Figure D2-9

Turbocharging system – fault diagnosis chart Sheet 3 of 5

Boost control solenoid valve

Remove the two hoses from the adapter on the boost control solenoid valve
Connect a clean hose to one of the hose connections on the adapter (see item A)
Blow down the hose
Does air only escape from the open connection on the adapter and not from the screened vent port?

NO → Replace the boost control valve

YES ↓

Leave the hoses as in the previous test
Switch on the ignition
Blow down the hose
Does air now escape from both the open connection on the adapter and the screened vent port?

NO → Replace the boost control valve

YES ↓

Identify the boost control system air pressure transducer (APT) (refer to sheet 2 of 5)
Withdraw the plug from the APT
Switch on the ignition
Is the boost control solenoid valve 'clicking'?

NO → Withdraw the plug from the air pressure transducer
Switch on the ignition
Is the voltage on the green/slate cable more than 3.6 volts?

NO → Disconnect the electrical connecti
air pressure transducer, the boost
ECU (see item C), and the KE2-J
(see item D)
Check for cable continuity betwee
the air pressure transducer and p
KE2-Jetronic ECU, and pin 10 on
control ECU
Are these continuous?

YES ↓

Measure the resistance of the bo
solenoid valve
Is it 26 to 27Ω?

YES ↓

Change the ECU
Retest the system
Is it now satisfactory?

YES ↓

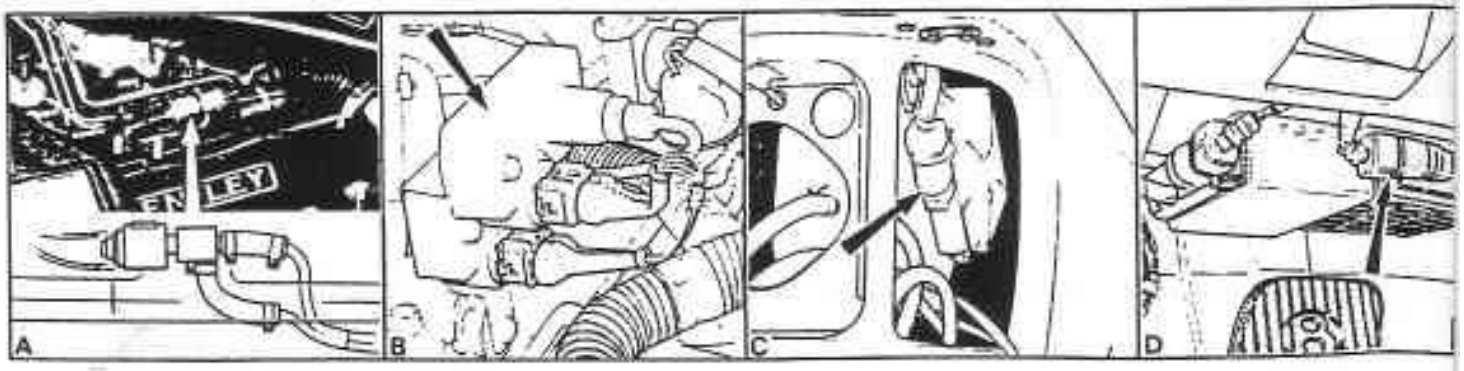
Boost control system working sa

YES ↓

Change the boost control system ECU and retest the system

YES ↓

Boost control solenoid valve working satisfactorily



ons to the
control
etronic ECU

n pin 2 on
n 19 on the
the boost

NO → Rectify faulty cables

st control

NO → Change the boost control solenoid valve

NO → Check the brake lamps, automatic speed control, and knock sensing systems

isfactorily

Figure D2-9

Turbocharging system – fault diagnosis chart Sheet 4 of 5

Wastegate

Ensure that there is no blockage of the following
1. Wastegate signal pipe
2. Compressor to boost control valve signal pipe
3. Compressor signal pipe tapping on the turbocharger compressor

Are these components free from obstruction?

NO → Eliminate the blockage or replace the respective component

YES

Remove the hose from the boost control valve that feeds air to the wastegate.
Fit the Mityvac pump RH 12495.
Apply 0,41 bar (12 in Hg) of air pressure to the wastegate signal pipe and listen carefully for the wastegate to operate.
Does the wastegate open when the air pressure is applied and close again when the pressure is released?

NO → Remove the wastegate
Inspect the valve and diaphragm for sticking and/or damage (including a ruptured diaphragm)

YES

Wastegate operates satisfactorily
Proceed to check the dump valve system

Dump valve

Disconnect and blank the vacuum hose to dump valve vacuum switch. Disconnect th vacuum hose from the dump valve at the induction manifold. Connect the Mityvac pump RH 12495 to the induction manifold hose connection.
Start the engine.
Is the dump valve closed?

YES

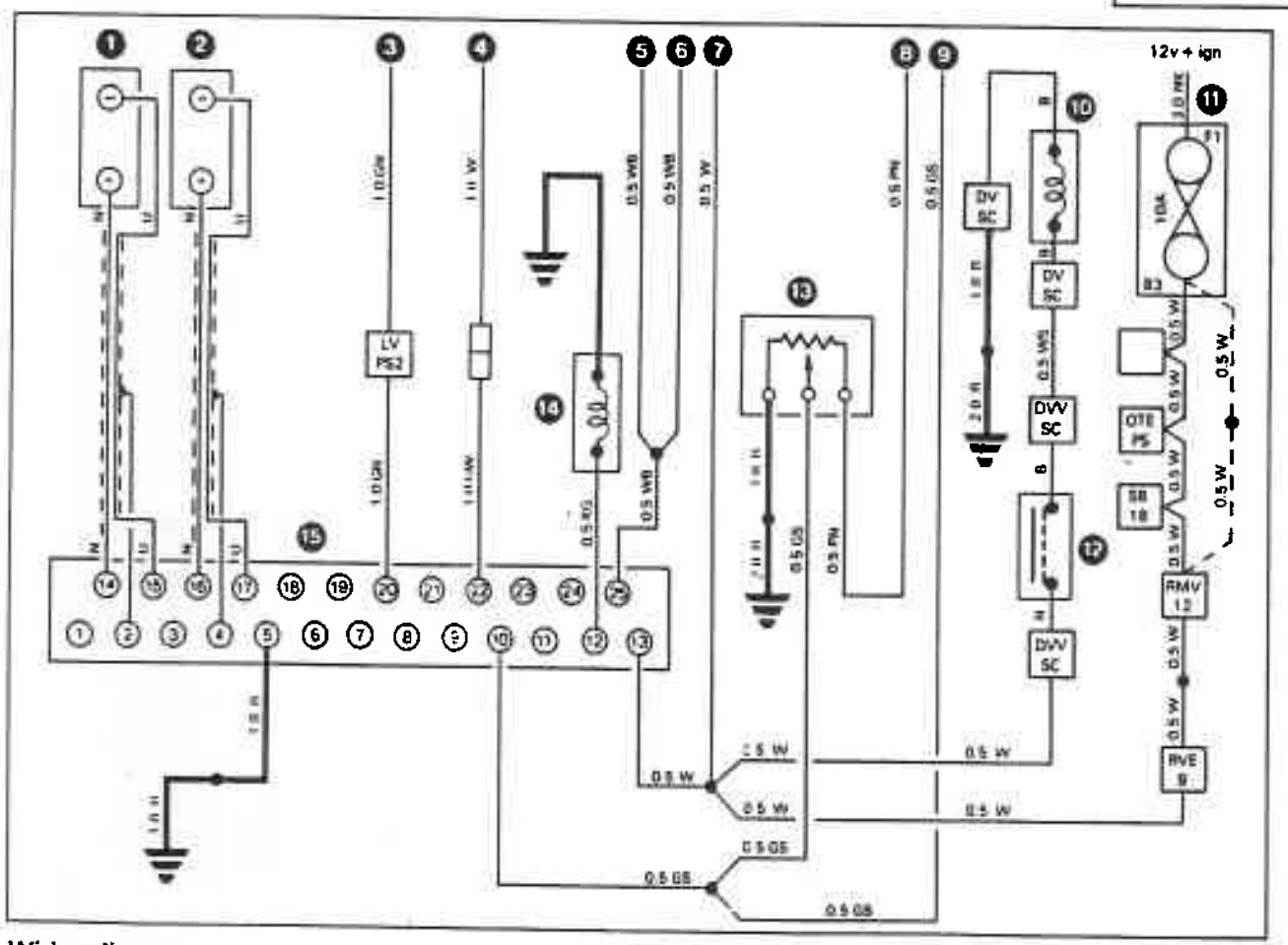
Apply a vacuum of 0.5 bar (15 in Hg)
Does the valve open rapidly (audible 'click') between 0,4 bar and 0,47 bar (1 in Hg and 14 in Hg)?

YES

Slowly release the vacuum
Does the valve close as the vacuum fall below 0.42 bar (12.5 in Hg)?

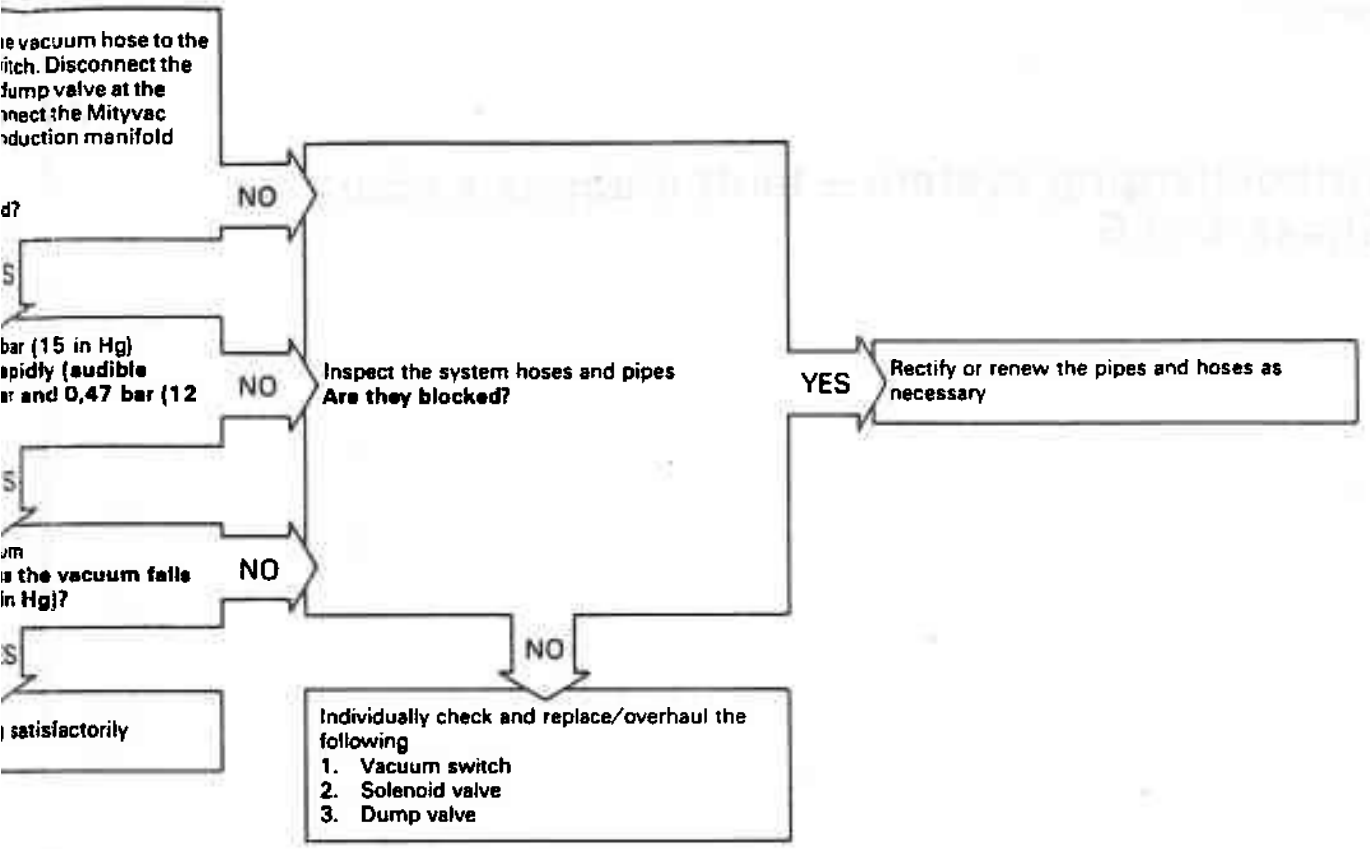
YES

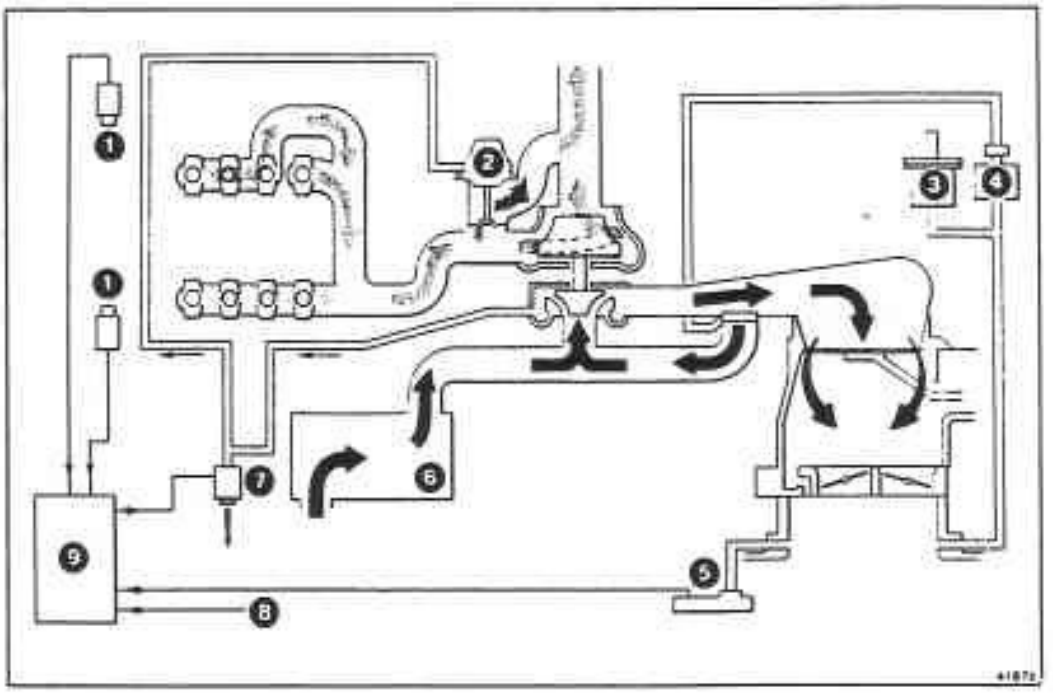
Dump valve is operating satisfactorily



Wiring diagram

1 Knock sensor – A bank
2 Knock sensor – B bank
3 From braking system
4 From speed control system
5 From fuel injection system ECU
6 From ignition system ECU
7 To ignition system ECU
8 To fuel injection system ECU
9 To fuel injection system ECU
10 Purge control solenoid (if fitted)
11 Fuse
12 Purge control vacuum switch (if fitted)
13 Air pressure transducer
14 Boost control solenoid
15 Boost control system ECU





The turbocharging system

1 Knock sensor
2 Exhaust gas wastegate
3 Dump valve vacuum switch
4 Dump valve solenoid valve
5 Air pressure transducer
6 Air intake filter housing
7 Boost control solenoid valve
8 Ignition input signal (engine speed)
9 Electronic control unit (ECU)

Figure D2-9

Turbocharging system – fault diagnosis chart Sheet 5 of 5

Brake lamps, Cruise control, and Knock sensors

The boost control system switches to base pressure and hence naturally aspirated performance if
1. The brakes are applied (stall torque limiting function)
2. The cruise control is activated

Switch on the ignition
Are the brake lamps illuminated without depressing the brake pedal?
YES → Refer to Workshop Manuals TSD 4700 (Chapter G) or TSD 4701 and rectify the fault
NO

Switch on the ignition
Depress the brake pedal and measure the voltage at pin 20 of the boost control ECU (see item A)
Is it 10 to 13 volts?
NO → Check the stop lamps circuit refer to Workshop Manual TSD 4701
YES

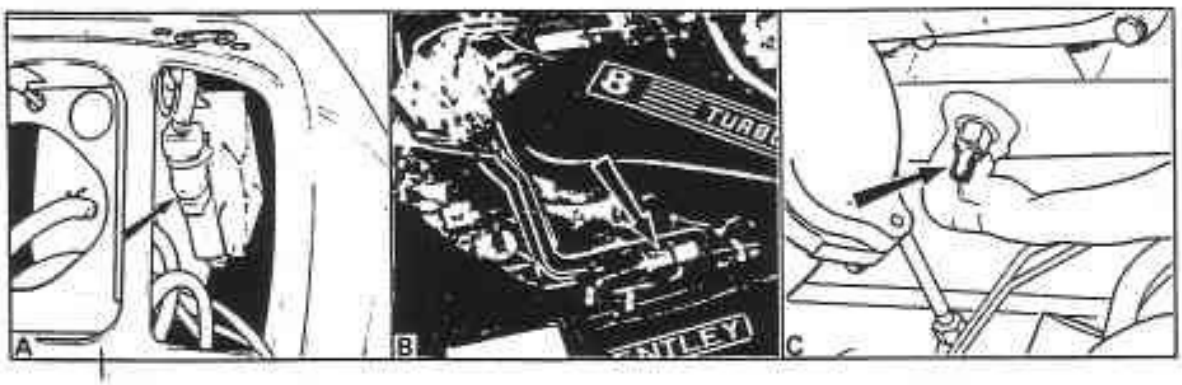
Disconnect pin 22 (cruise control) from the boost control ECU. **Insulate the wire very carefully.** Retest the vehicle
Has the performance improved?
YES → Check for a fault in the cruise control system
NO

Start the engine
Check the operation of the boost control valve (see item B)
Is it 'clicking' at random?
YES → Disconnect the knock sensor connectors, one at a time (see item C)
Start the engine
Measure the voltage on the pink/green cable at the boost control valve plug
Is it greater than 9 volts and is the valve not 'clicking'?
NO → Check the condition and conti knock sensor cables. Note the
Are they continuous and in condition?
NO → Rectify faulty cables
YES → Replace knock sensor(s)
NO

Start and run the engine at idle speed
Measure the voltage on the pink/green cable at the boost control valve plug
Is it less than 5 volts?
YES → Replace knock sensor(s)
NO

Start the engine with the transmission in park
Increase the engine speed to between 3000 and 3500 rev/min
Measure the voltage of the pink/green cable at the boost control valve plug
Is it less than 5 volts?
YES → Check the integrity of knock sensor cables at the pin connectors
Check pins, substitute knock sensors, and ensure protective sleeves are securely fastened
NO

System operating satisfactorily



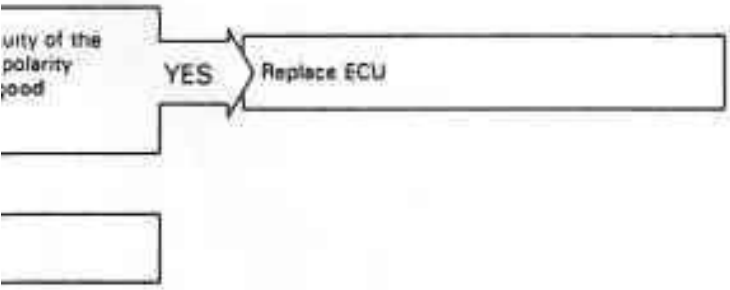

uity of the
polarity
pod
YES
Replace ECU

Figure D3-9

Turbocharging system – fault diagnosis chart Sheet 1 of 5

Preliminary checks and conditions

Important

1. Unless a fault is absolutely obvious it is recommended that the complete fault finding procedure is carried out
2. Ensure that the battery is fully charged
3. Always use a digital multimeter to carry out electrical circuit tests
4. Always switch off the ignition when either disconnecting or connecting electrical connections
5. Always remake any connection(s) before proceeding to the next test

Symptoms	Possible cause
Poor performance (general)	Knock sensors
Poor performance (intermittent)	Air pressure transducer
Excessive performance	Boost control valve
Misfire	Stall torque limiter – brakes
Overboosting	Wastegate
Detonation	Turbocharger
Surging [113 km/h to 144 km/h (70 mile/h to 90 mile/	Dump valve

Visually inspect the electrical connections to the components illustrated below. Detach the multiplug from the boost control ECU and check the integrity of the 15 connections in the plug
Are these satisfactory?

NO → 1. Remake the connections 2. Replace the cables

YES

Switch on the ignition
Wait for approximately 10 seconds
Does the boost control valve 'click' continuously?
Note The valve may 'click' briefly for between 5 and 10 seconds when the ignition is switched on

NO → Disconnect the electrical plug from the boost control valve
Switch on the ignition and measure the voltage at the loom connector
Is it 10 to 13 volts?

NO → Check the cables to the boost control solenoi valve

YES

YES → Carry out checks to the air pressure transducer loom

Check the voltage on the purple/brown cable
Is it 4.9 to 5.3 volts?

NO → Check the boost control valve

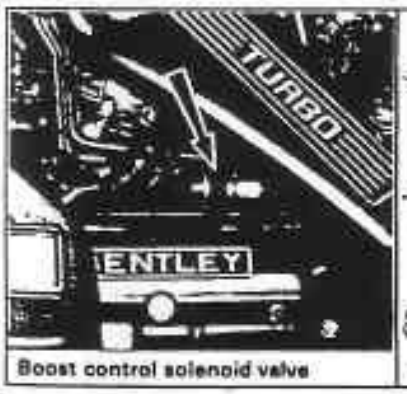
YES

Check for cable continuity between the black cable and earth
Is it continuous?

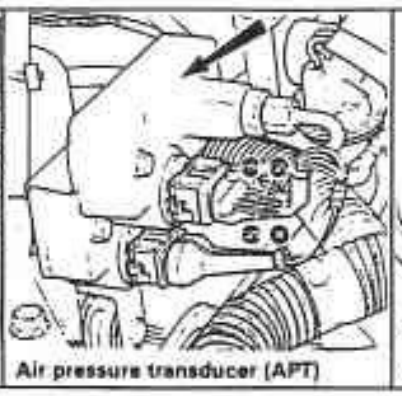
YES → Check the air pressure transducer

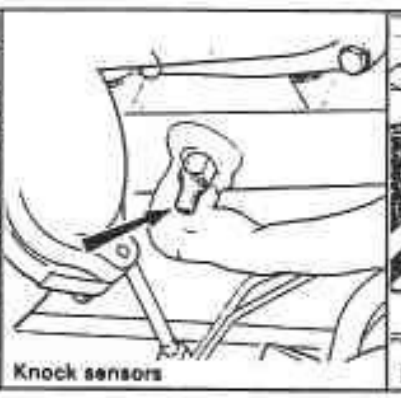
NO

Rectify faulty cable



Boost control solenoid valve


Air pressure transducer (APT)


Knock sensors


Boost control ECU

Figure D3-9

Turbocharging system – fault diagnosis chart
Sheet 2 of 5

Boost control system air pressure transducer (APT)

Carefully withdraw the rubber moulding from the APT electrical plug (see item A) for the duration of the test. This plug has four cables.
Do not remove the plug.
Connect a multimeter between the purple/brown cable in the plug and earth
Switch on the ignition and check the voltage
Is it 4.9 to 5.3 volts?

NO → **Is the reading zero volts?**

NO → Replace the fuel i

YES → Withdraw the plug from the APT
Check for cable continuity between the purple/brown cable in the plug and pin 9 in the boost control ECU plug (see item C)
Is it continuous?

YES → Withdraw the plug from the APT
Check for cable continuity between the black cable in the plug and the body earth (see item B)
Is it continuous?

NO → Rectify faulty cable

YES → **Is the voltage drop on the cable less than 0.05 volts?**

NO → Rectify faulty cable

YES → Do not remove the plug from the APT
Start and run the engine at idle speed
Measure the voltage between the green/slate cable in the plug and earth
Is it 0.7 to 1.0 volts?

NO → Rectify faulty cable

YES → Withdraw the plug from the APT and the EGR ECU 10 way
Check for cable continuity between the green/slate cable in the plug and pin 10 in the boost control ECU plug (see item C)
Check for cable continuity between the green/slate cable in the plug and pin 7 in the EGR 10 way
Are the cables continuous?

NO → Rectify faulty cable

YES → Disconnect the metal manifold feed pipe from the APT
Do not remove the plug
Switch on the ignition and measure the voltage between the green/slate cable in the plug and earth
Is it 2.2 to 2.8 volts?

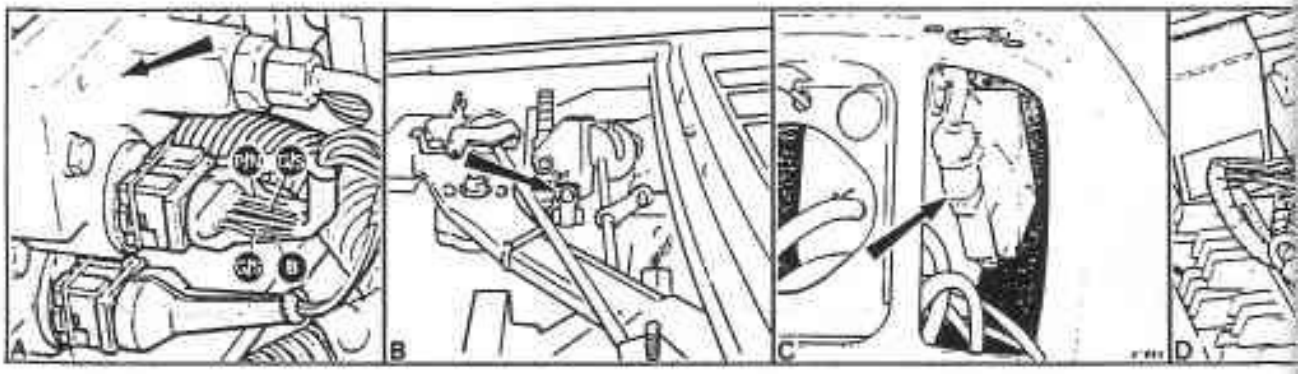
YES → Check for a 'crimped' or blocked signal hose from the induction manifold to the APT
Is it satisfactory?

YES → Check that the m
or leaking
Is it satisfactory

NO → Clean out or replace the hose

Rectify the pipe

NO → Replace the APT



jection system ECU

tal signal pipe is not blocked

YES

Replace the boost control ECU

NO

Switch on the ignition
Wait for approximately 10 seconds
Is the boost control valve 'clicking' continuously?

NO

System operating satisfactorily

YES

Retest the system

Figure D3-9

Turbocharging system – fault diagnosis chart
Sheet 3 of 5

Boost control solenoid valve

Remove the two hoses from the adapter on the boost control solenoid valve
Connect a clean hose to one of the hose connections on the adapter (see item A)
Blow down the hose
Does air only escape from the open connection on the adapter and not from the screened vent port?

NO → Replace the boost control valve

YES ↓

Leave the hoses as in the previous test
Switch on the ignition
Blow down the hose
Does air now escape from both the open connection on the adapter and the screened vent port?

NO → Replace the boost control valve

YES ↓

Withdraw the plug from the boost control system APT (see item B)
Switch on the ignition
Is the boost control solenoid valve 'clicking'?

NO → Withdraw the plug from the air pressure transducer
Switch on the ignition
Is the voltage on the green/slate cable more than 3.6 volts?

NO → Disconnect the e
air pressure tran
ECU (see item C
item D).
Check the cable
the air pressure
EGR ECU 10 wa
10 on the boost
Are these conti

YES ↓

Boost control solenoid valve working satisfactorily

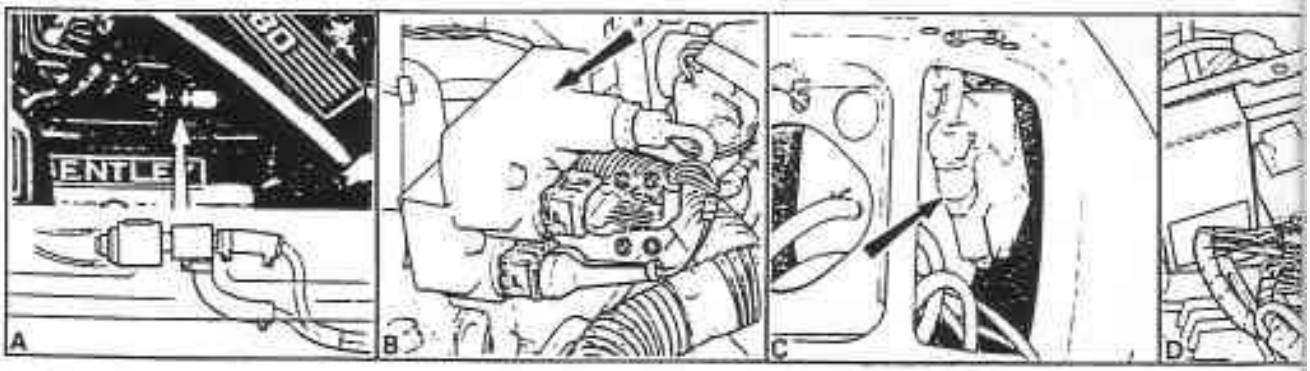
YES ↓

Change the boost control system ECU and retest the system

Measure the resi
solenoid valve
Is it 26 to 27Ω

Change the ECU
Retest the syste
Is it now satisfa

Boost control sy



ectrical connections to the
ducer, the boost control
and the EGR ECU (see

ontinuity between pin 2 on
ansducer and pin 7 on the
plug and socket, and pin
control ECU
uous?

NO → Rectify faulty cables

YES

tance of the boost control

NO → Change the boost control solenoid valve

YES

ctory?

NO → Check the brake lamps, automatic speed control, and knock sensing systems

YES

em working satisfactorily

Figure D3-9

Turbocharging system – fault diagnosis chart Sheet 4 of 5

Wastegate

Ensure that there is no blockage of the following
1. Wastegate signal pipe
2. Compressor to boost control valve signal pipe
3. Compressor signal pipe tapping on the turbocharger compressor

Are these components free from obstruction?

NO → Eliminate the blockage or replace the respective component

YES

Remove the hose from the boost control valve that feeds air to the wastegate
Fit the Mityvac pump RH 12495.
Apply 0,41 bar (12 in Hg) of air pressure to the wastegate signal pipe and listen carefully for the wastegate to operate.

Does the wastegate open when the air pressure is applied and close again when the pressure is released?

NO → Remove the wastegate
Inspect the valve and diaphragm for sticking and/or damage (including a ruptured diaphragm)

YES

Wastegate operates satisfactorily
Proceed to check the dump valve system

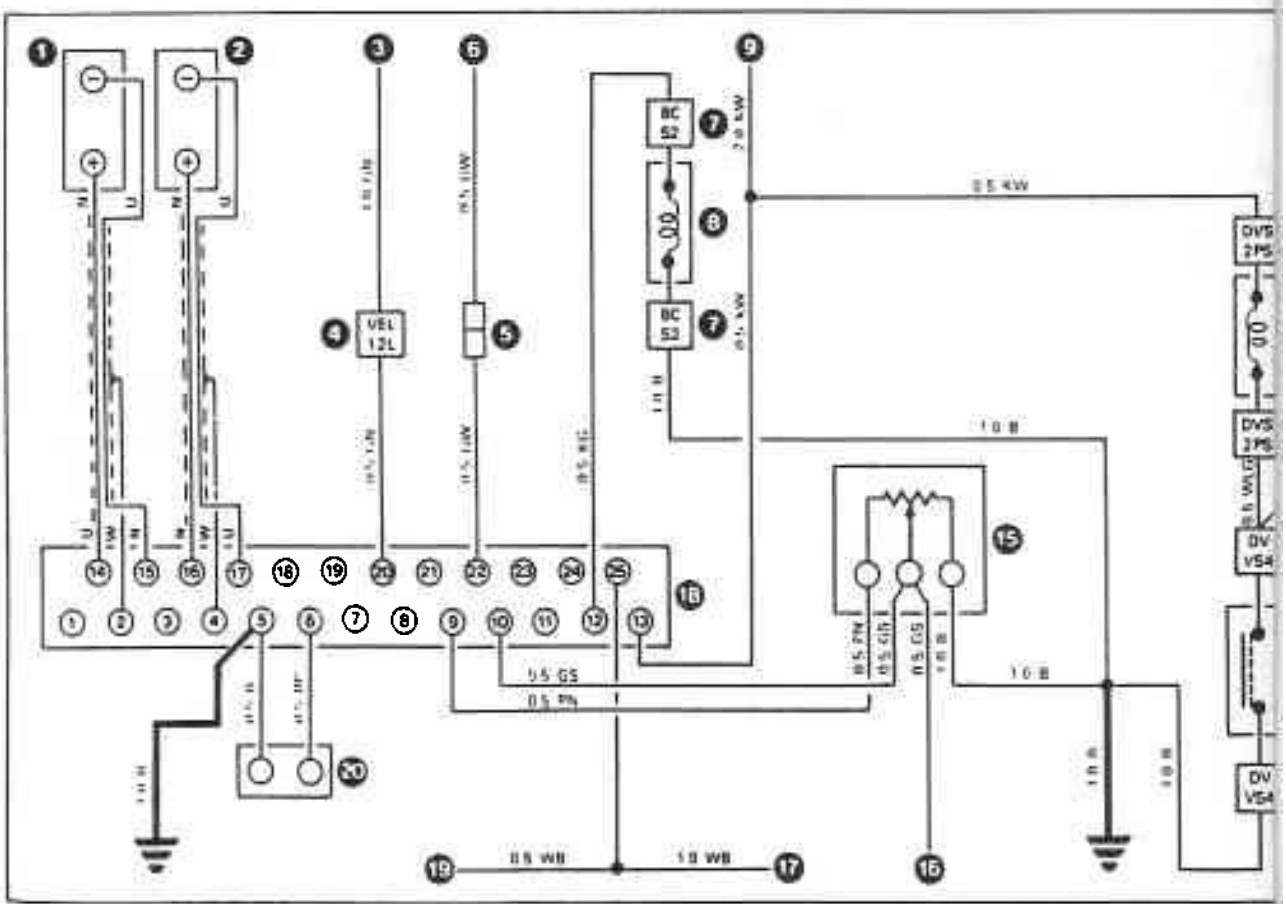
Dump v

Disconnect the
valve vacuum s
pump RH 12495
Start the engine
Is the dump val

Apply a vacuun
Does the valve
'click') betwee
in Hg and 14 i

Slowly release
Does the valve
below 0,42 ba

Dump valve is



1 'A' bank knock sensor
2 'B' bank knock sensor
3 Braking system
4 Left-hand valance 12 way plug and socket
5 Left-hand valance single connection
6 Speed control system
7 Boost control solenoid 2 way plug and socket
8 Boost control solenoid
9 Right-hand valance 7 way plug and socket
10 Dump valve solenoid 2 way plug and socket
11 Dump valve solenoid
12 Left-hand valance 12 way plug and socket
13 Dump valve vacuum switch
4 ay plug and socket
14 Dump valve va
15 Air pressure tr
16 EGR ECU
17 EGR ECU
18 Boost control
19 K-Motronic EC
20 Parameter cod
required on ca
catalytic conve

valve

vacuum hose to the dump
witch. Connect the Mityvac
to the vacuum switch.
re closed?

NO

YES

of 0.5 bar (15 in Hg)
open rapidly (audible
n 0,4 bar and 0,47 bar (12
n Hg)?

NO

Inspect the system hoses and pipes
Are they blocked?

YES

Rectify or renew the pipes and hoses as necessary

YES

he vacuum
close as the vacuum falls
(12.5 in Hg)?

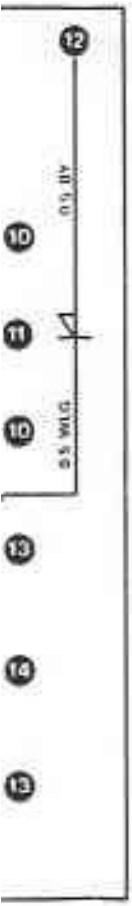
NO

NO

YES

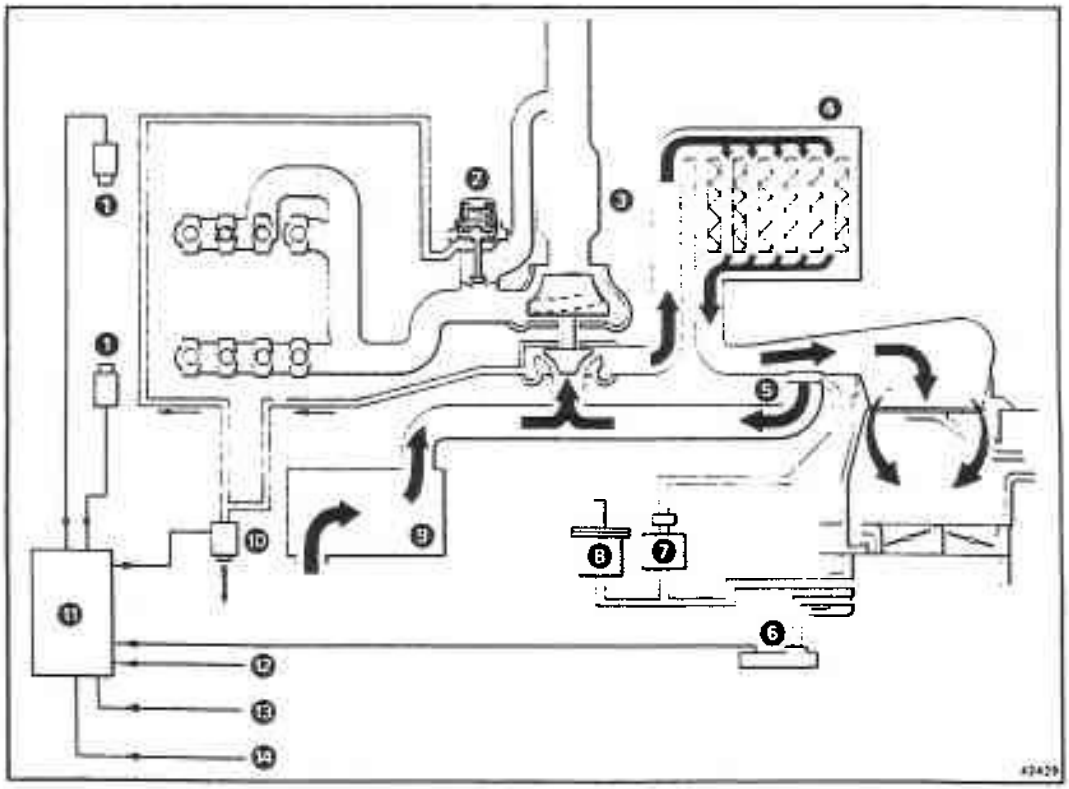
perating satisfactorily

Individually check and replace/overhaul the following
1. Vacuum switch
2. Solenoid valve
3. Dump valve



uum switch
nsducer

CU
J
socket (link
s fitted with
ters)



1 Knock sensor
2 Wastegate
3 Warm-up catalytic converter
4 Intercooler
5 Dump valve
6 Air pressure transducer
7 Dump valve solenoid
8 Dump valve vacuum switch
9 Air intake filter housing
10 Boost control solenoid
11 Boost control ECU
12 K-Motronic
13 Braking system
14 Speed control system

Figure D3-9

Turbocharging system – fault diagnosis chart
Sheet 5 of 5

Brake lamps, Cruise control, and Knock sensors

The boost control system switches to base pressure and hence naturally aspirated performance if
1. The brakes are applied (stall torque limiting function)
2. The cruise control is activated

Switch on the ignition
Are the brake lamps illuminated without depressing the brake pedal?

YES → Refer to Workshop Manuals TSD 4700 (Chapter G) or TSD 4848 and rectify the fault

NO

Switch on the ignition
Depress the brake pedal and measure the voltage at pin 20 of the boost control ECU (see item A)
Is it 10 to 13 volts?

NO → Check the stop lamps circuit refer to Workshop Manual TSD 4848

YES

Disconnect pin 22 (cruise control) from the boost control ECU. **Insulate the wire very carefully.** Retest the vehicle
Has the performance improved?

YES → Check for a fault in the cruise control system

NO

Start the engine
Check the operation of the boost control valve (see item B)
Is it 'clicking' at random?

YES → Disconnect the knock sensor connectors, one at a time (see item C)
Start the engine
Measure the voltage on the pink/green cable at the boost control valve plug
Is it greater than 9 volts and is the valve not 'clicking'?

NC → Check the con
knock sensor
Are they cont
condition?

YES → Replace knock sensor(s)

Rectify faulty c

NO

Start and run the engine at idle speed
Measure the voltage on the pink/green cable at the boost control valve plug
Is it less than 5 volts?

YES → Replace knock sensor(s)

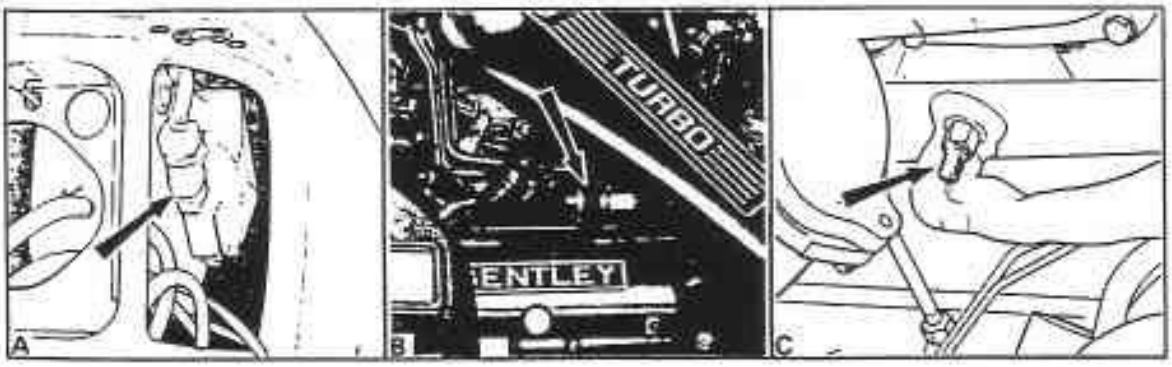
NO

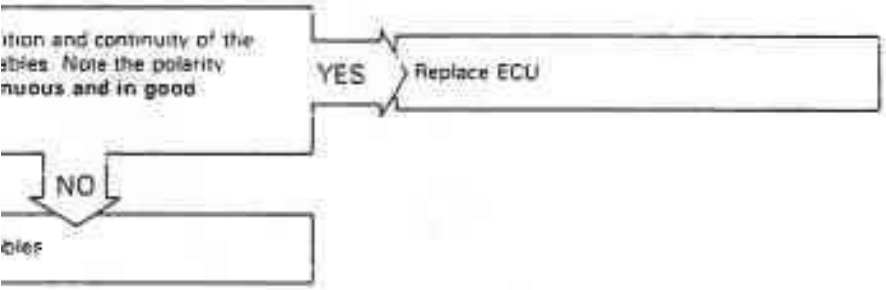
Start the engine with the transmission in park
Increase the engine speed to between 3000 and 3500 rev/min
Measure the voltage of the pink/green cable at the boost control valve plug
Is it less than 5 volts?

YES → Check the integrity of knock sensor cables at the pin connectors
Check pins, substitute knock sensors, and ensure protective sleeves are securely fastened

NO

System operating satisfactorily




ition and continuity of the
ables. Note the polarity
nuous and in good
YES
Replace ECU
NO
bles

the CO measuring pipe from the main exhaust pipe below the turbocharger.
14. Unscrew the two setscrews securing the oil drain pipe to the bottom of the turbocharger. Free the joint.
15. Unscrew the exhaust clamp ring, securing the turbocharger assembly to the exhaust downtake pipe.
16. Unscrew the four nuts retaining the turbocharger assembly to the exhaust manifold mounting flange. Collect the distance washers.
17. Carefully withdraw the turbocharger assembly, taking care not to damage the machined mating faces of both the turbocharger and the exhaust manifold.
18. Fit the turbocharger by reversing the removal procedure, noting the following.
19. Ensure that the face joint surfaces between the turbocharger and exhaust manifold are clean and undamaged.
20. Torque tighten the retaining nuts to the figures given in Chapter L.
21. Before connecting the lubrication pipes, the turbocharger must be primed with clean engine oil in the following manner.
a. Slowly pour the engine oil into the feed port on top of the turbocharger and manually spin the compressor blades. Exercise care to ensure that the blades are not damaged.
b. Once the oil drains from the port on the bottom of the turbocharger, clean the joint face and fit both the gasket and oil return pipe.
c. Fill the turbocharger through the feed port and then clean the joint face and fit both the gasket and oil feed pipe.

Exhaust wastegate – To remove and fit
(see fig. D3-11)
1. Locate the boost pressure pipe connection on the side of the wastegate assembly. Unscrew the male pipe nut and withdraw the pressure pipe.
2. Unscrew the setscrews securing the wastegate to the exhaust manifold. Collect the washers.
3. Withdraw the wastegate and collect the 'O' ring.
4. Fit the wastegate by reversing the removal procedure, noting that the sealing ring fitted between the wastegate and housing must be in good condition.

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

Air dump valve (recirculation) pipe – To remove and fit
The recirculation pipe is an integral part of the cast intake assembly.
1. Unscrew the worm drive clip securing.
a. the main intake hose to the cast intake assembly.
b. the hose from the air dump valve to the metal pipe.

Twist each hose to free the joint.
2. Unscrew the intake assembly retaining nut and collect the washer (see fig. D3-12).
3. Withdraw the pipe assembly.

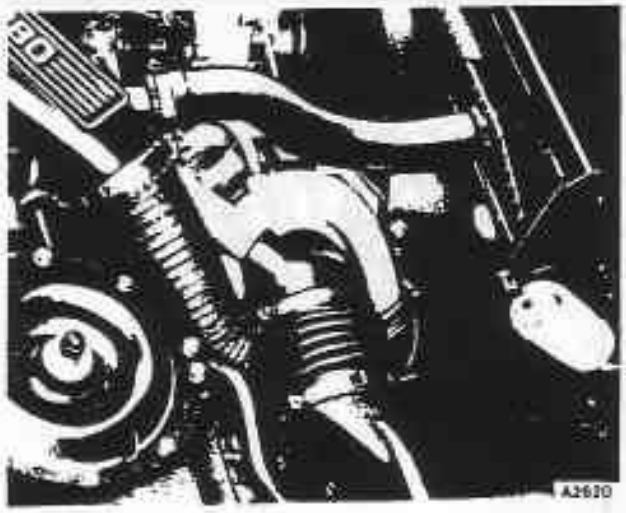


Fig. D3-10 Turbocharger and inlet pipes

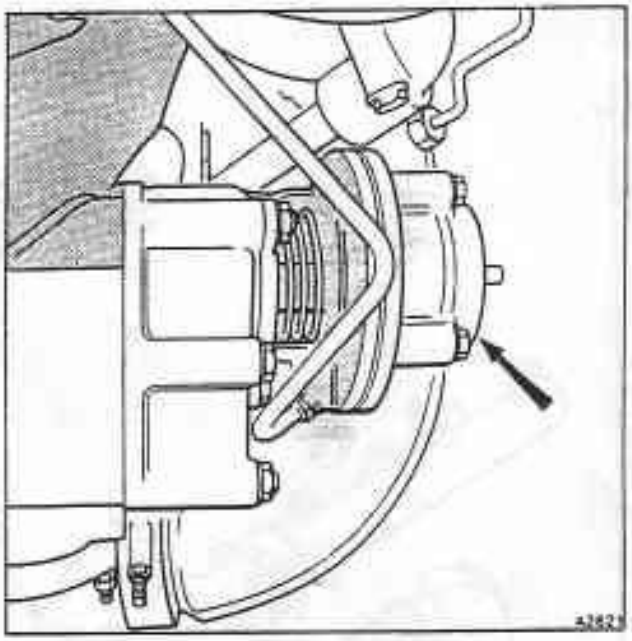


Fig. D3-11 Exhaust gas wastegate

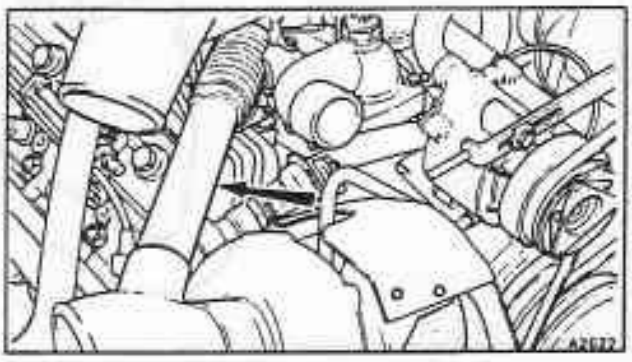


Fig. D3-12 Air dump valve pipe

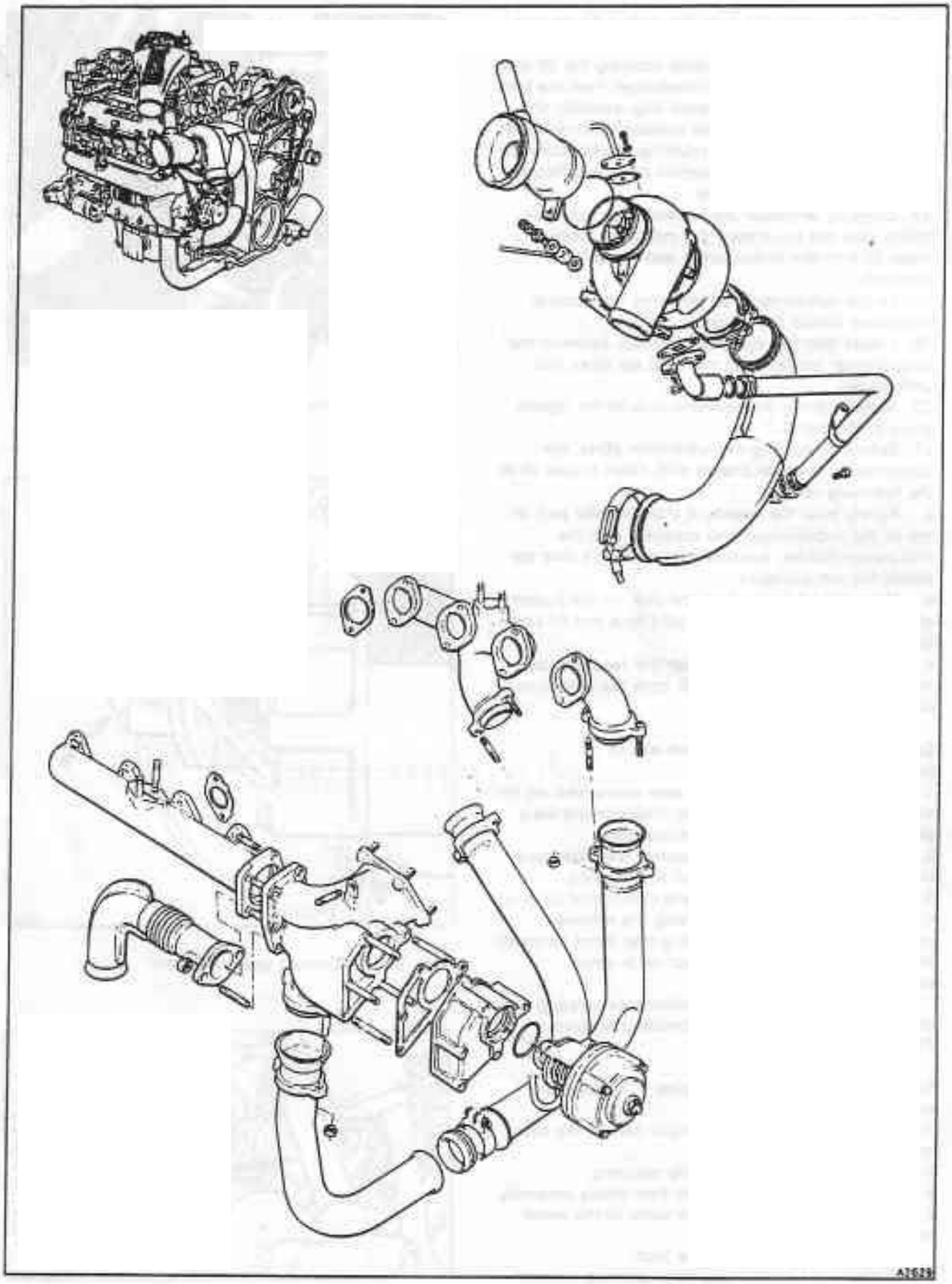


Fig. D3-13 Turbocharger and exhaust fittings

4. Fit the pipe assembly by reversing the procedure, ensuring that the hoses are in good condition.

Air dump valve – To remove and fit
1. Free the two flexible hoses from their respective connections on the bottom of the dump valve (see fig. D3-14).
2. Remove the cast engine air intake elbow (refer to Chapter B, Section B4, Mixture control unit assembly – To remove and fit).
3. Invert the cast elbow.
4. Unscrew the three setscrews retaining the dump valve. Collect the washer fitted under the head of each setscrew.
5. Withdraw the dump valve assembly.
6. Fit the dump valve by reversing the procedure, ensuring that the gasket is in good condition.

Air dump valve – To dismantle, inspect, and assemble (see fig. D3-5)
1. Remove the dump valve from the cast air intake elbow.
2. Collect the rubber sealing ring.
3. Unscrew the two Allen screws retaining the circular end plate to the assembly. Collect the gasket.
4. Unscrew the two through setscrews from the base of the dump valve. Collect the washer from each setscrew.
5. Withdraw the valve from the casting.
6. Unscrew the four setscrews situated around the diaphragm retaining ring.
7. Unscrew the nut from the centre through bolt. Collect the washer.
8. Lift off the seal assembly, diaphragm, spring guide, spring, and base washer.
9. Withdraw the through bolt, guide, and washer from the valve housing.
10. Clean the parts and examine the rubber diaphragm, body sealing ring, and the valve seal assembly plate.
11. Assemble the components by reversing the dismantling procedure.

Air dump valve vacuum switch and solenoid – To remove and test (see fig. D3-5)
This solenoid and switch are fitted adjacent to the air flow sensor potentiometer on the mixture control unit.

Vacuum switch – To remove and fit
1. Disconnect the vacuum signal hose from the switch.
2. Disconnect the electrical connections to the switch, at the 4-way connection.
3. Carefully prise the shakeproof securing washer from the cylindrical body of the switch, below the mounting bracket.
4. Lift the switch from the mounting bracket.
5. Fit the switch by reversing the dismantling procedure.

Vacuum switch – To test
1. Locate the switch electrical connection block and connect a digital multi-meter between the brown cable and earth.
2. Slacken the vacuum switch signal hose clamp screw and withdraw the hose. Connect the Mityvac pump RH 12495 to the connection on the switch.
3. Switch on the ignition noting that the reading on the multi-meter is between 8 volts and 15 volts.
4. Operate the vacuum pump and apply a vacuum to the switch. The meter should read zero when the reading on the gauge is between 317,50 mm Hg and 381,0 mm Hg (12.50 in Hg and 15 in Hg).
5. Slowly release the vacuum, noting that the meter again reads between 8 volts and 15 volts before the vacuum drops below 317,50 mm Hg (12.50 in Hg).
6. If the operation of the switch is suspect, it should be renewed.

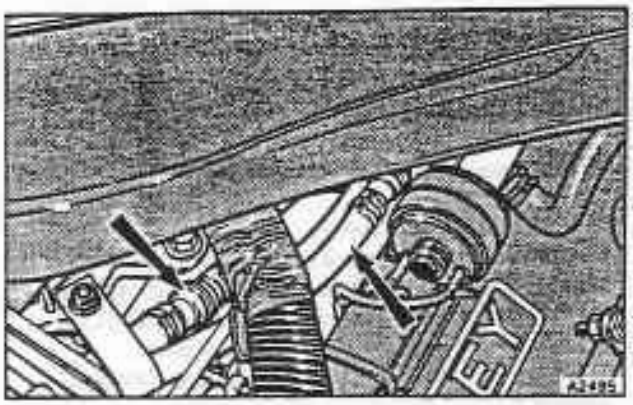


Fig. D3-14 Dump valve signal hoses

Solenoid valve – To remove and fit
1. Disconnect the inlet and outlet hoses from the solenoid valve.
2. Disconnect the electrical connections to the solenoid valve at the 2-way connection block.
3. Carefully slide the solenoid from its rubber mounting.
4. Fit the solenoid valve by reversing the dismantling procedure.

Solenoid valve – To test
1. Disconnect the electrical connections to the solenoid valve at the 2-way connection block. This block is situated between the air potentiomer (mixture control unit) and the solenoid valve.
Note The connection block is usually clipped together with the connection block for the vacuum switch.
2. Slacken the hose clamp screws on the solenoid inlet and outlet connections. Twist each hose to free the joint. Withdraw the two hoses.
3. Connect a suitable length of hose to the front connection on the solenoid and blow down the open end of the hose. It should be possible to blow through the solenoid valve.
4. Connect a 12 volt supply to the solenoid. Note that it should not be possible to blow down the hose

when the solenoid is energized.

Note If the solenoid valve is fitted to the car for this test, exercise care to eliminate the possibility of an electrical spark.

Boost control ECU – To remove and fit
(see fig. D3-6)

1. Disconnect the battery.
2. Remove the front left-hand flasher and side lamp assembly (refer to Workshop Manual TSD 4848).
3. Disconnect the multi-pin plug from the ECU.

Note Do not finger the ECU terminal pins.

4. Unscrew the setscrews securing the engine cooling system expansion bottle to the wing valance. Carefully manoeuvre the expansion bottle into the engine compartment to gain access to the ECU securing screws.
5. Unscrew the three self-tapping screws that retain the ECU to the wing valance.

   Support the ECU before the last securing screw is removed.
6. Withdraw the ECU through the front flasher and side lamp wing aperture.
7. Collect the three screw clips from the ECU.
8. Fit the ECU by reversing the removal procedure.

Air pressure transducer (APT) – To remove and fit

1. Disconnect the electrical plug at the APT.
2. Unscrew the metal pipe nut from the adapter on the APT.
3. Unscrew the two mounting screws and withdraw the APT.
4. Fit the assembly by reversing the removal procedure.

Engine knock sensors – To remove and fit

1. Locate the sensor mounted half-way along the crankcase on each side.
2. Detach the electrical plug from the end of the sensor.
3. Unscrew the sensor from the crankcase.
4. Fit the sensors by reversing the removal procedure. Ensure that the heat resistant sleeves fitted to protect each sensor cable, are in good condition and satisfactorily clipped along their entire length.