

Service Manual

Repairs and maintenance

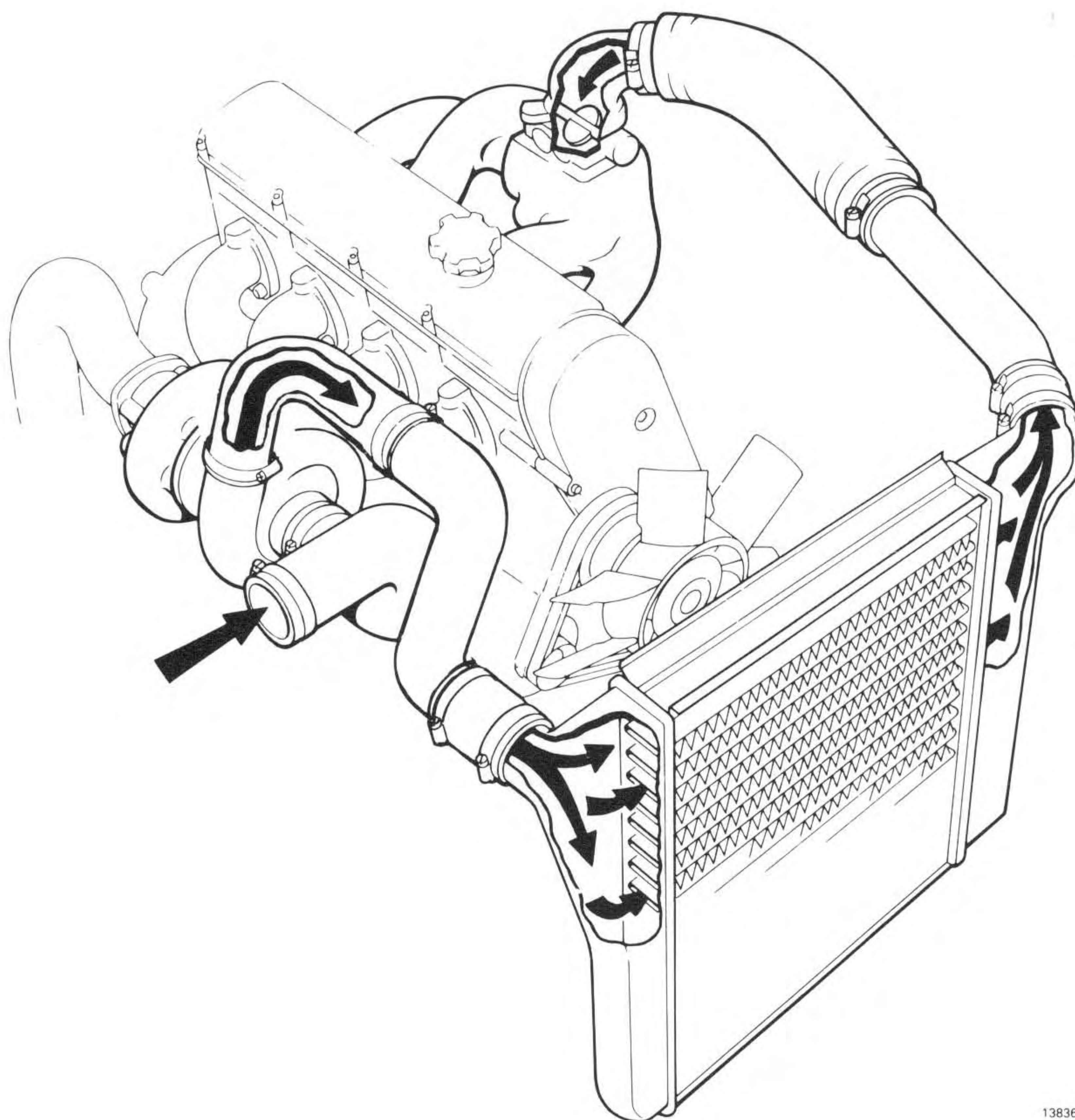
Section 2

B21FT
Intercooler

240 1984

Preliminary edition

VOLVO



138364

B21 FT intercooler:

- USA and Canada only
- Supersedes early versions of B 21 FT
- Introduced in spring 1984

Volvos are sold in versions adapted for different markets. These adaptations depend on many factors including legal, taxation and market requirements.

This manual may therefore show illustrations and text which do not apply to cars in your country.

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Repairs and maintenance

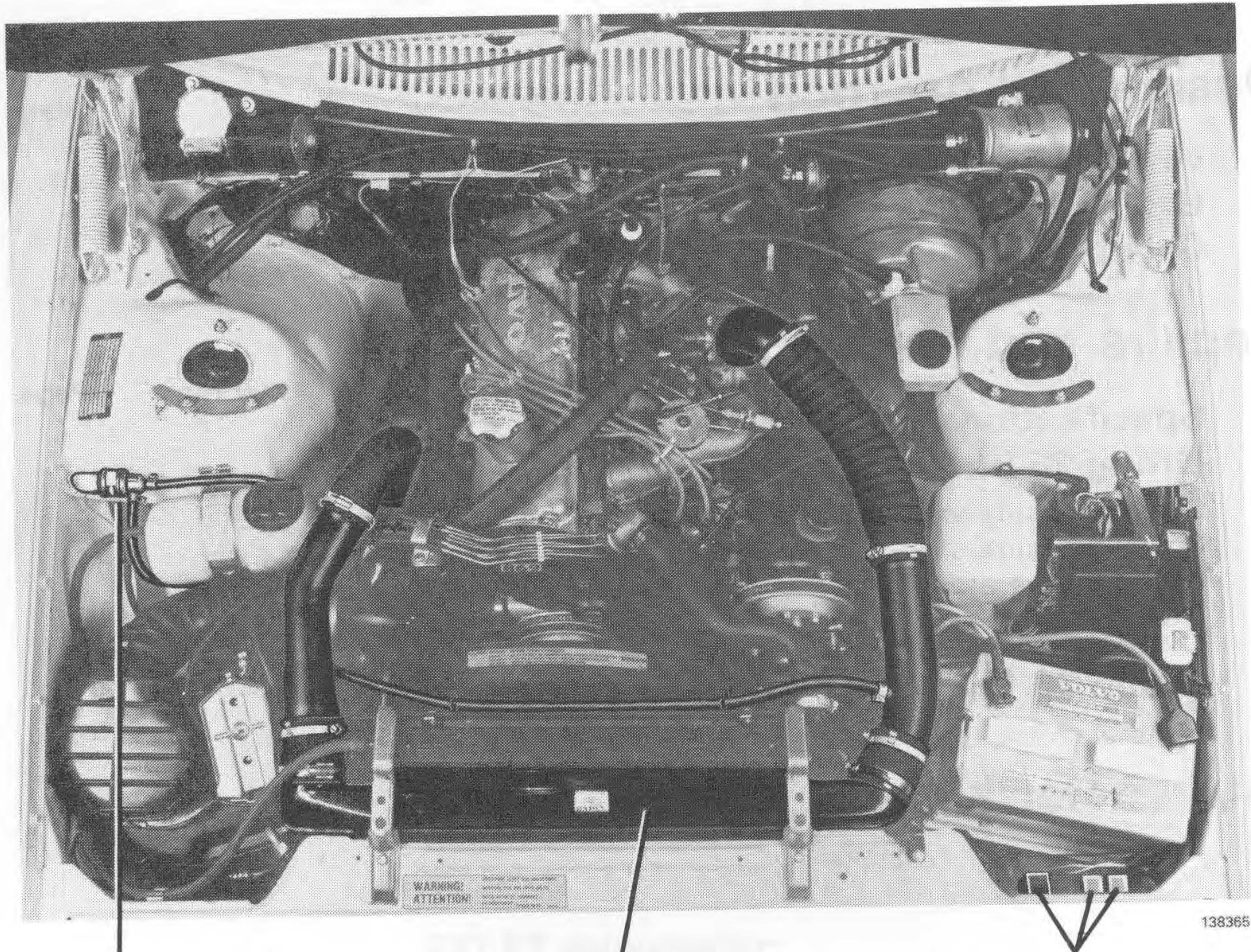
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Order number: TP 30685/2

We reserve the right to make alterations without prior notification

Design and Function

Group 20 General



Solenoid valve,
charge pressure

Intercooler

Relays:
– engine rpm relay
– electric cooling fan relay
– relay, disengaging
AC compressor

New car features

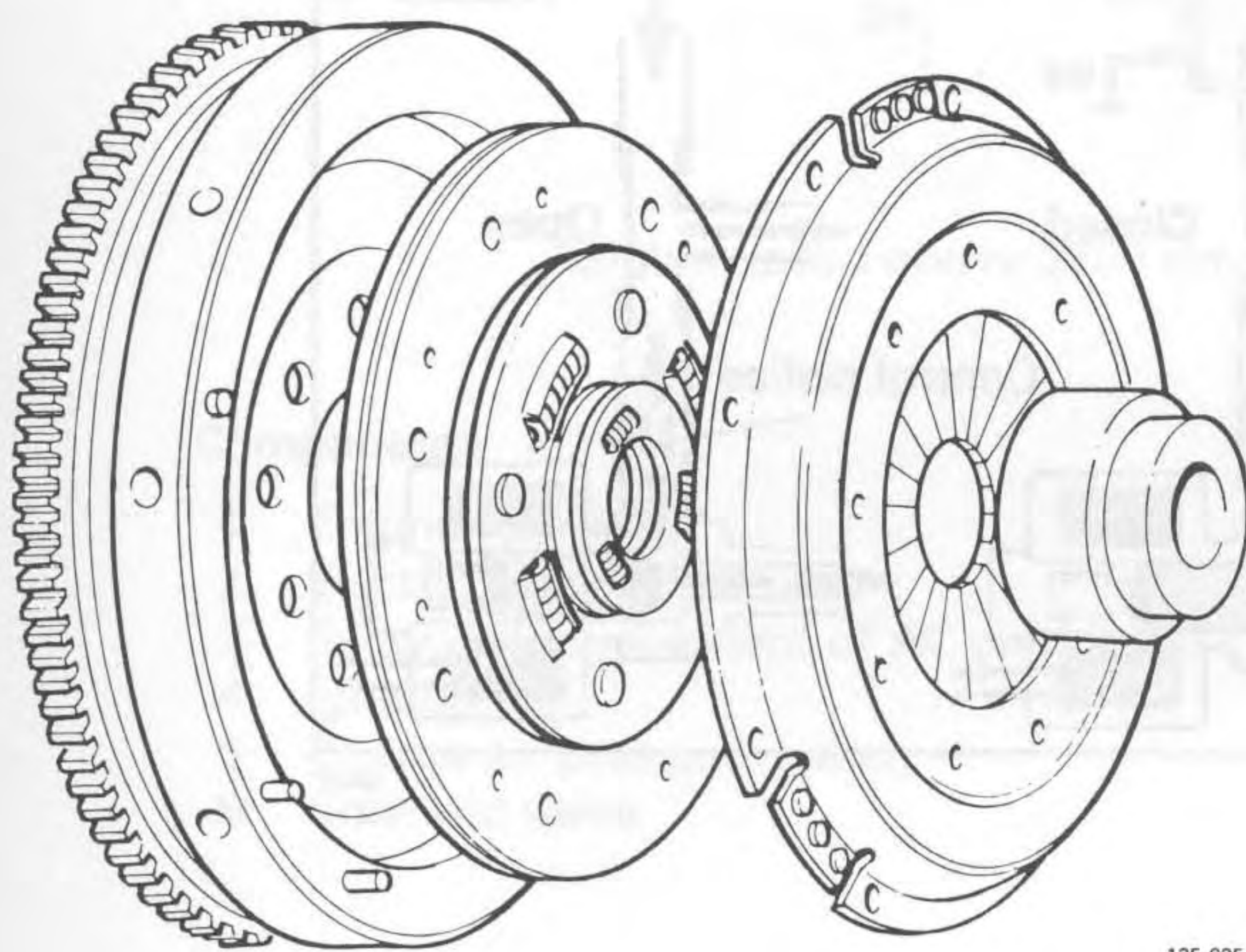
- Intercooler
- Charge pressure control system (engine rpm relay & solenoid valve)
- Relay to disengage AC compressor

Performance

	B 21 FT	B 21 FT intercooler
Output, according to SAE J 1349 net..... kW at r/s	98/90	121/85
hp at r/min	131/5400	162/5100
Max torque, according to SAE J 1349 netNm at r/s	210/63	245/65
ft lbs at r/min	155/3750	181/3900
Octane rating, unleaded gasoline RON	91	91
(R+M)/2	87	87

Modifications to B 21 FT intercooled engine compared with earlier B 21 FT:

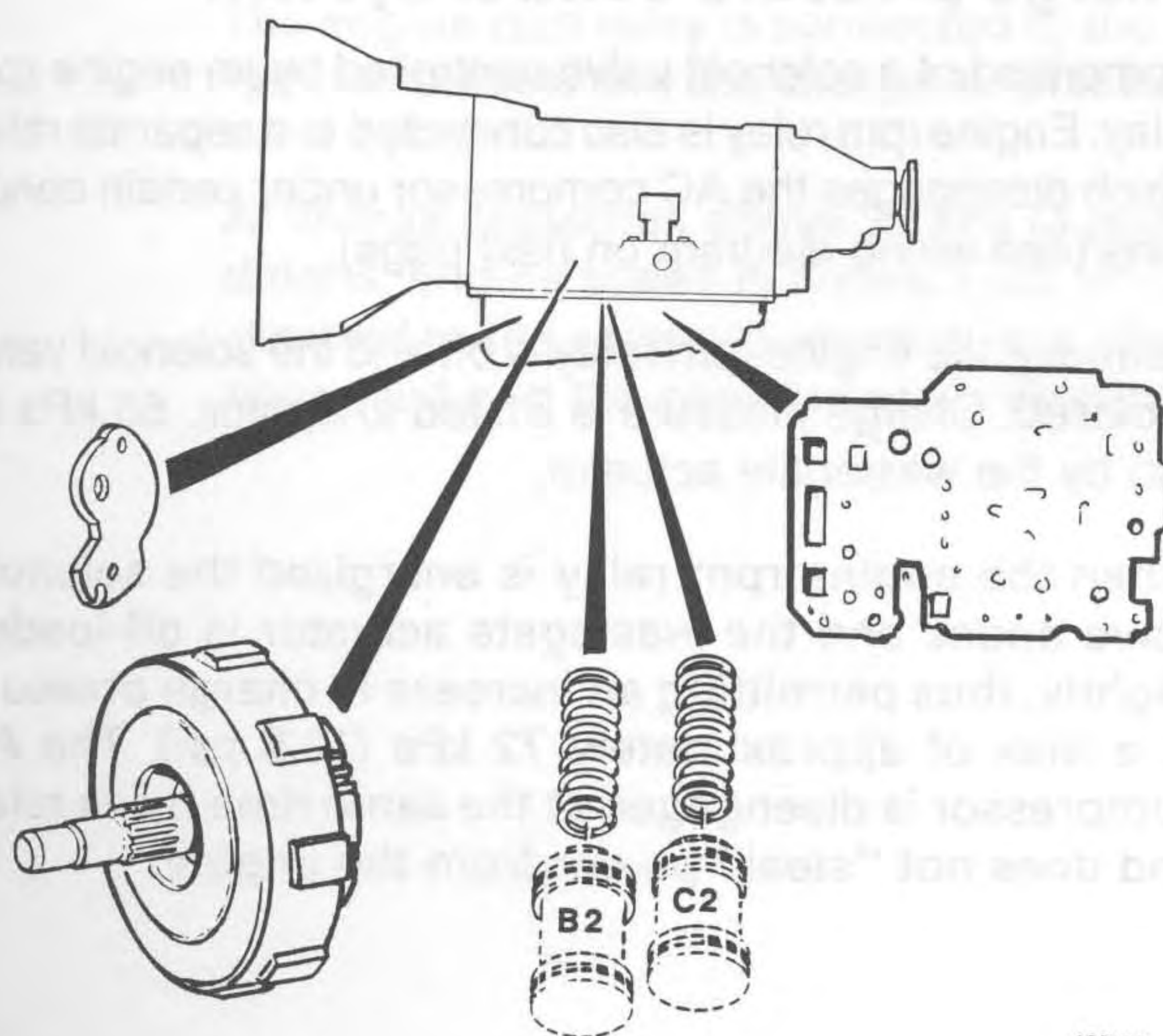
- heavier flywheel (12.7 kg or 27.9 lb. previously 9.6 kg or 21.1 lb.) on vehicles with manual transmission. Provides more stable idling than previous version and more space for new larger clutch
- modified guard plate above fuel distributor
- new turbocharger wastegate actuator
- new charge air overpressure switch, opening pressure approx. 105 kPa (14.9 psi)
- new dashboard pressure gauge (modified scale)
- reinforced inlet hose between air mass meter and turbocharger. Additional bracket attached to hose mount at air mass meter
- electric cooling fan fitted as standard (see group 26)
- new type expansion tank and mounting bracket
- radiator moved towards engine to make space for intercooler. Accordingly fan shroud, radiator hoses, oil cooler tubes (auto trans) and oil cooler mounting brackets have all been modified.



Modifications undertaken as a result of the increased performance

M 46 manual transmission

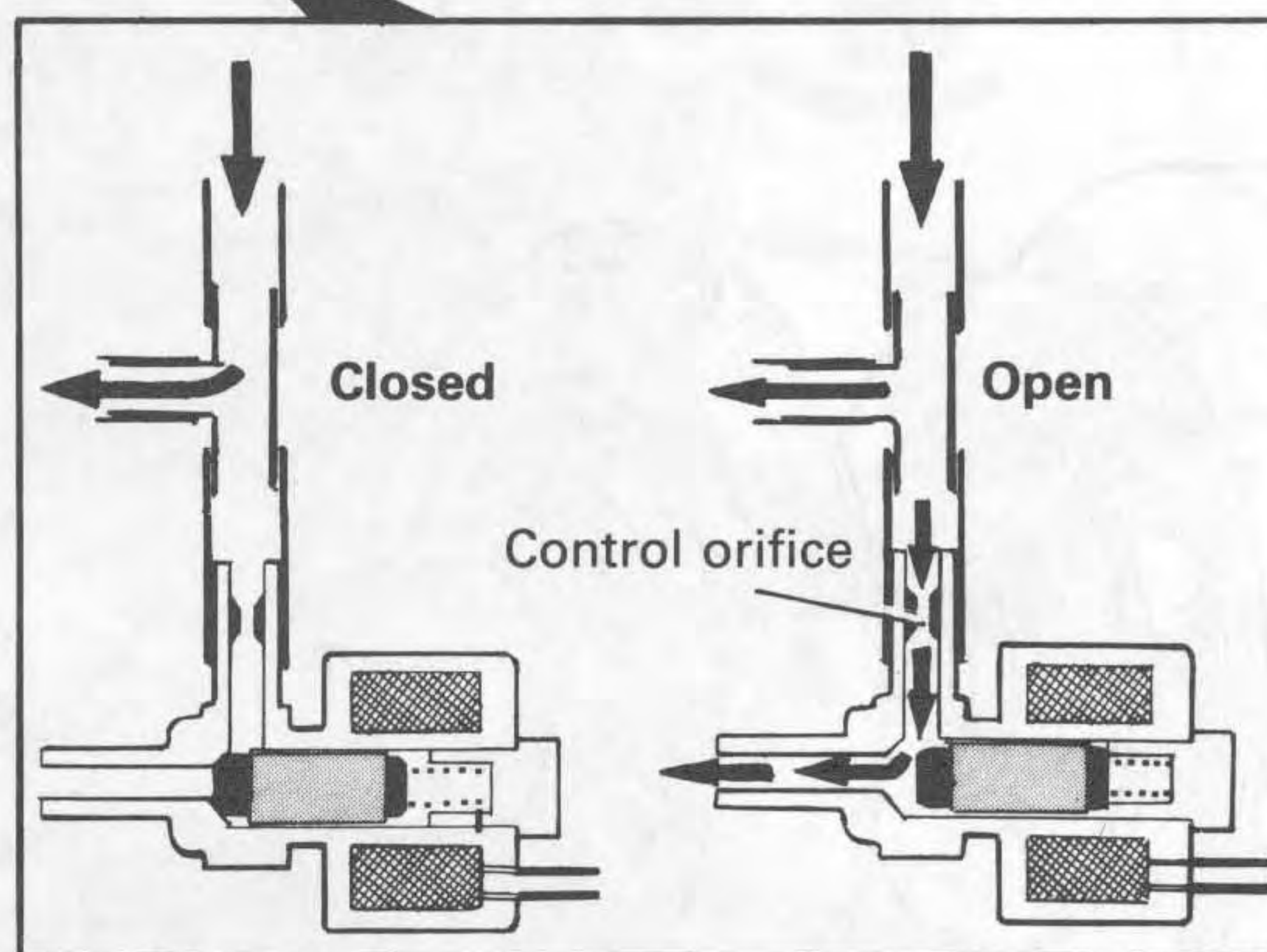
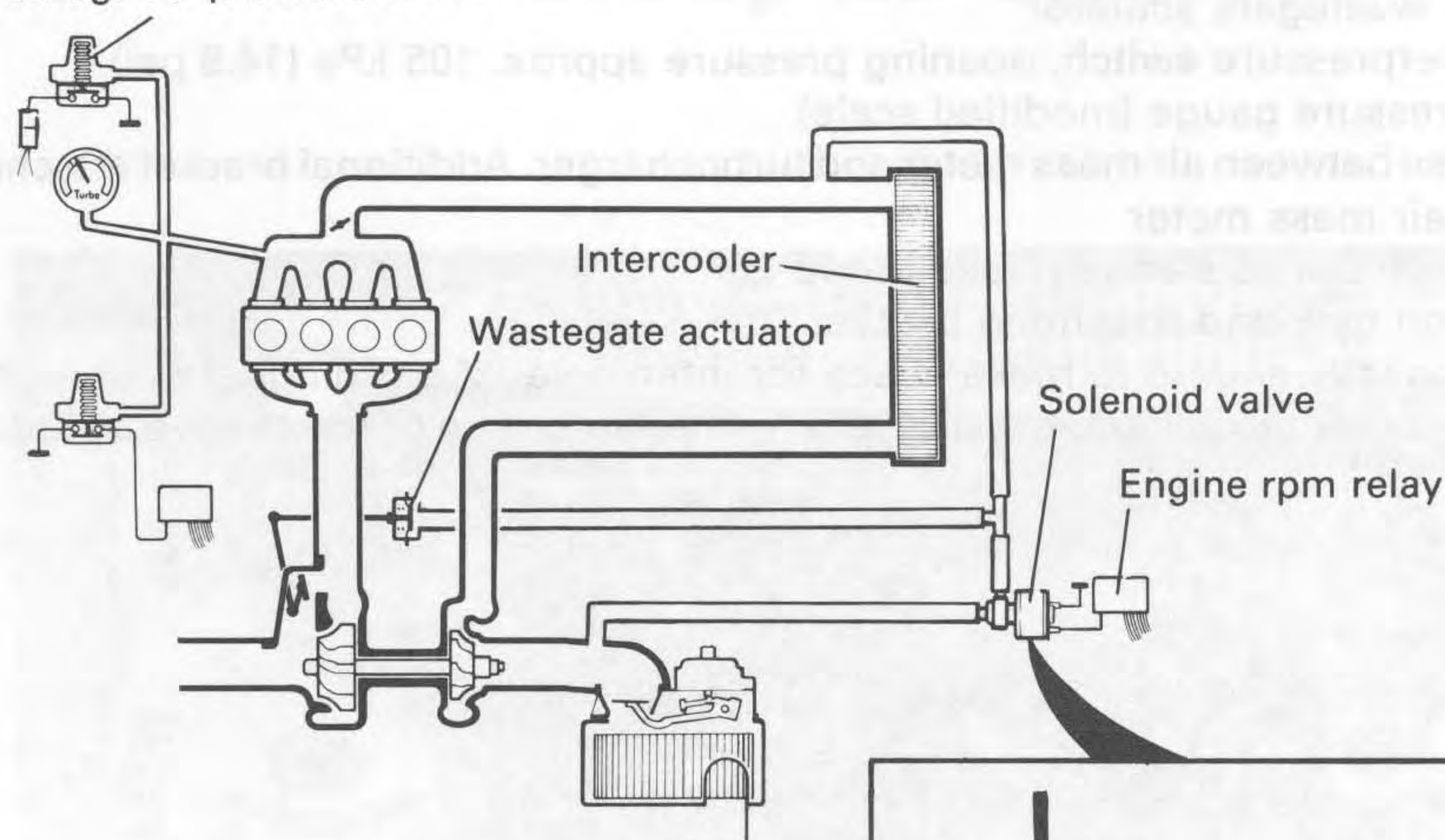
- Clutch driven plate recessed into flywheel
- Driven plate diameter 228.5 mm (9 in). previously 216.0 mm (8.5 in)
- Driven plate incorporates three small pre-damping springs

**AW 71 automatic transmission**

- Reshaped throttle cam
- Extra disc in C1 front clutch pack
- New B2 and C2 accumulator piston springs
- Modified separator plate in valve body assembly
- modified control orifices

Group 25 Intake and exhaust systems

Charge air pressure switch



138367

Intercooler

Inlet air density is increased by the turbocharger compressor before the air is pumped to the engine. During compression the temperature of the air is increased by 40–80°C (72–144°F).

To counteract this an intercooler is connected between the turbocharger and engine to cool down inlet air. The temperature of the air leaving the intercooler is 30–50°C (54–90°F) lower than that of the air entering it. Also, its density is further increased and a reduction of the thermal load on the engine is achieved.

$$\text{Density} = \text{kg/m}^3$$

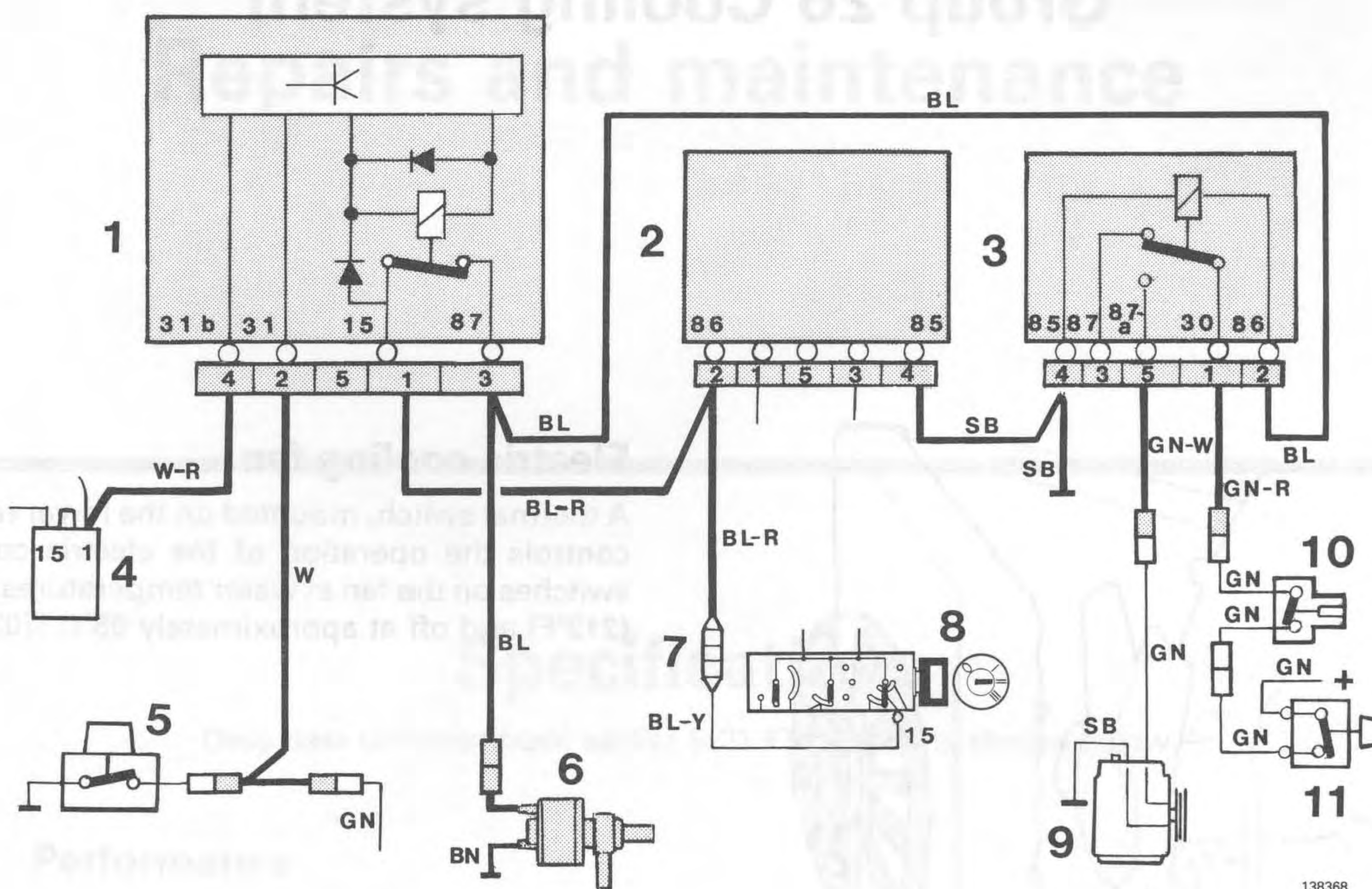
The colder the air the greater the density i.e. the greater the amount of fuel that can be combusted = higher output.

Charge pressure control system

Comprised of a solenoid valve controlled by an engine rpm relay. Engine rpm relay is also connected to a separate relay which disengages the AC compressor under certain conditions (see wiring diagram on next page).

Normally, the engine rpm relay is off and the solenoid valve is closed. Charge pressure is limited to approx. 55 kPa (8 psi) by the wastegate actuator.

When the engine rpm relay is energized the solenoid valve opens and the wastegate actuator is off-loaded slightly, thus permitting an increase in charge pressure to a max of approximately 72 kPa (10.5 psi). The AC compressor is disengaged at the same time by its relay and does not "steal" power from the engine.



138368

Engine speed above 3700 r/min and charge pressure above 20 kPa (3 psi)

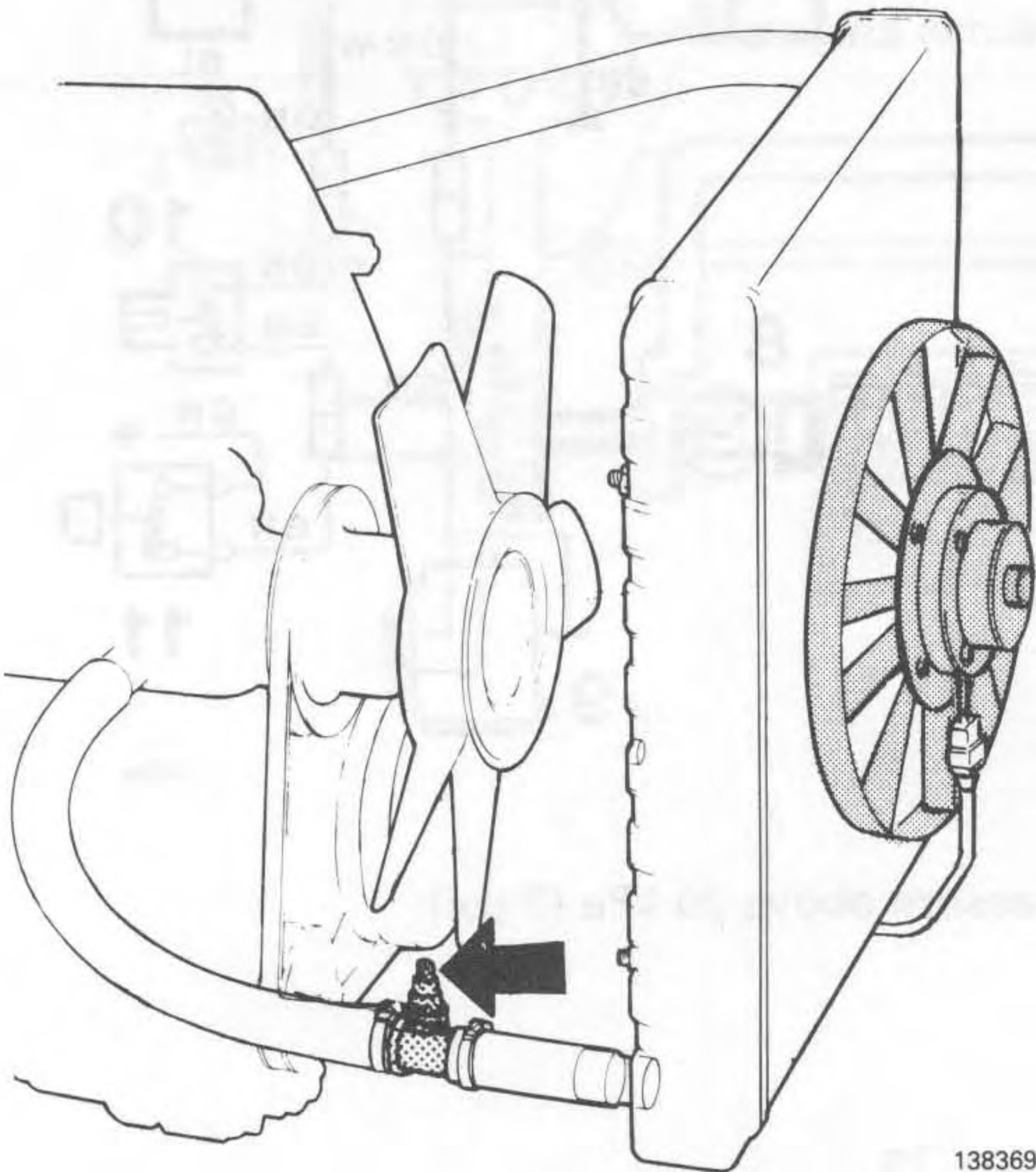
Components

- | | |
|---|--|
| 1 Engine rpm relay | 7 Fuse No. 13 |
| 2 Electric cooling fan relay | 8 Ignition switch |
| 3 Relay, disengagement of AC compressor | 9 AC compressor |
| 4 Ignition coil | 10 Low pressure switch (mounted in receiver/dryer) |
| 5 Charge air pressure switch | 11 AC dashboard switch |
| 6 Solenoid valve | |

The engine rpm relay is connected to the ignition coil, from which it receives information on ignition pulses, and the charge air pressure switch (which is also connected to the Lambda-sond system).

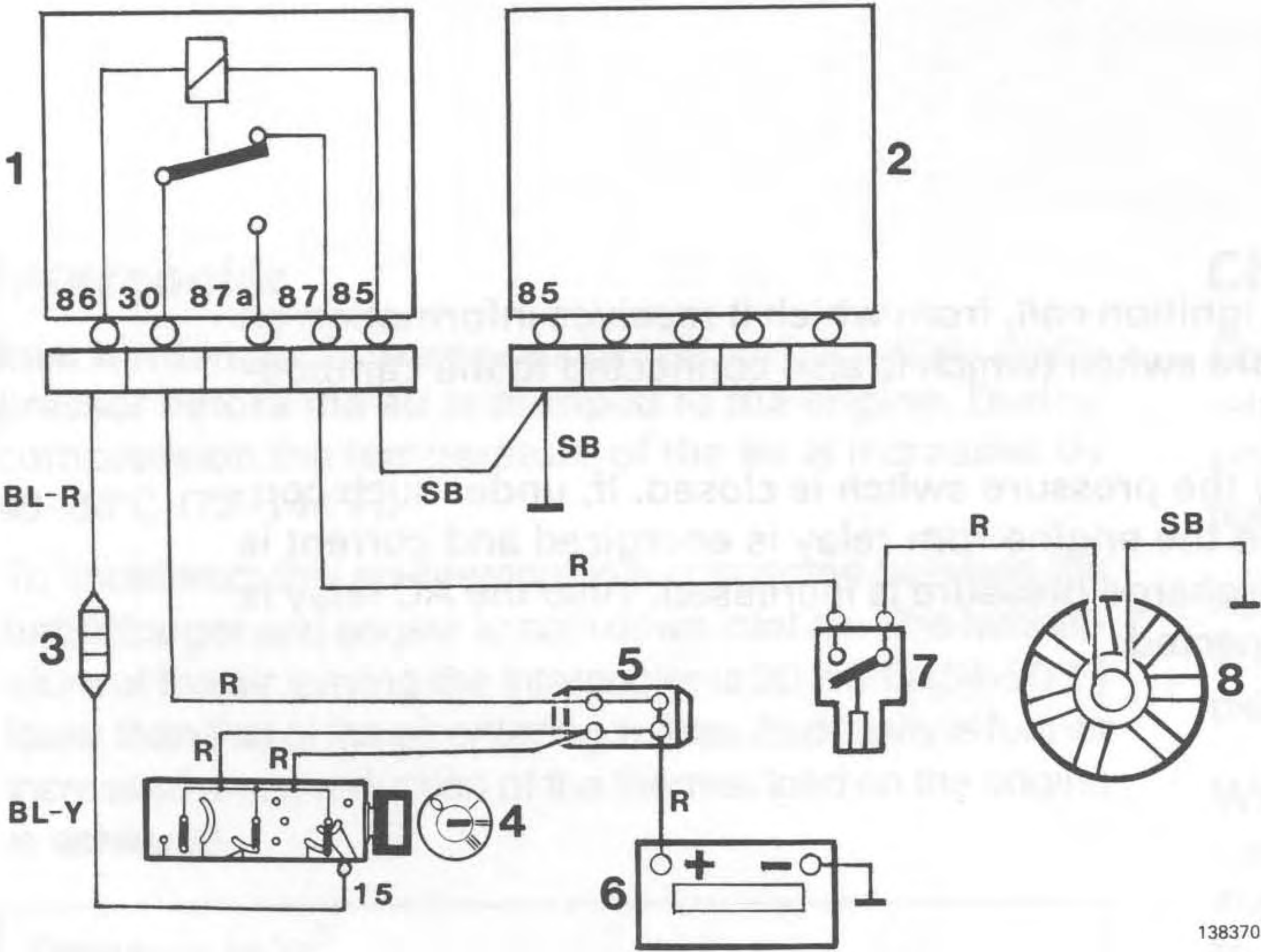
At charge pressures above 20 kPa (3 psi) the pressure switch is closed. If, under such conditions, engine speed is above 3700 r/min the engine rpm relay is energized and current is directed to the solenoid which opens, the charge pressure is increased. Also the AC relay is energized and the compressor is disconnected.

Group 26 Cooling system



Electric cooling fan

A thermal switch, mounted on the lower radiator hose, controls the operation of the electric cooling fan. It switches on the fan at water temperatures above 100°C (212°F) and off at approximately 95°C (203°F).



Components

- 1 Relay, electric cooling fan
- 2 Relay, disengagement of AC compressor
- 3 Fuse No. 13
- 4 Ignition switch
- 5 Connector
- 6 Battery
- 7 Thermal switch
- 8 Electric cooling fan

Repairs and maintenance

Specifications

Only data different from earlier B 21 FT models is shown below.

Performance

Output, according to SAE J 1349 net.....	121 kW at 85 r/s 162 hp at 5100 r/min
Max torque, according to SAE J 1349 net	245 Nm at 65 r/s 181 ft lbs at 3900 r/min

Charge pressure

At 3000 r/min full-load, checking value	50–58 kPa (7.1–8.2 psi)
setting value	55 kPa (7.8 psi)

Charge air overpressure switch

Opens at pressure	100–110 kPa (14.2–15.6 psi)
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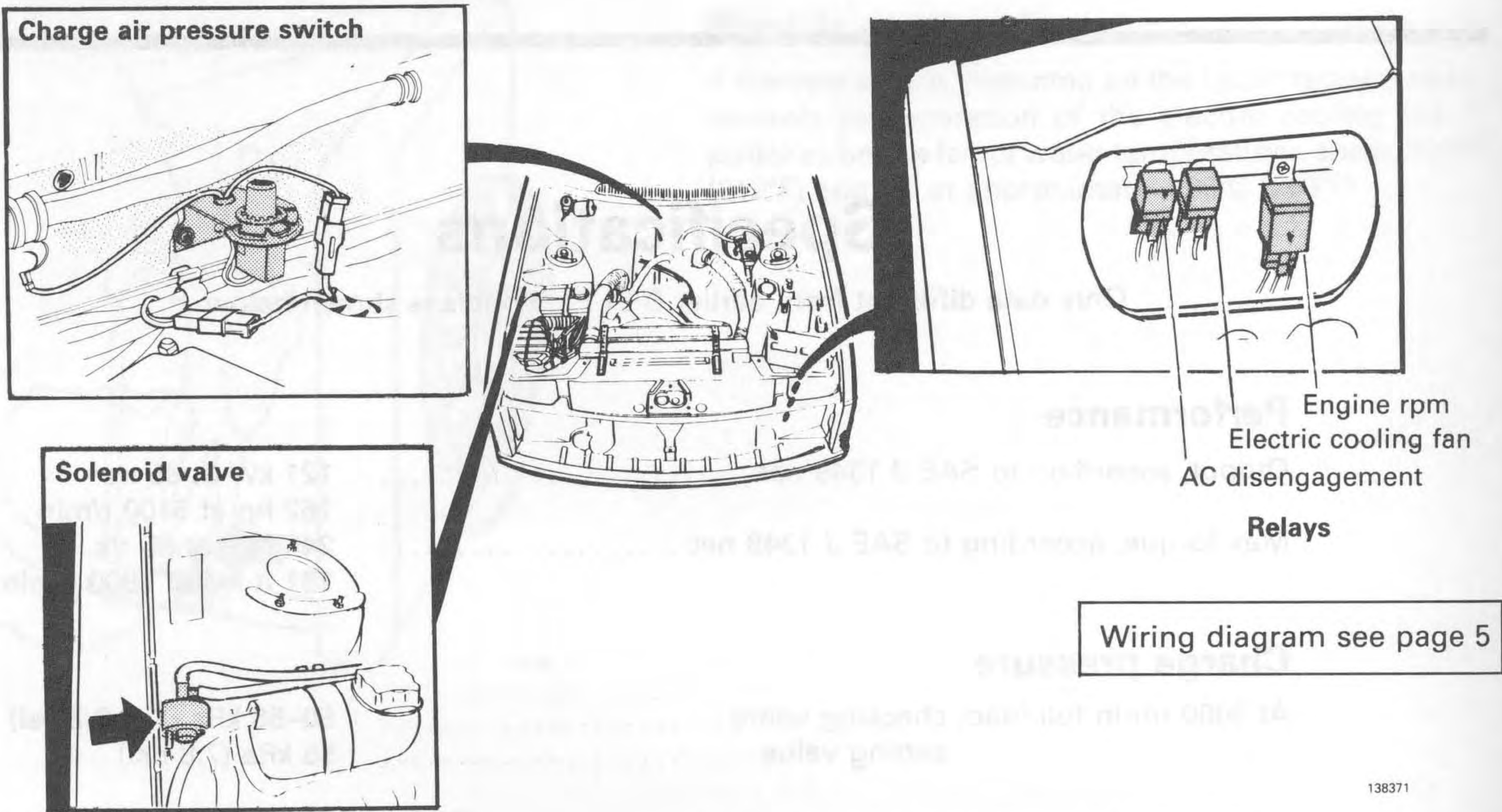
Charge pressure control system

Group 25 Intake and exhaust systems

A. Charge pressure control system

A1

Location of components



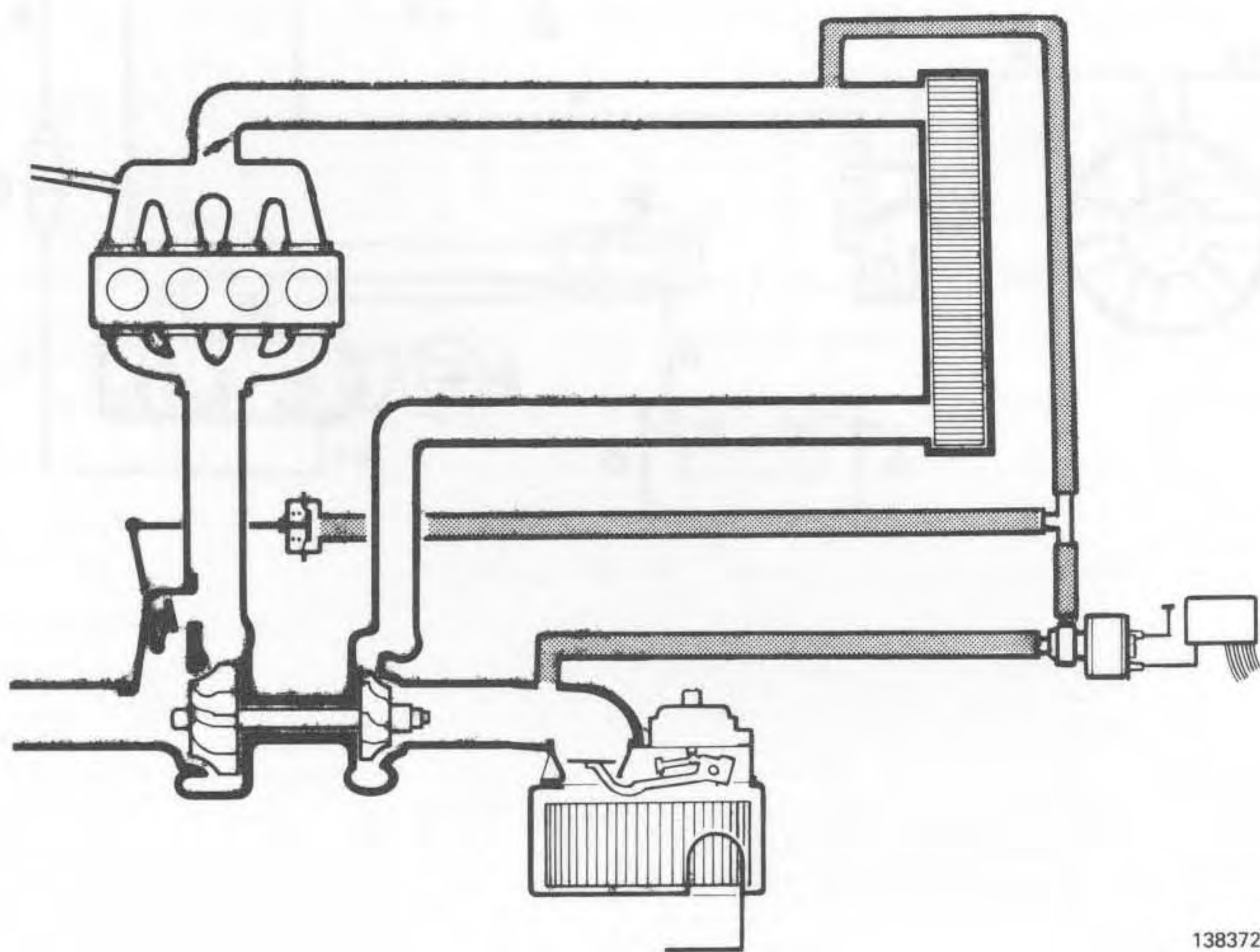
Function check

Special tool: 5230

A2

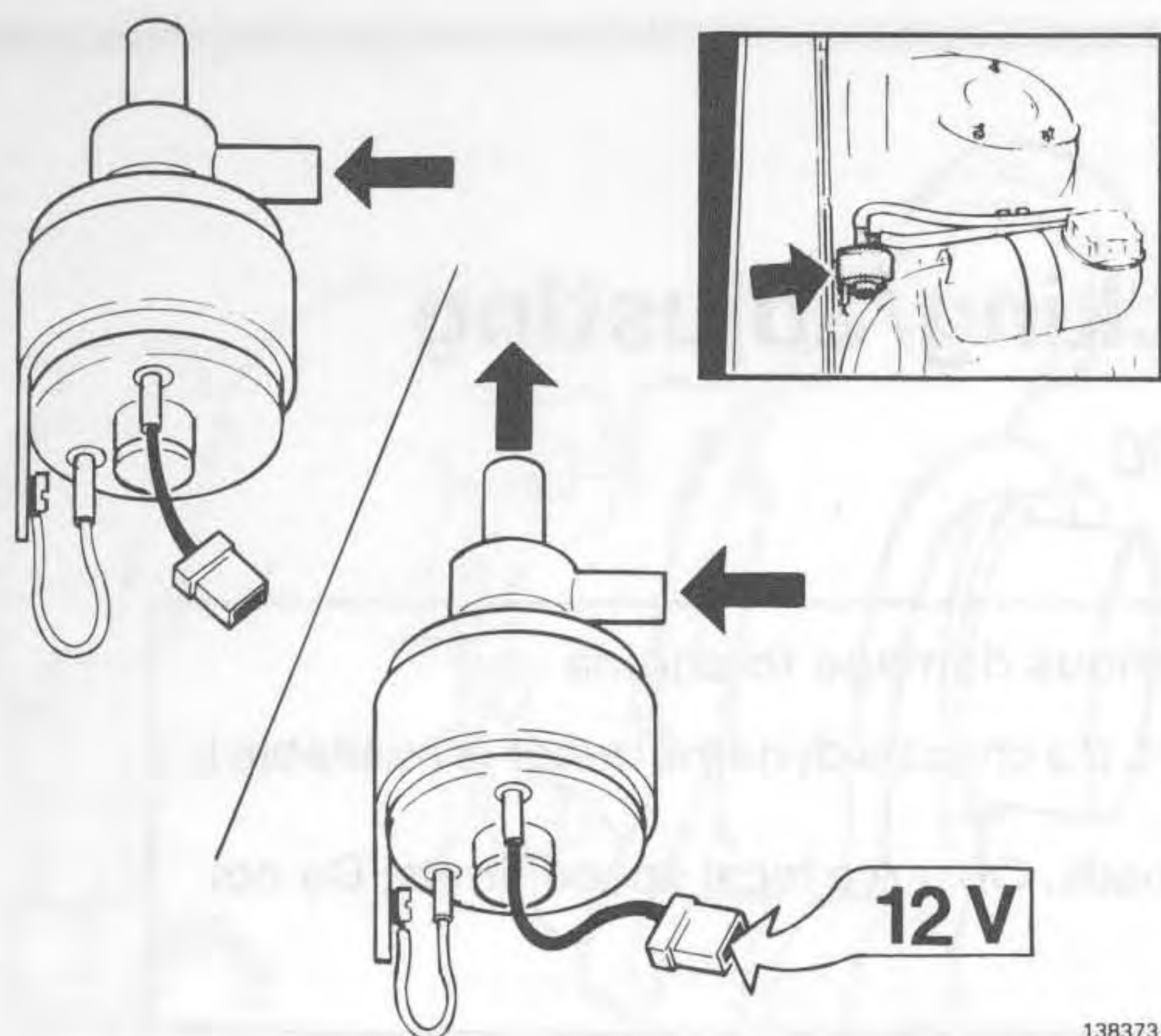
Check hoses

Check that hoses are correctly connected, not kinked or damaged. T-connector must be located as shown.



Charge pressure control system

A3

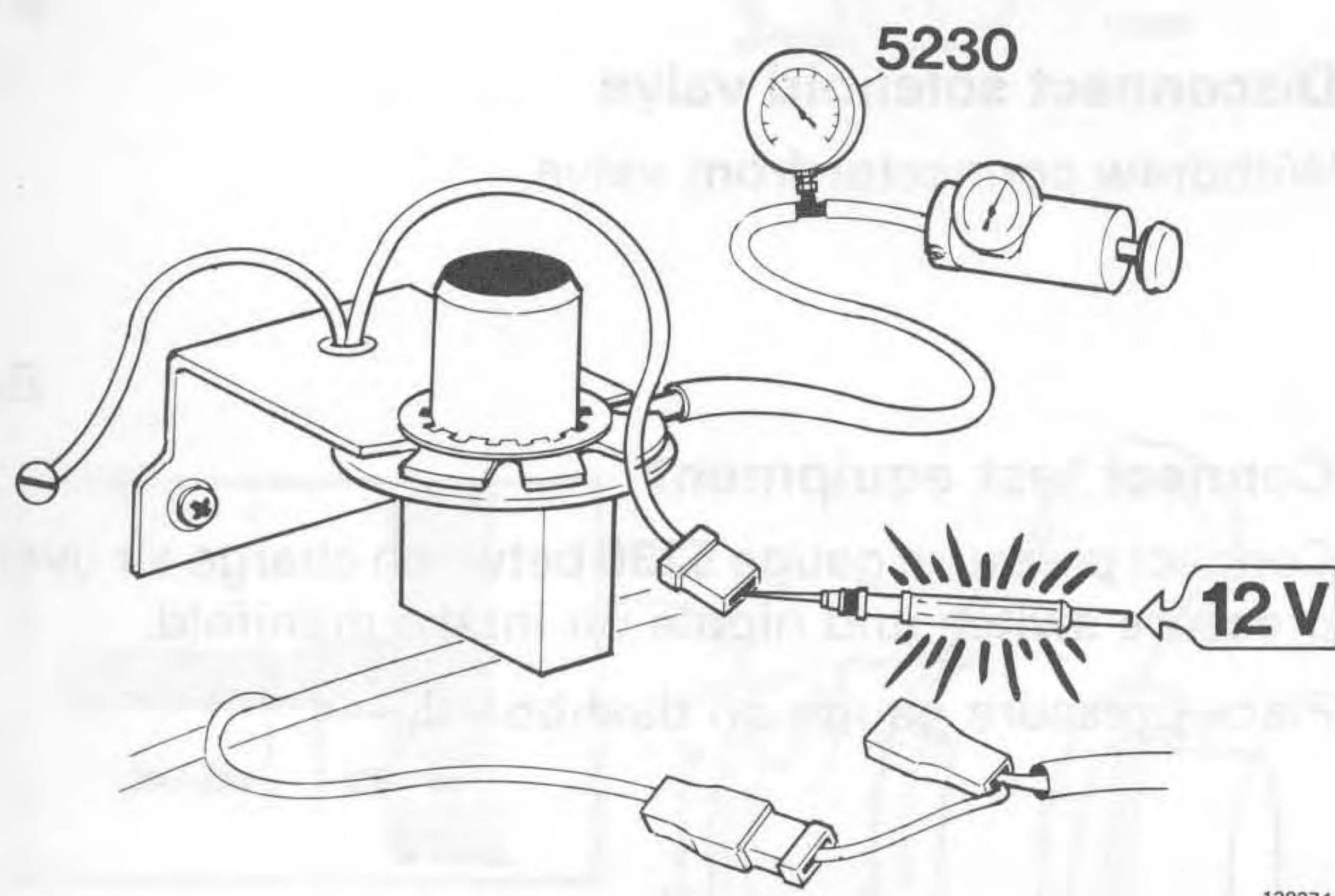
**Check solenoid valve**

Check function by blowing through valve.

Valve should be closed.

Connect 12V power source to valve and check that it opens. If not, check ground wire.

A4

**Check charge air pressure switch**

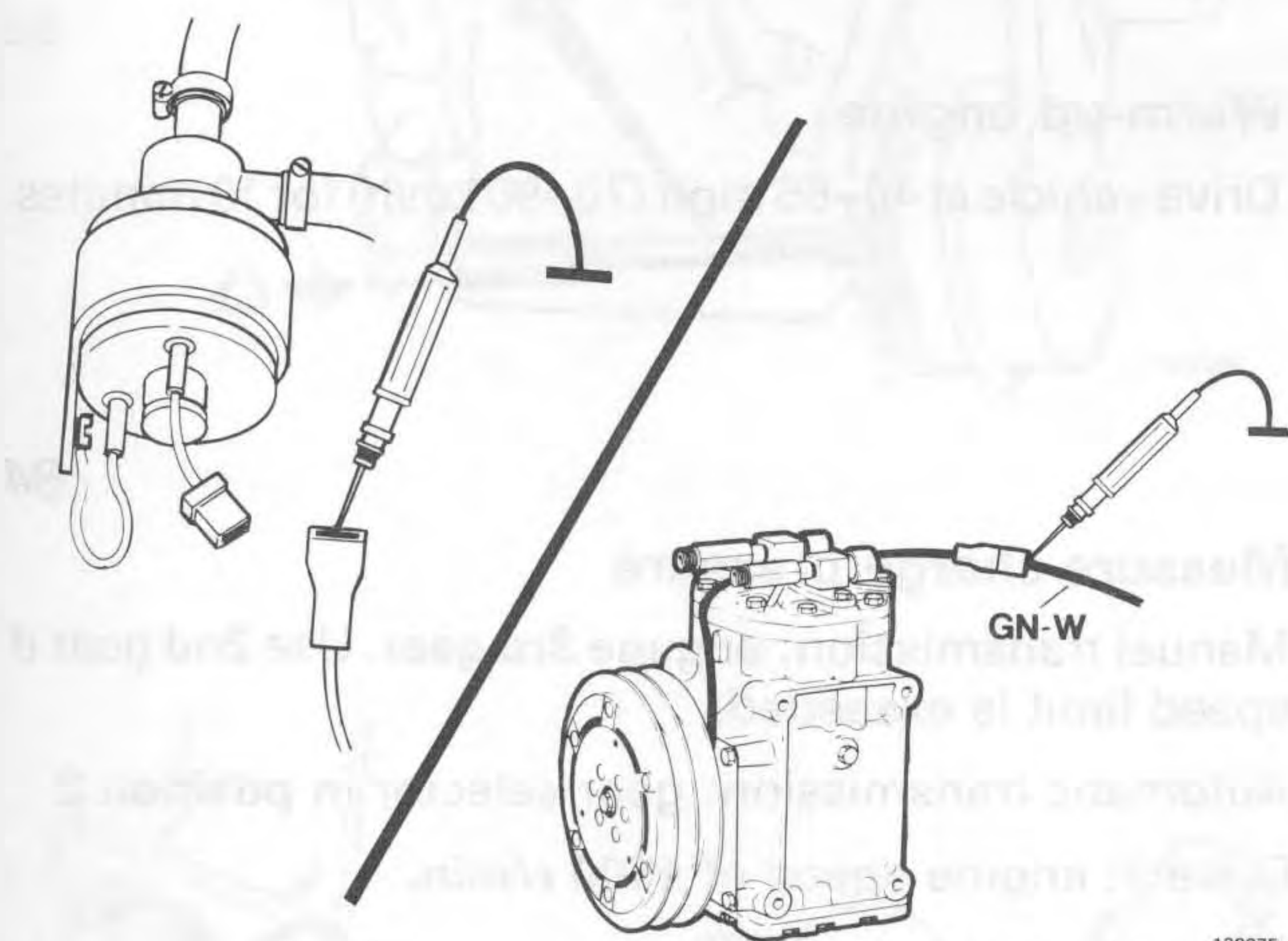
Connect pressure gauge **5230** and a pump to switch.

Connect a test lamp between contact and 12V power supply.

Increase pressure to 20.3 kPa (2.9 psi) and check that lamp lights up; i.e. contact closes.

Disconnect test light and reconnect wire. Do not disconnect pressure gauge and pump at this point.

A5

**Connect test lights**

Connect test light between solenoid connector and ground.

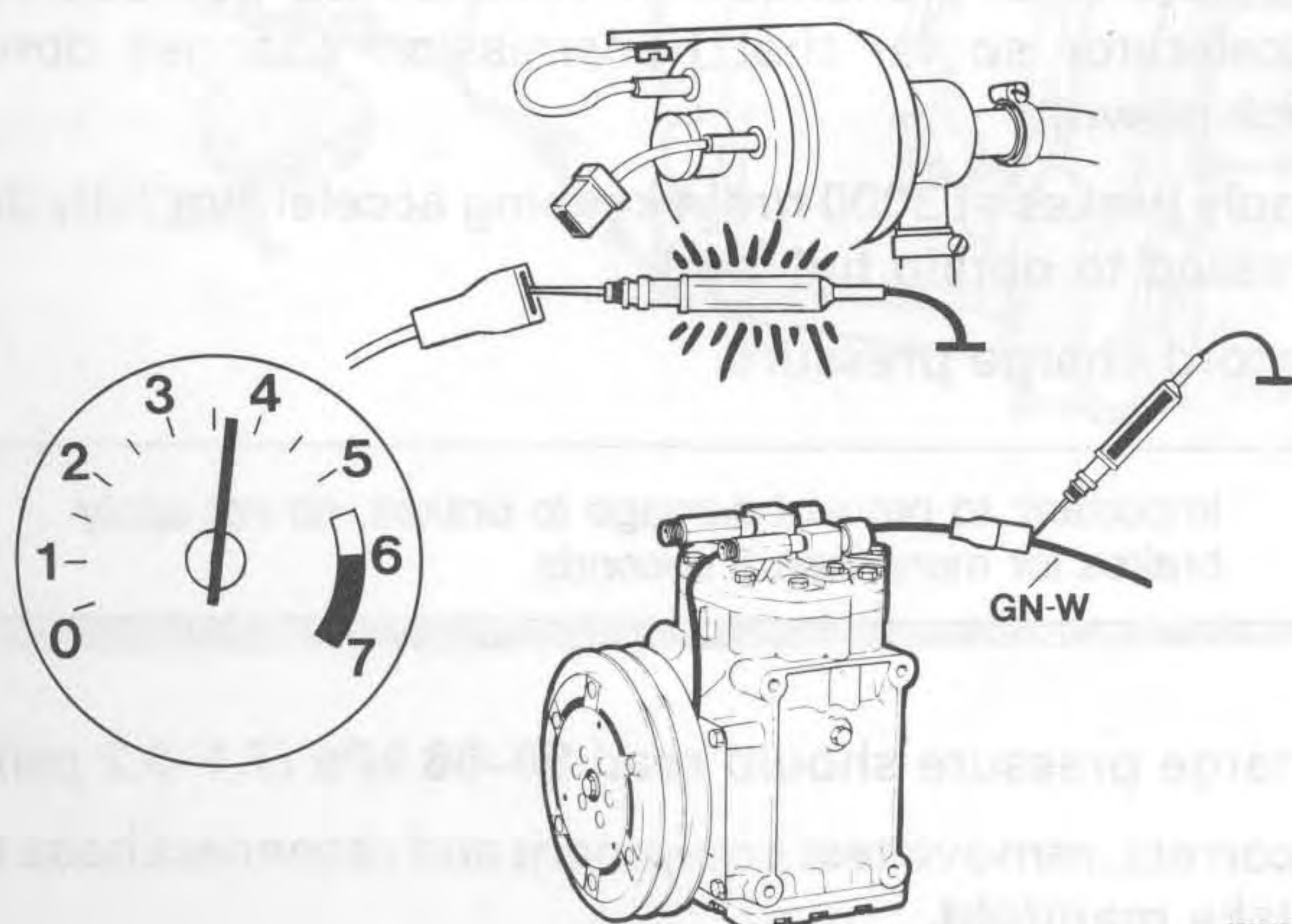
Connect a second test light at compressor between wire and ground.

A6

Start engine**Turn on air conditioning unit**

Set AC to Max Cool.

A7

**Check engine rpm relay and AC relay**

Check that charge air pressure switch is closed. If necessary increase pressure.

Rev-up engine to 3700 r/min and check that engine rpm relay is energized (test light at solenoid lights up). Also check that at same time AC compressor is disengaged (test light goes out).

If incorrect, check wiring, (see wiring diagram on page 5). If wiring is OK, test circuit with a new relay.

A8

Remove test equipment

Reconnect wires, hoses etc.

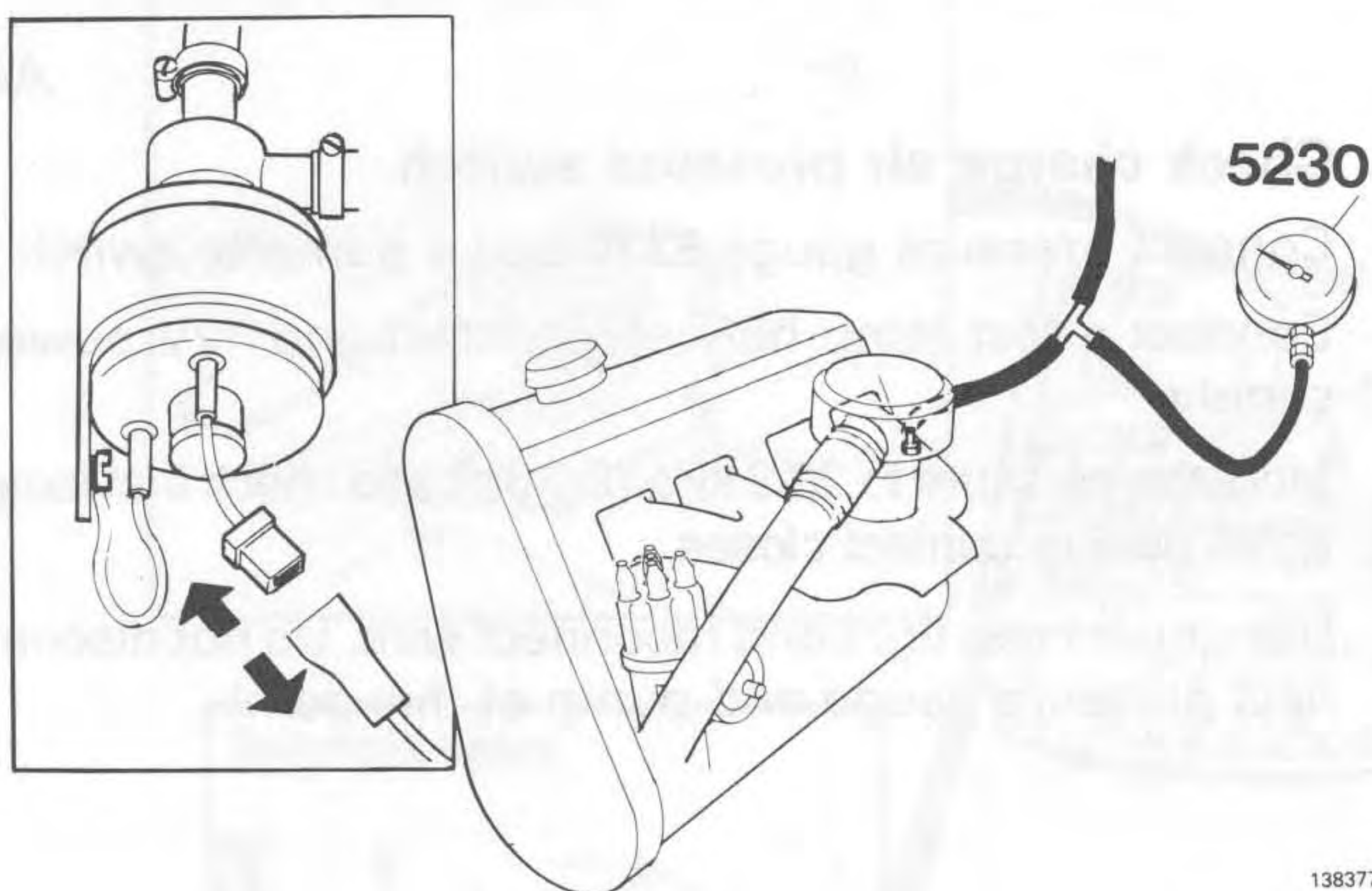
Charge pressure

B. Charge pressure, checking/adjusting

Special tool: 5230

Important! Excessively high charge pressure can cause serious damage to engine**WARNING!** Exercise extreme caution in performing this test. If a chassis dynamometer is available it should be used.

Do not perform this test on heavily traveled or residential roads. Observe local speed limits. Do not perform test on wet or icy roads.



138377

B1

Disconnect solenoid valve

Withdraw connector from valve.

B2

Connect test equipmentConnect pressure gauge **5230** between charge air over-pressure switch and nipple on intake manifold.

Place pressure gauge on dashboard.

B3

Warm-up engine

Drive vehicle at 40–55 mph (70–90 km/h) for 10 minutes.

B4

Measure charge pressureManual transmission: engage **3rd gear**. Use 2nd gear if speed limit is exceeded.Automatic transmission: gear selector in **position 2**Drive at engine speed of **1500 r/min**.

Depress accelerator to floor.

On automatic transmission vehicles do not depress accelerator so far that transmission changes down (kick-down).

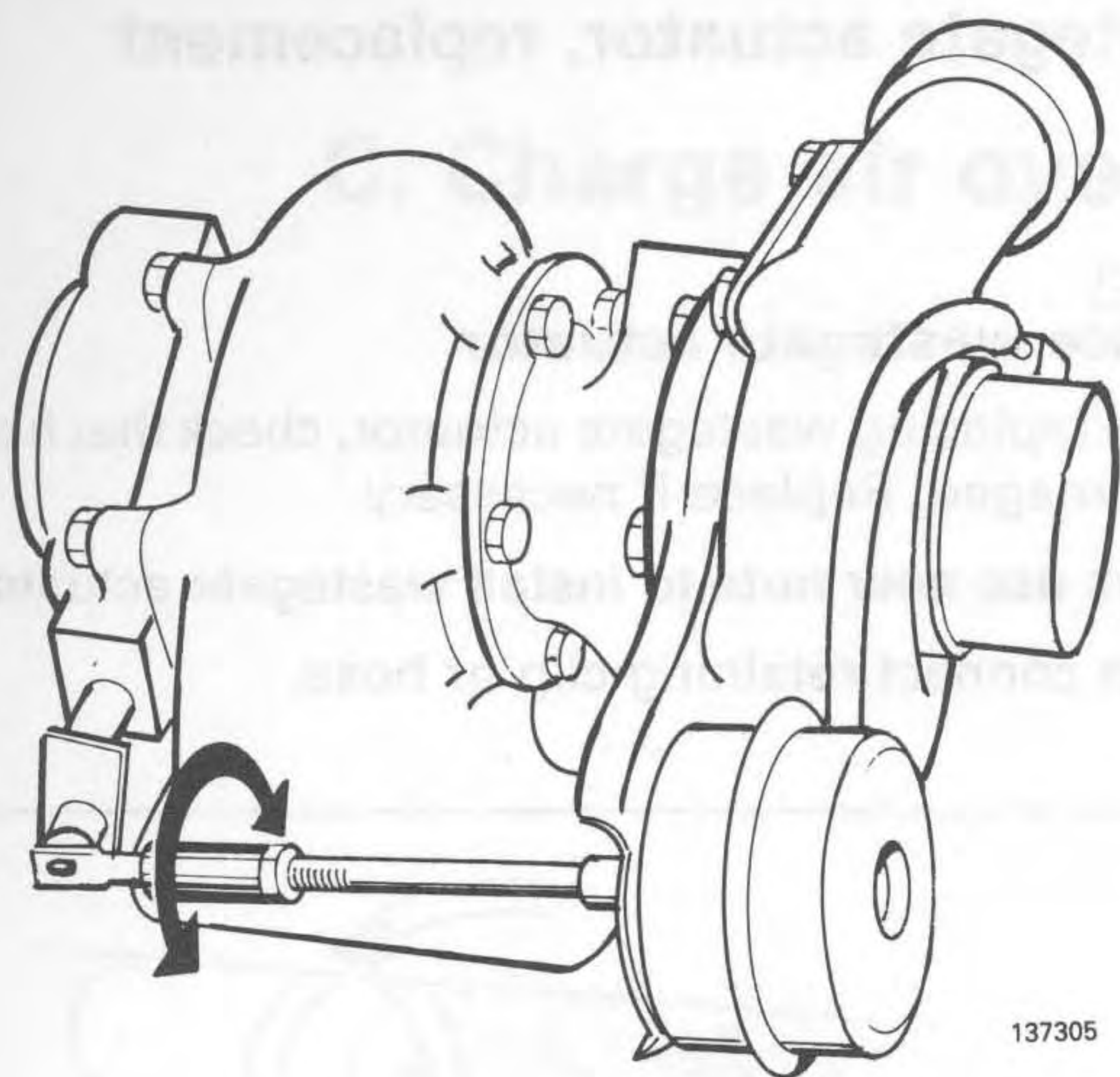
Apply brakes at 3000 r/min keeping accelerator fully depressed to obtain full-load.

Record charge pressure.

Important: to prevent damage to brakes, do not apply brakes for more than 5 seconds.

Charge pressure should read **50–58 kPa** (7.1–8.2 psi).

If correct, remove test equipment and reconnect hose to intake manifold.



Adjusting charge pressure

B5

Adjust charge pressure

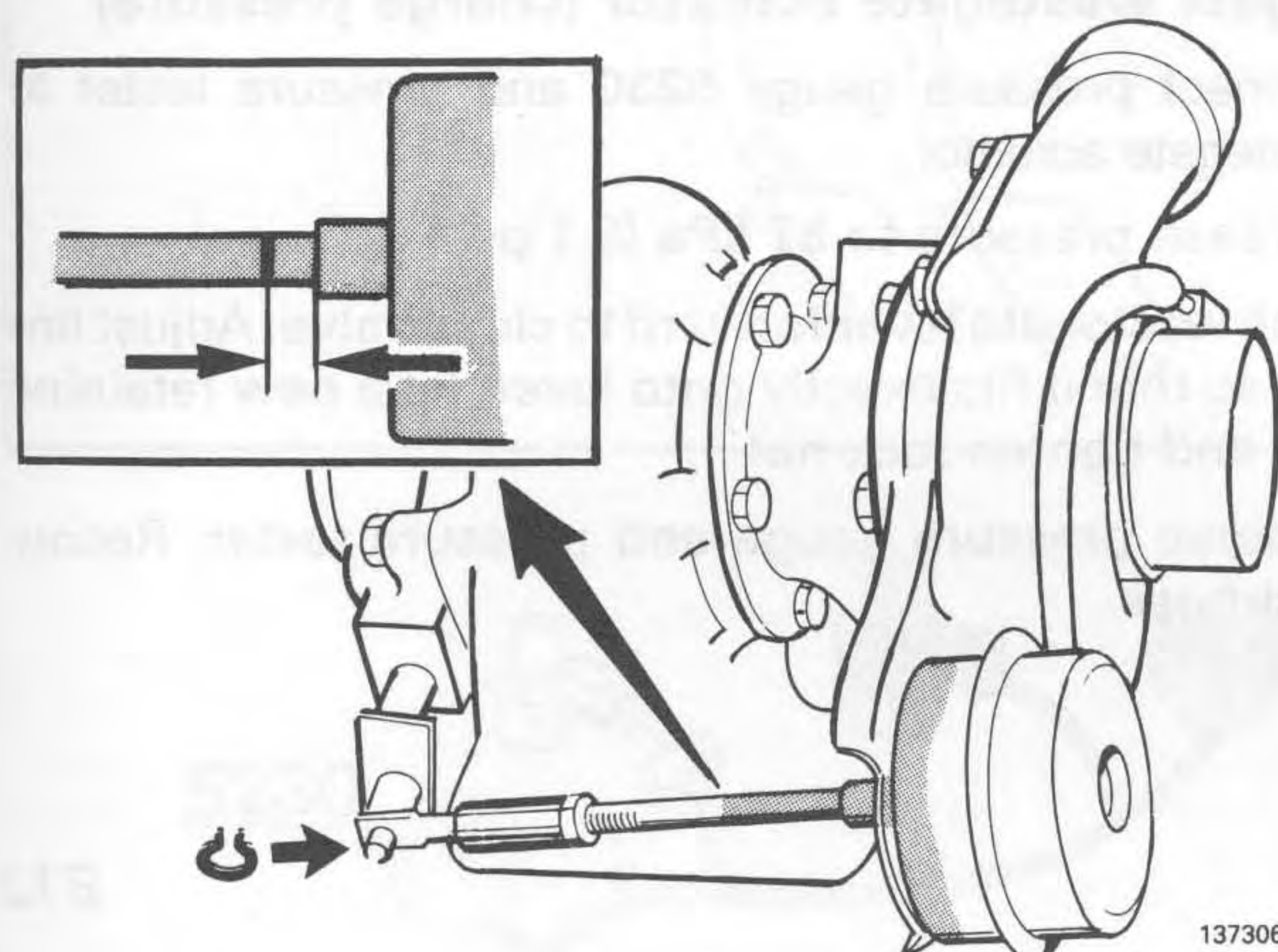
Remove seal and release retaining clip.

Adjust pressure to **55 kPa** (8 psi) by turning rod sleeve.

Turning sleeve **inward increases** charge pressure.

Turning sleeve **outward decreases** charge pressure.

One turn is equivalent to a pressure change of approx. **2 kPa** (0.3 psi).



B6

Check basic position of link rod

Link rod travel must be between 2-6 mm (0.08-0.24 in) to obtain correct operating function.

Disconnect rod sleeve from lever.

Mark position of rod at wastegate actuator.

Reconnect sleeve to lever.

Measure distance between mark and wastegate actuator.

Distance = **2-6mm** (0.08-0.24 in).

If incorrect, replace wastegate actuator, see B10.

B7

Fit new retaining clip

B8

Check charge pressure

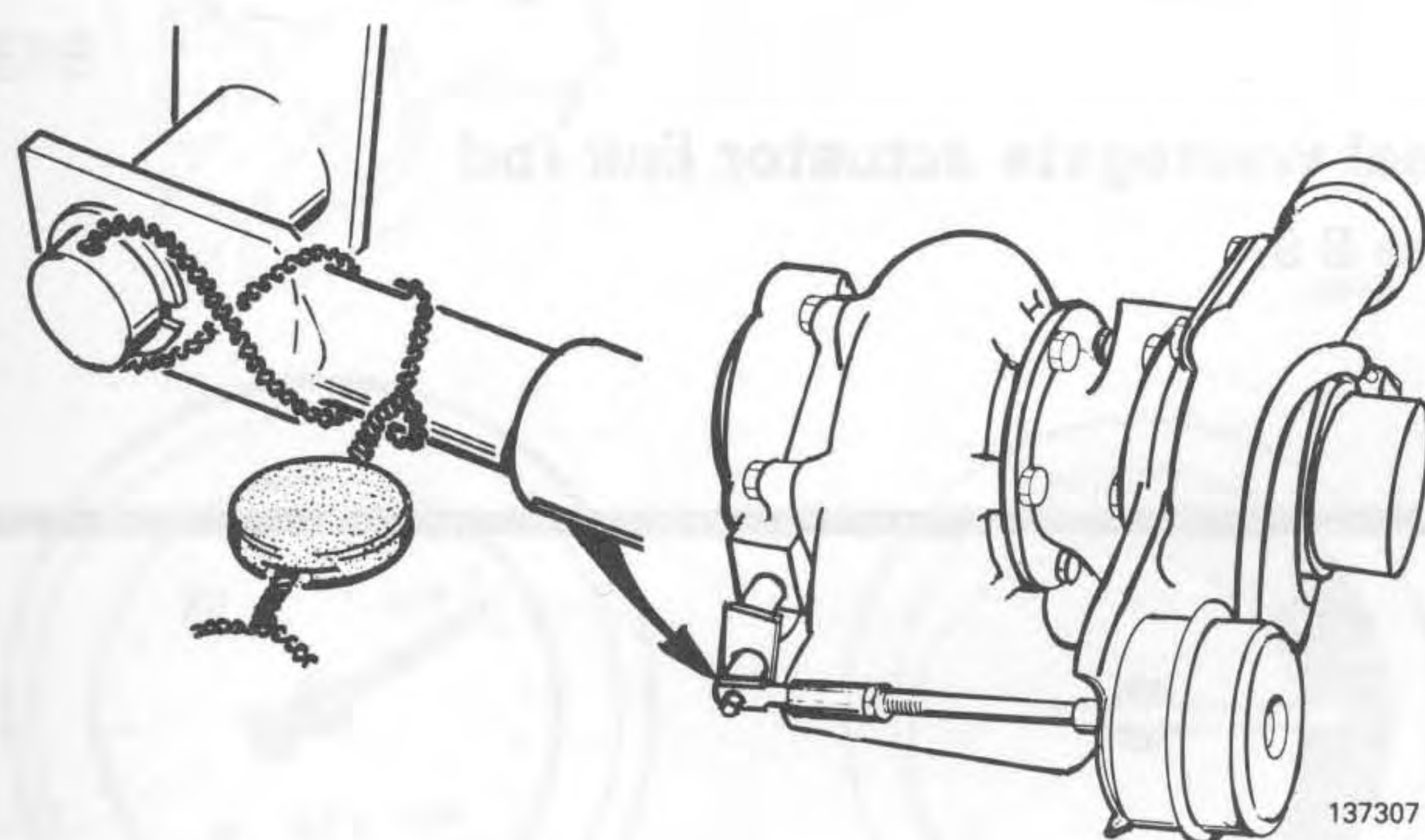
See B 3-4.

B9

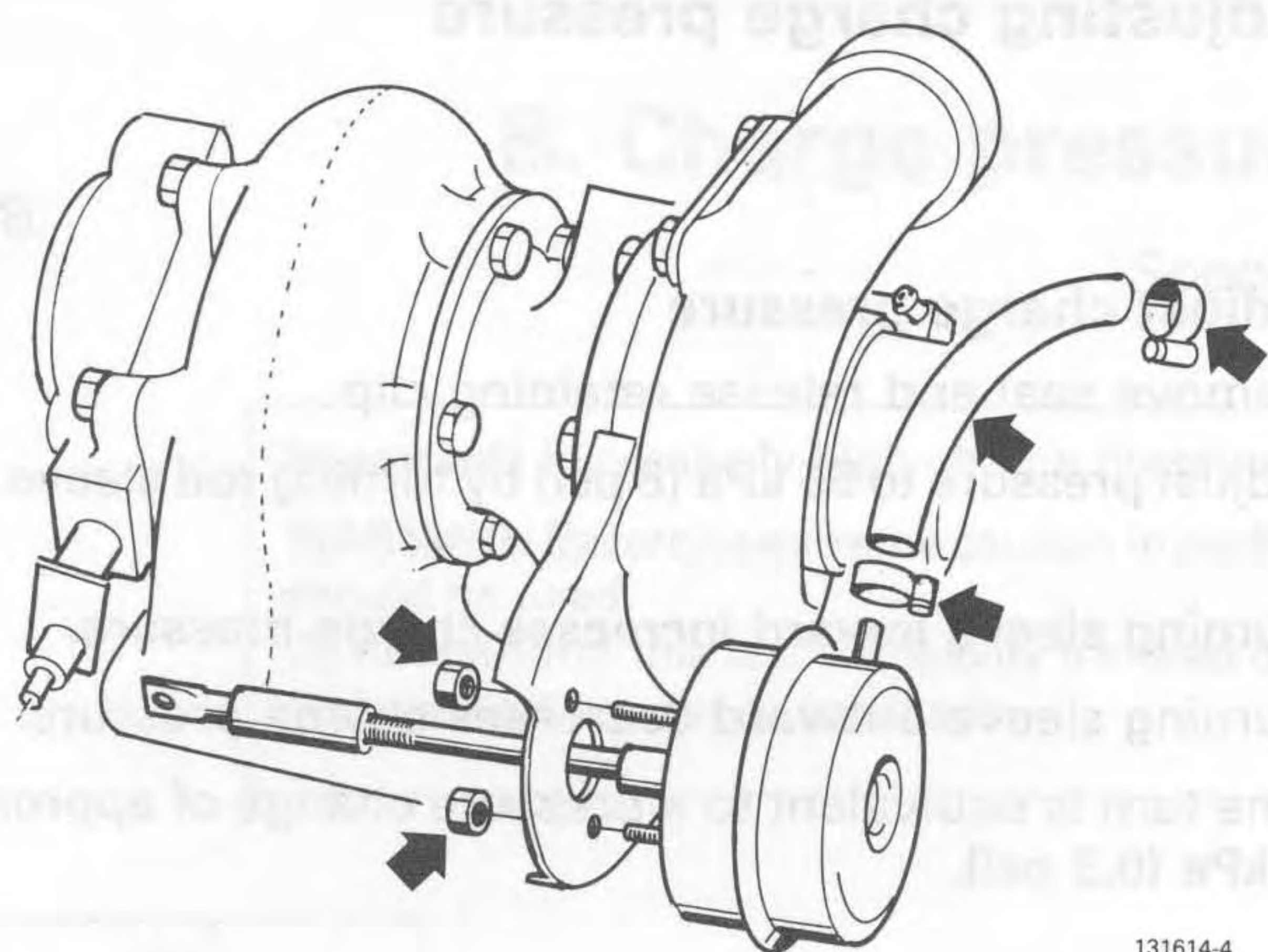
Seal wastegate actuator link rod

To prevent seal vibrating loose, it is important that wire is firmly wrapped around rod sleeve as illustrated.

Sealing tool, including Volvo stamp. P/N 9986408-4.



Charge pressure



131614-4

Wastegate actuator, replacement

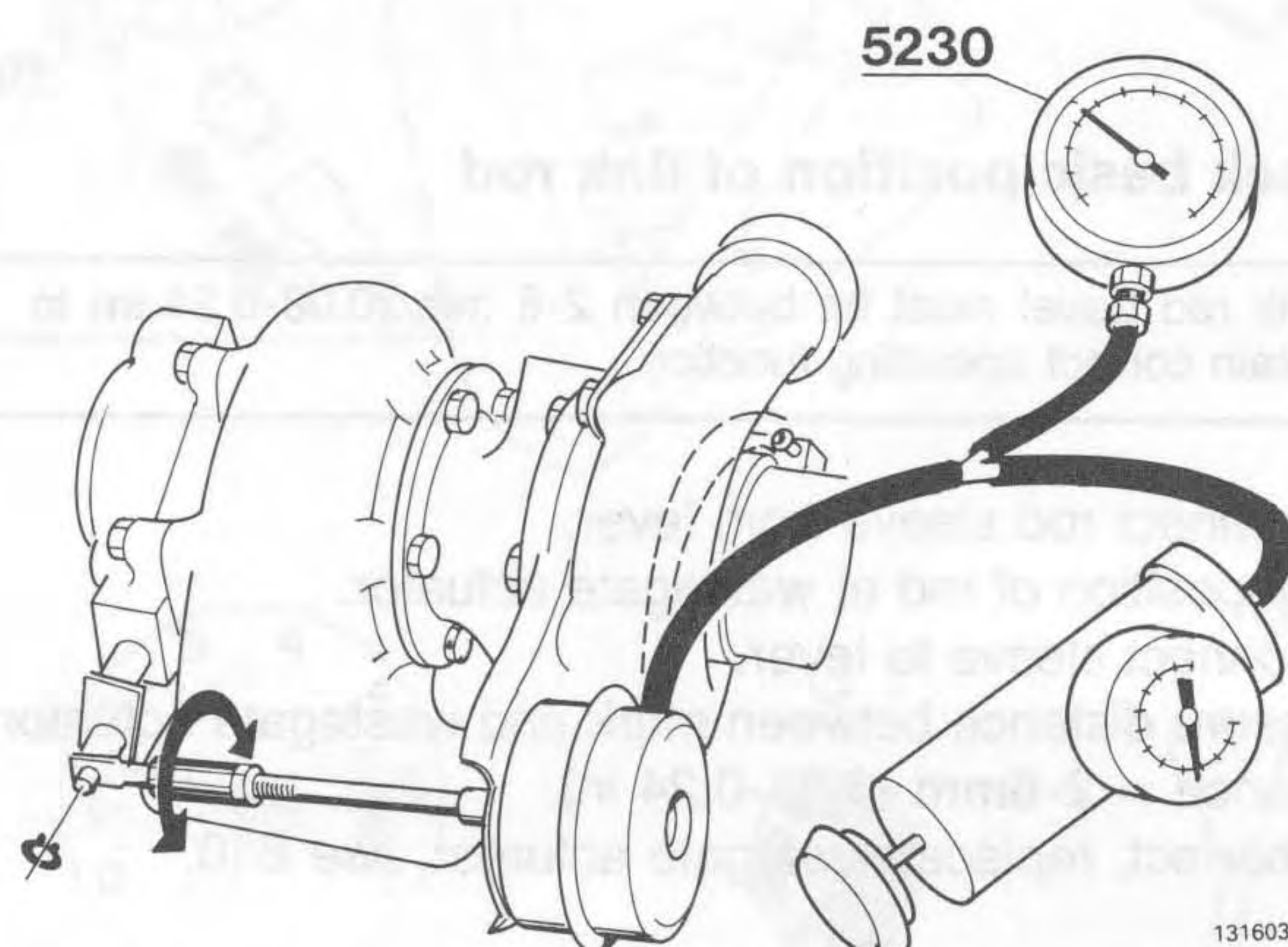
B10

Replace wastegate actuator

Before replacing wastegate actuator, check that hose is not damaged. Replace if necessary.

Always use **new nuts** to install wastegate actuator.

Do not connect retaining clip or hose.



131603

B11

Adjust wastegate actuator (charge pressure)

Connect pressure gauge **5230** and pressure tester to wastegate actuator.

Increase pressure to **57 kPa** (8.1 psi).

Push wastegate lever forward to close valve. Adjust link rod so that it fits exactly onto lever. Fit a **new retaining clip** and tighten lock nut.

Remove pressure gauge and pressure tester. Reconnect hose.

B12

Check charge pressure

See B 1-4.

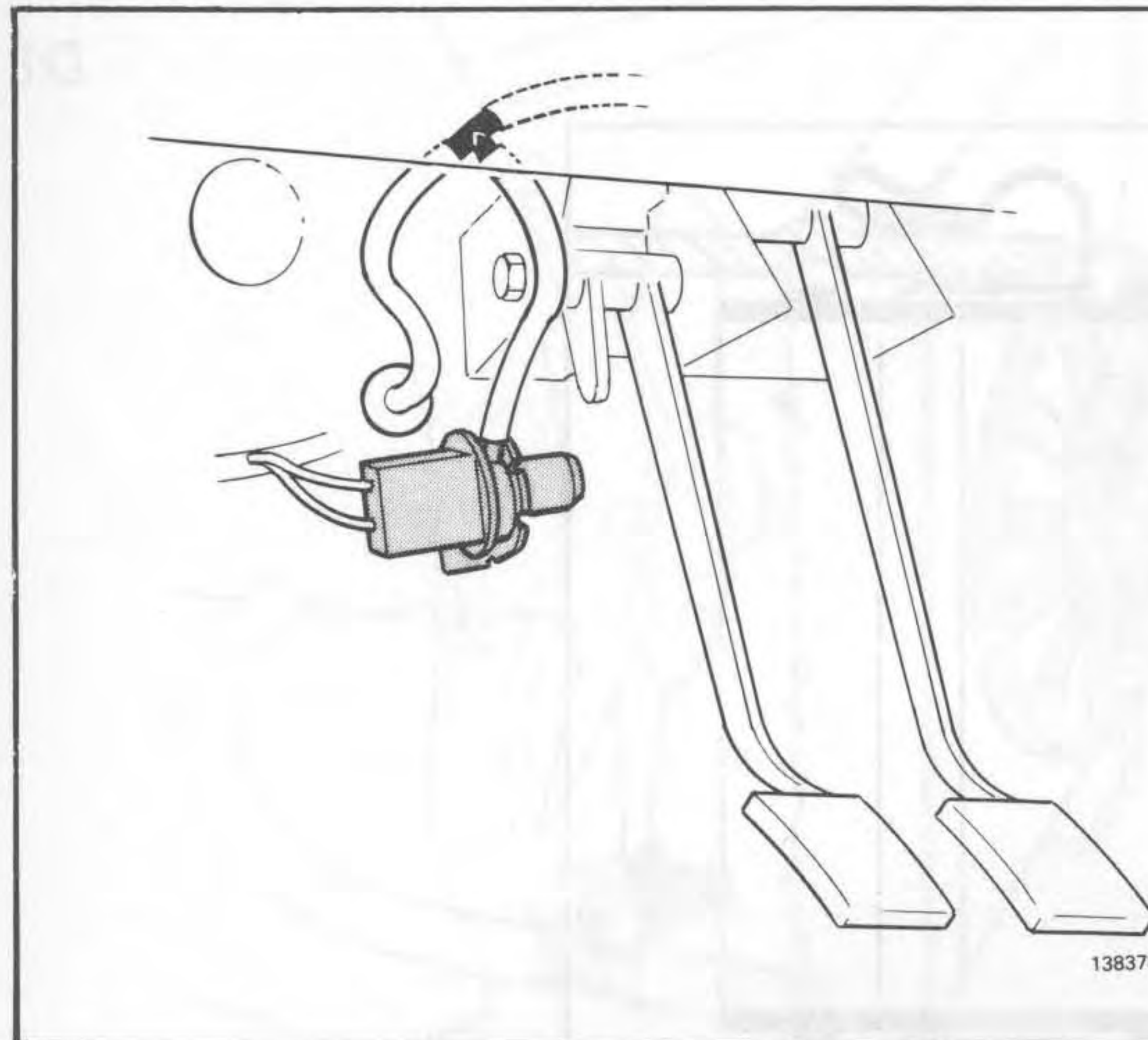
B13

Seal wastegate actuator link rod

See B 9.

C. Charge air overpressure switch, checking

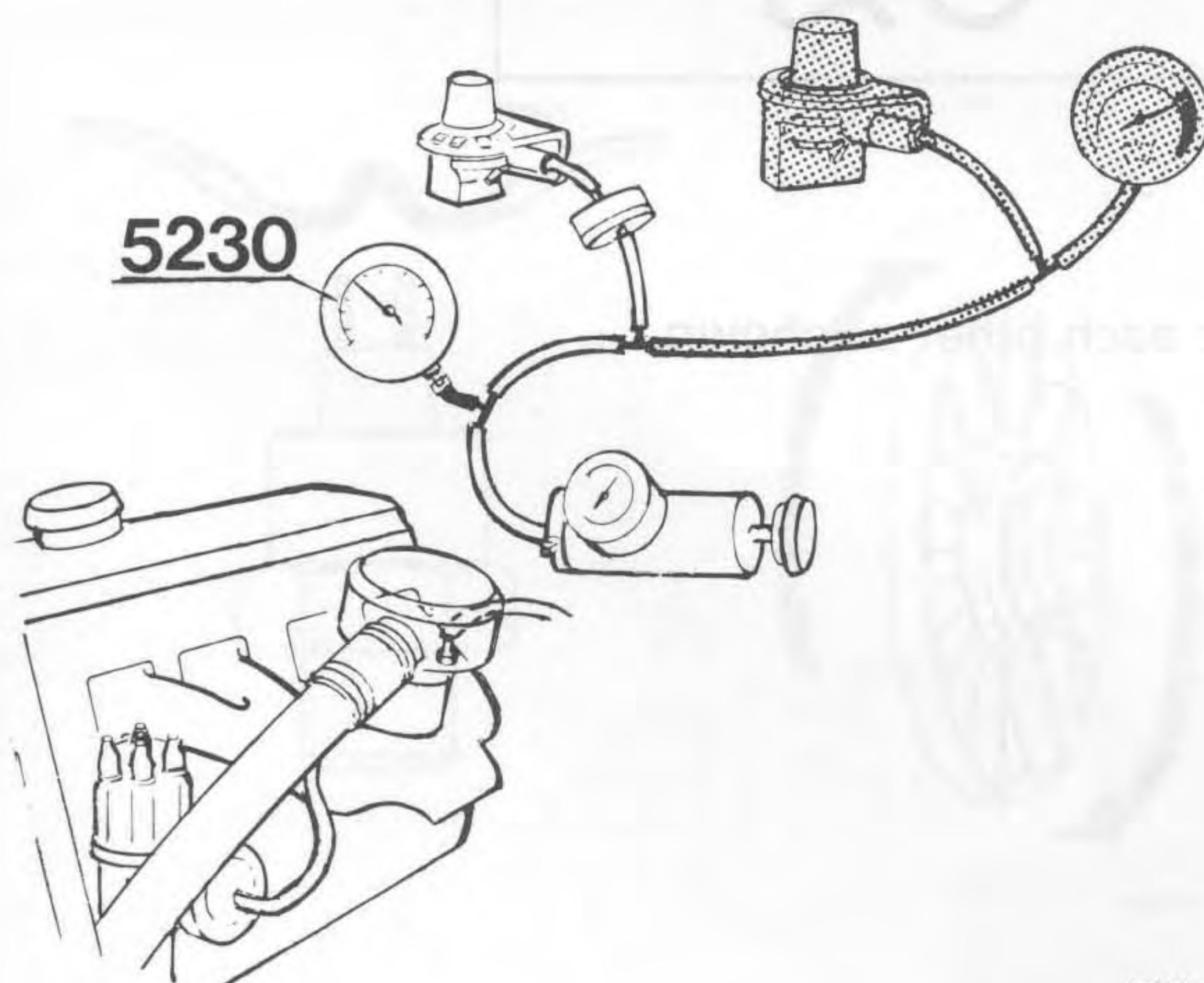
Special tool: 5230



Charge air overpressure switch is located under dash above pedal assembly.

It breaks system relay ground connection if charge pressure should exceed approx. 105 kPa (14.9 psi).

The switch is automatically reset when charge pressure returns to normal.



Connect test equipment

Connect pressure gauge **5230** and a pressure tester to hose at intake manifold.

C1

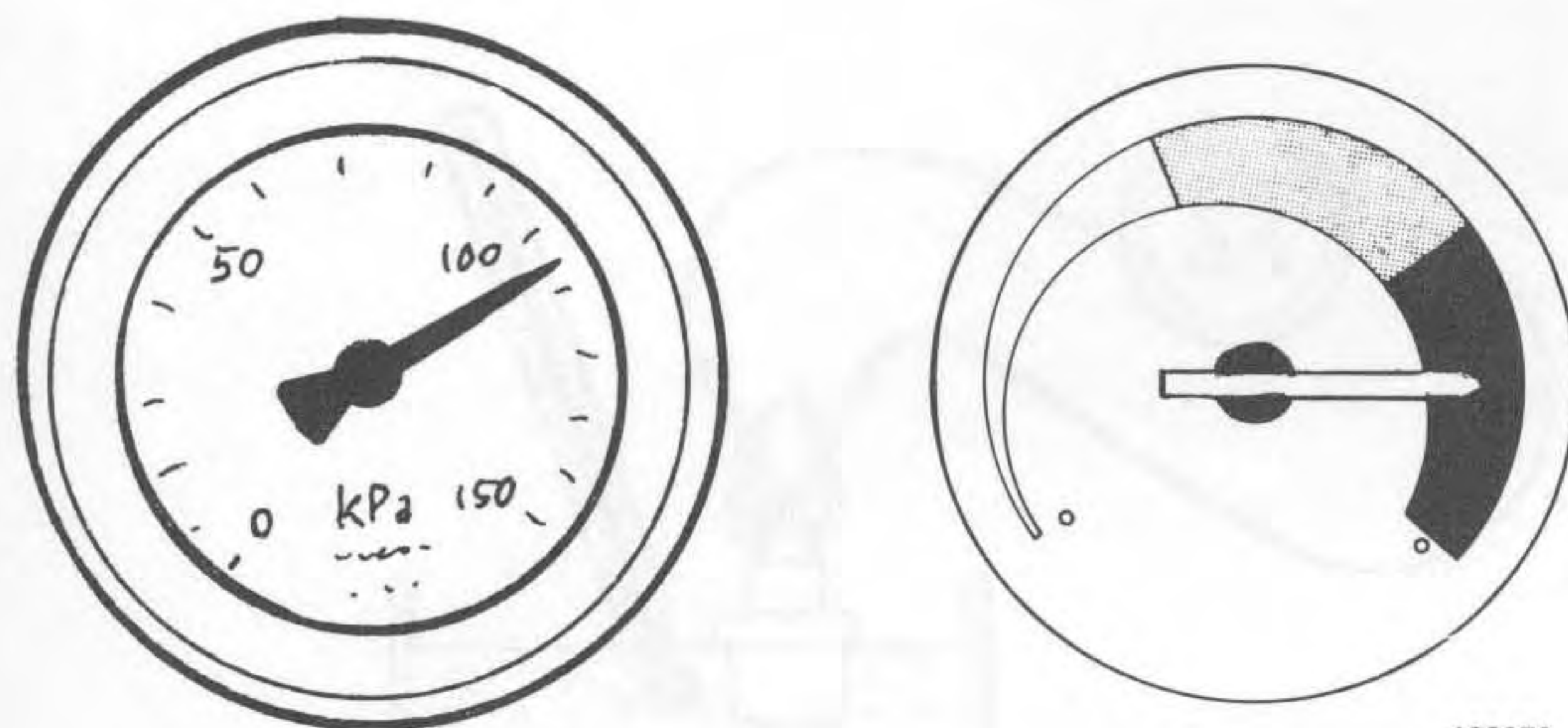
Check charge air overpressure switch

Start engine.

Increase pressure until engine stalls i.e. switch opens.

C2

Important! Do not exceed 120 kPa (17.1 psi) or dashboard pressure gauge may be damaged.



Engine should stall at **100–110 kPa** (14.2–15.6 psi) and pointer should be in red section on dashboard gauge.

Replace switch if defective.

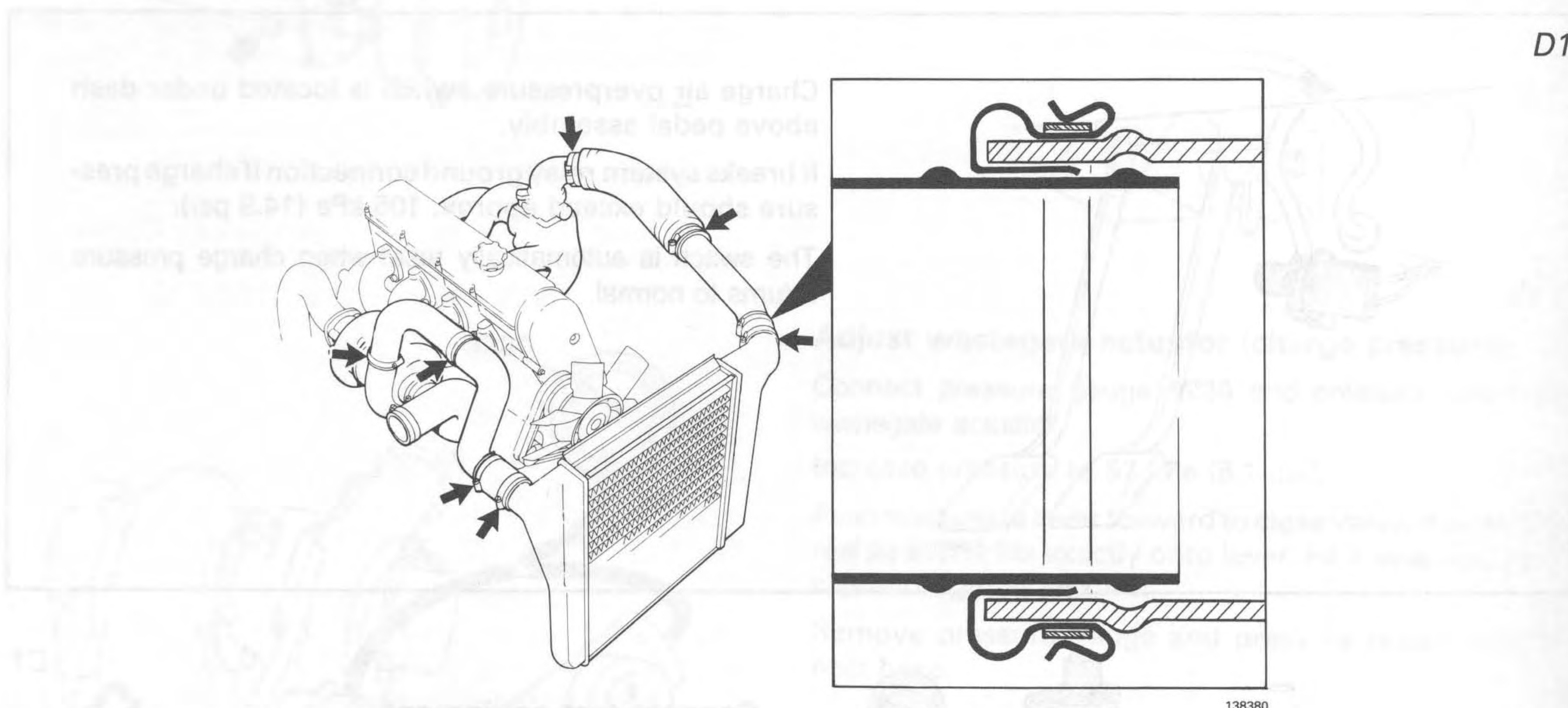
C3

Remove test equipment

Turn off ignition.

Remove pressure gauge 5230 and pressure tester. Reconnect hose to intake manifold.

Intercooler, hoses, clips

D. Intercooler hoses, clips

- Two retainers per clip
- Retainers should be opposite each other as shown.

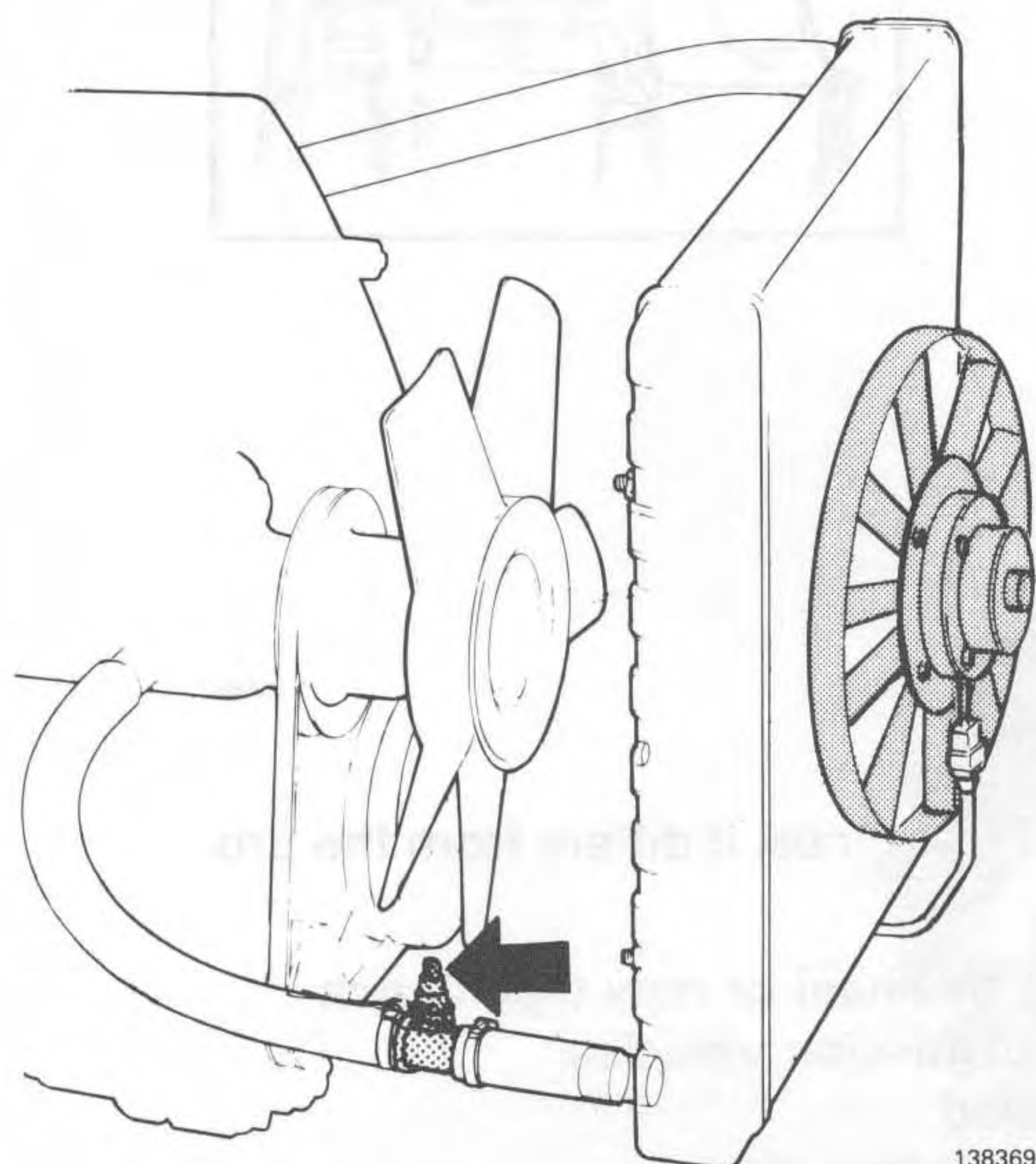
Group 26 Cooling system

E. Thermal switch – electric cooling fan, checking

E1

Electric cooling fan is controlled by a thermal switch mounted on lower radiator hose. It switches fan on at 100°C (212°F) and off at 95°C (203°F).

Wiring diagram, see page 6.



138369

E2

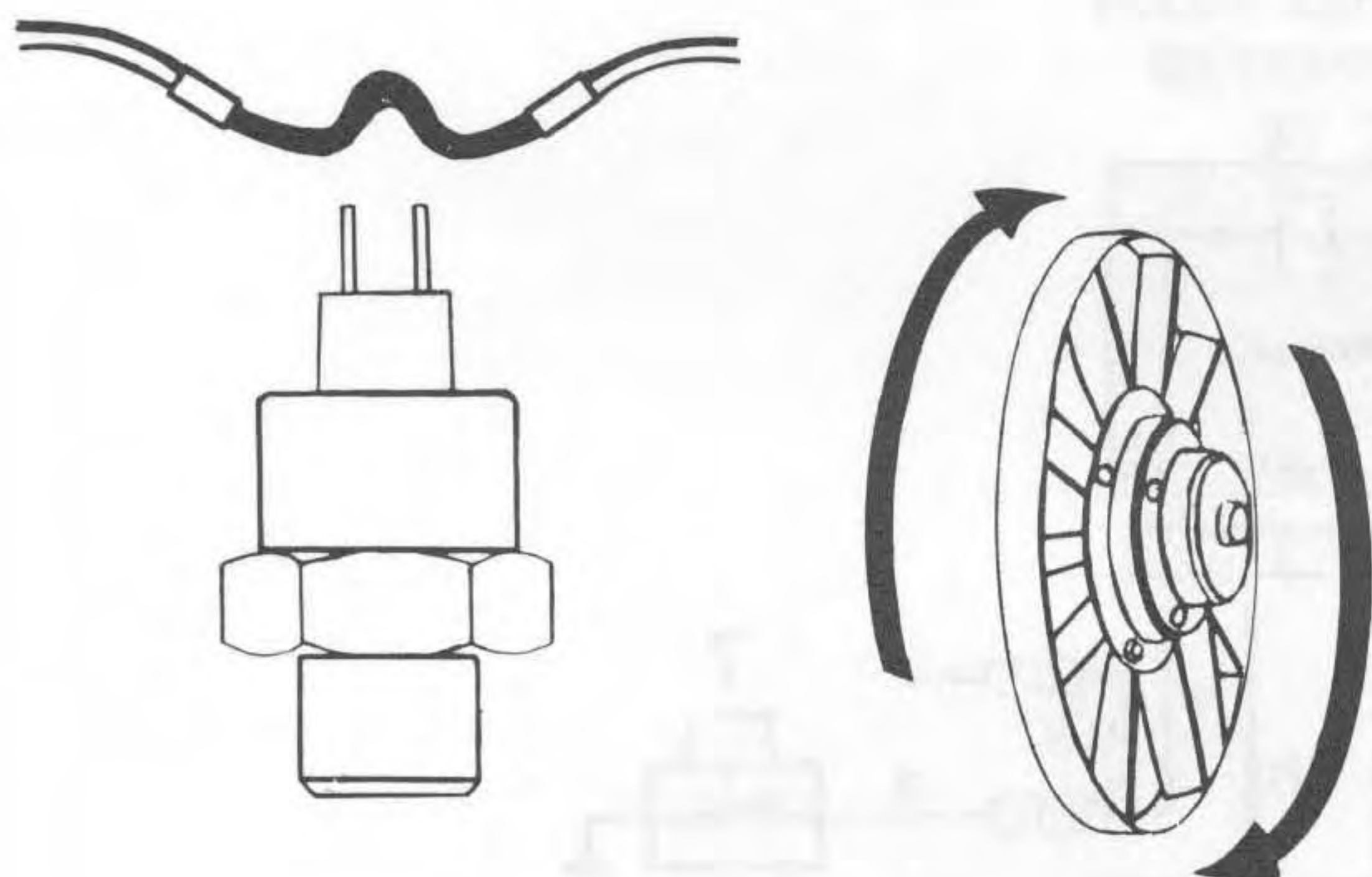
Checking electric cooling fan relay and fan

Turn on ignition.

Join the two wires connected to the switch.

Fan should start.

If not, check wires and relay, see wiring diagram on page 6.



138381

E3

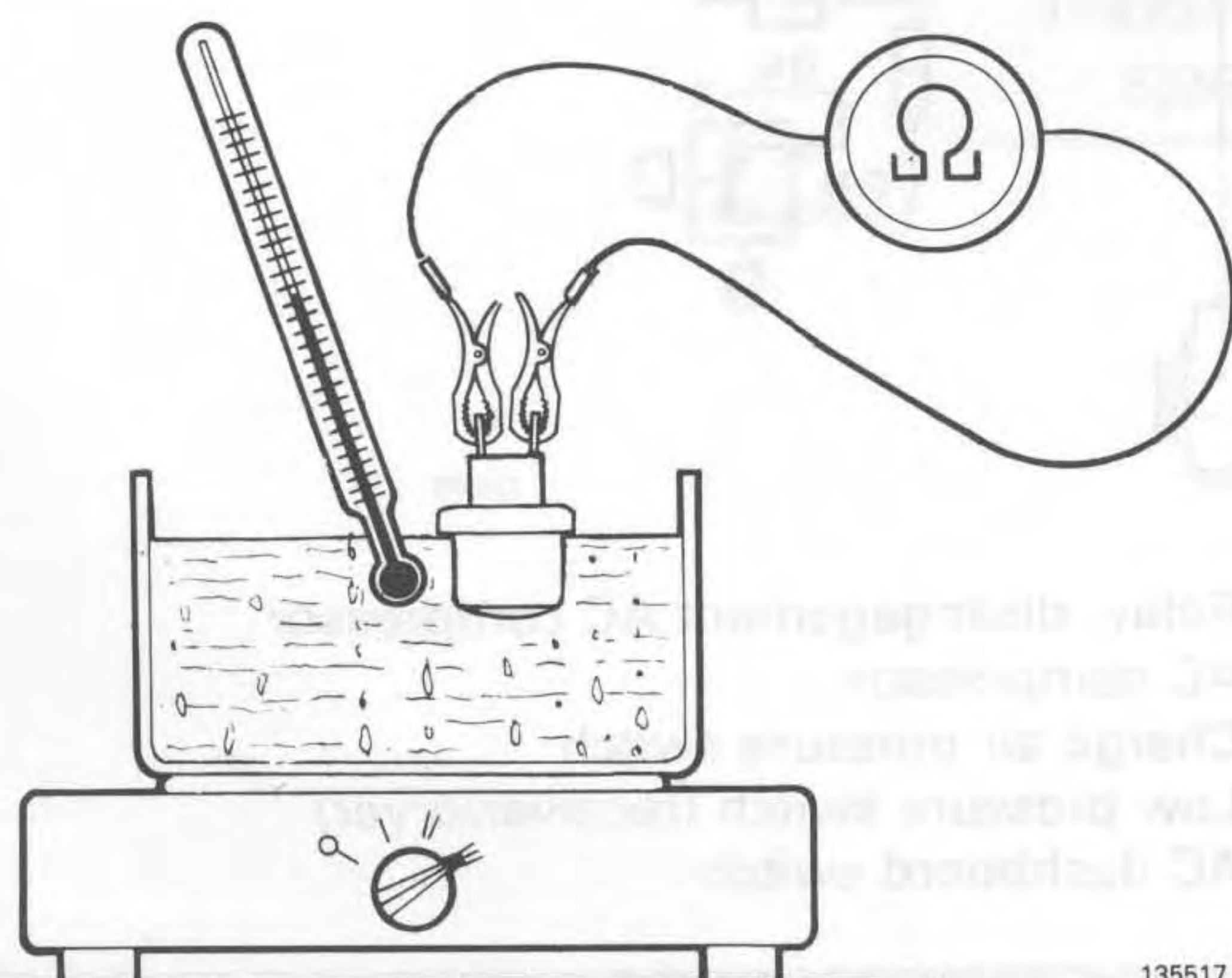
Checking thermal switch

If required the thermal switch can be tested by heating it in an oil bath or oven and observing the pointer of an ohm meter connected between the two terminals.

The switch should cut in at **97–102°C** = 207–216°F (small deflection).

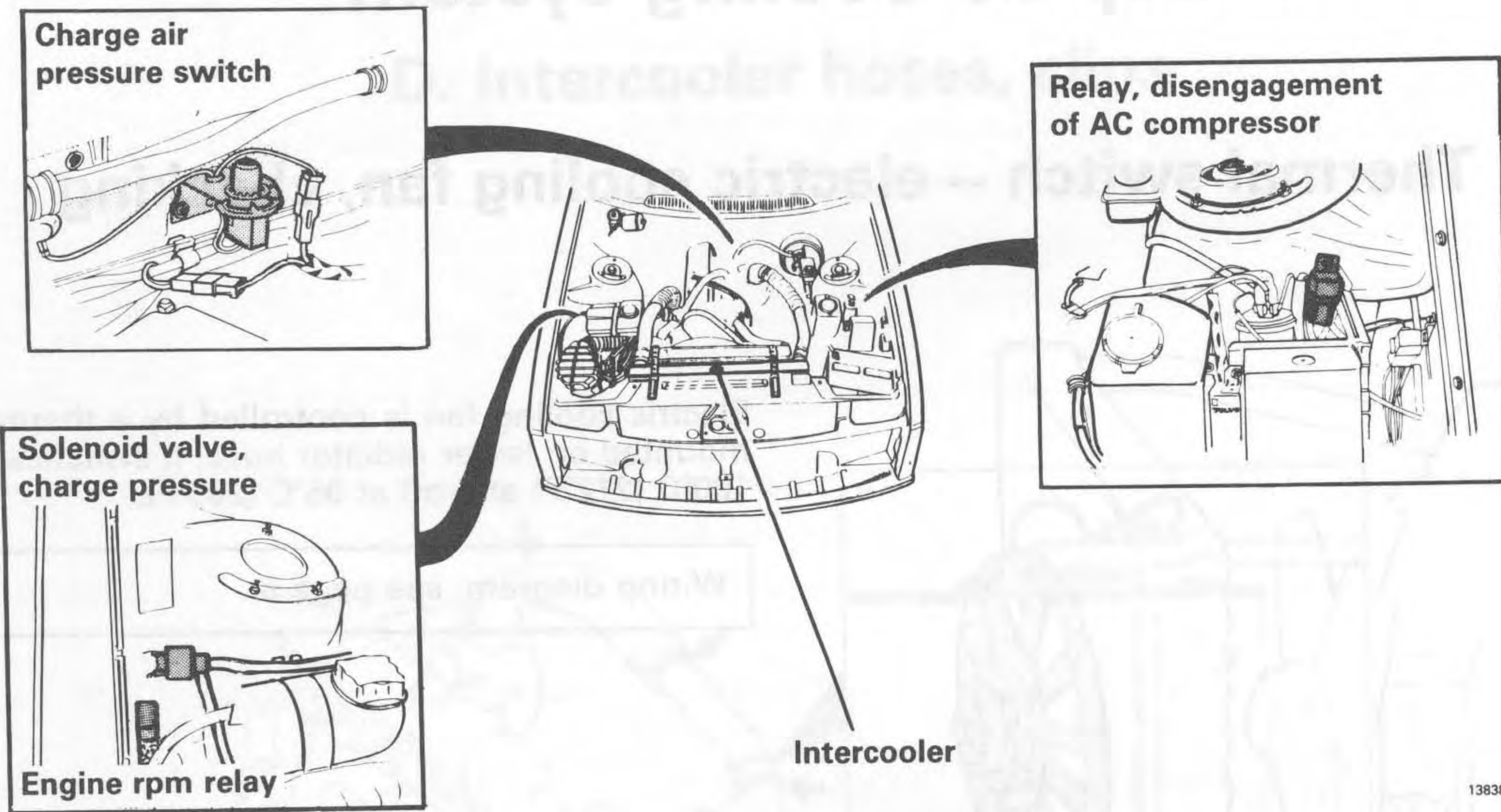
On cooling to **97–92°C** (207–198°F) the switch should break the circuit (large deflection).

If an oil bath is used to heat the switch care should be taken to ensure that the switch does not touch the sides or bottom of the bath. Also, the thermometer should be held near to the switch.



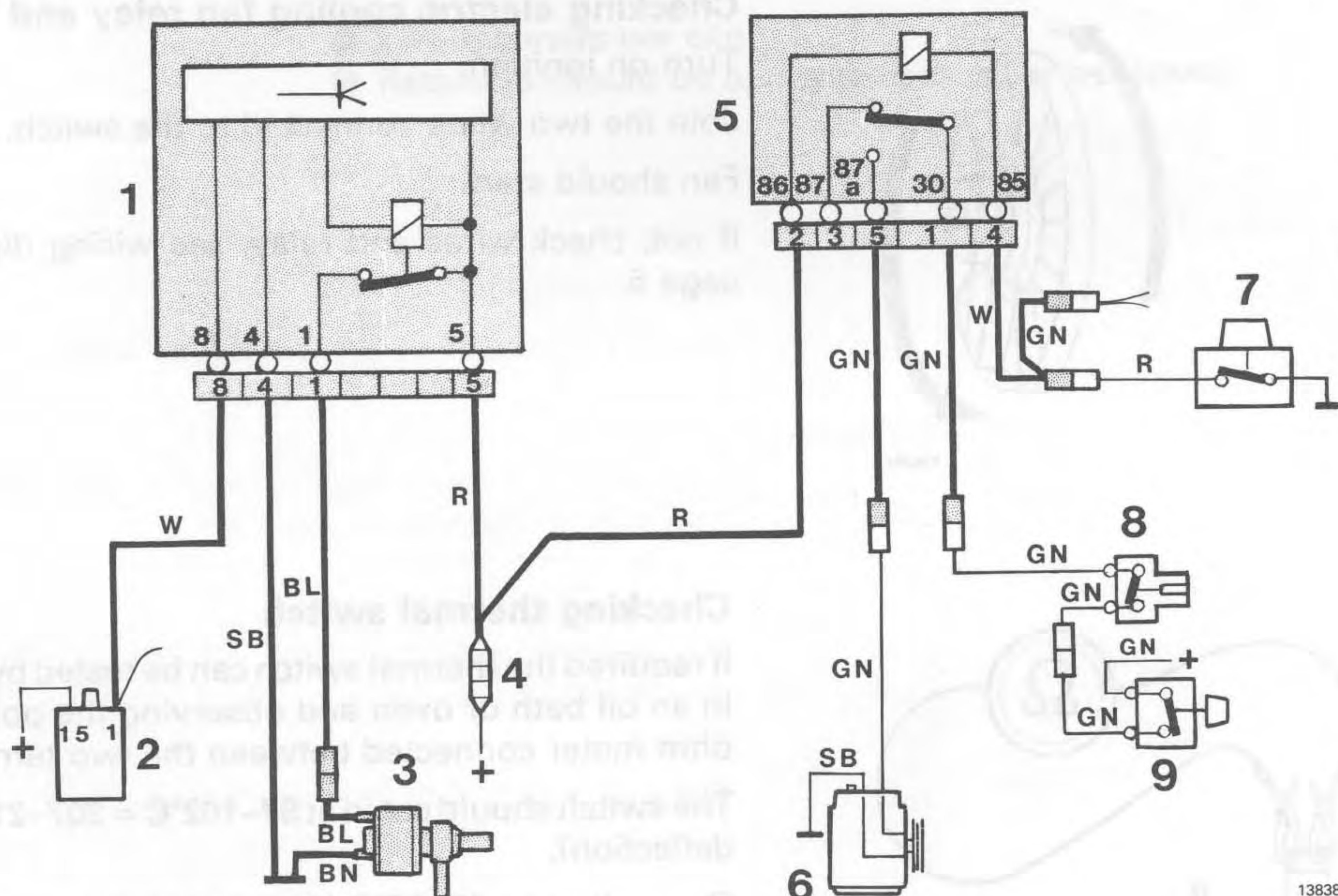
135517

Intercooler kit



An intercooler conversion kit is available for earlier B 21 FT engines. It differs from the production version in the following points:

- it does not include an electric cooling fan, heavy-type flywheel or new type clutch
- modified C1 type clutch is not fitted on automatic transmission vehicles.
Also modified valve body separator plate is not supplied
- engine rpm relay is slightly different and is not fitted in same place
- wiring is different



- 1 Engine rpm relay
- 2 Ignition coil
- 3 Solenoid valve
- 4 Fuse No. 12

- 5 Relay, disengagement AC compressor
- 6 AC compressor
- 7 Charge air pressure switch
- 8 Low pressure switch (receiver/dryer)
- 9 AC dashboard switch



**VOLVO SUPPORTS VOLUNTARY
MECHANIC CERTIFICATION
BY THE N.I.A.S.E.**

(U.S.A. only)

Service literature

*Your
most important
special tool*

VOLVO

TP 30685/2
6000 04.84
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