Section C6

Fault Diagnosis

The fault diagnosis section of Chapter C is divided into three sub-sections which are entitled and defined as follows.

Sub-section 1
Checking and Setting Instructions
(Section C4 - Operations 1 to 36 inclusive)

In this sub-section will be found straight forward fault diagnosis instructions which are directly connected by Operation Number to the check and setting instructions in Section C4.

It is recommended that when a fault is suspected, the complete check and setting instructions be carried out as a matter of course, suspect faults can so easily be the result of an incomplete understanding of the system and how it works. In addition, there may be more than one fault, therefore, carrying out the full check and setting sequence will enable the symptom(s) to be established and by consulting this first sub-section the fault can be correctly diagnosed.

Should the suspect fault(s) defy the straight forward diagnosis given in sub-section 1, refer to the more detailed and involved diagnosis of sub-section 2.

Sub-section 2
Circuit Operation and Description

This sub-section contains detailed information of each circuit's operation and it is recommended that this sub-section be consulted if the fault cannot be diagnosed from the information given in sub-section 1.

Sub-section 3
Refrigerant, Coolant and Mechanical Features

This sub-section contains information for the diagnosis of faults in connection with the refrigerant, coolant and mechanical features of the system.

Sub-section 1
Checking and Setting Instructions
(Section C4 - Operations 1 to 36 inclusive)

Under normal conditions the automatic air conditioning system will only operate when the engine is running, but for the purpose of testing the system, when it is not convenient to run the engine, the inhibit system may be temporarily by-passed as follows.

1. Disconnect the wire from the oil pressure transmitter located adjacent to the engine oil filter.
2. The automatic air conditioning system will now operate when the ignition is switched on and the appropriate switch positions selected.
3. If the ignition is to be switched on for a period of time it is advisable to disconnect the feed wire to the ignition coil to prevent overheating.
4. Always leave a note close to the ignition switch stating which wires have been disconnected.

The Operation numbers at the beginning of each check below are directly related to the operations for checking and setting the system given in Section C4.

Operation 7
During this operation the test box (RH 8851) is used as a voltmeter with a range of 0 volts to 10 volts.

1 CHECK VOLTS switch in position 1
The reading on the Voltmeter should be 9.1 volts + or - 0.5 volts. This test is to check the value of the stabilised voltage from the stabiliser to the servos.
For a reading of 0 volts check the following.
a) Check the fan and compressor fuse and the automatic air conditioning fuse (see the fuse-board identification plate for the location of the fuses).
b) Check that the automatic air conditioning system (function) switch is switched on and that either the engine is running or the ignition is switched on and the oil pressure transmitter is disconnected.
c) Check that a 12 volt feed is reaching the voltage stabiliser module via the 9 pink cable in the module plug and socket. If not proceed to (f).
d) Check that 9.1 volts is being fed from the voltage stabiliser via the 9 red cable in the module plug and socket. If not proceed to (g).
e) If tests (a) to (d) inclusive are correct, the fault must lie in the loom interconnections between the voltage stabiliser module and the servos, or in the servos themselves.
f) The 12 volt feed to the voltage stabiliser module is fed via the servo isolation relay and then via the 14 yellow/black cable from the fan and compressor relay. Check all connections to these relays, especially the 9 pink cable from the servo isolation relay through the right-hand toeboard socket D to the voltage stabiliser.
For correct operation, the servo isolation relay should not be energised and the fan and compressor relay should be energised. If these relays are not energised and de-energised as stated, the circuits associated with the relays must be checked. For further details of the interlock circuits refer to sub-section 2.
g) There are two reasons for the voltage stabiliser module not giving out 9.1 volts on the 9 red cable.
(i) There is a short on the 9 red line either in the loom or in the servos.

Note A short circuit will not damage the voltage stabiliser module.

(ii) If the voltage stabiliser module is faulty it must be replaced.

For a reading of between 0 and 8.6 volts check the following.

a) Check for an incorrect connection on the 9 pink cable causing a partial short circuit.

b) If check (a) is satisfactory the voltage stabiliser module must be faulty and should be replaced.

For a reading above 9.6 volts check the following.

a) Check the earth to the stabiliser. (9 black/pink cable to 44 black cable to left-hand A post earth point).

b) If check (a) is satisfactory the voltage stabiliser module must be faulty and should be replaced.

2 CHECK VOLTS switch in positions 2 and 4

The reading on the voltmeter should be between 1 volt and 4 volts. This test is a check of the voltages on the upper and lower servo position potentiometers inside the servos.

a) Ensure that the voltmeter reading for the test with the CHECK VOLTS switch in position 1 is correct. If not carry out the instructions with the switch in position 1 and correct as necessary.

b) Remove the servo modules. If this cures the fault replace the relevant servo module.

If removing the servo modules does not correct the fault, replace the complete servo assembly as the fault is internal.

3 CHECK VOLTS switch in positions 3 and 5

The reading on the voltmeter should be between 1 volt and 4 volts. This test is a check of the voltages on the upper and lower temperature selector and sensor chains where the control lines are brought into the servo modules.

Refer to Chapter C - Section C4, test and adjusting procedure, carry out Operations 8 to 21 inclusive. If these tests can be completed satisfactorily the fault lies in the temperature sensor networks and the instructions given below should be followed. If Operations 8 to 21 inclusive cannot be completed see the relevant instructions for those tests.

a) An incorrect reading with the CHECK VOLTS switch in position 3 indicates a fault in the lower sensor network. An incorrect reading with the CHECK VOLTS switch in position 5 indicates a fault in the upper sensor network.

b) Too high a reading indicates that the resistance of the sensor chain is too high or open circuit.

c) Too low a reading indicates that the resistance of the sensor chain is too low or short circuit.

Actual resistance values are given in sub-section 2 under the heading of Temperature Sensors.

Operation 12

If the lower servo fails to move during this operation, refer to Fault Flow Chart 1 in sub-section 2.

Operation 14

If a meter reading of 43 cannot be obtained check the following.

a) If the lower servo movement is erratic the trim potentiometer is faulty and either this or the servo must be replaced.

b) If the trim potentiometer is turned fully clockwise and the meter reading is below 43 proceed as follows.

(i) Check to ensure that the servo trim cover socket has been disconnected .

(ii) Change the lower servo module.

(iii) Check the resistance of the lower selector temperature potentiometer. The resistance with the leads disconnected and the dial in the mid-position should be 490 ohms + or - 30 ohms.

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(iv) Check the interconnections between this potentiometer and the lower servo.

If all these checks are satisfactory and the fault still persists the servo must be replaced.

Operation 15

If the upper servo fails to move during this operation, refer to Fault Flow Chart 1 in sub-section 2.

Operation 17

a) Should there be a fault in the fan motors speed refer to Fault Flow Chart 2 in sub-section 2.

b), c), d) Ignore faults in this section as all these items are checked individually later.

Operation 18

1 The recirculation actuators do not operate

a) Check that the actuators are not faulty by using a slave actuator or test the voltages at the actuator plugs.

b) Check the electrical feeds to the actuators at the recirculation relay. The 9 red/brown cable should have a live feed from fuseboard A. If correct, check the wiring from this relay to the actuators.

c) Check that the recirculation relay is energised when the upper servo moves away from the full cold position. With the relay energised the recirculation flaps should close (i.e. admit only ambient air).

d) Check that the recirculation relay is not energised when the upper servo is at full cold. When the recirculation relay is not energised the flaps should open (i.e. admit only recirculated air).

e) If the relay is not operating check that the relay coil has a live feed for all on positions of the automatic air conditioning (function) switch. If not, check the wiring to and from the automatic air conditioning (function) switch and the switch itself.

f) Check that the relay coil is earthed when the upper servo moves away from full cold and is not earthed at full cold. If not, check the wiring from the relay to the servo. If the wiring is correct ensure that the servo does move to full cold.
g) If the servo does move to full cold and the earth signal is incorrect check the in-line diode. If this is correct the servo is faulty and should be replaced.

2 The recirculation actuators run on

a) Pull out the right-hand recirculation actuator plug. If this stops the left-hand actuator from running on then the right-hand actuator is feeding back, and one or both of the diodes in the automatic air conditioning system diode board is faulty (i.e. either the diode between the orange/slate coloured cable and the orange/brown coloured cable or the diode between the orange/green coloured cable and the orange/light green coloured cable).
b) If the left-hand actuator still runs on then there is a wiring or actuator fault.

Operation 19

1 The lower quantity flap actuator does not operate

a) Check that the actuator is not faulty by using a slave actuator or test the voltages at the actuator socket.
b) Check the wiring from the lower quantity flap relay to the lower quantity actuator.
c) Check that when all automatic air conditioning system (function) switch positions except DEF are selected, the 14 blue/red cable at the lower quantity flap relay is live when the upper servo is to the hot side of 10%, (i.e. as in the test and adjusting procedure, Operation 19(b) - Section C4) and is not live when the upper servo is to the cold side of 10% (i.e. as in the test and adjusting procedure, Operation 19(c) - Section C4). If this is not so, proceed to Operation (e).
d) Disconnect the 14 yellow/brown cable from the lower quantity flap relay and repeat the test and adjusting Operations 19(b) to 19(d) (Section C4) inclusive. If the lower quantity flap actuator does not run proceed to (f). If the lower quantity flap relay is energised the lower quantity flap will not open. Therefore, if removing the 14 yellow/brown cable rectifies the fault the relay is being earthed incorrectly, either by the lower quantity flap micro-switch, by the fan delay thermostat or by the cables connected to them. The lower quantity flap micro-switch should only earth this line when the lower quantity flap is fully open.
e) Repeat check (c) and monitor the voltage at the 14 blue/green cable on the upper servo plug and socket. If the voltage switches when the servo crosses the 10% position the fault lies within the automatic air conditioning system (function) switch or in the wiring between the servo plug and socket on the lower quantity relay. If the voltage does not switch at the upper servo plug and socket, check that the 9 pink cable to the upper servo is live; if it is, the servo must be replaced as the fault is internal.
f) Test the lower quantity flap relay and if this is correct check the 14 blue/white cable from the C3 terminal on the relay through the diode board to the 14 orange/white cable on the actuator.

2 The lower quantity flap actuator runs on

a) Check the action of lower quantity flap relay. When energised terminal C1 should be live and terminal C3 should not.
b) Check the four relevant diodes on the automatic air conditioning system diode board which are in the circuit to prevent the actuator from running on. The diodes are between the following.
blue/white cable and orange/white cable
yellow/brown cable and yellow/green cable
blue/green cable and green/pink cable
orange/black cable and green/pink cable

3 The lower quantity flap actuator moves at incorrect meter reading

a) Adjust the 10% micro-switch on upper servo or replace the servo.

Operation 20

a) The mode flap actuator does not operate

(i) Check that the actuator is not faulty with a slave actuator or check the voltages at the actuator socket.
(ii) Check that the 14 orange/purple cable at the upper servo plug and socket is live when the mode should be to the screen [i.e. as in the check and setting operation 20(b) (i)]. Check the 14 orange/blue cable is live when the mode should be to the facia [i.e. as in the check and setting operation 20(d) (i)]. If not check that the 9 pink/cable to the upper servo is live.
(iii) If the voltages at the 14 orange/purple cable or the 14 orange/blue cable do not switch at 25% upper servo position and there is a live feed to the 9 pink cable, there is an internal fault and the servo should be replaced.
(iv) Check the wires and the interconnections between the upper servo plug and socket and the mode flap actuator via the automatic air conditioning system diode board.

Operation 20

b) (i) The fan motors do not stop

Check that the fan speed module switch-off relay is energised. If not proceed to paragraph 5.
Check the relay connections.
Ensure that the C2 terminal is connected to earth.
Earth the 14 blue/black cable from the fan speed module. If this does not stop the fans, the fan speed module is faulty and must be replaced. If fans do stop, the switch-off relay is faulty.

Earth the W1 terminal on fan speed module switch-off relay. If fans do not stop proceed to the next paragraph. If fans do stop, the fault is in the yellow/pink cable path to earth. Check the associated circuits.

Connect the W2 terminal to a live feed after disconnecting the twin 14 brown/pink cables. If the fans do not stop replace the fan speed module switch-off relay. If fans stop the fault is in the 14 brown/pink cable feed from the 14 red/brown cable via the automatic air conditioning system (function) switch.

Operation 20

b) (ii) No feed to the heated rear window

Proceed to 20(d) (iii)

Operation 20

b) (iii) Meter reading incorrect

Adjust the 25% micro-switch on upper servo or replace the servo assembly.

Operation 20

c) (i) Lower quantity flap does not open

Only proceed if Operation 19 has been completed satisfactorily.

If Operation 19 is correct this fault is caused by an incorrect earth on the 14 yellow/brown cable on the lower quantity relay. Check by disconnecting the 14 yellow/brown cable from the lower quantity flap relay, if the flap now opens proceed to the next paragraph. If not, repeat Operation 19. Ensure that the 14 yellow/brown cable from the lower quantity flap relay to the fan delay thermostat is not shorting to earth.

Check the diode between the 14 yellow/brown cable and the 14 yellow/green cable on the automatic air conditioning system diode board is not short circuiting. If there is a short circuit the lower quantity flap relay will be receiving an incorrect earth from the lower quantity flap relay micro-switch.

Operation 20

c) (ii) Fans do not start

Proceed only if Operation 20(b) (i) has been checked successfully.

If 20(b) (i) is satisfactory the circuits connected with the fan speed module switch-off relay are operating correctly. Therefore, the fault lies in the interconnections between the lower quantity flap micro-switch and the fan speed module switch-off relay, or the lower quantity flap micro-switch itself. Check particularly that the lower quantity flap linkage is operating the micro-switch when the flap is fully open.

Operation 20

c) (iii) Air flow is not to the windscreen

If the operation of the mode flap actuator has been checked as in Operation 20 and 20b (ii) and is found correct, the crank on the actuator must be incorrectly set.

Operation 20

d) (i) Mode flap actuator does not operate

See Operation 20.

Operation 20

d) (ii) Air flow is not from facia

If Operations 20 and 20(c) (iii) are correct, there is a flap linkage fault.

Operation 20

d) (iii) Incorrect feeds to the rear window demister

If Operation 20(b) (iii) was incorrect and there is now a feed at the heated rear window (blue/grey cable) then the heated rear window relay is operating correctly but its contacts are wired incorrectly.

Check that the 28 blue/grey cable is connected to the C2 relay terminal and 28 brown/grey cable is connected to the C3 relay terminal.

If Operation 20(b) (iii) is correct and there is still a live feed at the 28 blue/grey cable, check that the heated rear window relay is energised. If not check the relay feed back to the upper servo socket.

Check the heated rear window relay and replace if it is faulty.

If feed cannot be obtained at the 28 blue/grey cable when the system is in the screen or facia mode check the heated rear window fuse.

Check the feed to the 28 brown/grey cable on the C3 relay terminal.

Check the feed to the relay winding in the facia mode and check the earth to the relay.

Check the relay and replace if faulty.

Operation 20

d) (iv) No airflow from the lower outlets

If Operation 19 is checked satisfactorily proceed as follows.

Check that the lower quantity flap relay is energised. If not proceed to the fourth paragraph.

Disconnect the W2 terminal on the lower quantity flap relay. If the lower quantity flap actuator now opens there is a false earth on the yellow/brown cable.

The lower quantity flap relay or its connections are faulty as all other circuits were checked in Operation 19.

Operation 21

Unable to obtain a reading of 51 on the flap position meter

a) **Is the servo movement erratic**

If so the trim potentiometer is faulty and either this or the servo must be replaced.

b) **If the trim potentiometer is turned fully clockwise and the meter reading is below 51**

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Ensure that the servo trim cover socket has been disconnected.

Change the servo module.

Check the resistance of the upper select temperature potentiometer. The resistance with the leads disconnected and the dial in the mid-position should be 420 ohms + or - 30 ohms.

Check the interconnections between this potentiometer and the servo.

If all these checks are satisfactory the servo must be replaced if the fault is still present.

Operation 22

a) **The recirculation flaps do not open**

If Operation 18 has been completed successfully the only cause of this fault can be that the 14 brown/pink feed cable to the recirculation relay is permanently live.

(i) Check the 14 brown/pink cable from the recirculation relay back to the automatic air conditioning system (function) switch.

(ii) Check the automatic air conditioning system (function) switch. The 14 brown/pink cable should be live for all positions except OFF.

b) **The fan motors do not stop**

(i) Check the voltage at the 14 brown/pink cable on the fan and compressor relay. If this point is live then either the automatic air conditioning system (function) switch is faulty, as this should break the 12V feed in the OFF position, or the 14 brown/pink cable is obtaining an incorrect feed which must be traced.

(ii) If this point is not live and the fans are still running the fan and compressor relay must be faulty or wired incorrectly.

Operation 23

a) **The recirculation flaps do not close**

Repeat Operation 18.

b) **The fan motors do not restart**

Refer to the fault flow chart 2 in sub-section 2.

Operation 27

The lower servo does not move

(i) Turn the lower temperature selector to maximum temperature and then warm the knee roll sensor with the fingers. If the flap lever now moves downwards, the system is correct and further action should not be taken.

(ii) If the servo does not move, remove the 5-way trim cover socket and repeat Operation 12.

(iii) When the test box (RH 8851) has been calibrated to read lower servo positions replace the 5-way trim cover socket.

(iv) Switch the test box to RUN and AUTO positions. If the test box indicates that the servo has moved to 100 there is a sensor chain fault and so Operation 7 switch position 3 in the check procedure should be repeated.

(v) If the test box reads between 0% and 100%, warm the lower sensor with the fingers. If the servo now starts to move towards 0% then this is correct and the reason that the servo temperature flap lever did not move, was that prevailing temperature conditions in the car dictated that the servo was in the overtravel position, where the temperature flap lever is held stationary by spring pressure but the servo is still free to move.

(vi) If the test box reads 0% turn the lower temperature selector to maximum temperature. If the servo now moves away from 0% warm the lower sensor with the fingers. If the meter now moves towards 0% this is correct and further action should not be taken.

(vii) If the servo remains on 0% there is a sensor chain fault and Operation 7 switch position 3 in the test and adjustment procedure should be repeated.

Operation 28

The upper servo does not move

Repeat the tests given in Operation 27 but read upper for lower and warm the cantrail sensor with the fingers.

Operation 29

No increase in fan speed

(i) Disconnect the 5-way trim cover socket so that both servos will run to their respective full hot positions and so demand maximum fan speed. If the fan speed then increases the system is correct and further action need not be taken.

(ii) Connect a cable between the 14 blue/brown cable in the fan module plug and socket and the 90 yellow cable in the lower servo plug and socket. If this causes an increase in fan speed both the servo and the fan speed module are correct proceed to (iii), if no speed change occurs proceed to (iv).

(iii) At the automatic air conditioning system (function) switch connect the 90 yellow cable to the 14 blue/brown cable. If the fan speed increases, the automatic air conditioning system (function) switch is faulty and should be replaced. If the fan speed does not increase the fault lies in 90 yellow cable line to the lower servo or the 14 blue/brown cable line to the fan speed module.

(iv) With a voltmeter (not a test lamp) check that the 90 yellow cable in the lower servo plug and socket is live (i.e. approximately 12 volts). If the 90 yellow cable is live the fan speed module is faulty proceed to (vi). If the 90 yellow cable is not live check the voltage at the 14 yellow/black cable in the lower servo plug and socket. If this reads approximately 12 volts, the servo is faulty and should be replaced. If the reading is zero check the 14 yellow/black cable, which is the positive feed to the automatic air conditioning system, back to the fan and compressor relay.

(v) If the servo has been replaced or a fault found in the 14 yellow/black feed and the fan speed is still not correct go back to (ii).

(vi) If a live feed to the 14 blue/brown cable does not increase the fan speed, the fan module is faulty. In the fan speed module disconnect the green plug from the socket on the printed circuit board (on early models disconnect both green plugs from the two boards). If the fan speed now increases change the printed circuit board (or the larger board if there are two). If the fan speed does not increase the power switching circuit is faulty and should be replaced.

Operation 30

No increase in fan speed

(i) Proceed only if Operation 29 is correct.

(ii) Ensure that the 14 yellow/black cable at the automatic air conditioning system (function) switch is live. If not, check this line to where it picks-up a feed from the 44 yellow/black fan speed module feed at splice X.

(iii) Short the 14 yellow/black cable to the 14 blue/brown cable at the automatic air conditioning system (function) switch. If the fan speed increases the switch is faulty and should be replaced, if not check the 14 blue/brown cable to the fan module.

(iv) If the speed does not increase, connect a voltmeter across one of the fan motors. If this reads 12 volts or more, the fans are running at maximum speed and if this reading does not reduce when AUTO is selected, it is the AUTO fan speed which is incorrect. To rectify this fault, fit a new air conditioning system (function) switch.

Operation 31

a) Servos do not travel to full hot

(i) Disconnect the 5-way trim cover socket. If the servos now travel to their respective full hot positions there is a short in the temperature sensor chain or the automatic air conditioning system (function) switch is faulty. If the servos do not travel to full hot, repeat the testing and adjusting procedure Operations 1 to 6 inclusive (see Section C4).

(ii) Disconnect the 9 orange cable at the automatic air conditioning system (function) switch. If the servos now travel to full hot, the automatic air conditioning system (function) switch is faulty and a new one should be fitted.

(iii) If the servos do not move, the 9 orange cable is shorting to earth. Check all interconnections and the ambient sensors.

b) The air flow is not to the screen

Repeat Operation 20(d).

c) The lower quantity actuator is not closed

Proceed only if Operation 19 is correct.

(i) Check that the 9 red/brown cable at the automatic air conditioning system (function) switch is live. If not check the feed from the fuseboard.

(ii) Join the 9 red/brown cable to the 9 orange/black cable at the automatic air conditioning system (function) switch connections. If this closes the lower quantity flap actuator, the automatic air conditioning system (function) switch is faulty and a new one should be fitted.

(iii) Check that the 9 orange/black cable is live at the automatic air conditioning system diode board. If not, check the 9 orange/black cable from the automatic air conditioning system switch to the diode board.

(iv) Check the diode between the 9 orange/black cable and the 9 green/pink cable on the automatic air conditioning system diode board, change if faulty.

(v) If the fault still persists, repeat Operation 19.

d) Fan motors not running at maximum speed

Note The fan connections and automatic air conditioning system switch contacts are identical for DEF as for HIGH. Therefore for any faults, repeat Operation 30.

Operation 32

Fan motors have stopped

(i) Disconnect the 9 orange cable from the fan delay relay. If the fan motors now start there is a short on the 9 orange cable or the automatic air conditioning system (function) switch is faulty.

Note This fault will also result in both servos not running to the full hot position.

(ii) Disconnect the 14 yellow/pink cable from the fan delay relay. If the fan motors now start and the 9 orange cable is still disconnected, the relay is faulty, or wired incorrectly. Check that the 14 yellow/green cable is connected to the C1 terminal and the 14 yellow/pink cable is connected to the C2 terminal.

(iii) Disconnect the twin 14 yellow/pink cable from the fan module switch-off relay. If the fans now start there is a short to earth in the 14 yellow/pink line.

(iv) Disconnect the 14 blue/black cable from the fan speed module switch-off relay. If the fans now start, the fan speed module switch-off relay is faulty, or wired incorrectly. Check that the 14 black cable is connected to the C2 terminal, the 14 blue/black cable is connected to the C1 terminal and the 14 blue/purple cable is connected to the C3 terminal. If the fans do not start, the fan speed module is faulty.

Sub-section 2
Circuit Operation and Description

Interlock circuit (see Fig. C59)
Both the fan and compressor and the servo circuits are fed from the fan and compressor fuse. The fan and compressor feeds are switched by the fan and compressor relay and the servo feed is taken from the fan and compressor feed but via the servo isolation relay. Therefore, the fans and compressor are switched on when the fan and compressor relay is energised; the servos are switched on, when the fan and compressor relay is energised and the servo isolation relay is not energised.

The yellow/black switched fan feeds are taken from C1 on the fan and compressor relay, through toeboard socket E, then directly to the fan speed module.

A yellow/black switched feed is taken from C2 on the servo isolation relay to the compressor ambient switch and then to the compressor clutch. The contacts on the compressor ambient switch break when the temperature falls below 0°C. (32°F.). The compressor clutch is earthed via the fan switch-off relay, the 14 blue/purple switched earth line running from the compressor clutch, through toeboard socket D, then to the fan switch-off relay. Thus the compressor clutch is engaged when the fan and compressor relay is energised, the fan switch-off relay is not energised and the ambient temperature is above 0°C. (32°F.).

The switched feed to the servos is taken by the 9 pink cable from C3 on the servo isolation relay, through toeboard socket D and then directly to the servos.

A 9 pink cable is looped from the servos to feed the voltage stabiliser module.

The coils which operate the fan and compressor relay and the servo isolation relay are fed by the air conditioning fuse number 3. To achieve the required switching combinations, both the live and earth sides of both these relay coils are switched as follows.

The fan and compressor relay is energised when the ignition is switched on, except when the air conditioning (function) switch is OFF or when the starter motor is in operation. This is achieved by feeding the relay coil via the air conditioning (function) switch and earthing the relay through the starter motor. The starter motor provides a low resistance earth path at all times except when the motor is fed with 12 volts which effectively shorts out the relay coil causing it to become de-energised. The feed to the air conditioning (function) switch is taken from the air conditioning fuse by the 9 red/brown cable.

The switched feed to the fan and compressor relay coil is taken from the air conditioning (function) switch by the 14 brown/pink cable through toeboard socket D. This 14 brown/pink cable is live for all air conditioning (function) switch positions except OFF. The earth line for this relay coil is the 14 brown/blue cable which is routed directly from the relay coil to the starter motor.

The servo isolation relay is energised when the ignition and air conditioning system are switched on and the engine oil pressure transmitter contacts are closed (i.e. when there is no engine oil pressure).

The live feed to the servo isolation relay coil is switched by the air conditioning (function) switch, the 14 brown/pink switched feed being taken from the switch at the same point as the feed to the fan and compressor relay. However, this feed to the servo isolation relay is routed via the fan switch-off relay and a diode on the air conditioning diode board. The feed is brought out of the diode board on the 9 white/blue cable, through toeboard socket D to the servo isolation relay coil. The 14 white/brown earth line for this relay is taken to the oil pressure transmitter via toeboard socket F, the 14 white/brown cable being fed into the car at this point and then to the oil pressure warning lamp.

The sequence of events for the interlock circuits is as follows.

With the ignition switch on and the air conditioning (function) switch in the LOW, AUTO, HIGH or DEF position, the fan and compressor relay is energised and so supplies a feed to the fan speed module, the compressor clutch and the servo isolation relay. The servo isolation relay is also energised since the oil pressure switch contacts are closed due to the lack of oil pressure. This results in the feed to the servos being broken by this relay.

Whilst the engine is being cranked the fan and compressor relay becomes de-energised, thus breaking the feed to the fan speed module, the compressor clutch and the servo isolation relay. Therefore, even if oil pressure builds up during cranking, which would result in the servo isolation relay becoming de-energised, there will be no feed to the servos because it has been broken by the fan and compressor relay. Although the fan speed module was receiving a live feed when the ignition was first switched on, the fans will not operate due to the action of the inhibit circuits.

The purpose of routing the switched feed to the servo isolation relay through a diode, is to prevent the oil warning lamp from finding an earth path via the servo isolation relay coil, the fan and compressor relay coil and the starter motor, when the air conditioning (function) switch is in the OFF position. Therefore, if this diode has failed in short circuit, the oil pressure lamp will glow dimly when the air conditioning system is switched off.

The symptoms of an open circuit failure are more obvious.

It can be seen that under normal working conditions the car engine must be running before any air conditioning checks are carried out. If this is not convenient, the oil pressure transmitter can be disconnected by withdrawing the lucar connection on the 14 white/blue cable. The air conditioning circuits will then operate as soon as the ignition is switched on.

Inhibit circuit (see Fig. C60)
The inhibit circuits are used to 'hold-off' the fans and compressor for a number of required temporary periods by means other than switching off their voltage supplies. The fans and compressor are held off for three conditions as follows.

1. When the ignition is first switched on before the engine has been started.
2. When the coolant temperature is below 44° C. (111° F.) and the system is in screen mode (i.e. demanding hot air).
3. When the system is in screen mode and the lower quantity flap is in any position other than fully open, regardless of coolant temperature.

Both the fans and compressor are held off for these periods by the fan switch-off relay. This relay has its moving contact, C2, connected to earth. The normally closed contact, C3, is connected by the 14 orange/purple cable, via toeboard socket D, to the compressor clutch. The normally open contact, C1, is connected by the 14 blue/black cable to the fan speed module. When this 14 blue/black cable is connected to earth, it holds off the output transistor in the fan speed module which then prevents the fans being switched on. Therefore, when the fan switch-off relay is not energised, the compressor clutch is earthed by the relay and can operate normally (the 14 blue/black cable to the fan speed module is open-circuit thus enabling the fans to be switched on). When the relay is energised the earth line to the compressor clutch is interrupted, preventing the relay from engaging (the fan speed module is earthed through the 14 blue/black cable so holding off the fans).

The fan switch-off relay coil receives a switched live feed on the 14 brown/pink cable from the air conditioning (function) switch and so is live whenever the ignition is switched on and the air conditioning (function) switch is in any position other than OFF .

The coil of the fan switch-off relay has two possible routes to earth. One earth path is the 14 yellow/pink cable through the diode board and then via the 14 white/brown cable through toeboard socket F to the oil pressure transmitter and then to earth. The relay is energised using this earth route when the ignition and the air conditioning system are switched on and there is no oil pressure. This is the method used to inhibit the fans and compressor when the ignition is first switched on before starting the engine.

The second earth route is the 14 yellow/pink cable through toeboard socket D to the fan delay relay. If this relay is energised, the fan switch-off relay is earthed on the 14 yellow/green cable by the lower quantity flap micro-switch, via toeboard socket D (or by the fan delay thermostat via toeboard socket D), the diode board, where the earth line emerges on the 14 yellow/brown cable and back through toeboard socket D. Thus this second earth route can only operate the fan switch-off relay when the fan delay relay is energised.

The fan delay relay is energised when the air conditioning system is operating in the screen mode, except when DEF is selected. The feed to the fan delay relay is switched by the 25% mode change micro-switch in the upper servo. When the mode is to the screen, the 14 orange/purple cable from the upper servo is live and this feeds the fan delay relay via the air conditioning diode board and the 14 yellow cable which is routed through toeboard socket D. The fan delay relay coil is earthed by the 9 orange cable through toeboard socket E to the air conditioning (function) switch. This line is earthed for all positions except DEF . Thus the fan delay relay provides the second route to earth for the fan switch-off relay and provides the necessary signal to hold off the fans and compressor when the coolant temperature is below 44° C. (111° F.) and the mode is to the screen, also when the lower quantity flap is not fully open and the mode is to the screen. This circuit also prevents the fans from being 'held-off' when DEF has been selected.

The reason for the lower quantity flap micro-switch inhibiting the fans is to initiate a fixed sequence of events when the coolant temperature switch operates, as a further refinement of the inhibit system. When the coolant temperature is below 44° C. (111° F.) (the coolant temperature switch connects the 14 yellow/brown cable to earth) not only are the fans and compressor inhibited but also the lower quantity relay is held closed. Thus, when the coolant temperature exceeds 44° C. (111° F.) and the contacts of the coolant temperature switch open, the fans do not start immediately since the lower quantity flap micro-switch is inhibiting this. However, the opening of the coolant temperature switch contacts causes the lower quantity relay to become de-energised and the lower quantity flap begins to open.

When the lower quantity flap is fully open it operates the lower quantity flap micro-switch which causes the fans to start and the compressor clutch to engage (this action prevents a sudden unexpected air flow through the screen outlets). The circuit controlling the lower quantity flap actuator is described under the appropriate heading.

The diode between the 14 white/brown and 14 yellow/pink cables is to prevent the oil pressure warning lamp from finding an earth through the fan switch-off relay coil and the fan and compressor relay coil, through the starter motor. **If this diode has failed in short circuit, the oil pressure warning light will glow dimly when the air conditioning system is switched off.**

Air conditioning (function) switch (see Fig. C8 and Fig. C61)
The function switch has two double wafers, connected by 10 flying leads into the air conditioning loom by means of single lucar connectors behind the instrument board. This switch can be completely disconnected locally, making replacement a simple operation. A chart showing connections for all switch positions is given with the circuit diagram in Section C9. It is not recommended that the first procedure for suspected faulty switch operation is to check the switch in accordance with the chart

provided in Section C9, unless the instrument board trim has already been removed. It is quite possible, that a fault in the interconnections and associated components connected to the switch produces symptoms which indicate faulty switch operation. These points can be checked by removing very little trim and unless the instrument board trim has already been removed, should be checked before carrying out the first procedure for checking for faulty switch operation.

Temperature selectors (see Fig. C8 and Fig. C62)
These are two 10 000 ohms inverse logarithmic potentiometers mounted on the instrument board. Each potentiometer is shunted by a fixed resistance and is connected by means of inline lucars in the air conditioning loom. The upper potentiometer is shunted by 910 ohms and the lower by 1 300 ohms which means that the two assemblies are **not interchangeable.** If the potentiometers are disconnected from the air conditioning loom, the resistance of the upper one should be 480 ohms and the lower 530 ohms, both measured with their knobs in the mid-position. The resistances should decrease as the potentiometers are turned towards maximum temperature.

Temperature sensors (see Fig. C10, Fig. C62 and Fig. C63)
The temperature sensors form a potential divider network in conjunction with the temperature selectors. A fault in either the selectors or the sensors is indicated by an incorrect reading in Operation 7, Test and adjusting procedure of Section C4.

Upper system
This has three temperature sensors, connected as shown in Figure C62. To check the upper system the test box (RH 8851) is connected as described in Operation 7, Test and adjusting procedure of Section C4 Position 5, where the test box is reading voltage V in Figure C63. Too high a reading indicates that the resistance of the network between A and B is too low or that the resistance of the network between A and C is too high. If the test box reads 9.1 volts, this indicates that the circuit between A and C is open-circuit, or the circuit between A and B is short-circuit. Too low a reading indicates that the resistance of the network between A and B is too high or that the resistance between A and C is too low. Figure C62 will assist location of any faults in conjunction with the chart below.

Resistance of ambient sensor between 9 yellow/blue and 9 orange is 1 000 ohms.
Resistance of top roll sensor between 9 yellow/blue and 9 yellow/white is 3 100 ohms.
Resistance of cantrail sensor between 9 yellow/white and 9 yellow/blue is 2 100 ohms.
Resistance of temperature selector in central (vertical) position is 480 + or - 30 ohms.
Resistance of servo trim cover plug between 9 yellow/white and 9 yellow/white is 510 ohms.
Resistance of servo trimming potentiometer variable between 0 and 1 000 ohms.

All sensor resistances are measured at 25°C. (77°F.). If the temperature is lower all readings will be slightly higher and vice-versa. For resistance values at different temperatures and resistance measurement techniques refer to 'Resistance measurement' in this section.

Note A component whose resistance is being checked must be disconnected from the car looms.

Lower system
This has two temperature sensors (see Operation 7, Test and adjusting procedure of Section C4) connected as shown in Figure C62. A fault in this sensor chain or in the lower temperature selector is indicated by an incorrect reading in Operation 7, Test and adjusting procedure of Section C4 position 3. For this test the test box (RH 8851) is connected as a voltmeter reading voltage V shown in Figure C62. Too high a reading indicates that the resistance of the network between X and Y is too low or that the resistance between X and Z is too high. If the test box reads 9.1, this indicates that the circuit between X and Z is open-circuit or that the circuit between X and Y is short-circuit. Too low a reading indicates that the resistance of the network between X and Y is too high or the resistance between X and Z is too low. A test box reading of zero indicates that the circuit between X and Z is short-circuit or that the circuit between X and Y is open-circuit. Figure C62 will assist the location of faults in conjunction with the chart below.

Resistance of ambient sensor between 9 yellow/purple and 9 orange is 1 100 ohms.
Resistance of lower sensor between 9 yellow/red and 9 yellow/purple is 2 100 ohms.
Resistance of temperature selector in central (vertical) position is 530 + or - 30 ohms.
Resistance of servo trim cover plug between 9 yellow/red and 9 yellow/red is 510 ohms.
Resistance of servo trimming potentiometer variable between 0 and 1 000 ohms.

All sensor readings are measured at 25°C. (77°F.). If the temperature is lower, all readings will be slightly higher and vice-versa. For resistance values at different temperatures and resistance measurement techniques refer to 'Resistance measurement' in this section.

Note A component whose resistance is being checked must be disconnected from the car looms.

Resistance Measurement
Curves showing the resistances, of the five temperatures from 10°C. (50°F.) to 30°C. (86°F.) are given in Figure C63.

If the sensor connections are not easily accessible, curves 1 and 4 give the total resistances of the upper and lower sensor chains, as these can be measured on the car by removing only the servo trim cover. Although such measurements will not show which of the sensors is faulty, it does indicate whether a fault is present in the system without dismantling or removing components.

To measure the resistances of the servo chains, first disconnect the servo trim cover plug and then connect a suitable resistance measuring instrument between a car earth point and either one of the 9 yellow/red cables for the lower system or one of the 9 yellow/white cables for the upper system, at the trim cover socket. As there are two 9 yellow/red cables and two 9 yellow/white cables in the socket it is necessary to check that the correct one of each pair is being used. If the correct cable has been chosen, the resistance reading will not change when the temperature selector knob is rotated. Therefore if the reading does change in sympathy with the position of the temperature selector, change the connection to the other cable.

The connections at the trim cover socket can also be used to measure the total resistance of the temperature selector potentiometer, the servo trimming potentiometer and the servo module range resistor, all of which are connected in series. For these measurements connect the resistance measuring instrument between the 9 pink line at the servos and one of the pair of 9 yellow/red cables for the lower system or 9 yellow/white cables for the upper system. The cable which produces a resistance change when the temperature selector knob is rotated is correct.

With the servo trimming potentiometers fully clockwise and the temperature selectors in the central position, the resistance for the upper system should be 1 230 ohms + or - 5% and the resistance for the lower system should be 1 280 ohms + or - 5%. With the servo trimming potentiometers fully anti-clockwise, both these resistances should increase by 1 000 ohms ± 20%.

Temperature Flap Servos (see Fig. C11)
The temperature flap servos are each driven by a small motor which drives the main gear on the servo output shaft.

Each temperature flap lever is connected to the output shaft by means of a spring which is strong enough to operate the temperature flap but allows the servo to continue to rotate when the flap levers are restrained by stops, to give servo overtravel.

The servo overtravel is designed to make 'in-car' temperature a linear relationship to servo angular position. On the lower servo, this overtravel occurs on heating where the 'in-car' temperature increases after the flap is at full hot, since the servo is still opening the water tap and increasing the fan speed. The overtravel occurs on the upper servo on cooling, where the temperature flap is moved to full cold before the servo is at full cold and extra cooling effort is obtained solely by the servo increasing the fan speed.

Two small gearwheels are driven by the main gear of each servo. The small gearwheels drive the fan speed potentiometer and the servo position (feedback) potentiometer. Each servo position potentiometer is connected to the relative servo module and both fan speed potentiometers are connected in parallel. Both potentiometers are then connected to the fan speed module.

Also connected to each servo output shaft is a nylon disc which has two sets of cams moulded into it. These operate the hot and cold limit micro-switches in both servos and the 10% and 25% micro-switches in the upper servo. The angular positions at which all these micro-switches operate is adjustable by means of a screw and a lock-nut.

The potentiometers and micro-switches in the servos have been set up very carefully using specialised test equipment. Therefore, the servo mechanism should not be dismantled as these settings will invariably be altered. Not only would this action cause the servo to operate unsatisfactorily but also, it could easily be damaged by either the potentiometers being forced past their mechanical stops or the flap lever stalling the servo due to incorrect setting of the limit switches. If the servo assembly does not operate correctly refer to the fault flow chart shown in Figure C12.

Servo Modules (see Fig. C11)
A faulty servo module is difficult to diagnose on the car and therefore they should be checked by substitution. However, if a servo module fault is suspected it it most important that substitution is **not** the first check as a fault in the associated circuitry may have destroyed the module. Therefore, it is important that the system is carefully checked before a replacement module is fitted or this too will be destroyed. As a faulty servo module will almost certainly result in the servo not operating, it is recommended that the fault flow chart shown in Figure C12 is followed.

Recirculation Actuators (see Fig. C13 and Fig. C64)
Figure C64 illustrates the circuits associated with the recirculation actuators. The two actuators are connected in parallel through two diodes, to prevent them running by one actuator feeding the other.

It is normal for the right-hand actuator to sometimes turn through two revolutions. The two actuators are supplied from the recirculation relay, the centre contact C2 being supplied directly from fuse number 3.

The relay winding is also supplied from fuse number 3 but is switched by the function switch so that W2 is live for all switch positions except OFF.

The relay winding is earthed through an in-line diode and the upper servo cold limit micro-switch. This earth path is broken only when the upper servo moves to full cold. To check the operation of this switch it is essential that the servo has moved to full cold and has operated the limit switch. This is most easily achieved using the air conditioning test box (RH 8851), since it is by no means true to assume that the servo will move to full cold when minimum temperature has been selected.

When the cold limit switch has operated, the blue/pink cable becomes live. The purpose of the in-line diode is to prevent this voltage from being supplied back along the brown/pink cable through the relay coil, as it is possible for this to latch in any of the other relays being supplied from this line.

Lower Quantity Flap Actuator (see Fig. C14 and Fig. C65)
The lower quantity flap actuator is operated primarily by the upper servo 10% micro-switch such that the actuator is closed on the cold side of 10% and open on the hot side. However, this is complicated by two overriding conditions. The lower quantity flap is always closed when DEF is selected on the function switch or when the coolant

temperature is below 44° C. (111° F.).

In view of this fault finding can be simplified by ensuring that neither of these overriding conditions exist. Check therefore, that the function switch is not at DEF and disconnect the 14 yellow/brown cable on the coolant temperature switch to simulate the warm coolant. Naturally, if the coolant is already above 44°C. (111°F.) and by disconnecting the 14 yellow/brown cable the fault is cured, the coolant temperature switch is faulty.

With the aid of an air conditioning test box (RH 8851), motor the upper servo to full hot where the lower quantity flap should be in the open position. A positive feed should now be present at the orange/white cable to the lower quantity flap actuator. This having been supplied from the 9 pink feed into the servos, through the upper servo 10% micro-switch, out to the function switch, through the lower quantity relay which should not be energised, and finally through the diode board. The feed to the servos via the 9 pink cable is supplied from the servo isolation relay. If the 9 pink cable is not live refer to 'Interlock circuit' in this section.

Next motor the upper servo to full cold where the 10% micro-switch should have changed over to feed the green/pink cable to the lower quantity flap actuator, which should make the actuator run to the closed position.

If DEF is selected, the orange/white actuator feed is broken by the function switch between the blue/red and blue/green cables. Further, a new supply is supplied directly from the fuseboard, via the diode board, to the green/pink actuator feed which drives the actuator to the closed position.

If the function switch is at LOW, AUTO or HIGH, the upper servo is to the hot side of 10% and the coolant temperature is above 44° C. (111° F.) (i.e. the 14 yellow/brown cable is not being earthed), the lower quantity flap should be open as described previously. However, if the coolant is cold (i.e. the 14 yellow/brown cable is connected to earth) the lower quantity relay should be energised, joining C1 or C2. Thus the 10% micro-switch signal will be overriden and the 'closed' contact of the lower quantity flap actuator will be supplied from C1 on the lower quantity relay.

Diode A is to prevent the lower quantity relay contacts being supplied by the lower quantity flap actuator when it is travelling towards the closed position. Such a feed would cause the lower quantity relay to vibrate continuously as the coil would be supplied through its own contacts. Diode B is also present to stop the lower quantity relay being incorrectly supplied. A feed back to C1 would cause the relay to 'latch-in' once the coil had been energised. Although a diagnosis of static conditions proves that such a condition could not exist, it has been found that the upper servo 10% micro-switch consistently switches more quickly than the relay reacts to the signal from the switch, so the relay 'latches-in'.

Diode C is to prevent a feed from the 9 green/pink cable connected to the upper servo (which is not ignition switched) being supplied back through the 9 red/brown cable to fuse number 3 when DEF is selected. If this was permitted to occur the air conditioning circuits would feed into the ignition switched circuits and it would be impossible to switch off the engine when the function switch is at DEF.

Although both the fan delay coolant temperature switch and the lower quantity flap micro-switch are required to inhibit the fans, the lower quantity relay must be operated only by the temperature switch, not the lower quantity flap micro-switch. Diode D is used to prevent the lower quantity relay being operated by the lower quantity flap micro-switch causing the system to 'lock-up'(i.e. the flap holding the micro-switch closed and unable to move until the micro-switch had opened.)

Mode Flap Actuator (see Fig. C16 and Fig. C66)

The mode flap actuator is controlled by the upper servo 25% micro-switch. This is supplied by the 9 pink cable from the servo isolation relay and if this is not live the 'Interlock circuits' described in this section are at fault.

When the upper servo is to the cold side of the 25% position, the micro-switch feeds the orange/blue cable, so driving the flap to the facia position. When the servo is to the hot side of the 25% position, the micro-switch feeds the orange/purple cable which is supplied to the diode board and emerges on the orange/red cable which drives the actuator to the screen. While there are no overriding circuits in this circuit, the 25% micro-switch does command other functions as described in 'Interlock circuits'.

The diode between the orange/red and the orange/purple cables prevents the mode actuator from feeding the fan delay, whilst it is being driven to the facia position.

Voltage Stabiliser and Fan Speed Module (see Fig. C17)

These two units cannot be checked independently of the car system whilst they are in position. Therefore, the course of action should be to check the feeds and other connections to the units as the usual reason for non-operation is a fault in the inhibit and interlock systems.

If however, the fault does appear to be in the module itself, some checks can be carried out as follows. While the operation of the modules itself is not expected to be understood, and indeed is not described, a knowledge of the function of each cable will assist in fault diagnosis.

Voltage Stabiliser (see Fig. C67)

This is the unit which supplies the 9.1 volts supply to the servo modules and a 7.0 volts supply to each servo motor. The three stabilised voltages are obtained from three independent circuits, all of which obtain their unstabilised 12 volt supply from the 9 pink cable which is fed from the servo isolation relay, via toeboard socket D and the servo connections.

The 9.1 volts stabilised supply is produced on the 9 pink/red cable, the 9 black/pink cable being used to earth this stabilising circuit. The 9 pink/red 9.1 volts line is tested by the air conditioning test box (RH 8851) in Operation 7 Position 1 of the 'Testing and adjusting procedure', Section C4.

If the test box reading is 9.1 volts, ± 0.5 volts, the circuit is correct. A reading in excess of 10 volts indicates that the circuit is not stabilising, either due to the earth line being open-circuit or an internal fault in the stabiliser. A reading of zero can be due to either an open or short circuit in any of the stabiliser connections.

A short circuit in the 9 pink/red cable will not damage the stabiliser and a short circuit in the 9 pink cable will blow the fan and compressor fuse. It is also worthwhile to check the servo earth as the module may be operating correctly but the test box may not be finding an earth through the servo earth.

The 7.0 volts supplies are identical to each other and independently serve the two servo motors. These supplies cannot be tested using the air conditioning test box (RH 8851) so a fault may be difficult to diagnose. If one or both of these supplies is faulty then the relative servo will either fail to run, or run much too quickly. If a servo fails to run, the first action should be to follow the flow chart Figure C18, as this will eliminate all other possible causes of servo failure. If the servo power supplies are the cause of the fault, the following checks should be carried out.

Since the two 7.0 volts servo power supplies are identical, the following instructions are written for the lower servo power supply, and the cable colour for the upper system power supply is shown in brackets.

To test the stabiliser, disconnect the 9 way plug and socket adjacent to the voltage stabiliser and fan speed module and connect a 12 volt feed to the 9 pink cable, and connect the 9 black/pink to earth. Connect a voltmeter across the 9 pink/light green (9 pink/blue) and the 9 black/pink cable. The reading should be 12 volts. Next, connect the 9 pink/black (9 pink/purple) cable to the 9 black/pink and the reading should fall to 7.0 ± 0.5 volts.

Disconnect the 9 pink/black (9 pink/purple) cable from the 9 black/pink cable and connect the 9 pink/brown (9 pink/yellow) cable to the 9 black/pink cable. The reading should again fall to 7.0 ± 0.5 volts. With a 12 ohm resistor connected as a load across the voltmeter repeat the tests on the 9 pink/black (9 pink/purple) and 9 pink/brown (9 pink/yellow) cables. In this case neither voltage reading should be less than 4.5 volts.

If any of the above readings is incorrect, the module is faulty and a new one should be fitted. The stabiliser unit consists only of the 'U' shaped chassis with three large diodes mounted on it.

If the stabiliser is found to operate correctly, and the fault persists, the loom connecting the module to the servos should be checked.

Fan Speed Module (see Fig. C66)

Fan speed is controlled by the fan speed module electronic circuits which provide the on-off cycle.

The supply to the fan speed module is the 44 yellow/black cable which is fed from the fan and compressor fuse, via the fan and compressor relay and through toeboard socket E. Thus the supply to the fan speed module is switched on when the fan and compressor relay is energised. The 14 yellow/black cable which runs parallel to the 44 yellow/black cable also provides a positive supply to the electronic circuits in the fan speed module.

The two fan motors are fed by the 44 yellow/green cables, the feeds being separately routed to each fan motor through the toeboard connections. Although the fan speed module is protected by the fan and compressor fuse, a short circuit on one of the 44 yellow/green cables can damage the fan speed module since it is quite possible for the output transistor to blow more quickly than the fuse. Therefore, it is essential that if a fan module is suspected of being faulty, the 44 yellow/green lines must be tested for short circuits before the module is replaced.

The 14 blue/black connection from the fan speed module is to facilitate fan inhibit. This cable is connected to the fan switch-off relay and the fans should be inhibited when this relay is energised. If the fans do not operate, it is always advisable to first disconnect the 14 blue/black cable from the relay to find whether it is the inhibit circuit or the fan module circuit which is at fault.

The 14 blue/brown cable is connected to the fan speed module to facilitate external variation of fan speeds. The 14 blue/brown cable is connected directly to the function switch which connects various resistors between the 14 blue/brown and a positive feed (i.e. 14 yellow/black cable) for different switch positions.

On LOW, 36 000 ohms is connected between the 14 blue/brown cable and the 14 yellow/black cable, on AUTO the fan speed potentiometer in series with 6 800 ohms are connected across these cables, and on HIGH and DEF the 14 blue/brown cable is connected directly to the 14 yellow/black cable. Thus is the 14 blue/brown cable is open circuit, the fans will run very slowly or stop. If the 14 blue/brown cable is shorting to a 12 volt supply, the fans will run at maximum speed.

The 12 volt supply to the fan speed potentiometers, 14 yellow/black cable, is supplied from the splice X connection and routed directly to the servos. The return from the fan speed potentiometers, 14 orange/yellow cable, is supplied from the servo connections directly to the function switch where it is switched onto the 14 blue/brown cable via the 6 800 ohms resistor when AUTO is selected.

The fan speed module also incorporates the delay circuit which prevents the fans from running for 13 seconds after starting the car when the system is on screen mode and is not inhibited by the coolant temperature switch.

The fan delay circuit is mounted on the printed circuit board inside the module. The supply to the delay circuit is the 14 orange/purple cable which is live when the upper system is in the screen mode. The 14 blue/black cable from the starter motor initiates the delay, the delay period beginning at the end of the cranking period. The 14 orange/purple cable is connected from the fan speed module to the air conditioning diode board and from here back to the upper servo 25% micro-switch via the upper servo plug and socket. The 14 brown/blue cable from the starter motor is run via the fan and compressor relay and toeboard socket C back to the fan speed module.

Diagnosis charts for the fan speed module are given in Figures C18, C19 and C20.

Fig. C18

Fan Motors (Inoperative)

Fault Flow Chart

P931

Fans Inoperative (1)

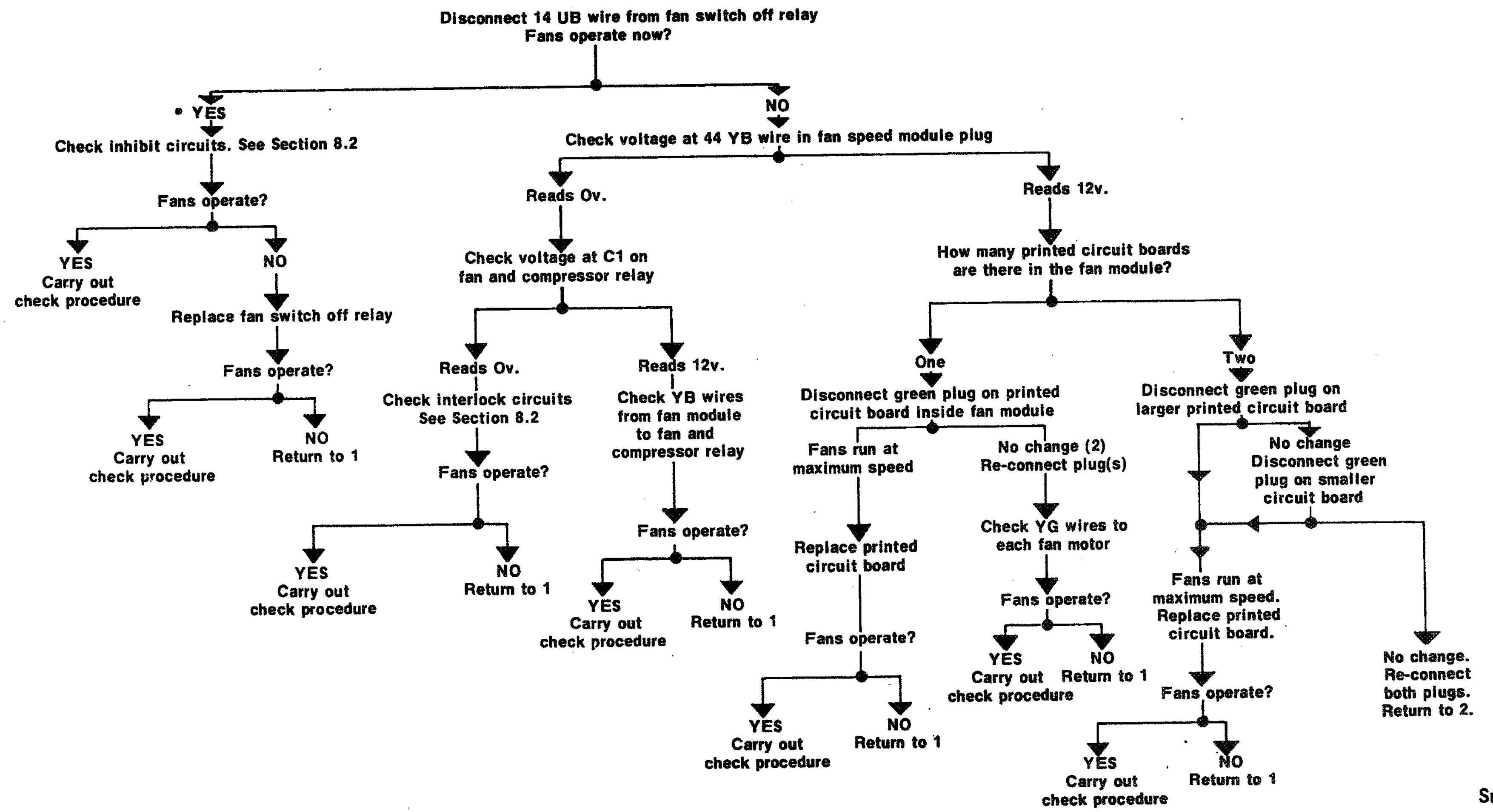


Fig. C12

Servo Assembly

Fault Flow Chart

Servo Will Not Operate

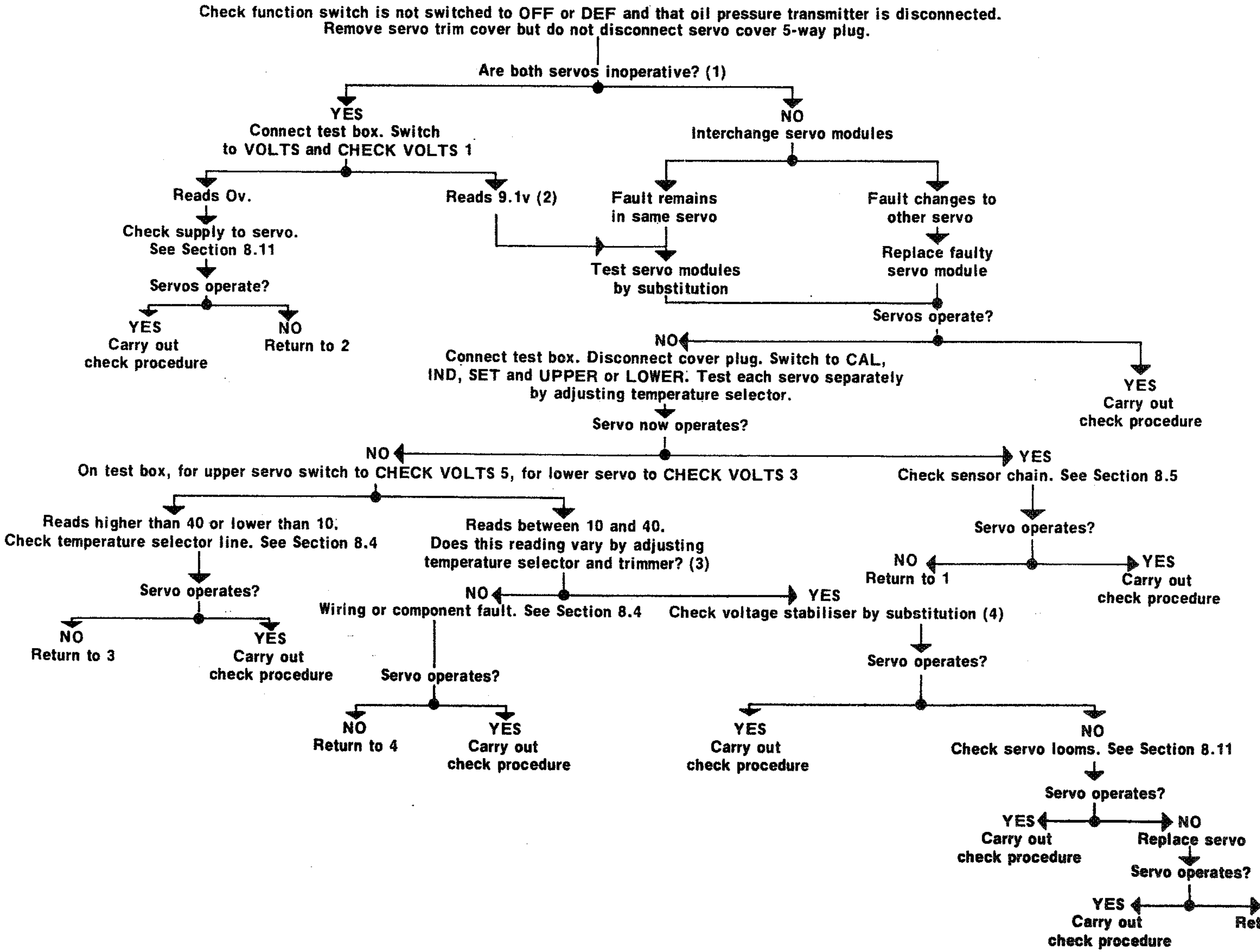


Fig. C19

Fan Motors (No Fan Speed Variation)

Fault Flow Chart

P 933

No Fan Speed Variation (1)

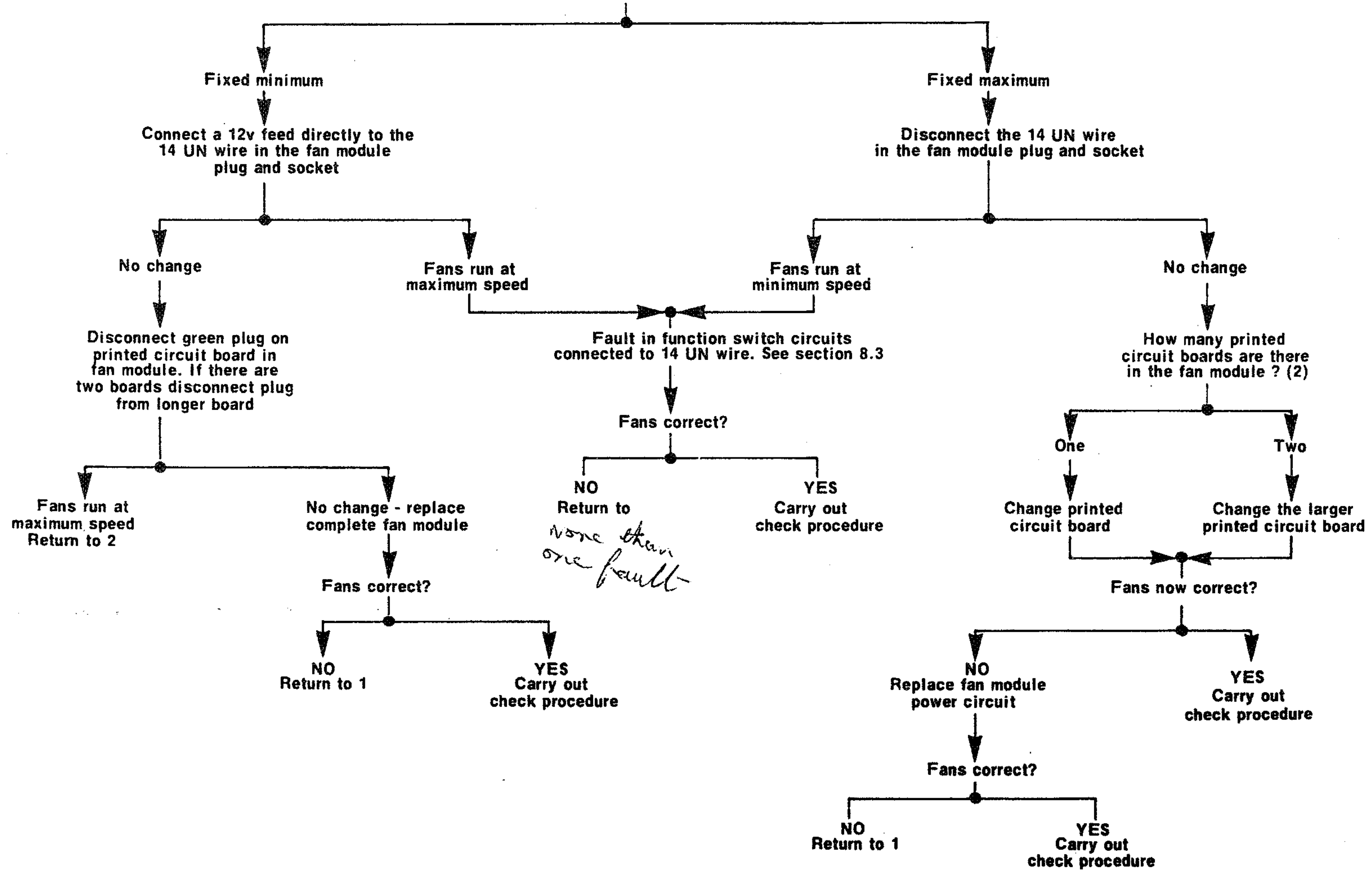
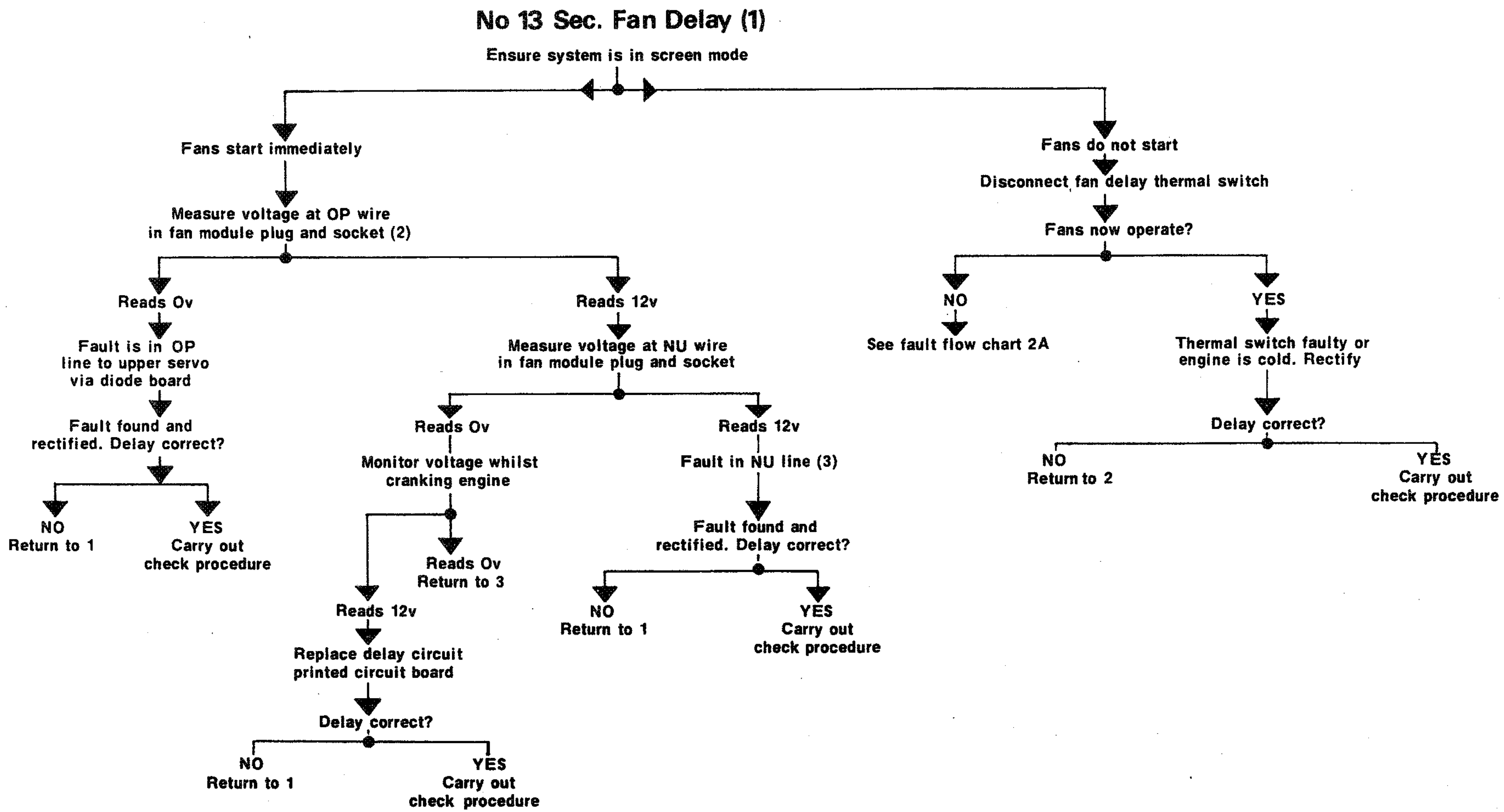


Fig. C20

Fan Motors (No 13 seconds Fan Delay)

Fault Flow Chart

P934



Sub-section 3

Refrigerant, Coolant and Mechanical Features

Symptom	Possible Cause
1. Refrigeration system inoperative	1. (a) Compressor belt slipping. (b) Compressor clutch slipping. (c) System low or empty of refrigerant. (d) Compressor clutch inoperative, (No voltage at clutch coil). (e) Blockage in system.
2. Insufficient cooling of air flowing from duct outlets	2. (a) Suction throttling valve incorrect operation (b) Suction throttling valve jammed in the closed position. (c) Expansion valve thermal bulb and capillary discharged. (d) Expansion valve jammed fully open. (e) Expansion valve inlet filter blocked. (f) Restriction in receiver/drier unit. (g) Condenser air flow restricted (insects, leaves etc.) usually indicated by high head pressure causing safety valve on compressor to blow-off. (h) Refrigeration hose or piping collapsed, kinked or otherwise damaged. (i) Compressor inlet filter blocked. (j) Compressor not pumping sufficiently. (k) System uses only ambient air when maximum cooling is required, will not switch to recirculated air (see Fault Diagnosis - Sub-sections 1 and 2). (l) Coolant tap remains in the maximum heating position (see Fault Diagnosis - Sub-sections 1 and 2).
3. Excessive cooling of too little air	3. (a) Suction throttling valve incorrect operation (b) Suction throttling valve jammed in the open position.
4. Noise or vibration	4. (a) Loose compressor belt. (b) Loose compressor mountings. (c) Damaged compressor shell or worn internal parts. (d) Defective expansion valve.
5. Insufficient heat	5. (a) Engine coolant level low. (b) Air locks in heater system. (c) Engine thermostat faulty. (d) 'Kinked' or blocked coolant hose(s). (e) Incorrectly adjusted coolant tap linkage.