

If the glow-spark plug is defective or if no fuel is delivered or for some reason the combustion fails, the safety switch (response time 130–200 secs.) de-energizes the circuit to the dual relay. To switch the heater on again, the lever on the safety switch must be pressed in the direction marked by the arrow (the lever jumps back to its original position). The lever must not be moved back until the defect which caused it to operate has been eliminated.



Overheating switch (9)

If the heater air blower is defective or the warm air ducts blocked so that no air is passed through the heat exchanger of the heater booster and there is danger of overheating, the overheating switch (operates at 302° F/150° C) cuts off the current to the fuel pump by blowing an 8 amp. fuse. The defect must be eliminated before a new fuse is installed in the holder (16).

Temperature control switch (5)

The diode prevents the heater booster from being switched off when the control contact (1–2) is opened during the glow time only by the heat generated by the vehicle engine. The dual relay is then energized by the thermo-switch contact NO via contact 2–3 until the glow plug is switched off – contact NO on the thermo-switch is now ineffective – and combustion continues only via the spark plug.

List of possible defects

By subjecting the heating system to a systematic test, it is possible to localize a defect. For this reason, trouble shooting should always be carried out in the sequence given in the instructions.

Pull heater flap lever right back and operate regulating lever

The following functional defects could occur:

- A – Heater does not work (see F 2.2/1–2)
- B – No warm air flow (see F 2.2/1–4)
- C – Heater smokes (see F 2.2/1–4)
- D – Heat output insufficient (see F 2.2/1–5)
- E – Heater goes out (see F 2.2/1–5)

In addition, the following can occur:

- F – Run-on does not switch off (see F 2.2/1–6)
- G – Heater does not work at low outside temperatures (see F 2.2/1–6)

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

F 2.2 Trouble Shooting and Testing Instructions

A – Heater does not work

First check the heater air and combustion air blowers visually to determine that they are operating, then check that the fuel pump is working (the pump ticks audibly). If these units are working, check the glow-spark plug (at the same time check whether fuel is pumped right into the heater – check at exhaust pipe).

Defective units should be repaired or replaced with new ones.

If, when carrying out this check, the heater does not work at all, check as follows:

Operation	Possible defect	Remedy
1 – Check all heating system units and warm air ducts as well as electrical connections for tightness, check exhaust system for damage	<ul style="list-style-type: none"> a – Reduction in cross section Exhaust pipe and warm air ducts loose b – Loose connection in electrical system 	<ul style="list-style-type: none"> a – Replace damaged parts with new ones b – Tighten loose push-on connections
2 – Check 16 amp. main fuse (no voltage at relay terminal E)	Short circuit in electrical system	Disconnect cables at relay terminals C, F and G. Install new fuse and reconnect cables individually. If fuse blows, check appropriate cables and units and replace if necessary
3 – Check 8 amp. overheating fuse for continuity with ohmmeter	<ul style="list-style-type: none"> a – Overheating due to failure of heater air blower b – Warm air duct blocked (fresh air and defroster vents or outlets in foot-well) c – Heater flaps closed 	<ul style="list-style-type: none"> a – Check heater air blower (see F 1.3/2–3) b – Check warm air duct for blockages c – Adjust heater flap cable (see F 2.9/1–2)
4 – Test battery voltage with heavy discharger		Charge battery (if necessary start vehicle engine)
5 – Disconnect cables at fuel pump so that no fuel is delivered during further tests		

Operation	Possible defect	Remedy
6 – Switch heating on. Disconnect cable at relay of terminal A, then reconnect cable (relay must be heard to work)	<ul style="list-style-type: none"> a – Safety switch has cut-in because of defect in fuel supply or in ignition system b – Temperature control switch defective (open circuit) c – Contact on heater flap lever does not close 	<ul style="list-style-type: none"> a – Switch safety switch on and eliminate defect if necessary (see F 2.3/1–3) b – Check cut-in and regulating contact (see F 1.3/1–4) c – Check contact
7 – Measure voltage at relay terminals C, F and G	If there is no voltage, relay is defective (open circuit)	Install new relay (see F 2.5/2–1)
8 – Check whether heater air blower blows air into vehicle interior	Radial blower wheel looses	Check heater air blower and repair or replace if necessary (see F 1.3/2–3 and F 2.8/2–2)
9 – Disconnect plug at combustion air blower and connect intermediate plug (see F 2.3/1–3), connect tachometer then read off speed (5,500–6,500 rpm at nominal voltage)	<ul style="list-style-type: none"> a – If speed too low, voltage drop in plug for combustion air blower motor or in relay b – Armature burnt, brushes worn c – Bearing or winding damage 	<ul style="list-style-type: none"> a – Test and install new relay if necessary b – Repair combustion air blower motor (see F 1.6/1–1) c – Replace combustion air blower motor (see F 1.5/1–2)
10 – Remove main fuse. Push heater flap lever fully forward. Unscrew glow-spark plug. Reconnect cables, install fuse and operate heater flap lever. Sparks must jump between electrode and casing and glow element must glow (see F 1.3/2–1)	<ul style="list-style-type: none"> a – Thermo-switch defective (no current, glow time too short) b – Glow element open c – Glow-spark plug dirty d – Ignition contact breaker defective or maladjusted e – Ignition coil or cable defective 	<ul style="list-style-type: none"> a – Install new thermo-switch (see F 1.5/2–1) b – Install new glow-spark plug (see F 1.5/2–2) c – Clean glow-spark plug (see F 1.3/2–1) d – Adjust contact breaker or fit new if necessary (see F 1.3/2–2) e – Test ignition system and install new parts if necessary
11 – Turn heater off, remove pump and measure delivery quantity (see F 1.3/2–4) 1.3 US pt./1 Imp. pt. (0.6 liter) equals approx. 10 cc/min. at 6,000 rpm of combustion air blower motor	<ul style="list-style-type: none"> a – Contact breaker defective or maladjusted b – Open circuit in pump winding c – Maladjustment d – Fuel hoses, filter or strainer blocked e – Valve does not open 	<ul style="list-style-type: none"> a – Check contact breaker, install new if necessary (see F 1.6/1–4) b – Install new pump (see F 2.5/2–3) c – Correct adjustment (see F 1.3/2–4) d – Clean parts e – Fit new valve guide Readjust delivery quantity (see F 1.7/1–2 and F 1.7/2–1)

B – No warm air flow into vehicle interior

(Heater air and combustion air blowers operate, fuel pump ticks)

Operation	Possible defect	Remedy
1 – Check warm air duct from heater to body for tightness	Clips loose and hoses detached or damaged	Secure loose parts, replace damaged parts with new ones (see F 2.4/1–1)
2 – Loosen hose clip, disconnect hose to heater briefly (2 secs.) at fuel pump (first pinch hose), then check whether fuel is delivered by pump. Catch escaping fuel in a cloth	a – Check fuel supply b – Filter blocked c – Strainer dirty d – Valve guide blocked	a – Fill fuel tank b – Install new filter (see F 2.5/2–4) c – Clean strainer d – Replace valve guide and readjust delivery quantity (see F 1.3/2–4)
3 – Switch heater off. Remove glow-spark plug and check (see F 1.3/2–1)	a – Thermo-switch defective (no current, glow time too short) b – Glow element open c – Glow-spark plug dirty d – Ignition contact breaker defective or maladjusted e – Ignition coil or cable defective	a – Install new thermo-switch (see F 1.5/2–1) b – Install new glow-spark plug (see F 1.5/2–2) c – Clean glow-spark plug d – Adjust contact breaker or fit new if necessary (see F 1.3/2–2) e – Test and replace defective parts if necessary

C – Heater smokes

Operation	Possible defect	Remedy
1 – Check exhaust pipe and exhaust pipe cap for damage (cross section reduced)	a – Mechanical damage b – Partially blocked	a – Install new exhaust pipe b – Clean exhaust pipe and exhaust pipe cap
2 – Check delivery quantity of fuel pump	Excessive fuel	Correctly adjust delivery quantity (see F 1.3/2–4)
3 – Check combustion air intake for free passage (visual check)	Intake blocked	Clean combustion air intake
4 – Check combustion air blower motor speed (see F 2.3/1–3)	a – Battery voltage too low b – Radial blower wheel loose (chafes) c – Speed is not attained at nominal voltage (5,500–6,500 rpm)	a – Charge battery or start engine b – Remove combustion air blower, secure radial blower wheel (note air gap of .039 in./1 mm) and install new blower wheel if necessary (see F 1.6/1–5) c – Remove combustion air blower motor and check, install new one if necessary (see F 1.5/1–2)

D – Heat output insufficient

Operation	Possible defect	Remedy
1 – Check delivery quantity of fuel pump (see F 1.3/2–4)	a – Delivery quantity too small b – Filter blocked c – Strainer dirty d – Valve guide blocked	a – Adjust delivery quantity (see F 1.3/2–4) b – Install new filter (see F 2.5/2–4) c – Clean d – Install new valve guide (see F 1.7/1–2 and F 1.7/2–1)
2 – Remove and test temperature control switch (see F 1.3/1–4 and F 2.5/2–1)	a – Bimetal spiral preload maladjusted b – Control contact cuts out too early	a, b – Install new temperature control switch (see F 2.5/2–1)
3 – Check adjustment of heater flaps on engine heat exchanger	Bowden cable adjustment not correct	Adjust (see F 2.9/1–1)
4 – Non-return flaps in elbow between fan housing and exhaust muffler stiff or jammed	Wrongly installed	Check flaps, replace if necessary (see F 2.8/1–1)

E – Heater goes out

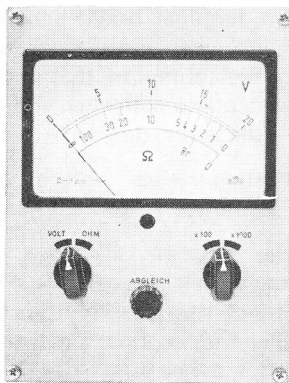
Operation	Possible defect	Remedy
1 – Check electrical connections for tightness	Loose connection	Check connections and secure
2 – Check exhaust pipe for obstructions	Exhaust pipe and exhaust pipe cap partially blocked	Clean exhaust pipe (pay attention to water drain hole) and, if necessary, install new one
3 – Remove temperature control switch and check regulating contact (see F 2.5/2–1 and F 1.3/1–4)	Regulating contact sticks (does not cut in again)	Install new temperature control switch (see F 2.5/2–1)
4 – Check cut-in time of glow element in glow-spark plug (at least 70 secs. at nominal voltage and 68° F (20° C) ambient temperature)	Thermo-switch defective (glow time too short)	Install new thermo-switch (see F 1.5/2–1)
5 – Check delivery quantity of fuel pump (see F 1.3/2–4)	Delivery quantity too small due to a – Maladjustment b – Filter dirty c – Strainer blocked d – Valve guide dirty	a – Correct adjustment (see F 1.3/2–4) b – Install new filter c – Clean strainer d – Install new valve guide

F – Run-on does not switch off

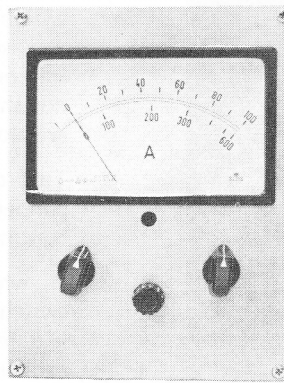
Operation	Possible defect	Remedy
Turn heater on with engine cold and let it run for 5 mins. Start stop watch and turn heater off. Check run-on time. Should be 120–240 secs.	Thermo-switch defective, contact sticks	Install new thermo-switch (see F 1.5/2–1)
With heater switched off, there should be no voltage at temperature control switch terminal 2 and 3.	Diode defective, has continuity.	Install new temperature control switch (see F 2.5/2–1)

G – Heater does not work at low outside temperatures

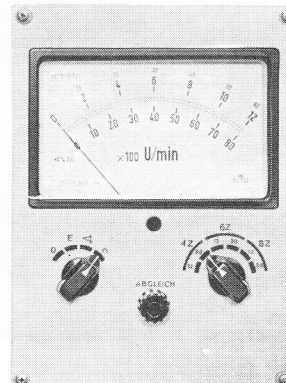
Operation	Possible defect	Remedy
1 – Measure battery voltage	Battery dead	Recharge battery
2 – Check fuel pump delivery quantity (see F 1.3/2–4)	Quantity too small due to a – Maladjustment b – Filter dirty c – Strainer blocked d – Valve guide dirty e – Combustion air blower motor speed too low	a – Correct adjustment (see F 1.3/2–4) b – Install new filter c – Clean strainer d – Install new valve guide e – Measure speed (see F 2.3/1–3); repair motor if necessary
3 – Remove glow-spark plug and check glow element	Glow element open	Install new glow-spark plug (see F 1.5/2–2)
4 – Connect voltmeter to terminal NO of safety switch and to ground, then turn heater on with engine cold. Voltage must be held for at least 70 secs.	Thermo-switch defective (cut-in time too short)	Install new thermo-switch (see F 1.5/2–1)



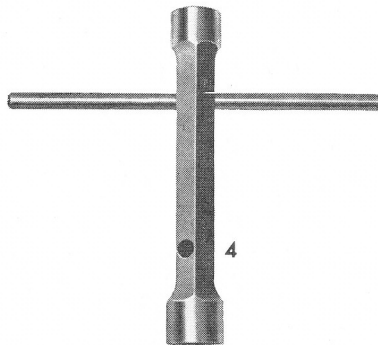
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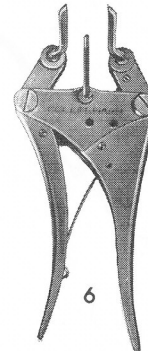
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4



5



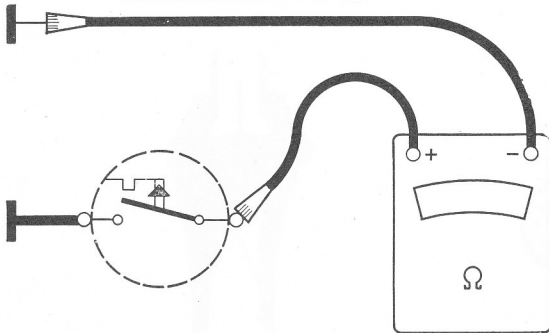
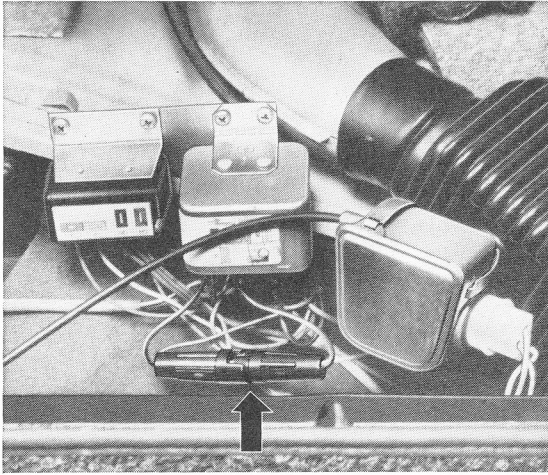
6

No.	Designation	Special tool	Remarks
1	Ohmmeter / voltmeter		range 0–20 volts
2	Ammeter		range 0–20 amps.
3	Tachometer		0–8000 rpm
4	Box wrench		22 mm A/F
5	Stop watch		
6	Three-pin spreader pliers		normal

Testing overheating switch (installed)

If the 8 amp. overheating fuse has blown, check that the overheating switch has moved to its original position before a new fuse is installed.

- 1 – Disconnect black-red cable to overheating switch from terminal bridge (on left under rear seat) and green cable from fuel pump (disconnect fuel pump so that continuity is not shown via pump coil when contact points are closed – see wiring diagram –).
- 2 – Test overheating switch with an ohmmeter connected as shown. The switch must have no continuity.
- 3 – If, when the heater is cold, the overheating switch makes contact (continuity), the switch is defective and a new one, together with new cable harness, must be installed.

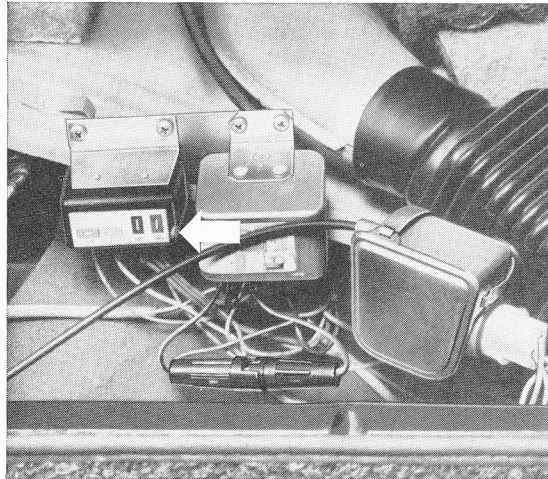


Testing ignition coil

- 1 – Disconnect cables from fuel pump and from glow-spark plug.
- 2 – Install a .16 in. (4 mm) diameter screw in the angled connector of the ignition cable.
- 3 – Turn heater on. When screw is held at a distance of .28 in. (7 mm) from suitable ground, a continuous spark must jump across the gap. (Hold ignition cable with insulated pliers).

Checking safety switch

- 1 – Disconnect cables at fuel pump and glow element of glow-spark plug.
- 2 – Turn heater on. After about 130–200 seconds (at nominal voltage and about 68° F/20° C ambient temperature), the safety switch should break the circuit to the relay (contact A).
- 3 – If the safety switch has operated within the required time, press lever on safety switch in direction of arrow and turn heater on again after cables for pump and glow-spark plug have been reconnected.

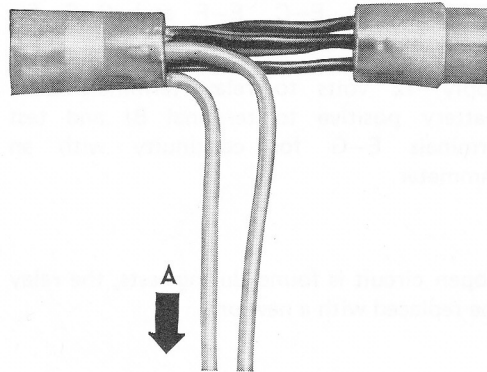


Testing combustion air blower

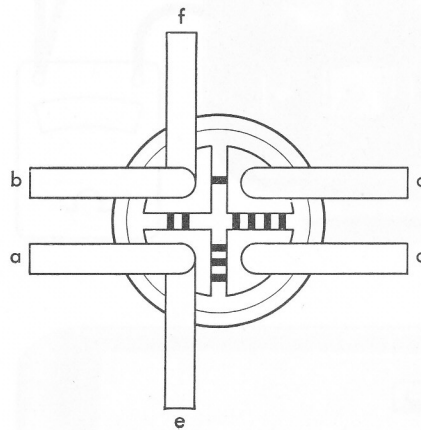
(measuring speed)

Note:

We recommend that an intermediate connector be made (see illustration) for measuring the speed. The cables must be soldered to the terminal pins and sleeves and must be located in the terminal sleeve housing according to the markings.



A = to tachometer

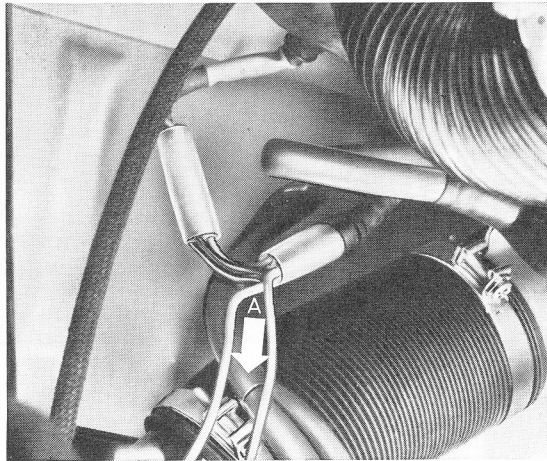


Qty.	Designation	Part no.	Cable color/length	
1	Terminal pin housing	411 963 225	a = sw (black) 1.57 in. (40 mm)	} between terminal pin housing and terminal sleeve housing
1	Terminal sleeve housing	411 963 253	b = sw/ge (black/yellow) 1.57 in. (40 mm)	
4	Terminal pin	411 971 953	c = gn (green) 1.57 in. (40 mm)	
4	Terminal sleeve	411 971 955	d = br (brown) 1.57 in. (40 mm)	
			e = sw (black) 39.37 in. (1000 mm)	} to tachometer
			f = sw/ge (black/yellow) 39.37 in. (1000 mm)	

F2.3

Checking Parts and Adjusting If Necessary

- 1 – Remove rubber grommet on blower plug with three-pin spreader pliers and disconnect plug.
- 2 – Connect intermediate connector (push terminal pin housing of intermediate connector into terminal sleeve housing of cable harness and terminal sleeve housing into terminal pin housing of cable harness to combustion air blower).

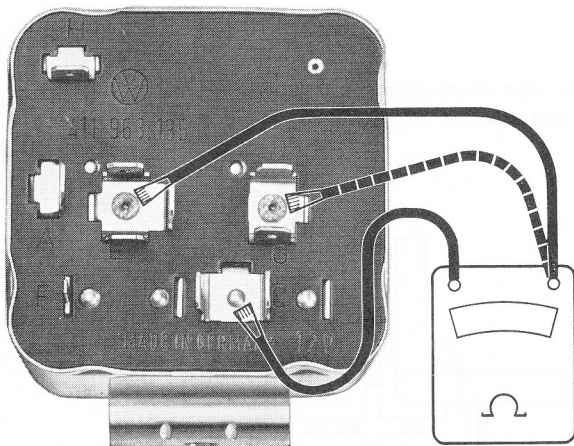


3 – Connect tachometer (see illustration) and switch heater on.

4 – At a working voltage of 12 volts, speed should be between 5,500 and 6,500 rpm. If speed deviates considerably, remove combustion air blower and test it.

5 – When reconnecting blower plug, install rubber grommet and ensure that it seals properly.

A – to tachometer

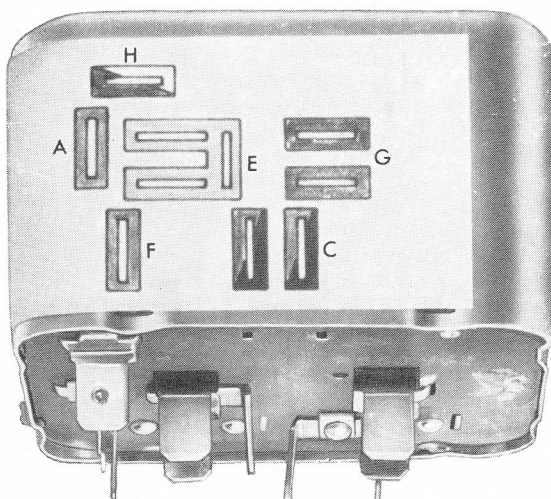


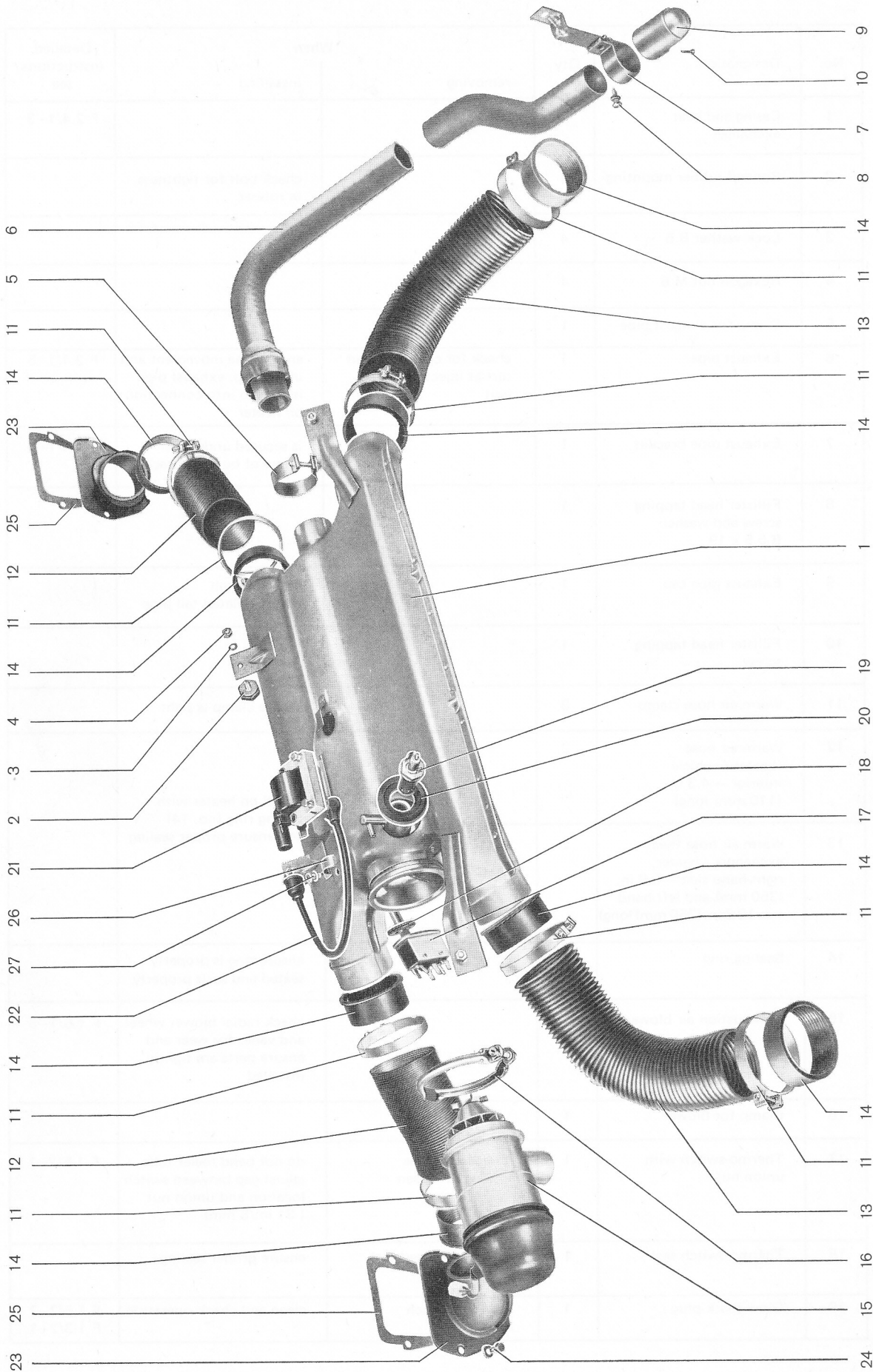
Testing dual relay

- 1 – Remove 16 amp. heater fuse from fuse box.
- 2 – Remove bracket and relay located on left under rear seat (the bracket screw only needs backing off) and disconnect cables.
- 3 – Apply 12 volts to relay terminals A–H and test terminals E–C, E–F and C–G for continuity with an ohmmeter.
- 4 – Apply 12 volts to relay terminals E–H (battery positive to terminal B) and test terminals E–G for continuity with an ohmmeter.

Note:

If an open circuit is found during tests, the relay must be replaced with a new one.





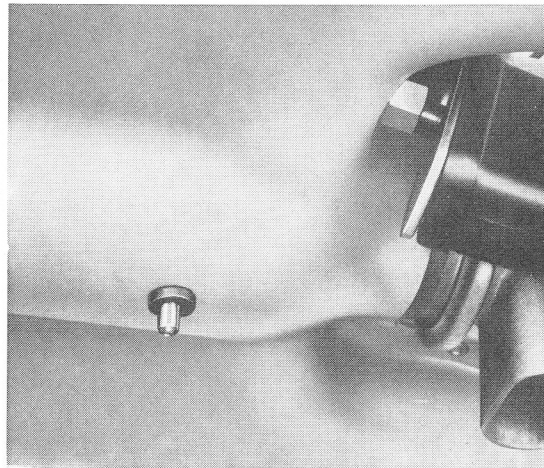
F2.4 Heater and Warm Air Ducts

No	Designation	Qty.	When		Detailed instructions see
			removing	installing	
1	Casing and heat exchanger	1			F 2.4/1-3
2	Bonded rubber mounting	4		check bolt for tightness in rubber	
3	Lock washer B 6	4			
4	Hexagon nut M 6	4			
5	Clamp for exhaust pipe	1			
6	Exhaust pipe	1	check for corrosion and dirt at injector and at exit	ensure free movement and install cap; exhaust pipe is pushed into connection on heater	F 2.4/1-5
7	Exhaust pipe bracket	1		is secured under rear screw of bumper bracket	F 2.4/1-5
8	Fillister head tapping screw and washer B 5.5 x 19	1			
9	Exhaust pipe cap	1		do not install chrome-plated tail pipe	
10	Fillister head tapping screw	1			
11	Warm air hose clamp	8		ensure clamp is tight	
12	Warm air hose (heater / vehicle interior - 4.3 in. (110 mm) long)	2		install on heater with sealing ring (no. 14) and ensure proper sealing	
13	Warm air hose (heat exchanger / heater, right-hand side - 9.8 in. (250 mm) and left-hand side 13.8 in. (350 mm) long)	2			
14	Sealing ring	8		ensure ring is properly seated and seals properly	
15	Combustion air blower	1		check radial blower wheel and vanes for wear and ensure parts are tightly installed	F 1.6/1-5
16	Clamp for blower	1			
17	Thermo-switch with union nut	1	if necessary, use solvent to loosen	do not bend feeler tube, adjust gap between switch location and union nut (.31 in./8 mm)	F 1.5/2-1
18	Thermo-switch seal	1	replace damaged seal with new one	ensure proper sealing	
19	Glow-spark plug	1	use box wrench 22 mm A/F	clean and check operation	F 1.5/2-2 F 1.3/2-1

No.	Designation	Qty.	When		Detailed instructions see
			removing	installing	
20	Plug bush seal	1	replace damaged seal with new one	ensure proper sealing	
21	Ignition coil	1			F 1.5/1 - 1
22	Ignition cable	1			
23	Flange and warm air pipe	2		apply D 17 sealing compound between flange and warm air pipe	
24	Hexagon head screw and washer for flange	6			
25	Flange seal	2			
26	Cable harness clamp	1			
27	Screw and spring washer	1			

Note:

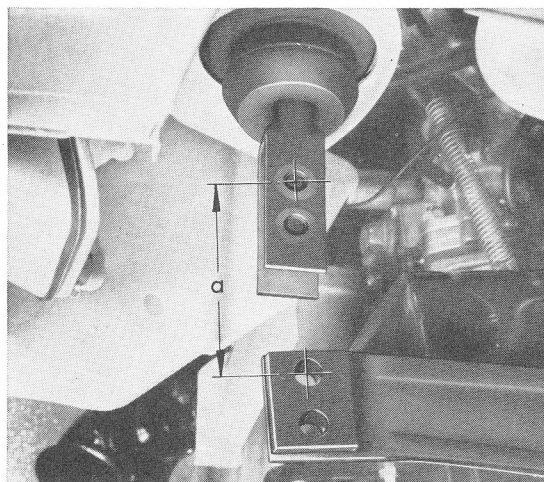
Ensure overflow pipe is clean and that seal seals properly



Removing and installing casing and heat exchanger

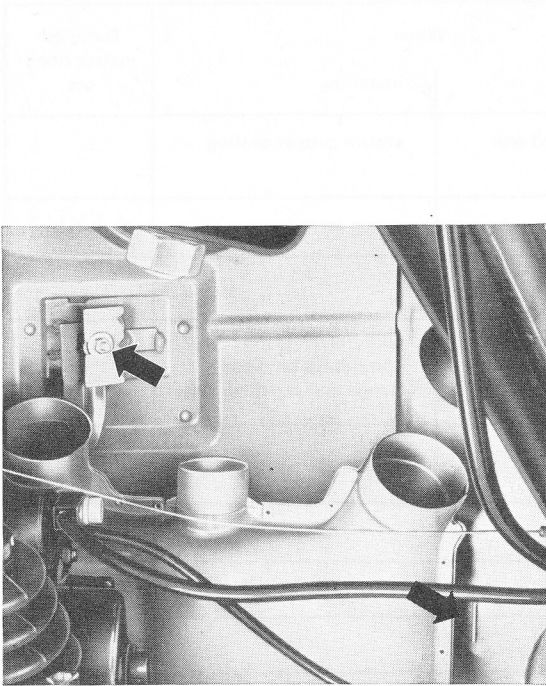
Removing

- 1 – Disconnect battery ground strap and disconnect cables to heater at dual relay and safety switch.
- 2 – Remove left rear wheel, shock absorber and spring plate stop.
- 3 – Take heater air blower and bellows off vehicle engine.
- 4 – Position trolley jack with VW 612/2 under engine, detach engine carrier on left-hand side and drop engine approx. $a = 2.8$ in. (70 mm).

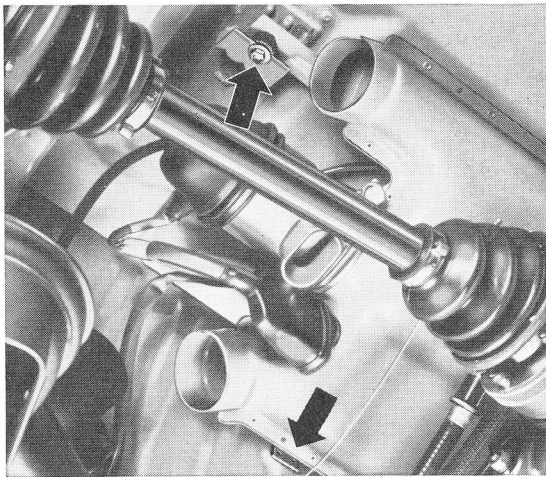


F2.4

Heater and Warm Air Ducts



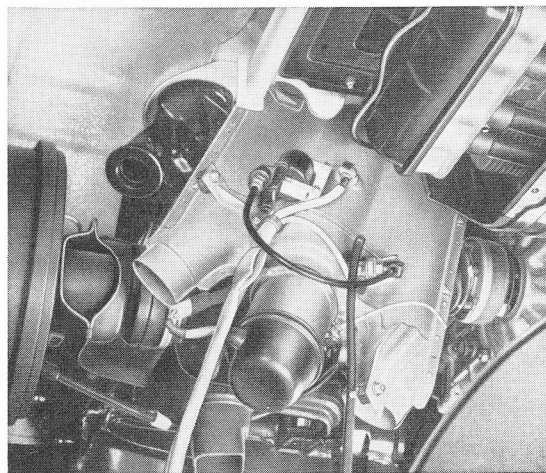
5 – Remove screws and clamps on left-hand engine heat exchanger. Bend engine carrier forward (with tire lever) and take heat exchanger out. **Reattach engine carrier.**



6 – Detach warm air hoses and exhaust pipe from heater.

7 – Detach fuel hose at pump and close with plug. (Catch escaping fuel).

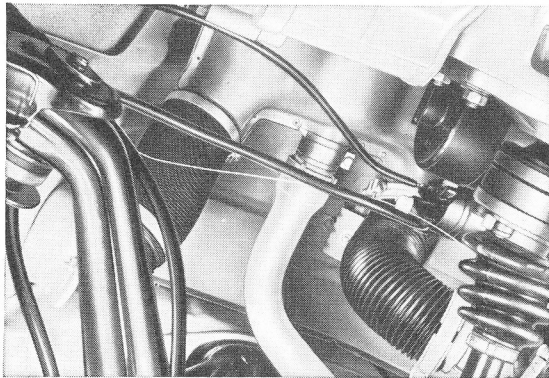
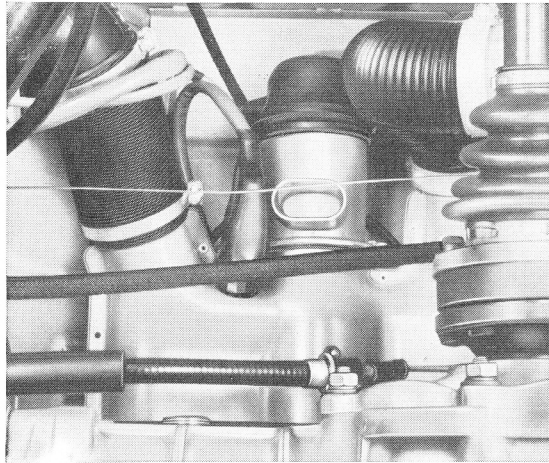
8 – Remove four nuts and lock washers from the welded-on brackets on luggage compartment floor (arrows).



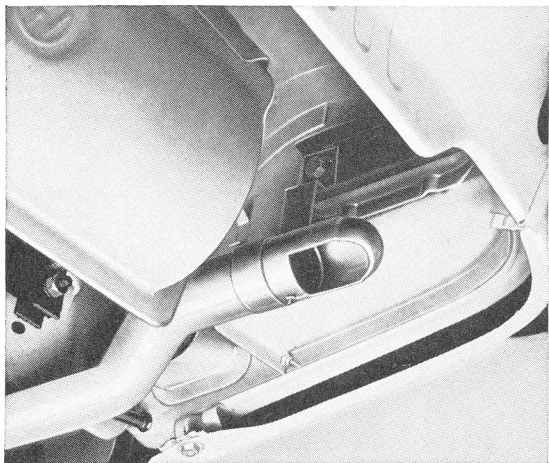
9 – Take heater out downward toward the left (over the half shaft toward rear).

Installing

- 1 – First insert heater and bonded rubber mountings into front and then into rear brackets on luggage compartment floor. Secure with lock washers and nuts.
- 2 – Route fuel hose over cross tube and connect to pump.
- 3 – Secure warm air hoses and sealing rings with clamps. Ensure that sealing rings seal properly.
- 4 – Route cable harness through grommet (beside left warm air pipe) to relays. Connect cables to pump.



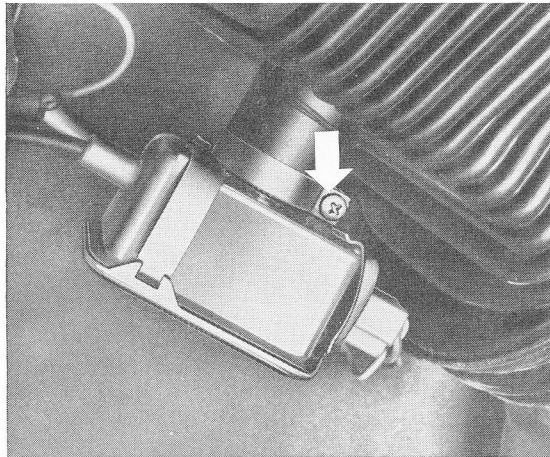
- 5 – Secure exhaust pipe to heater and at rear bracket.
- 6 – Lower vehicle and secure heat exchanger. Then guide engine carrier into bonded rubber mounting and secure hexagon bolts with new self-locking nuts (torque to 18 lb. ft./2.5 mkg) and lock washers.
- 7 – Reinstall shock absorber and spring plate rubber stop. Reinstall rear wheel (note torque).
- 8 – Install heater air blower and bellows.
- 9 – Connect cables to relays, connect battery and check operation of heater.



Removing and installing temperature control switch

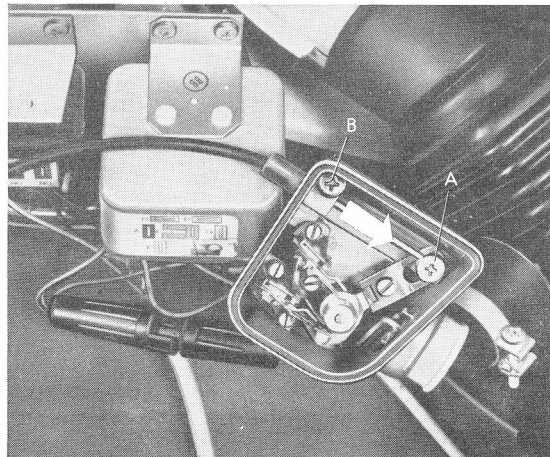
Removing

- 1 – Disconnect battery ground cable.
- 2 – Remove plug.
- 3 – Loosen clamp (arrow) and pull temperature control switch out of muffler.
- 4 – Lever springs off with screwdriver and take cover off.
- 5 – Back off screw (A) on thermostat control linkage and bowden cable screw (B), then pull bowden cable out.

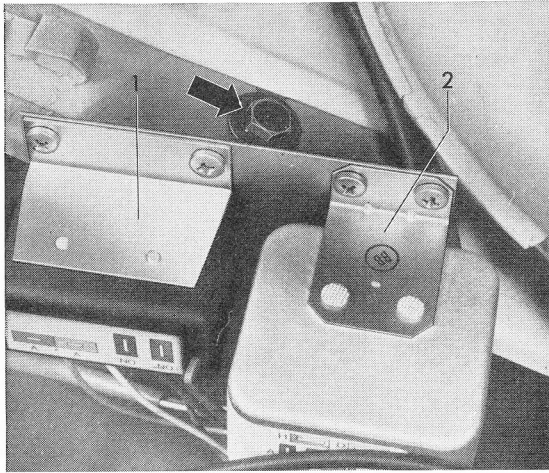


Installing

- 1 – Push regulating lever to the right as far as possible and insert bowden cable into temperature control switch. Push thermostat control linkage up to stop (arrow) and secure cable with screw (A). The bowden cable must have approximately the same bend as it has when installed. Clamp bowden cable with screw (B).
- 2 – Secure cover, ensuring that the seal is properly seated.
- 3 – Push plug and cables into socket.
- 4 – Insert temperature control switch into muffler (make sure groove in connection of muffler engages projection in temperature control switch) and secure with clamp.



Removing and installing dual relay and safety switch



Removing

- 1 – Disconnect battery ground strap from negative terminal.
- 2 – Remove relay bracket screw (arrow) and take bracket and relay out.
- 3 – Disconnect cables of defective relay and remove relay from bracket.

Installing

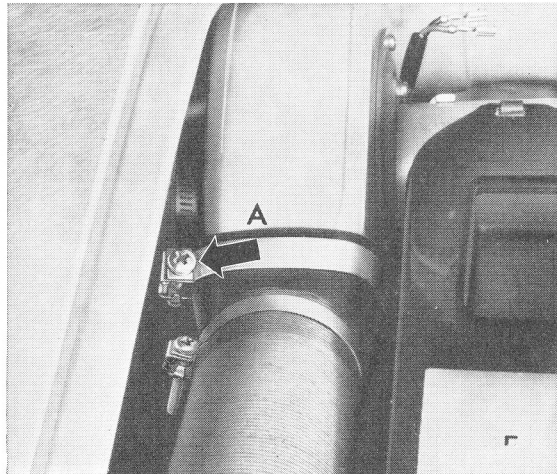
When installing, ensure that cables are connected according to wiring diagram.

- 1 – Safety switch
- 2 – Dual relay

Heater air blower

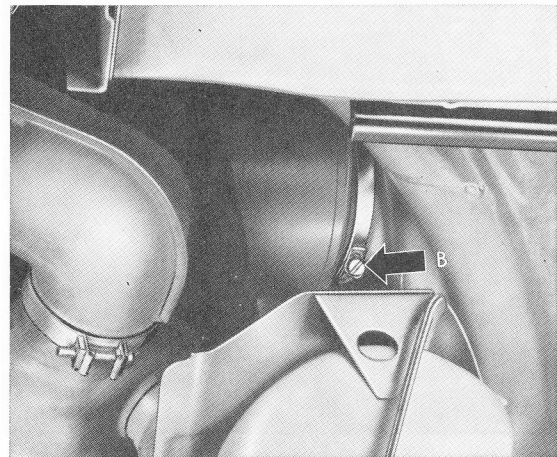
Removing

- 1 – Remove engine ignition coil and disconnect cables.
- 2 – Loosen clamp for securing branch pipe (arrow A) to blower and remove branch pipe and warm air hoses.
- 3 – From below, loosen clamp for securing blower (arrow B) in rear air deflector plate and take blower out.



Installing

- 1 – Insert heater air blower into connection without damaging rubber ring.
- 2 – Push branch pipe onto blower connection and secure.
- 3 – Turn blower in connection so that upper exit (hose to right-hand heat exchanger) of branch pipe is horizontal. Then secure blower (arrow B).
- 4 – Install ignition coil and connect cables (note cable colors).



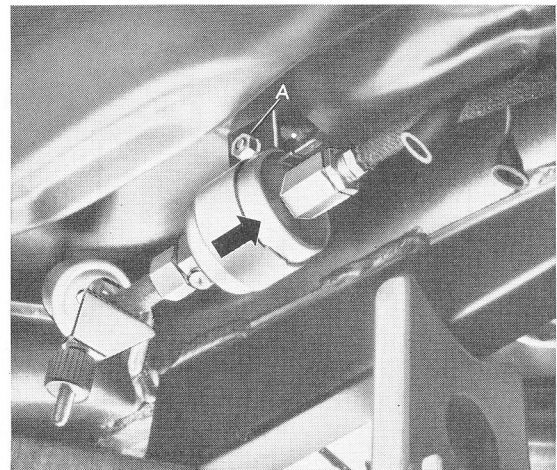
Note:

If the cables are installed in reverse order, the rotational direction of the blower motor is altered.

Fuel pump

Removing

- 1 – Disconnect cables, detach suction and pressure lines and close them with fuel hose clamp.
- 2 – Loosen clamp nut (A) and pull pump out toward front (arrow).



Installing

- 1 – Insert fuel pump into clamp and tighten nut. (Pay attention to flow direction of pump, bleeder screw is on filter end.)
- 2 – Connect suction and pressure lines and electric cables. Ensure that the caps on the pump terminal tabs are correctly installed.

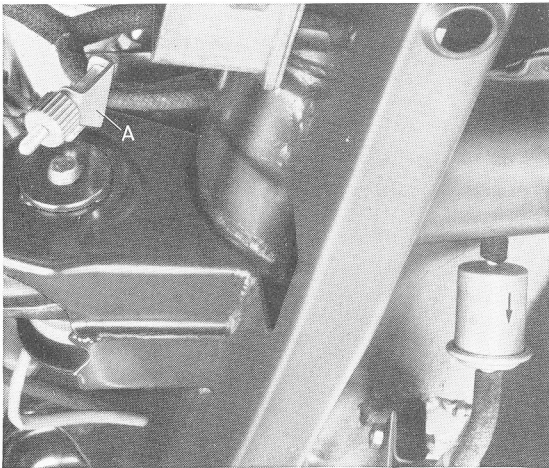
Filter

Removing

- 1 – Pinch fuel hose between filter and T-piece (in the vehicle engine fuel line) (A).
- 2 – Detach fuel hoses from filter. Catch any escaping fuel.

Installing

When installing, ensure that the arrow denoting the direction of flow of fuel faces the pump.



Warning lamp

Removing

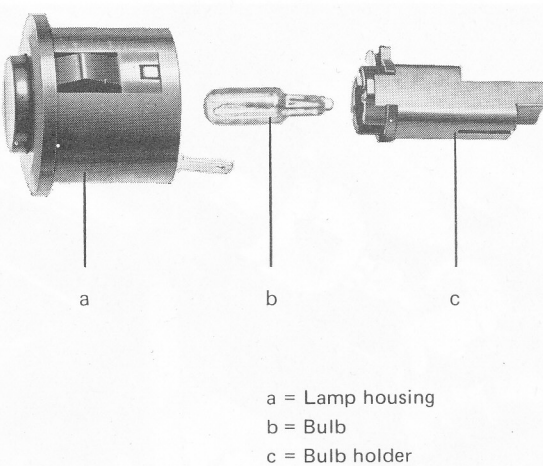
- 1 – Take 16 amp. main fuse out of fuse box.
- 2 – Reach behind instrument panel, turn bulb holder in lamp housing to left and pull out. Take bulb out.

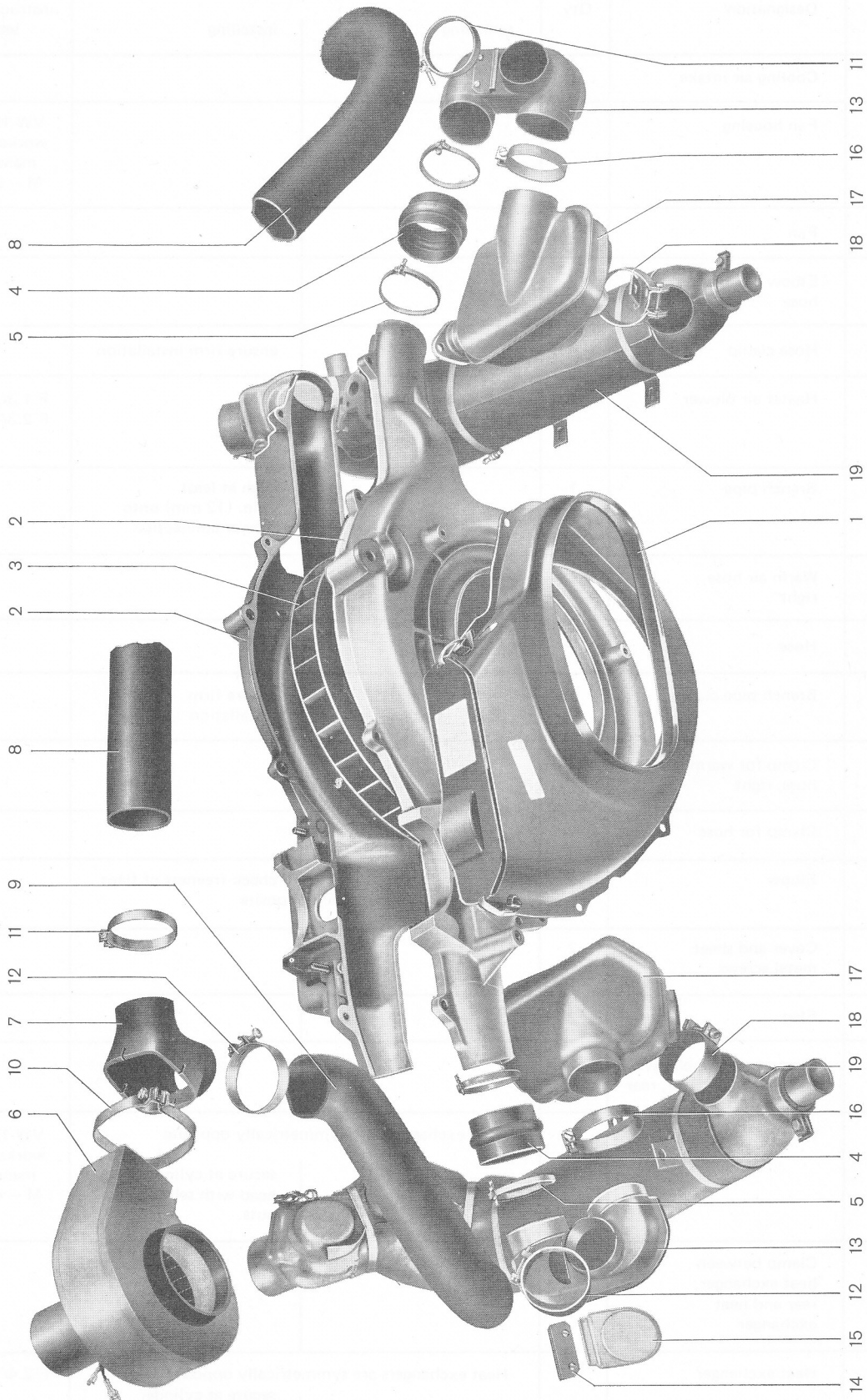
Installing

Push bulb into holder and insert holder into lamp. Turn holder and bulb clockwise.

Note:

To remove warning lamp, press retaining springs together and push lamp out toward vehicle interior.

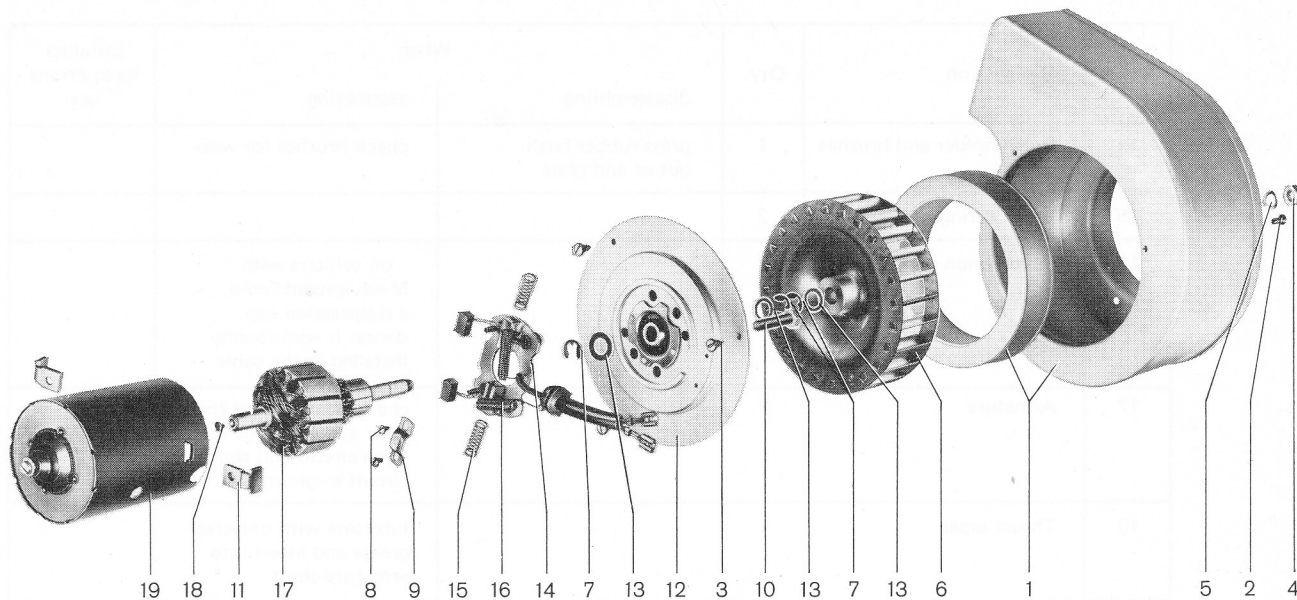




F2.8

Heater Air Blower and Warm Air Ducts / Heat Exchangers

No.	Designation	Qty.	When		Detailed instructions see
			removing	installing	
1	Cooling air intake	1			
2	Fan housing	1			VW 1500 workshop manual M – 5/3
3	Fan	1			
4	Elbow connecting hose	2			
5	Hose clamp	4		ensure firm installation	
6	Heater air blower	1	first remove ignition coil and then loosen clamp from below		F 1.3/2–3 F 2.3/2–3
7	Branch pipe	1		push at least .5 in. (12 mm) onto blower connection	
8	Warm air hose, right	1			
9	Hose	1			
10	Branch pipe clamp	1		ensure firm installation	
11	Clamp for warm air hose, right	2			
12	Clamp for hose	2			
13	Elbow	2		check freeness of flaps Elbows are symmetrically opposite	
14	Cover and sheet metal screws	2			
15	Flap	2			
16	Clamp between elbow and heat exchanger, rear	2			
17	Heat exchanger, rear	2	Heat exchangers are symmetrically opposite	secure at cylinder head with self-locking nuts	VW 1500 workshop manual M – 4/3
18	Clamp between heat exchanger, rear and heat exchanger	2			
19	Heat exchanger	2	Heat exchangers are symmetrically opposite	secure at cylinder head with self-locking nuts	F 2.4/1–4



No.	Designation	Qty.	When		Detailed instructions see
			disassembling	assembling	
1	Housing and air deflector ring	1		gap between radial blower wheel and air deflector ring = .02 in. (0.5 mm). If necessary, secure rubber ring with weatherstrip adhesive D 21	F 2.5/2-3
2	Fillister head screw	3			
3	Screw	3			
4	Hexagon nut	1	first remove housing	hold radial blower wheel	
5	Washer	1			
6	Radial blower wheel	1	check vanes for damage, note and mark relative position of wheel to shaft	note gap (.02 in./0.5 mm) between wheel and air deflector ring	
7	C-washer	3			
8	Screw	2			
9	Clamp	1			
10	Cheese head screw	2		seal with paint	
11	Attaching bracket	2		outer arm faces radial blower wheel	
12	End plate	1	mark position of pole housing to end plate	lubricate bearing with universal grease	
13	Washers	x	note quantity of washers		

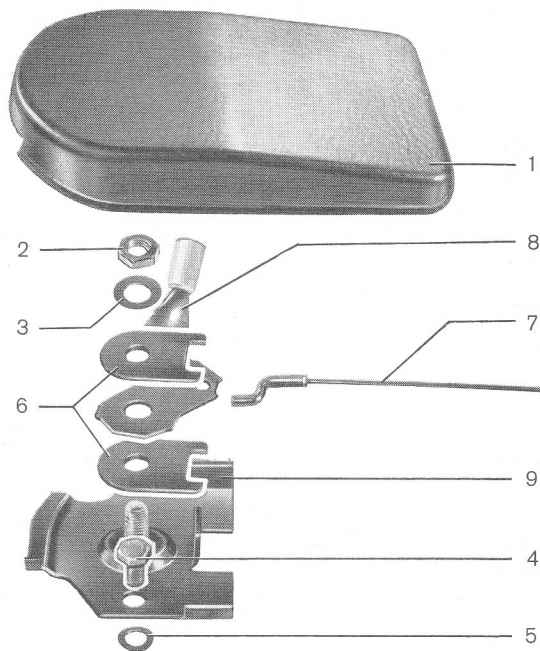
F2.8

Heater Air Blower and Warm Air Ducts / Heat Exchangers

No.	Designation	Qty.	When		Detailed instructions see
			disassembling	assembling	
14	Brush holder and brushes	1	press rubber bush out of end plate	check brushes for wear	
15	Brush spring	2			
16	Suppression choke 4 μ H	2		on vehicles with M-equipment radio, a suppression condenser is additionally installed in the cable	
17	Armature	1		check commutator for wear and windings for open circuit and short circuit to ground	
18	Thrust taper	1		lubricate with universal grease and insert into armature shaft	
19	Pole housing	1		lubricate bearing with universal grease	

Note:

Instructions for repairing and adjusting cables for heater flaps on heat exchangers and for footwell heating are given in the VW 1500 workshop manual on pages A-17/1-6. The contact on the heater flap lever is described on page F 1.9/1-1.



Removing and installing regulating lever

No.	Designation	Qty.	When		Detailed instructions see
			removing	installing	
1	Cap	1		engage in projections on support	
2	Hexagon nut	1		tighten so that regulating lever can be easily operated	
3	Dished washer	1			
4	M 6 screw	1			
5	Spring washer	1			
6	Friction washer	2			
7	Cable	1		cable has plastic sheathing; do not lubricate when installing	F 1.3/1-4
8	Regulating lever	1			
9	Support	1			