Figure F3-4

Exhaust gas recirculation system – fault diagnosis chart

Start and run the engine at idle speed
Increase the engine speed, noting the operation of the EGR valve
The valve should open at between 1250 rev/min and 1750 rev/min

Valve begins to open early → Check for retarded ignition timing refer to Chapter E

Valve either fails to open or opens late

Faulty electrical control circuit

Leak or blockage in the vacuum signal pipe to the EGR valve → Check for advanced ignition timing refer to Chapter E

Detach the hose from the EGR valve
Ignition off
Can you blow down the hose and through the solenoid?

NO → Investigate and rectify blocked hoses to the throttle body or renew the control solenoid (solenoid below connector see item A)

YES

Ensure that the engine is fully warmed-up
Detach the temperature switch plug (see item B and 3). Bridge the cables in the plug
Ignition on
Can you blow down the hose and through the solenoid?

YES → **Check the temperature switch circuit**
Leave the temperature switch bridged
Measure the voltage on the white/blue cable at the solenoid plug and socket (see item A and 7)
Is it 12 volts?

NO → Check the voltage on the slate/blue cable at the temperature switch plug 12 way plug and socket (see item D and 2)
Is it 12 volts?

NO → Disconnect the 12 way plug and socket
Disconnect the solenoid plug and socket
Check for continuity from item 2 to item 7

YES → Disconnect the solenoid plug and socket
Check the black cable to earth for continuity.
Is it continuous?

YES → Replace the solenoid

NO → Rectify the fault on the cable

NO

Ignition on
Fully open the throttles
Can you blow down the hose and through the solenoid?

YES → **Check the throttle position circuit**
Disconnect the temperature switch plug (see item B and 3)
Measure the voltage on the white cable at the throttle position switch plug and socket 4 way (see item C and 10)
Is it 12 volts?

YES → Measure the voltage on the white/green cable at the throttle position switch plug and socket 4 way (see item C and 10) when the throttles are fully opened
Is it 12 volts?

NO → Fully open the throttles
Measure the voltage on the white/blue cable at the solenoid plug and socket (see item A and 7)
Is it 12 volts?

YES → Check for continuity of the white/green and the white/blue cable between items C and 10, and A and 7

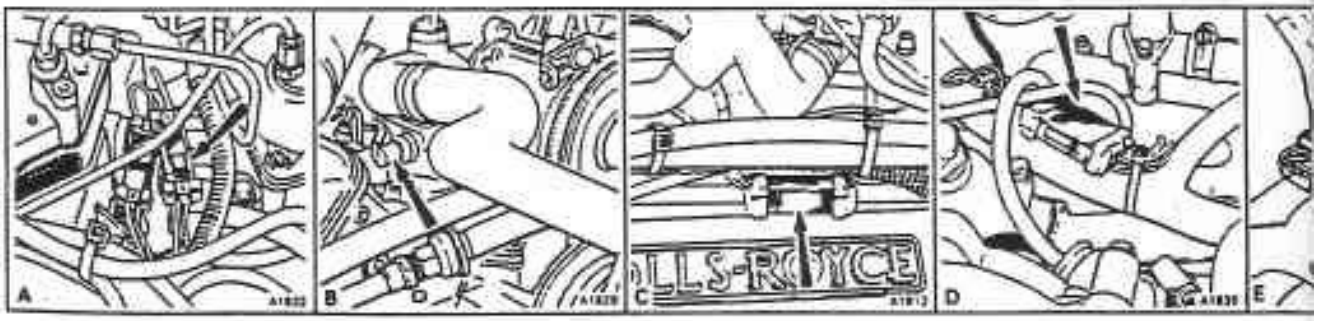
NO → Refer to TSD 4701
Check the ignition feed white cable to fuse B3 on fuseboard

NO

Ignition on
Release the throttles
Can you blow down the hose and through the solenoid?

NO → Replace the solenoid

YES → System functions satisfactorily



Excessive exhaust gas tail pipe extraction (this test is best carried out without any tailpipe restriction or extraction)

Excessive exhaust back pressure (this test is best carried out without and tailpipe restriction or extraction)

Incorrect or faulty throttle body assembly

Check the voltage on the white cable in the temperature switch plug
Is it 12 volts?

YES

Disconnect the 12 way plug and socket
Disconnect the temperature switch plug (see item B and 3)
Check the slate/blue cable for continuity

NO

Check the voltage on the white cable in the temperature switch plug and socket 12 way (see item D and 2)
Is it 12 volts?

NO

Refer to TSD 4701
Check the ignition feed white cable to fuse B3 on fuseboard

YES

Disconnect the 12 way plug and socket (item D and 2)
Disconnect the temperature switch plug (see item B and 3)
Check the white cable for continuity

Check for continuity of the yellow/purple cable between items 11, and C and 10
Is it continuous?

NO

Rectify fault on cable

YES

Reset or replace the throttle position switch

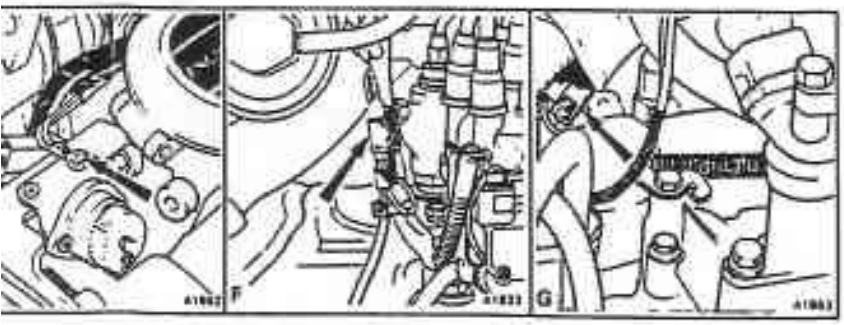
Disconnect the solenoid plug and socket (see item A and 7)
Check the black cable to earth for continuity
Is it continuous?

NO

Rectify fault on the cable

YES

Replace the solenoid



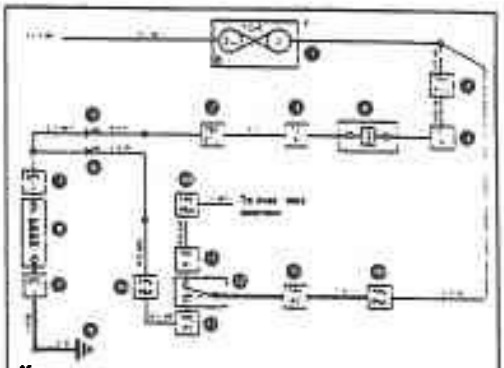
Diodes to test

Temperature switch circuit diode (see item F and 5)

1 Disconnect the temperature switch plug (see item B and 2)
2 Fully open the throttles
3 Measure the voltage on the slate/blue cable in the plug. This should be zero

Throttle position switch circuit diode (see item G and 6)

1 Disconnect the temperature switch plug (see item B and 2)
2 Bridge the cables in the plug
3 Measure the voltage on the yellow/purple cable in the throttle position switch plug and socket 4 way. This should be zero



Key

1 Fuse
2 Temperature switch plug and socket (12 way)
3 Temperature switch plug
4 Temperature switch
5 Diode – temperature switch circuit
6 Diode – throttle position switch circuit
7 Solenoid valve plug and socket (2 way)
8 Solenoid valve
9 Engine earth point
10 Throttle position switch plug and socket (4 way)
11 Throttle position switch plug
12 Throttle position switch
● Splice

Important

Before carrying out a test ensure that the following conditions apply

1. The battery is fully charged
2. The engine is fully warmed-up
3. Use a multimeter to carry out the electrical circuit tests
4. The engine is switched off when either disconnecting or connecting electrical connections
5. Always remake any connection immediately a test is complete
6. Ensure that fuse B3 on fuseboard 1 is intact
7. Ensure that the test is carried out in a well ventilated area (preferably outside) and without any exhaust extraction or restriction

Air injection system

The air injection system (see fig. F4-1) consists of a belt driven air pump that delivers air via an air switching valve to the exhaust ports, during engine warm-up. This air combines with the exhaust from the combustion chambers, to promote oxidation of the gases and faster warm-up of the catalytic converter.

When the coolant temperature is above 33°C (91°F) the air switching valve vents the output of the air pump into the engine air intake.

For details of the servicing and maintenance requirements of the air injection system refer to the Service Schedules Manual TSD 4702.

Air injection pump

The rotary vane pump is mounted at the front of the engine; and belt driven from the refrigeration compressor pulley. Air is drawn into the pump, through a centrifugal filter and exits from a connection on the rear of the pump.

Air switching valve (see fig. F4-2)

The air switching valve comprises a vacuum operated valve with integral control solenoid.

When the coolant temperature is below 33°C (91°F) the solenoid is energized thus applying inlet manifold vacuum to the diaphragm chamber. This causes the injected air to be re-routed to the exhaust manifolds.

When the solenoid is de-energized [at a coolant temperature above 33°C (91°F)] the manifold vacuum signal is inhibited and the diaphragm chamber vented to atmosphere. This causes the internal spring to return the valve to the rest position, routing the injection air to the engine air intake system.

Pressure relief valve

A pressure relief valve is fitted between the air injection pump and the air switching valve. It consists of a spring loaded disc that opens at a set pressure. This prevents excessive pressure build-up, that could damage the pump vanes under extreme conditions.

Check valves

A check valve is fitted into the air injection pipe to each exhaust manifold.

Each valve assembly consists of a spring and one-way disc. The assembly prevents the flow of exhaust gases back to the air switching valve if either the exhaust back pressure exceeds the pump delivery pressure, or the pump belt fails.

Air pump drive belt

Before commencing to adjust the drive belt inspect it for signs of wear or cracking. If the belt is found unsatisfactory it should be renewed.

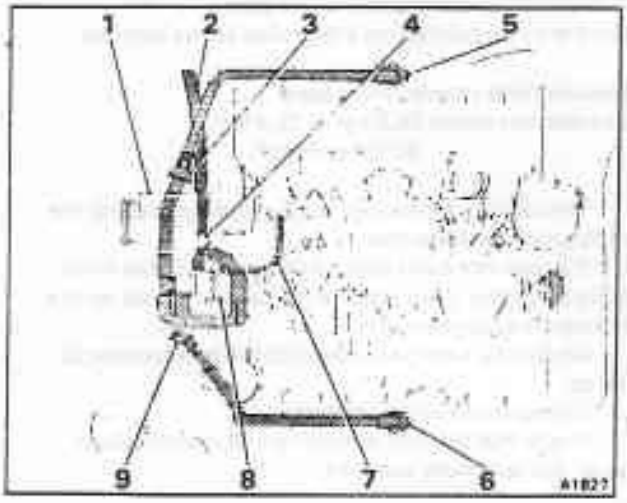


Fig. F4-1 Air injection system

1 Air pump
2 Vent hose to air cleaner
3 'A' bank check valve
4 Relief valve
5 'A' bank exhaust manifold connection
6 'B' bank exhaust manifold connection
7 Vacuum hose
8 Air switching valve
9 'B' bank check valve

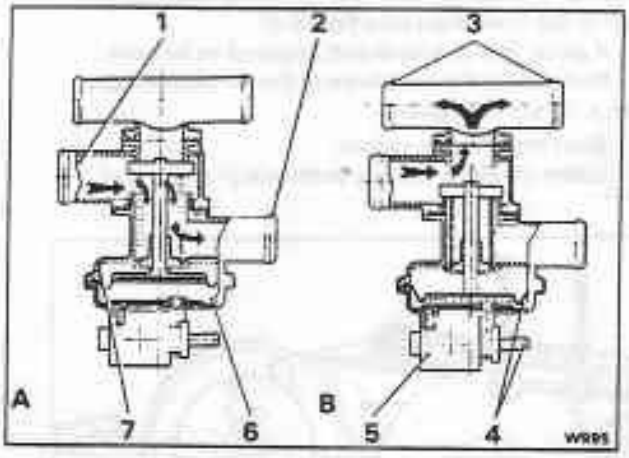


Fig. F4-2 Air switching valve

1 Inlet
2 Outlet to engine air intake
3 Outlets to exhaust ports
4 Inlet manifold vacuum
5 Solenoid valve
6 Diaphragm chamber
7 Atmospheric air bleed
A Solenoid de-energized
B Solenoid energized

The belt tension must be checked at a point midway between two pulleys (see fig. F4-3) by use of a belt tension meter.

Belt dressing must not be applied to prevent belt slip.

Refrigeration compressor to air pump
Load may be applied on either side of the belt run.

New belt and retensioning load
Belt tension meter 24,9 kgf to 29,4 kgf
(55 lbf to 65 lbf)

1. The tension of the belt is adjusted by altering the position of the air pump.
2. Slacken the pivot setscrews located at the front of the air pump. Also slacken the tensioner nut on the threaded adjustment arm.
3. Adjust the tensioner nut until the belt tension is correct.
4. Tighten both pivot setscrews.
5. Check that the belt tension is still correct when the air pump is fully secured.

Air pump – To remove and fit
1. Slacken the worm drive clip securing the hose to the pump outlet.
2. Release the belt tension (see Air pump drive belt).
3. Unscrew and remove the pivot setscrews (see fig. F4-3).
4. Fit the air pump by reversing the removal procedure, ensuring that the belt tension is correctly set.

Checking the air injection system for leaks and correct operation
To check that the system is functioning correctly, refer to the flow chart (see fig. F4-4).

If an air leak is suspected, proceed as follows.
1. Disconnect the vent hose to the air cleaner (see item A on the flow chart).
2. Start and run the engine.
3. Listen carefully for any evidence of an air leak from the system. When the coolant temperature increases to approximately 33°C (91°F) the air will be switched from the exhaust manifolds towards the air cleaner. This change can be detected by the noise the air will make as it leaves the open connection of the air switching valve.
4. If an air leak is suspected coat the suspect component with a soap solution; soap bubbles will confirm an air leak.
5. Fit the disconnected hose to the air cleaner.

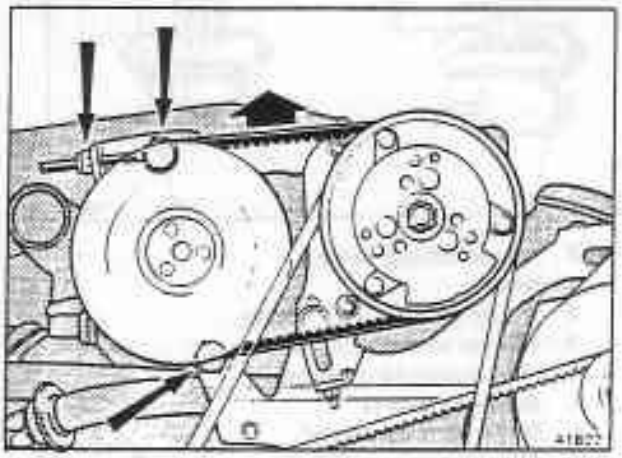


Fig. F4-3 Air pump drive belt adjustment and tension check point

Figure F4-4

Air injection system – fault diagnosis chart

1. Disconnect the air injection vent hose at the air cleaner (see item A)
   Switch on the ignition
2. Disconnect the plug from the front temperature switch in the thermostat housing. Bridge the white and slate/blue cables in the plug
   Start the engine, ensure that it is running on all eight cylinders
   Is air flowing through the vent hose (see item A)?

YES → Check the air switching valve vacuum hose and connections for air leaks (see item B)
Are there any leaks?

YES → Rectify the lea

NO → Stop the engine otherwise damage to the catalytic converter may result
Check the electrical wiring circuit as follows

NO → Stop the engine, unbridge the temperature switch in the thermostat housing
Connect the plug to the switch
Start and run the engine until it is fully warmed-up. Allow the engine to run at the idle speed setting
Is air flowing through the vent hose (see item A)?

YES → Locate the link loom 2 way plug and socket (see item D and 5)
Measure the voltage on the slate/blue cable in the plug
Is it 12 volts?

NO → Locate the the
12 way (see i
Check the volt
Is it 12 volts

YES → Disconnect the link loom plug and socket
Check for continuity of the black cable (see item B)

YES → Remove the a
switching valv
the valve in p
access to the
Release the p
plug. Note in
fitted to the v
H and 6). Det
and socket (s
Check the link
Is it continu

NO → Rectify the fault on the black earth cable

Check for cont
between the t
E and 2) and
(see item D a

Remove the hose from the air pump outlet and securely blank the outlet pipe (see item F)
Start the engine
Does the air pump relief valve open allowing air to flow to atmosphere?

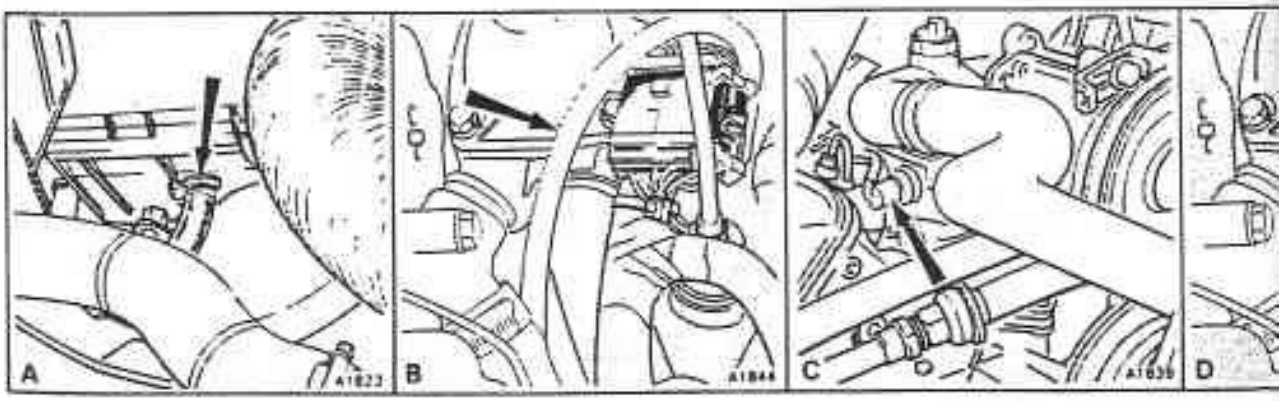
NO → Replace faulty relief valve

YES → Stop the engine
Remove the hose from 'A' bank check valve (see item G)
Start the engine
Is there a flow of exhaust gas from either of the following?
1. 'A' bank check valve or
2. The disconnected hose (it is still connected to 'B' bank check valve)

YES → Replace the appropriate check valve

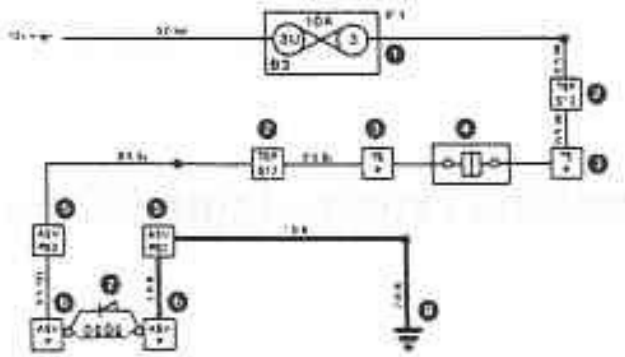
NO → System functions satisfactorily

Rectify the fa



Key

1 Fuse
2 Temperature switch plug and socket (12 way)
3 Temperature switch plug
4 Temperature switch
5 Air switching valve link loom plug and socket (2 way)
6 Air switching valve plug
7 Air switching valve
8 Engine earth point
● Splice



mostat loom plug and socket
m E and 2)
ge on the slate/blue cable

NO

Check the voltage on the white cable at the plug and socket 12 way
Is it 12 volts?

NO

Refer to TSD 4701
Check the ignition feed white cable to fuse B3 on fuseboard 1

YES

YES

nuity of the slate/blue cable
ermostat loom plug (see item
ne link loom plug
d 5)

Detach the plug from the front temperature switch in the thermostat housing (see item C and 3). Bridge the cables in the plug.
Again, check the voltage on the slate/blue cable at the 12 way plug and socket
Is it 12 volts?

NO

Leave the plug to the temperature switch bridged.
Disconnect the 12 way plug and socket
At the 12 way plug and socket check for continuity of the slate/blue cable and the white cable through the temperature switch plug

YES

Replace the temperature switch

pump, hoses to the air
, and the setscrew securing
sition. Turn the valve to gain
lectrical plug.
stic clip and withdraw the
which direction the plug is
ve. Bridge the plug (see item
ch the link loom 2 way plug
item D and 5).
loom for continuity
us?

YES

Renew the air switching valve

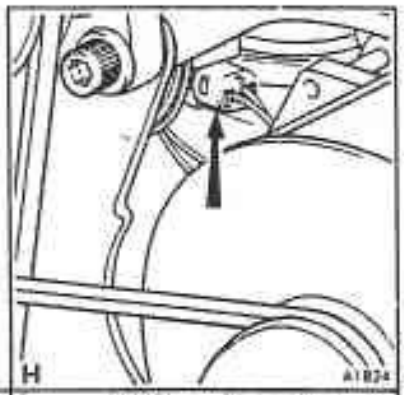
NO

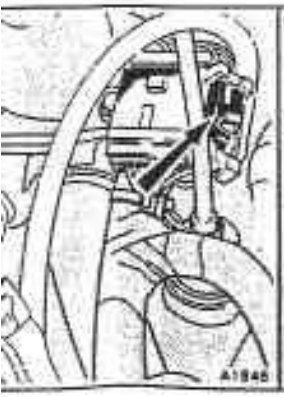
on the link loom cables

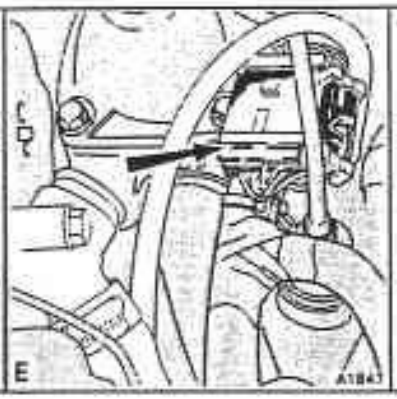
Important

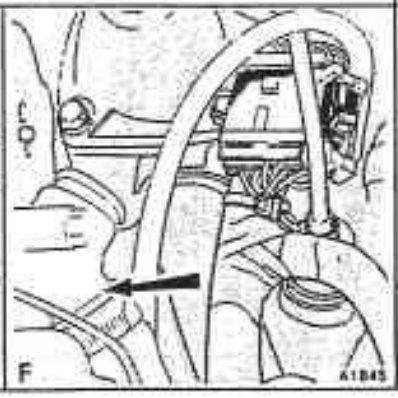
Before carrying out a test ensure that the following condition apply

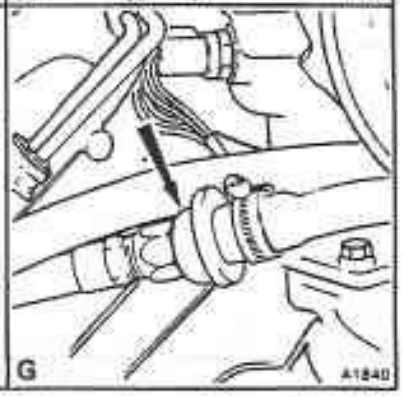
1 The battery is fully charged
2 The engine is cold
3 Use a multimeter to carry out the tests
4 The ignition is switched off when either disconnecting or connecting electrical connections
5 Always remake any connection immediately a test is complete
6 Ensure that the fuse B3 on fuseboard 1 is intact











Three-way catalyst system

The exhaust system is basically of dual pipe construction that utilizes a single catalytic converter in place of a conventional front silencer.

The dual exhaust pipes from the engine combine into a single pipe just prior to the catalytic converter. From the converter, the system reverts to a twin pipe system with both pipes entering a common rear silencer. A single tailpipe then conveys the exhaust to atmosphere.

Catalytic converter protection
To protect the catalytic converter from possible damage the following precautions should be taken.

Unleaded gasolene
Use unleaded gasolene only 87AKI (91 RON)* Min. The use of leaded gasolene will result in a substantial reduction in the performance of the catalyst.

Under no circumstances add fuel system cleaning agents to the fuel tank for induction into the engine, as these materials may have a detrimental effect on the catalytic converter.

*AKI = Anti-knock index
RON= Research octane number

Engine malfunction
If the engine misfires or suffers from a lack of power that could be attributed to a malfunction in either the ignition system or fuel system, operation of the vehicle should be discontinued. Driving the vehicle with a malfunction could cause overheating and consequent damage to the catalytic converter.

Fuel
Do not allow the vehicle to run out of fuel. A warning lamp situated on the facia illuminates to warn the driver of a low fuel level in the fuel tank. If the vehicle runs out of fuel at high speed, possible damage to the catalytic converter could result.

Starting the engine
The vehicle must not be pushed or towed to start the engine. Failure to observe this warning could cause overheating and consequent damage to the catalytic converter.

Exhaust emission control system
It is important that the vehicle is maintained in its correct operating condition. Failure to do so will result not only in loss of fuel economy and emission control but could also cause damage to the catalytic converter due to overheating.

Catalytic converter – To remove and fit (see fig. F5-2)
1. Remove the screws retaining the grass-fire shield(s) located below the catalytic converter.

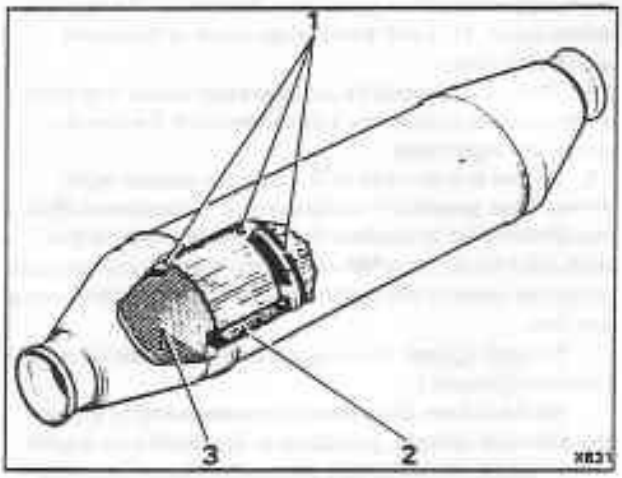


Fig. F5-1 Catalytic converter
1 Stainless steel mesh retaining rings
2 Stainless steel mesh
3 Monolithic catalyst (1 of 3 blocks)

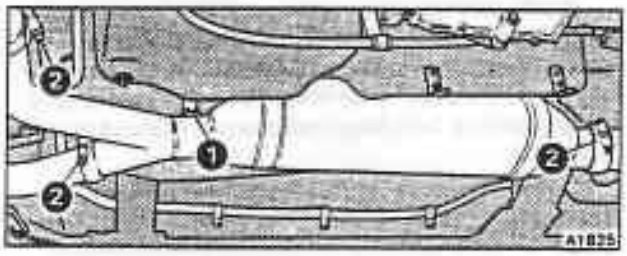


Fig. F5-2 Catalytic converter in position
1 Oxygen sensor
2 Exhaust joint clamps

Note Take care when removing the shield(s) as any sharp edges could cause injury to the operator's hands.
2. Ensure that the weight of the catalytic converter is temporarily supported.
3. Support the weight of the downtake pipes.
4. Unscrew and remove the oxygen sensor.
5. Unscrew the nuts from the exhaust clamps forward and rearward of the catalytic converter.
Collect the washers and bolts, then free the clamps.
6. Discard the temporary support and withdraw the catalytic converter.
7. Collect the sealing rings from the joints as the converter is removed.
8. Fit the catalytic converter by reversing the removal procedure, noting the following points.
9. The sealing rings and pipe flares must be

thoroughly clean and free from scale. They may be lightly dressed with fine emery cloth if required.
10. Apply Never-seez anti-seize compound to the clamp bolt threads before assembly.
11. The sealing rings, pipe flares, and grooves in the spherical joint clamp brackets should be lightly smeared with either graphite lubricant or Never-seez compound. This will assist alignment of the parts upon assembly.
12. The parts should be loosely assembled and then manoeuvred to give the best alignment, before the joints are tightened.
13. Smear the threads of the oxygen sensor with Never-seez assembly compound. It is important that the Never-seez is applied only to the threads of the unit. Care must be taken to ensure that the compound does not contact the slotted shield below the threaded portion.

Torque tighten the oxygen sensor to the figures given in Chapter L.

Do not allow the assembly compound to enter the exhaust system, particularly up stream (in front) of the catalytic converter, otherwise damage to the converter assembly will result.

Oxygen sensor warning lamp
On cars conforming to Australian and North American specifications an oxygen sensor warning lamp is situated on the facia.

When permanently illuminated, the lamp informs the driver that a malfunction has occurred in the 'closed loop' mixture control system. The cause of the malfunction must then be investigated by referring to the appropriate fault diagnosis chart contained in Chapter B.

The warning lamp may illuminate when the engine is being cranked but should extinguish soon after the engine starts. **The lamp will however, remain illuminated until the oxygen sensor reaches its normal operating temperature.**

Oxygen sensor
For details relating to the oxygen sensor refer to Chapter B.

Exhaust system overheat warning lamp
On cars conforming to a Japanese specification an exhaust overheat warning system is fitted. The warning panel for this system is situated on the facia. Illumination of the panel indicates that an overheating condition caused through an engine malfunction has been reached in the exhaust system.

If an exhaust overheat condition is indicated, stop the vehicle as soon as possible and switch off the ignition. After three minutes the engine may be started again and providing the overheat warning lamp remains extinguished, the vehicle can be accelerated gently up to a speed of 30 km/h (18 mile/h). This speed must not be exceeded until the cause of the overheat warning has been corrected by referring to the appropriate fault diagnosis flow chart (see fig. F5-3).

To check that the warning panel bulb is operating satisfactorily, ensure that the panel illuminates during engine cranking (i.e. starter motor engaged).

Exhaust system
For information relating to the remainder of the exhaust system refer to TSD 4700 Chapter Q, Exhaust system.

Figure F5-3

Exhaust overheat warning system – fault diagnosis chart
Sheet 1 of 2

Before carrying out a full diagnostic inspection ensure that the vehicle did not run out of fuel.

If the overheat warning lamp illuminates for reasons other than the above, a fault has occurred in

a. The various systems that lead into the exhaust (fuel system, air intake, etc.) or in the exhaust itself particularly the catalytic converter.

Any faults in these areas can be determined as **system faults**

b. The overheat warning circuit (faulty converter thermocouple, electronic control unit, wiring connections, etc.) causing the lamp to illuminate although the system is operating satisfactorily.

These faults can be determined as **circuit faults.**

Does an overheat condition exist and/or is the warning lamp illuminated at the commencement of the test?

NO → Verify the exact conditions prevailing at the time of the exhaust overheat warning.

YES →

If the overheat warning lamp illuminates (except during cranking and/or warning lamps test) for any reason other than running out of fuel, either a **system fault** or a **circuit fault** has occurred.

Start the engine.
Does the warning lamp illuminate during engine cranking and extinguish immediately the engine starts?

NO → Check the w
(item F and
Is it service

YES →

Replace the

Road test the car
Does the exhaust overheat condition occur and the warning lamp illuminate?

NO → Return the c

YES →

Fully warm-up car
Does the vehicle appear exceptionally hot particularly in the area of the catalytic converter?
Allow the car to go cold
Start the engine and immediately note the warning lamp. **Does it extinguish?**

NO → **Suspect t**

YES →

Disconnect t
socket in the
B and 9). Ch
blue and the
thermocoupl
Are they co

Replace the

Suspect a system fault

The following is a list of components and systems that may contribute to a malfunction in the exhaust resulting in overheating of the catalytic converter.

Any condition resulting in an engine misfire or uneven running should always be investigated first.

1. Ignition system – Chapter E
2. Faulty purge flow system – Chapter G
3. Faulty fuel injection system – Chapter B
4. Faulty EGR system – Chapter F
5. Blocked fuel system – Chapter C
6. Air injection system operating continuously – Chapter F

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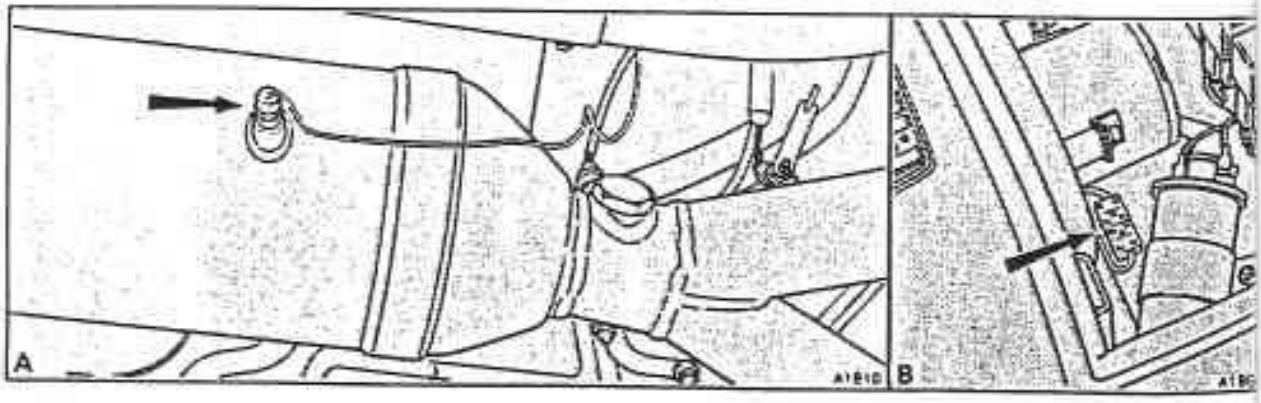

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multimeter to carry out the
ical circuit tests
ngine is switched off when either
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ctions
s remake any connection
diately a test is complete
s exercise extreme care when
ng out investigations around the
st and catalytic converter, as
components may be very hot.

Overheat warning
If an overheat condition is indicated, stop the vehicle as quickly as possible in a safe and orderly manner.

Switch off the ignition.

After three minutes the engine may be started again and providing the overheat warning lamp remains extinguished, the vehicle may be accelerated gently up to a speed of 30 km/h (18 miles/h).

This speed must not be exceeded until the cause of the overheat warning has been corrected.

ning lamp bulb

ble?

NO

ulb

r to the owner

warning circuit fault

e thermocouple 2 way plug and
engine compartment (see item
ck for continuity between the
rown cables to the

tinuous?

NO

ermocouple

YES

Check the white/purple cable between items C and 12, and F and 2
Is it shorted to earth?

YES → Rectify the cable

NO

Substitute the ECU
Does the warning lamp bulb illuminate during engine cranking?

YES → Discard the original ECU

NO

Check the warning lamp test circuit.
Refer to TSD 4701

YES

Connect the multimeter between either thermocouple cable and earth.
Have the cables been shorted to earth?

YES

Rectify cables

NO

Leave the engine compartment 2 way plug and socket disconnected.
Release the rubber strap retaining the catalyst overheat ECU in position (see item D).

Disconnect the 2 way plug and socket situated approximately 279,4 mm (11 in) from the ECU.

Check the continuity of the brown cable and of the blue cable between items 9 and 10
Are they continuous?

NO

Rectify the cable(s)

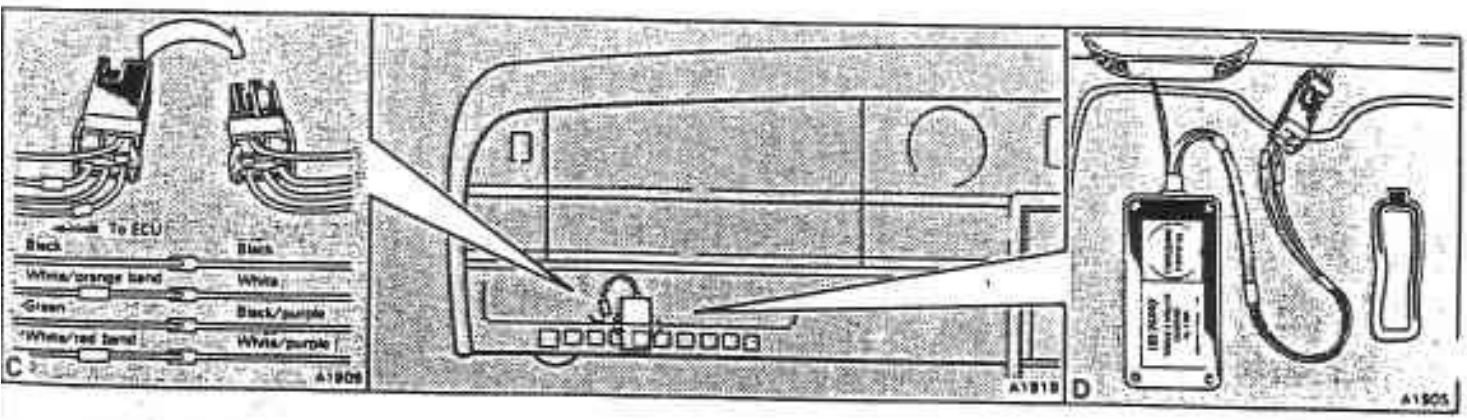
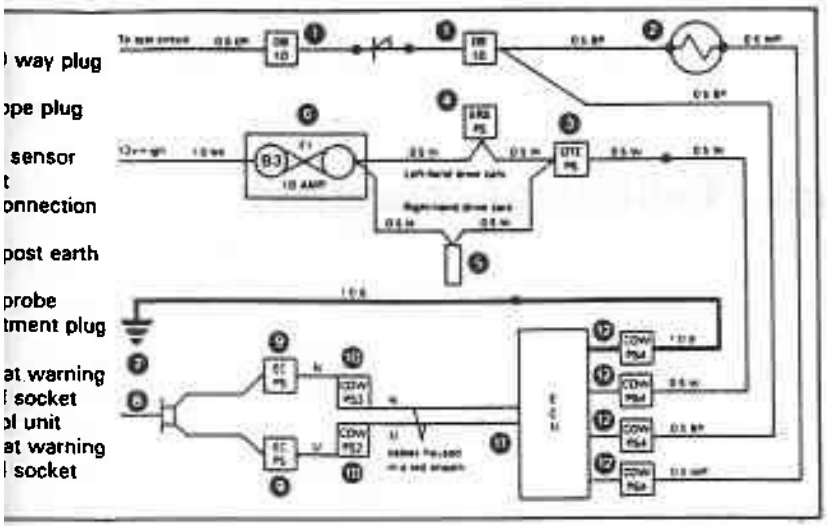


Figure F5-3

Exhaust overheat warning system – fault diagnosis chart
Sheet 2 of 2



tions correctly

amp test circuit.
1

NO → Rectify as necessary

YES

tching of the cables in the
e items C, D, and 12)
ing correct?

NO → Correct the cable mis-match

YES

the white cable at the
socket (see items C, D,

NO → Check the ignition feed white cable from the fuse for 12 volts supply (see wiring diagram)

YES

ple cable from the ECU 4
(see items C, D, and 12)
bulb (see item F and 2)

NO → Check the white/purple cable for continuity and/or short circuiting to another cable

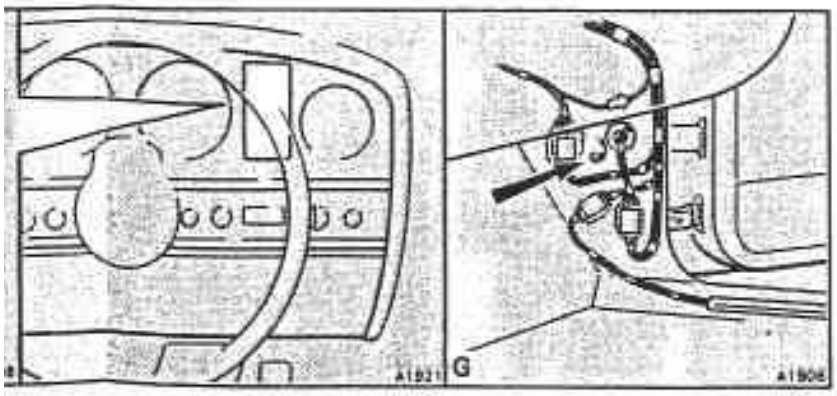
YES

4 way plug and socket
12)
able to the earth point

NO → Rectify the fault on the black cable

YES

ECU and thermocouple in
test



Key

1 Diode board 1
2 Warning lamp
3 Other than Eu and socket
4 Engine runnin plug and sock
5 Speedometer
6 Fuse
7 Right-hand 'A' point
8 Thermocouple
9 Engine compa and socket
10 Catalyst overh 2 way plug ar
11 Electrical cont
12 Catalyst overh 4 way plug ar

Keep the 2 way plug and socket disconnected.
Connect the multimeter between the end of the brown cable (see item 10) and earth.
Connect the multimeter from the engine compartment between the end of the blue cable (see item 10) and earth
Is either cable shorted to earth?

NO

YES

Rectify the cable(s)

Remake the electrical connections ensuring that the cable colours match (i.e. brown to brown)
Do the cable colours correspond?

NO

YES

1. Disconnect the catalyst overheat ECU 4 way plug and socket (see items C, D, and 12)
2. Disconnect the diode board 10 way plug (see item E and 1)
Check the black/purple cable
Is it shorted to earth?

NO

YES

Rectify the fault on the black/purple cable

Remake the conne

Check the warning
Refer to TSD 47
Is it satisfactory?

Check the colour m
4 way connector (s
Is the colour mat

Check the voltage
ECU 4 way plug an
and 12)
Is it 12 volts?

Check the white/pu
way plug and socke
to the warning lamp
Is it 12 volts?

Disconnect the EC
(see items C, D, an
Check the black
(see item G and 7)
Is it continuous

Substitute both the
turn, and repeat th