

Index

Evaporative system leakage

- troubleshooting 26-40

4-cylinder

Exhaust system

- component layout 26-10-1

5-cylinder

EGR system (California ONLY)

- checking 26-30

Exhaust system

- component layout 26-10-2

Vacuum circuit

- connections layout 26-20-2

Coupe

Exhaust system

- component layout 26-10-3

Vacuum circuit

- connections layout 26-20-1

Quattro

Exhaust system

- component layout 26-10-4

20-valve

EGR system (California ONLY)

- checking 26-30-9

Exhaust system

- component layout 26-10-5

Vacuum circuit

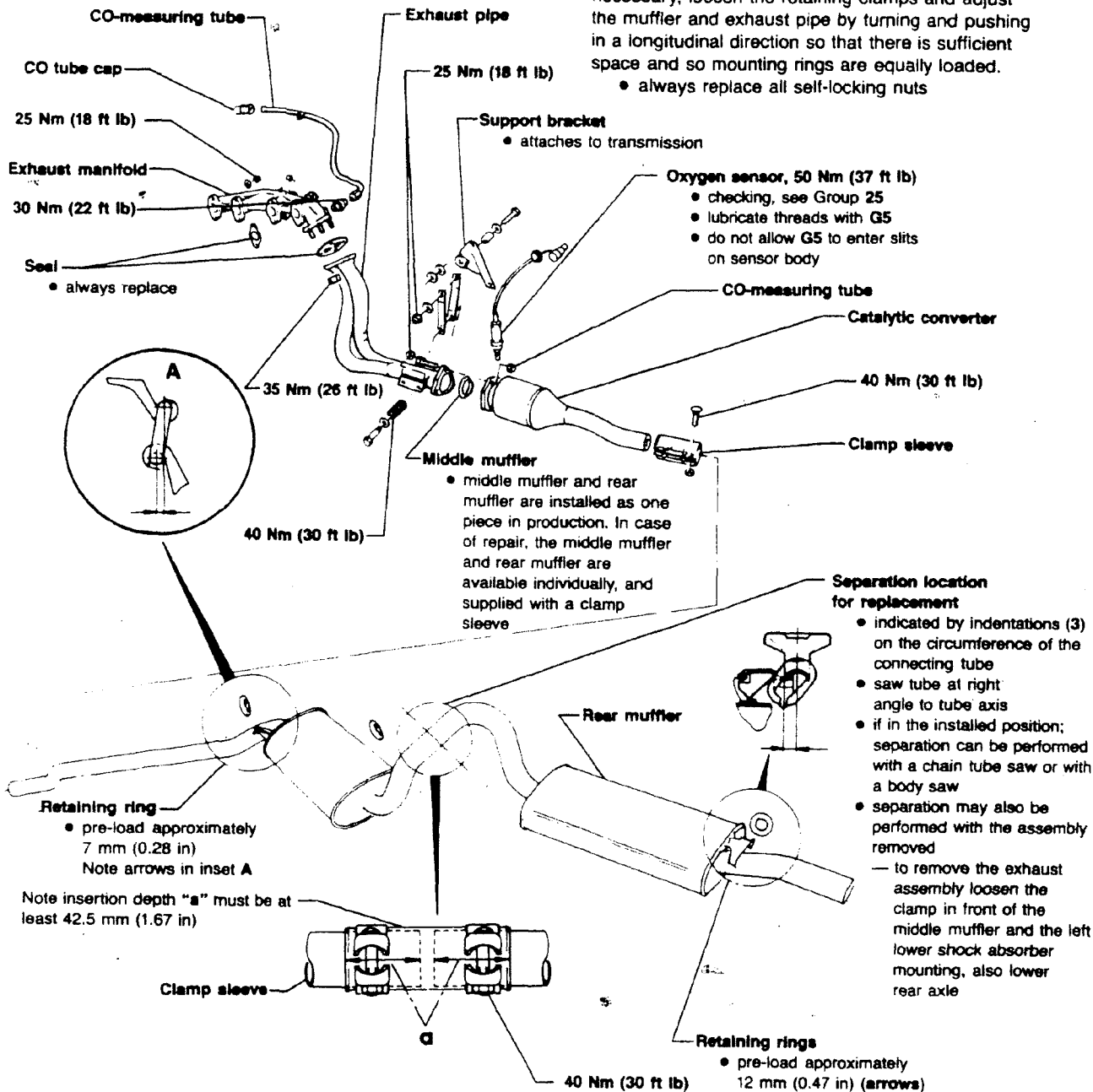
- connections layout (49-state) 26-20-3
- connections layout (California) 26-20-4

Exhaust System – Emission Controls

Note

After working on the exhaust system, check that system is not preloaded and that there is sufficient clearance between the system and the body. If necessary, loosen the retaining clamps and adjust the muffler and exhaust pipe by turning and pushing in a longitudinal direction so that there is sufficient space and so mounting rings are equally loaded.

- always replace all self-locking nuts

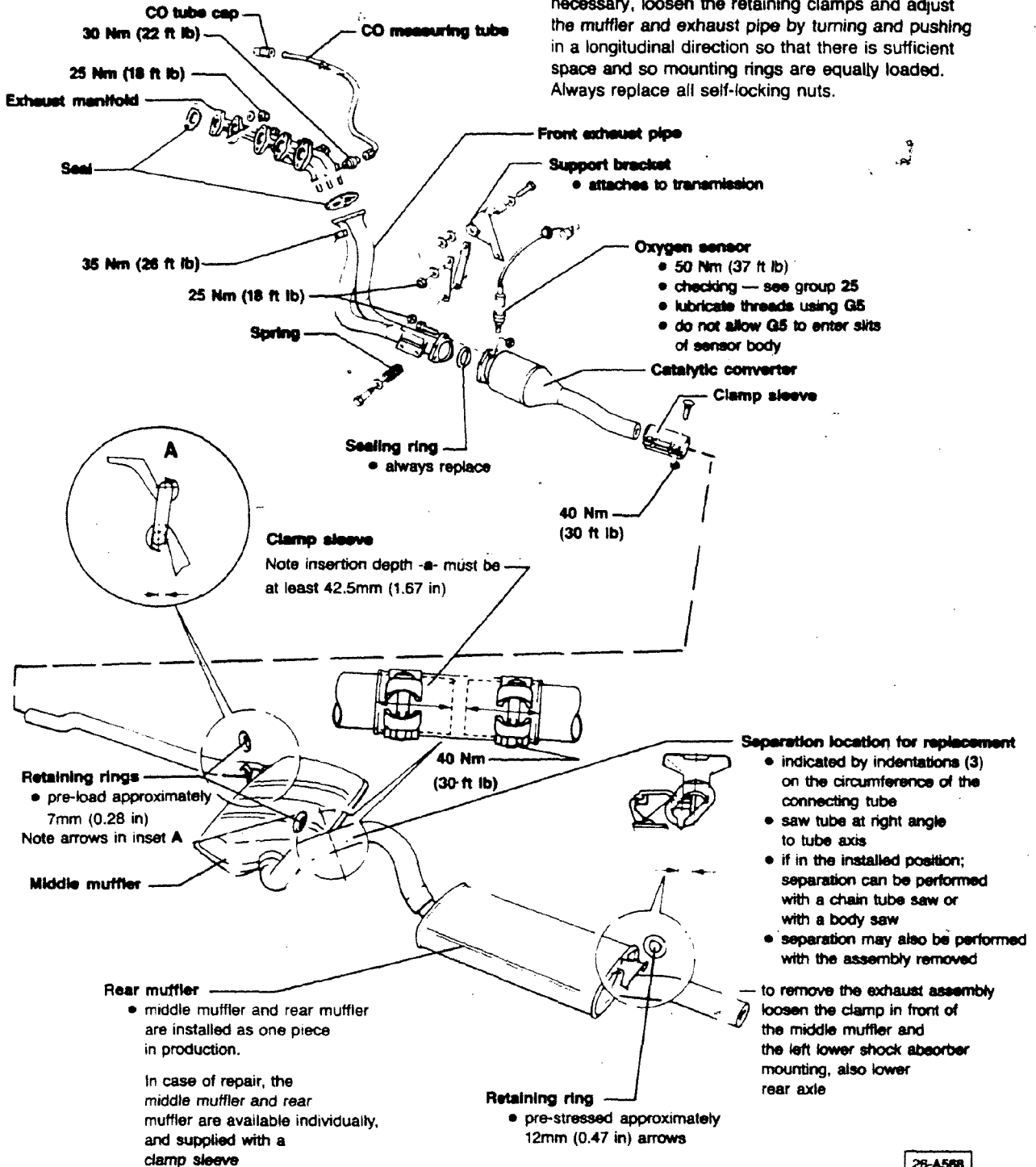


26-570

Exhaust System—Emission Controls

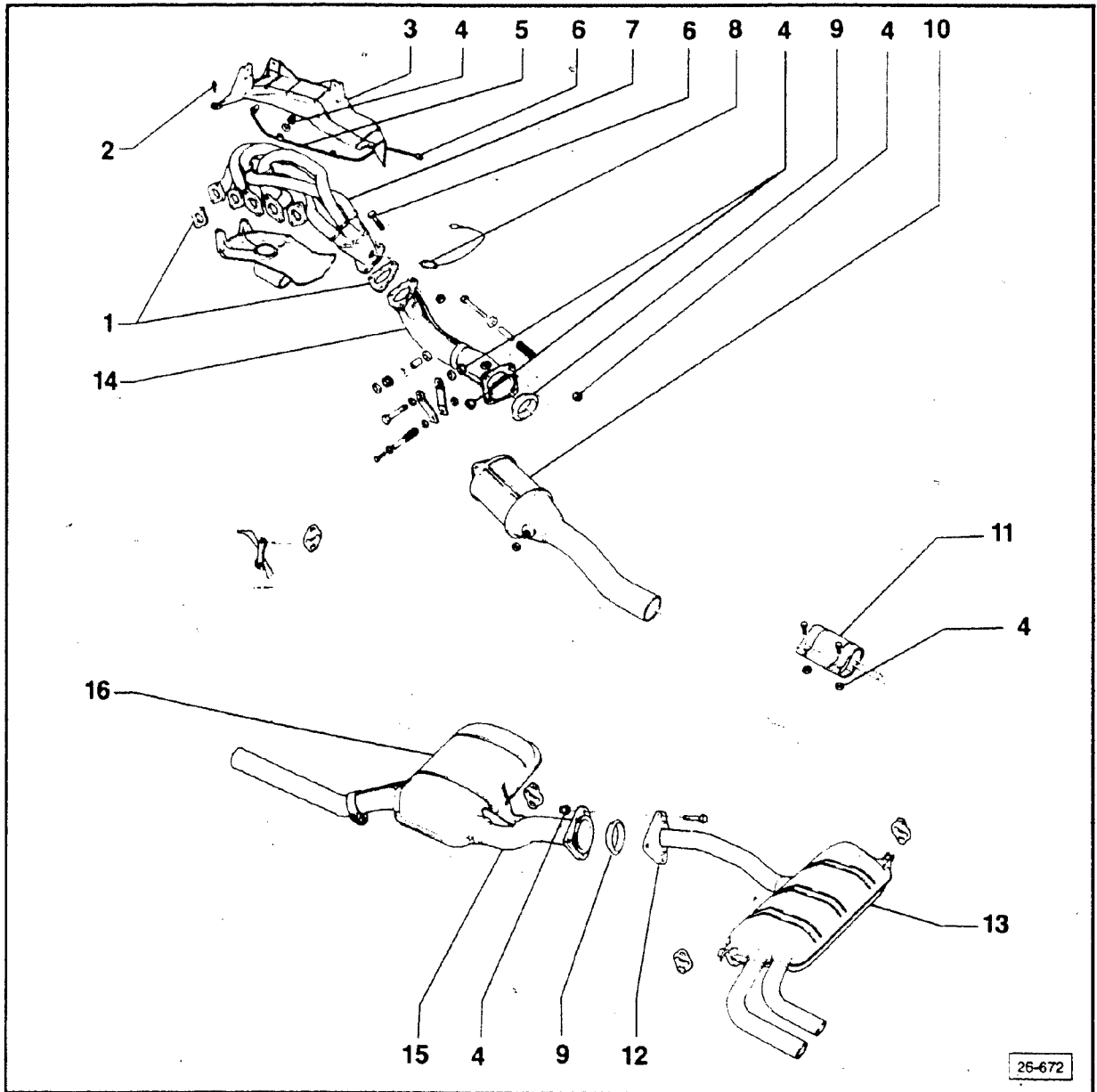
Note

After working on the exhaust system, check that system is not preloaded and that there is sufficient clearance between the system and the body. If necessary, loosen the retaining clamps and adjust the muffler and exhaust pipe by turning and pushing in a longitudinal direction so that there is sufficient space and so mounting rings are equally loaded. Always replace all self-locking nuts.



26-A568

Exhaust System – Emission Controls



Note

After working on the exhaust system ensure that the system (cold) is not preloaded.

Check for sufficient clearance between the exhaust system and the chassis.

If necessary, loosen the appropriate clamps to allow the mufflers and pipes to be turned and pushed in a longitudinal direction until sufficient clearance is obtained.

The hanging load must be distributed equally over the entire set of retaining rings.

Always replace self locking nuts.

- 1 — Gasket
replace
- 2 — 10 Nm (7 ft lb)
- 3 — Heat shield
- 4 — 25 Nm (18 ft lb)
- 5 — CO tap tube
- 6 — 30 Nm (22 ft lb)
- 7 — Exhaust manifold
- 8 — Oxygen sensor
50 Nm (37 ft lb)
checking, see Group 24

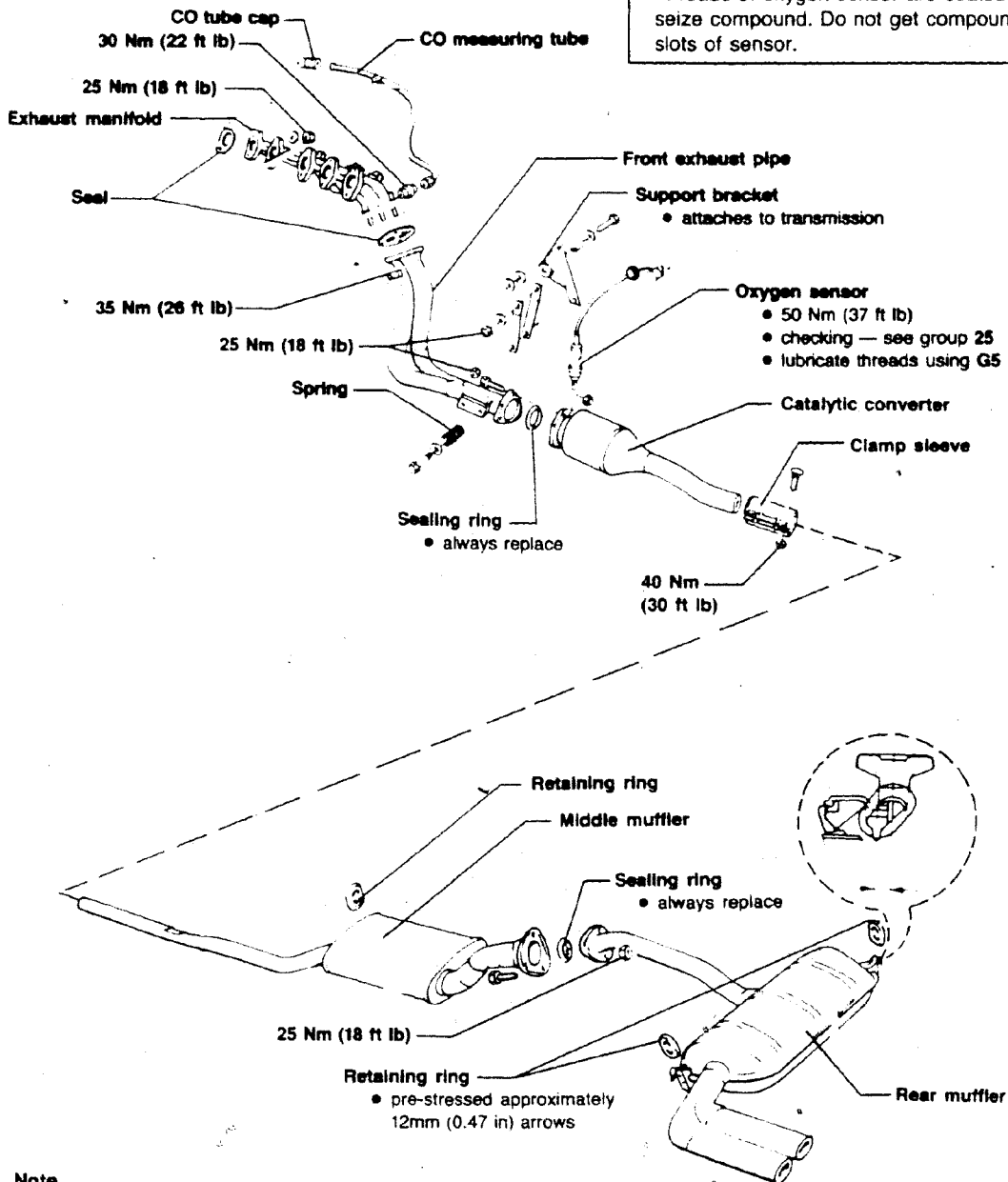
THIS FRAME INTENTIONALLY LEFT

BLANK

Exhaust System—Emission Controls

CAUTION

Threads of oxygen sensor are coated with anti-seize compound. Do not get compound into slots of sensor.



Note

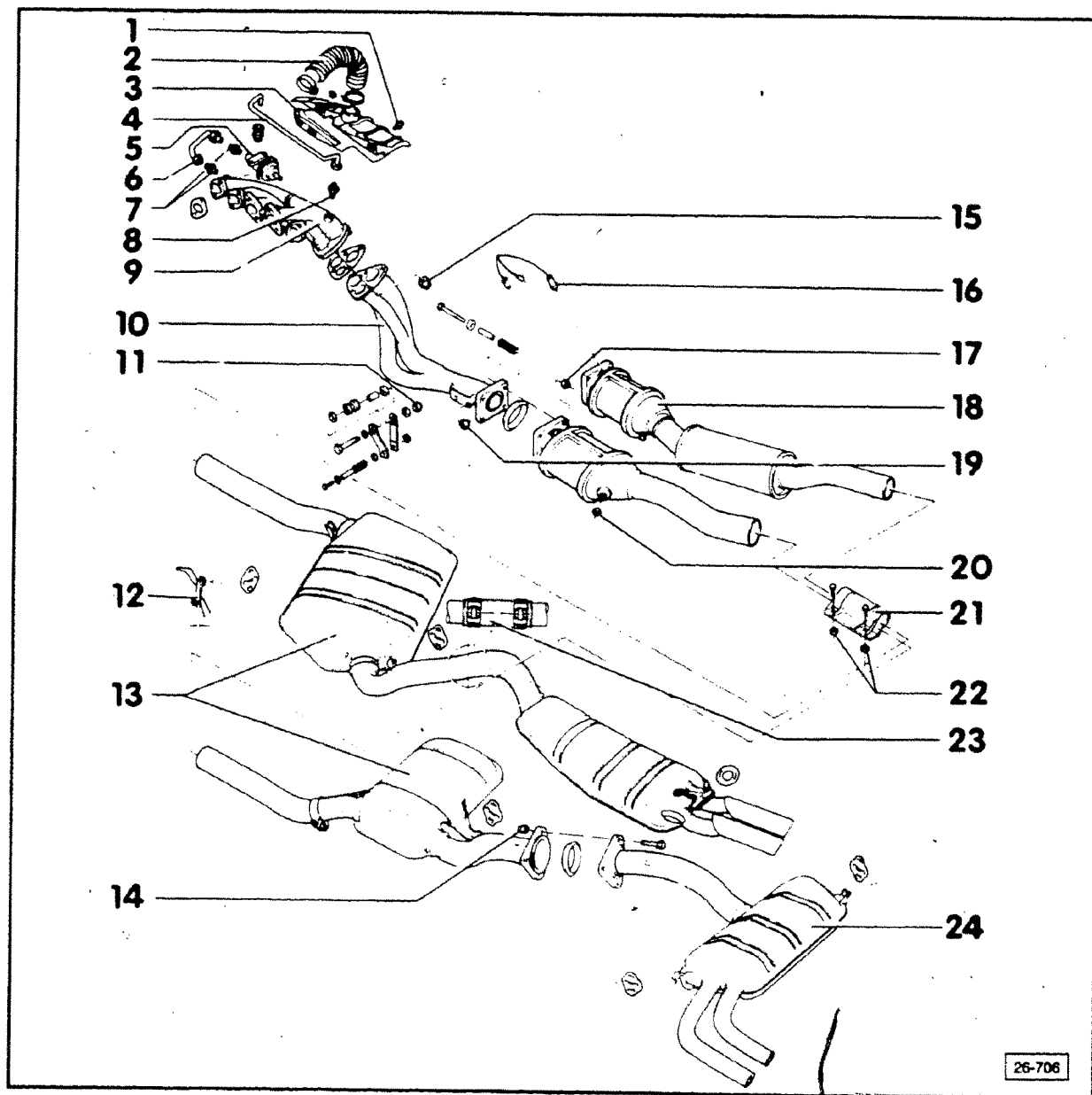
After working on the exhaust system, check that system is not preloaded and that there is sufficient clearance between the system and the body. If necessary, loosen the retaining clamps and adjust the muffler and exhaust pipe by turning and pushing in a longitudinal direction so that there is sufficient space and so mounting rings are equally loaded. Always replace all self-locking nuts.

26-A568

Exhaust System – Emission Controls

- 9 — **O-ring**
replace
- 10 — **Catalytic converter**
- 11 — **Clamp sleeve**
push on front half up to stop
adjust initial stressing force
on the rear half
- 12 — **Retaining rings**
when replacing, be sure new
part matches the original
- 13 — **Rear muffler**
- 14 — **Front exhaust pipe**
- 15 — **Retaining rings**
when replacing, be sure new
part matches the original
- 16 — **Center muffler**

Exhaust System – Emission Controls



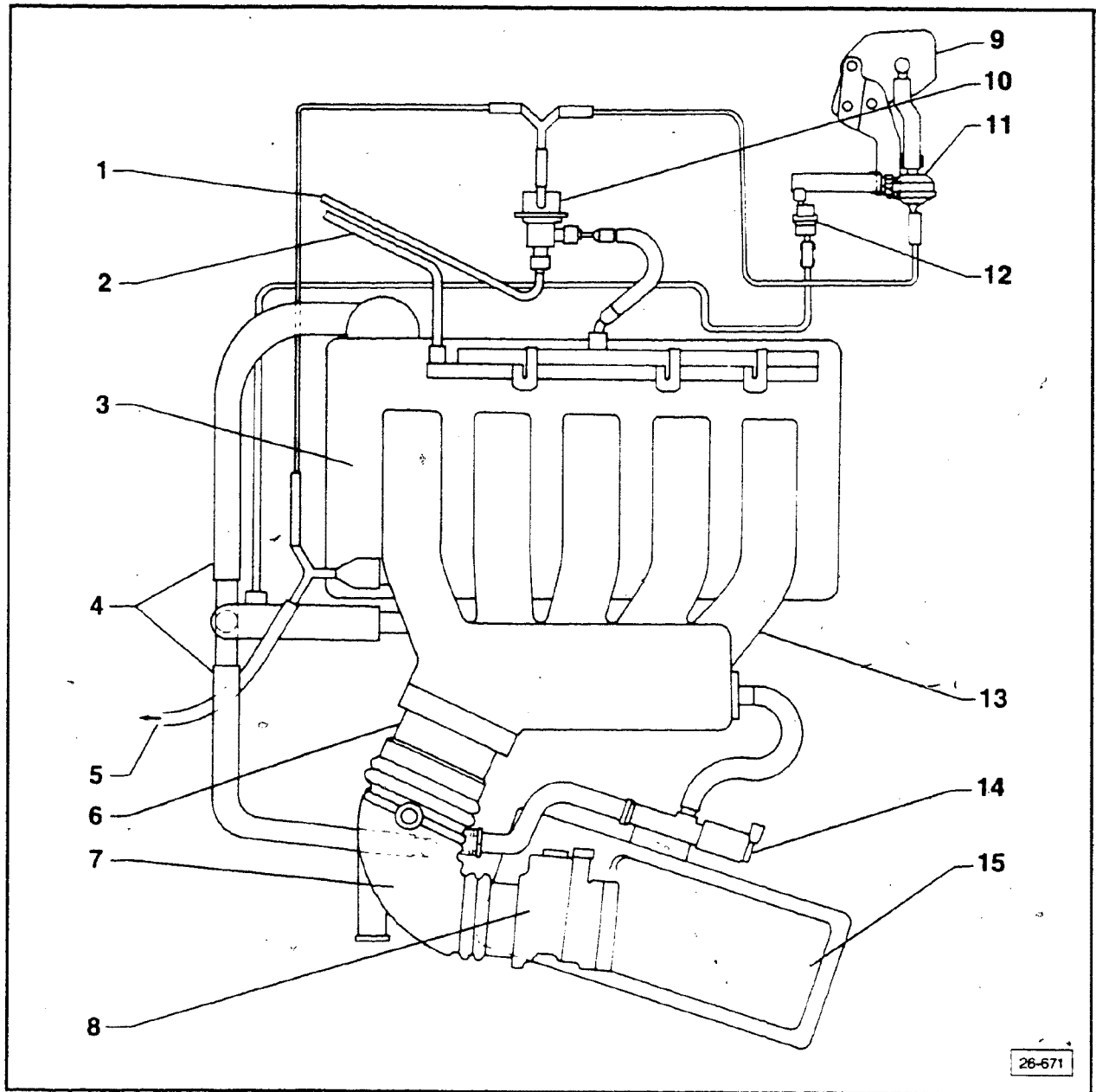
Note

- After working on the exhaust system ensure that the system (cold) is not preloaded.
- Check for sufficient clearance between the exhaust system and the chassis.
- If necessary, loosen the appropriate clamps to allow the mufflers and pipes to be turned and pushed in a longitudinal direction until sufficient clearance is obtained.
- The hanging load must be distributed equally over the entire set of retaining rings.
- Always replace self locking nuts.

- 1 — 20 Nm (15 ft lb)
- 2 — hose to intake air preheater stove
- 3 — Heat shield
- 4 — CO measuring tube
- 5 — EGR valve
 - checking, page 26-30-9
- 6 — EGR vacuum line
- 7 — Banjo bolts
 - 20 Nm (15 ft lb)
- 8 — Banjo bolt
 - 20 Nm (15 ft lb)

- 9 — Exhaust elbow
- 10 — Header pipe
- 11 — 30 Nm (22 ft lb)
- 12 — Retaining ring
 - tension approximately 8 mm (arrow)
- 13 — Resonator
- 14 — 25 Nm (18 ft lb)
- 15 — 30 Nm (22 ft lb)
- 16 — Oxygen sensor
 - 50 Nm (37 ft lb)
 - checking, see Repair Group 25
 - coat threads with G5, but do not let coating enter slits on sensor body
- 17 — 20 Nm (15 ft lb)
- 18 — Catalytic converter
- 19 — 25 Nm (18 ft lb)
- 20 — Seal washer
 - 20 Nm (15 ft lb)
- 21 — Clamping sleeve
 - 40 Nm (30 ft lb)
- 22 — 25 Nm (18 ft lb)
- 23 — Clamping sleeve
 - 40 Nm (30 ft lb)
- 24 — Rear muffler

Exhaust System – Emission Controls



- 1 — Fuel return line
- 2 — Fuel supply line
- 3 — Cylinder head
- 4 — Crankcase ventilation hoses
- 5 — to Differential lock
- 6 — Throttle body
- 7 — Intake air boot

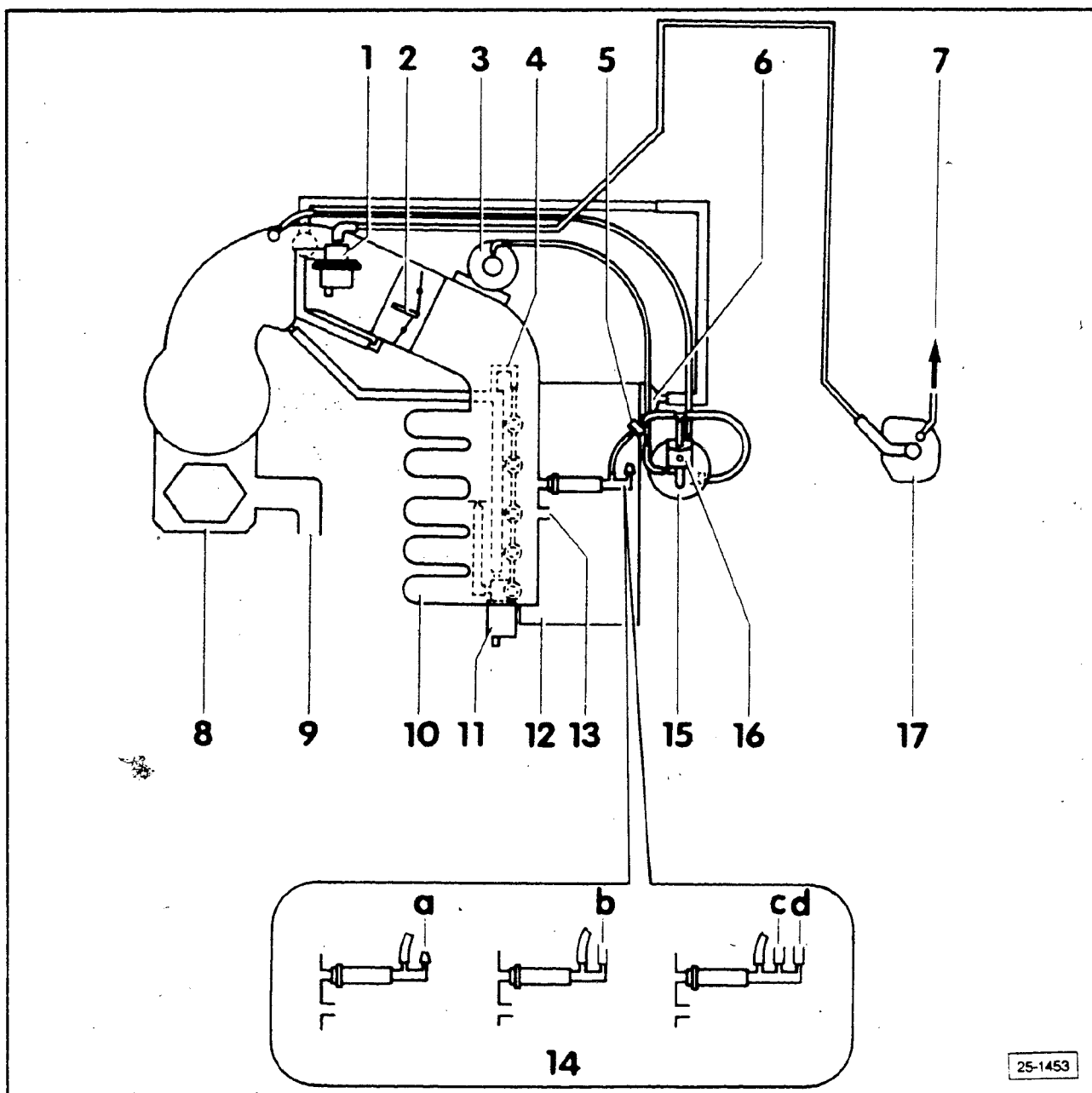
- 8 — Air mass meter
checking, see Group 28
- 9 — Carbon canister
- 10 — Control pressure regulator
checking, see Group 24
- 11 — Cut out valve
checking, see Group 20

- 12 — Carbon canister solenoid
valve
checking, see Group 24
- 13 — Intake manifold
- 14 — Idle stabilizer valve
checking, see Group 24
- 15 — Air filter

THIS FRAME INTENTIONALLY LEFT

BLANK

Exhaust System – Emission Controls



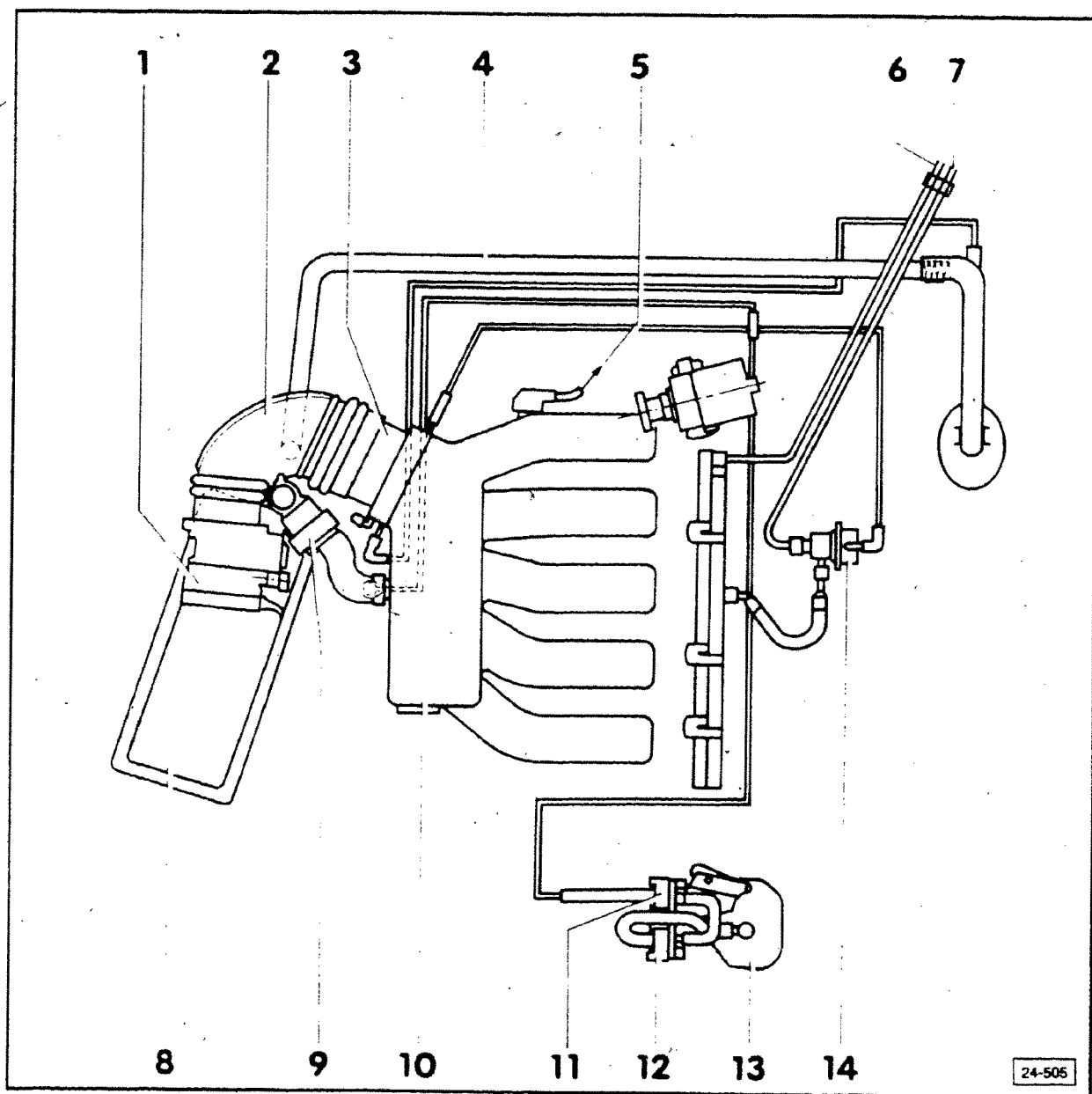
- 1 — Solenoid valve (N 80) for charcoal canister
- 2 — Throttle body
- 3 — EGR valve
- 4 — Fuel injector
- 5 — Check valve
- 6 — Crankcase ventilation
- 7 — to fuel reservoir
- 8 — Fuel distributor
- 9 — from air filter

- 10 — Intake manifold
- 11 — Idle stabilizer valve
- 12 — Cylinder head
- 13 — Brake booster vacuum connection
- 14a — Cap (vehicles with front wheel drive without A/C)
- 14b — A/C or differential lock connection
- 14c — Differential lock connection (vehicles with four wheel drive and A/C)
- 14d — A/C connection (vehicles with four wheel drive and A/C)

Exhaust System – Emission Controls

- 15 — Vacuum reservoir
- 16 — EGR frequency valve (N 121)
- 17 — Carbon canister

Exhaust System – Emission Controls

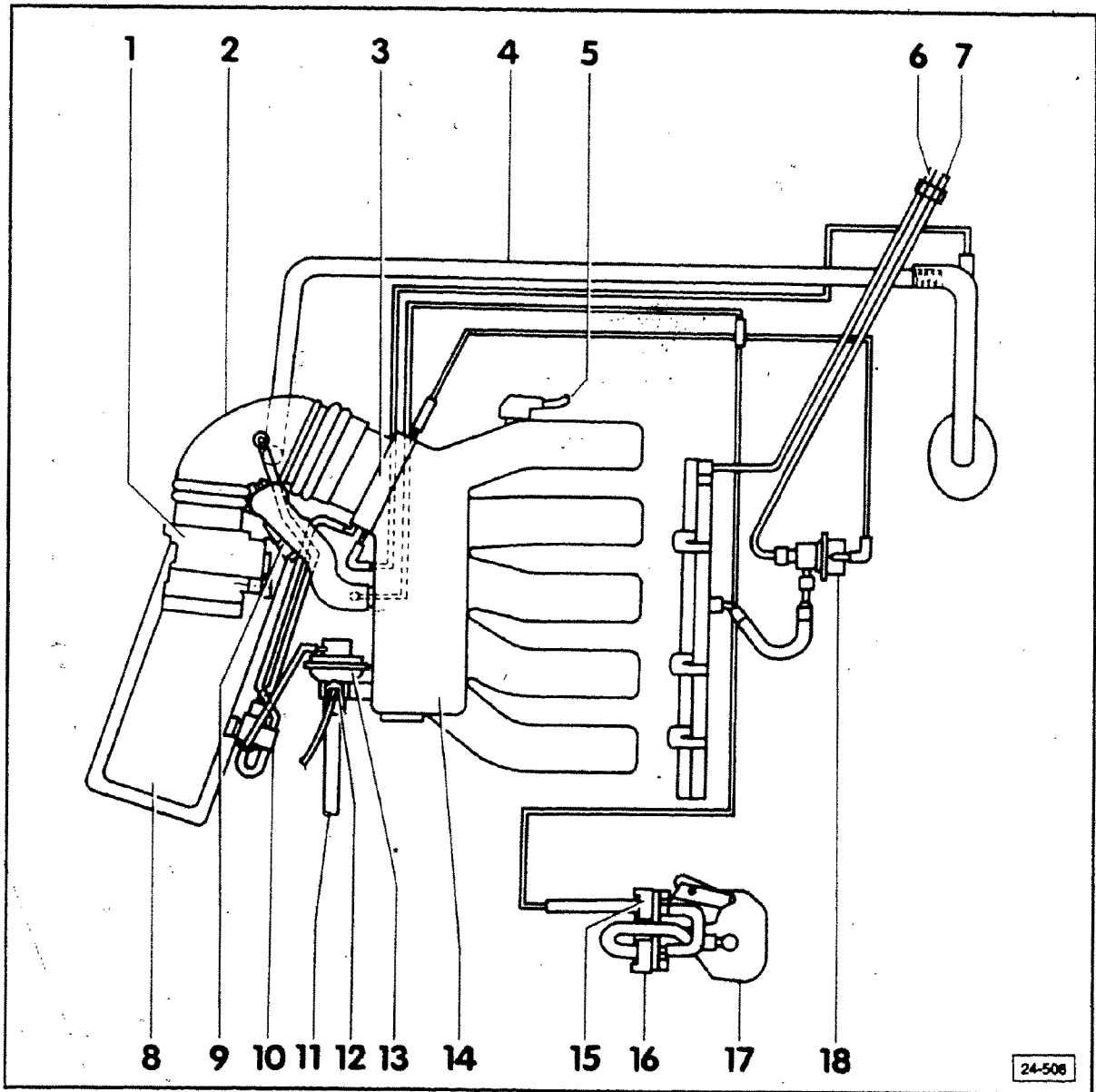


- 1 — Air flow sensor
- 2 — Intake air boot
- 3 — Throttle body
- 4 — Crankcase ventilation
- 5 — A/C and Differential lock connection
- 6 — Fuel supply line
- 7 — Fuel return line

- 8 — Air filter
- 9 — Idle stabilizer valve
- 10 — Intake manifold
- 11 — Carbon canister shut-off valve
- 12 — Carbon canister frequency valve
- 13 — Carbon canister
- 14 — Fuel pressure regulator

24-505

Exhaust System – Emission Controls



24-508

- | | |
|--|--------------------------------------|
| 1 — Air flow sensor | 10 — EGR frequency valve |
| 2 — Intake air boot | 11 — from exhaust manifold |
| 3 — Throttle body | 12 — EGR temperature sensor |
| 4 — Crankcase ventilation | 13 — EGR valve (mechanical) |
| 5 — A/C and Differential lock connection | 14 — Intake manifold |
| 6 — Fuel supply line | 15 — Carbon canister shut-off valve |
| 7 — Fuel return line | 16 — Carbon canister frequency valve |
| 8 — Air filter | 17 — Carbon canister |
| 9 — Idle stabilizer valve | 18 — Fuel pressure regulator |

D-15

Starting March 1990 production

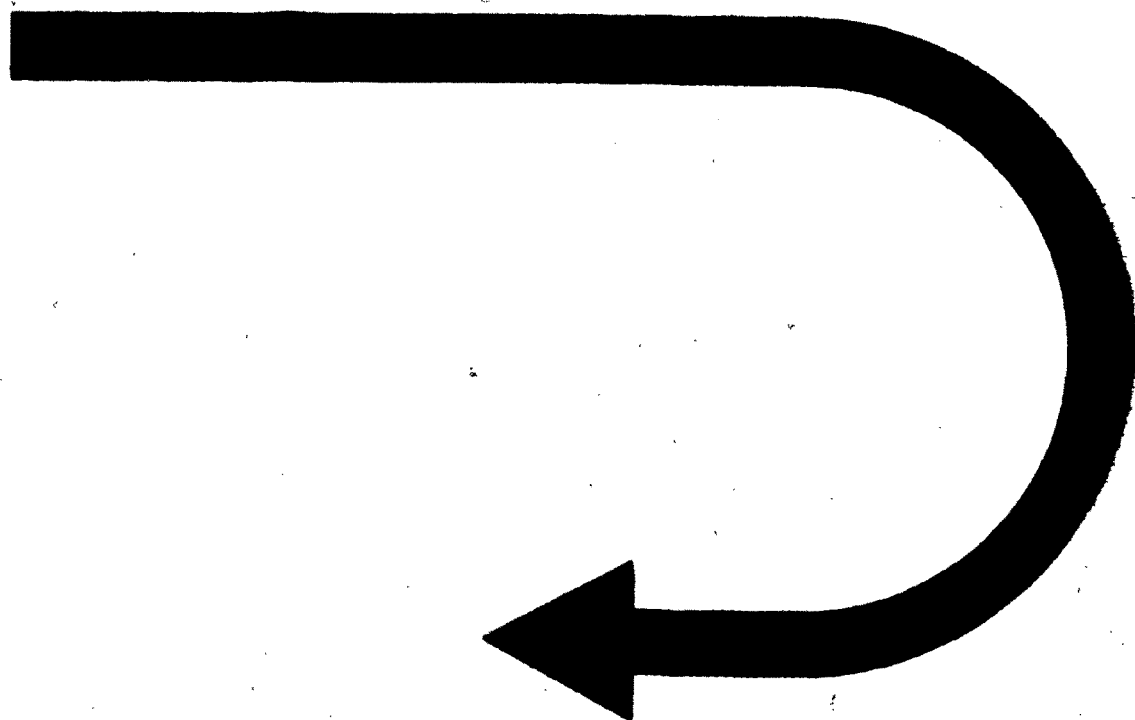
California

20 valve

Vacuum connections

26-20-4

CONTINUED IN THE
BEGINNING OF NEXT ROW



Exhaust Gas Recirculation system (EGR), checking (California ONLY)

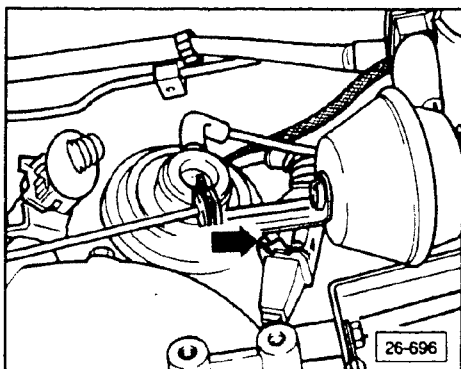
Note

The function of the EGR is monitored by the Fuel Injection control unit.

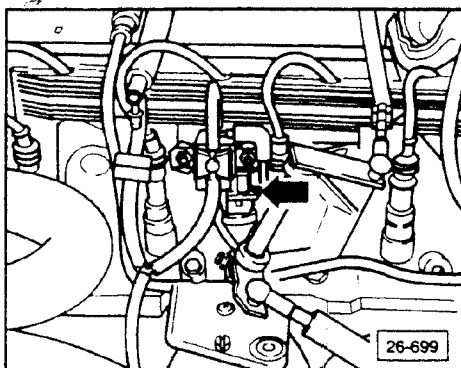
Conduct the following check only if Fault code **2411** "EGR System" is displayed. Repair as necessary; then conduct the functional test on page 26-30-6.

Requirements

- engine coolant temperature 80°C (176°F) minimum
- A/C switched **OFF**
- all electrical consumers switched **OFF**
- vacuum connections tight and leak-free
- vacuum lines **NOT** plugged or pinched
- radiator cooling fan must **NOT** be running while taking measurements

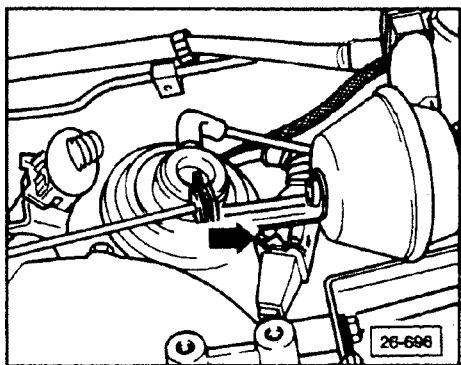


- ensure that harness connector (**arrow**) of EGR temperature sensor (G 98) is connected

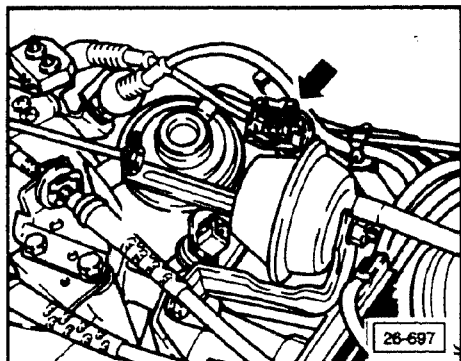


- ensure that EGR frequency valve (N 121) harness connector is connected (**arrow**)
- check EGR system vacuum lines per diagram, page 26-20-2

Exhaust System – Emission Controls



- disconnect harness connector (**arrow**) from EGR temperature sensor (**G 98**)



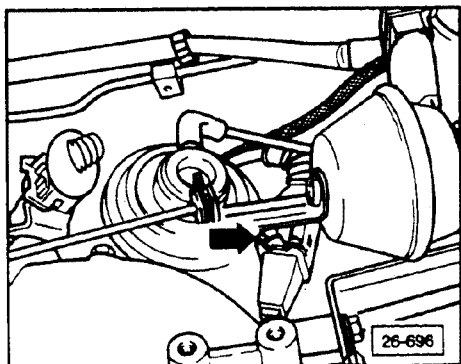
- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminals 1 and 2 of harness connector (**arrow**)
- switch **ON** ignition
 - must be approximately 5 volts

If voltage **NOT** obtained

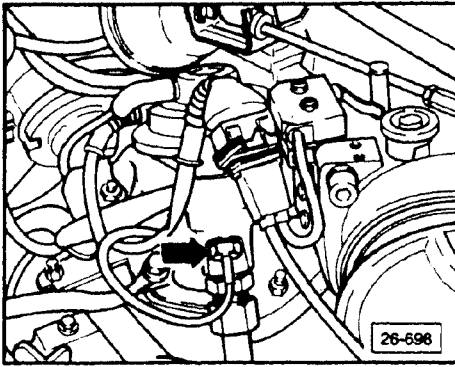
- check wiring using wiring diagram and repair as necessary

If voltage obtained

- switch **OFF** ignition and disconnect multimeter
- disconnect harness connector (**arrow**)



Exhaust System – Emission Controls



- remove EGR temperature sensor from EGR valve (**arrow**)
- switch multimeter **US 1119** to resistance range
- connect multimeter across terminals of temperature sensor
- submerge sensor in boiling water
 - multimeter must read between 80,000 and 160,000 Ohms

If **NO**

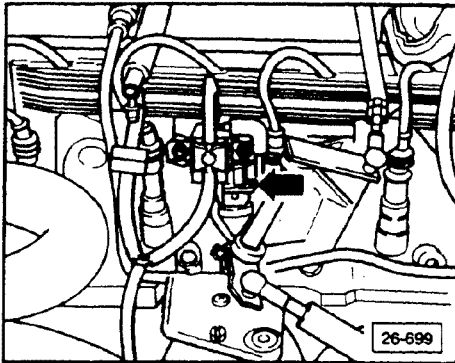
- replace EGR temperature sensor (**G 98**)

If **YES**

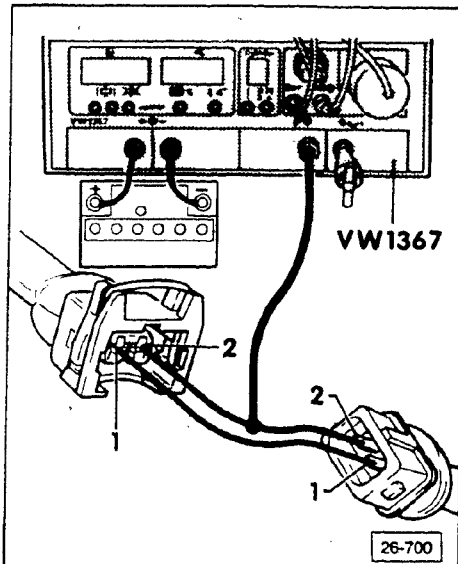
- reinstall temperature sensor into EGR valve
 - 20 Nm (15 ft lb)
- reconnect harness connector
- disconnect EGR frequency valve harness connector (**arrow**)

Note

It is possible for the frequency valve to be mounted in either of two locations; on the cylinder head or on the vacuum reservoir.



- switch **OFF** ignition
- connect **VAG 1367** engine tester
- connect terminals 1 and 2 of harness connector with terminals 1 and 2 of connector using **VW 1594** adaptor kit
- connect green lead of **VAG 1367** engine tester to adaptor wire connecting terminals 2 and 2
- depress % button on **VAG 1367** engine tester



- start engine and raise engine speed to approximately 2000 RPMs (use vehicle tachometer if necessary)
- record duty cycle as displayed on **VAG 1367**
 - $32 \pm 10\%$ at 2000 RPM

Note

Duty cycle is first triggered at 1800 RPM, it will not register below that speed.

If specified value **NOT** obtained

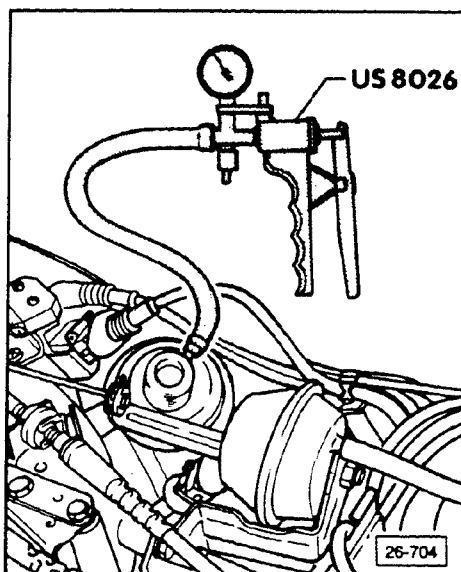
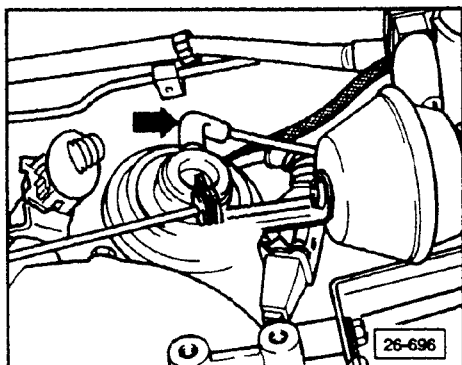
- check test connections

If **OK**

- check wiring using wiring diagram, replace or repair as necessary
- switch **OFF** ignition
- disconnect **VAG 1367** engine tester and **VW 1594** adaptors
- re-connect EGR valve harness connector
- disconnect vacuum connector (**arrow**) from EGR valve
- connect hand vacuum pump **US 8026** to EGR valve vacuum port

Note

Do **NOT** run the engine during these checks.



Exhaust System – Emission Controls

- using hand vacuum pump **US 8026**, apply 600 mbar (17.7 in. of Hg) of vacuum to EGR valve
 - it is permissible for vacuum to drop up to 100 mbar (2.95 inches of Hg)

If vacuum does **NOT** build up or if vacuum drops for a short time by more than 100 mbar (2.95 inches of Hg)

- check **US 8026** vacuum pump connection for leaks or poor connection

If OK

- replace EGR valve

Requirement for the following steps:

- engine coolant temperature must be 80°C (176°F) minimum

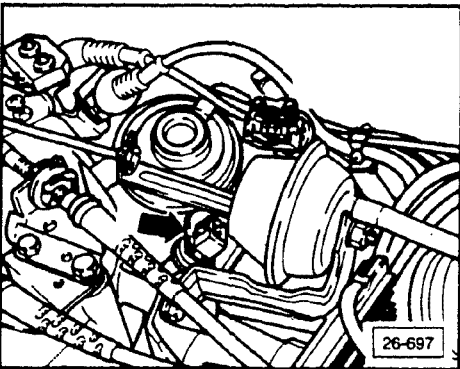
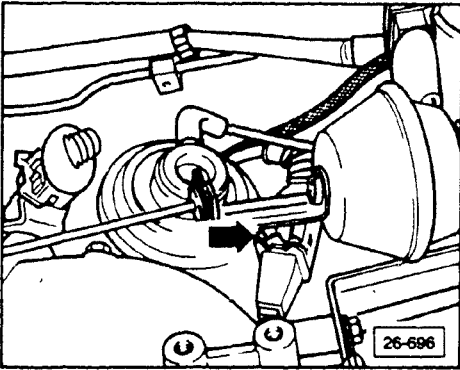
- disconnect EGR temperature sensor harness connector (**arrow**)
- switch multimeter **US 1119** to resistance range
- connect **US 1119** between terminals 1 and 2 of EGR temperature sensor connector (**arrow**)
- start engine and run at 2000 RPM
- using hand vacuum pump **US 8026** apply a vacuum of 130 ± 20 mbar to the EGR valve (3.8 ± 0.6 inches of Hg)
 - resistance must be between 1,000 and 19,000 Ohms

If NO

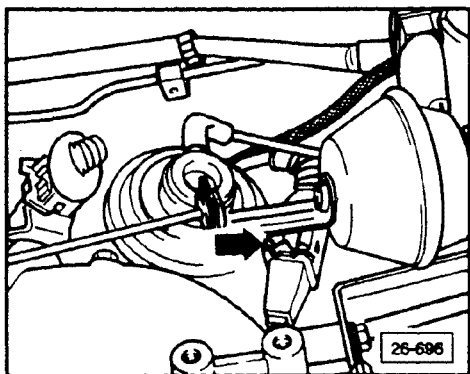
- replace EGR valve

If OK

- replace EGR frequency valve



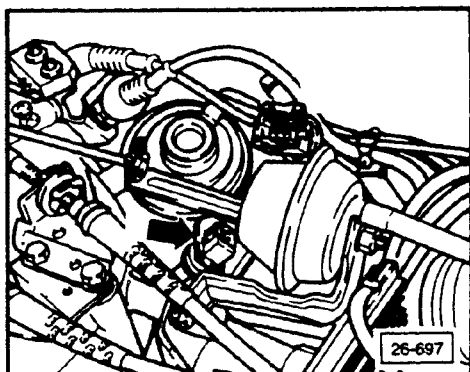
Exhaust System – Emission Controls



Functional check

Requirement

- EGR system vacuum connections **OK**
- switch **OFF** ignition
- disconnect temperature sensor harness connector (**arrow 1**)
- switch multimeter **US 1119** to resistance range (2 megOhm scale)
- connect multimeter to terminals 1 and 2 of temperature sensor connector (**arrow**) using long adaptor wires from **VW 1594** adaptor kit
- pass multimeter and wires through passenger side window and place on seat, fasten test and adaptor wires in place using adhesive tape
- start engine and let idle until it reaches operating temperature (radiator cooling fan comes on at least once)
- switch **OFF** ignition and wait ten minutes
- read display on multimeter
 - must be greater than 200,000 Ohms



If **NO**

- replace EGR temperature sensor

- start engine and let idle for at least three minutes
- switch multimeter **US 1119** to 200 kOhm range
- drive vehicle at constant speed of 50 to 60 mph on flat road for minimum of two and a half miles
 - A/C switched **OFF**
 - transmission selector in drive for automatic or in fifth for manual
- while test driving, observe the On Board Diagnostic (OBD) warning light; when the light comes **ON**: read the resistance display on the multimeter
 - must be less than 50,000 Ohms

If **LESS**

- check EGR system vacuum connections using vacuum diagram page 26-20-2, repair or replace as necessary

Fault code, troubleshooting

Fault Code	Possible Cause of Fault	Effect	Repair
1231	Wiring between instrument panel insert and fuel injection control unit is shorted or disconnected Transmission speed sender (G 68) faulty	Engine stalls when clutch is engaged	Check for short or disconnected wiring between instrument panel insert and terminal 29 of fuel injection control unit, using wiring diagram Check speed sensor (G 68) wiring, replace or repair as necessary
2411 (California ONLY)	Vacuum lines disconnected or pinched EGR temperature sensor (G 98) faulty EGR valve faulty EGR system Frequency valve (N 121) faulty Disconnected wire between temperature sensor (G 98) or Frequency valve (N 121) and fuel injection control unit	OBD light ON driving fault, e.g. vibration, poor idle Poor starting	Check EGR system, section 26-30-1 check wiring using wiring diagram replace or repair as necessary

Note for Fault Code 1231:

If this Fault is displayed; check first if speedometer is OK.

If YES: disregard this code.

Exhaust Gas Recirculation system, checking (For California vehicles ONLY)

Requirement

- Fuse 28 OK

EGR frequency valve (N 18), electrical check

- disconnect EGR valve (N 18) harness connector
- switch multimeter **US 1119** to resistance range
- connect multimeter across terminals of EGR valve
 - must be 25 to 35 ohms

If NO

- replace EGR valve (N 18)

Voltage supply, checking

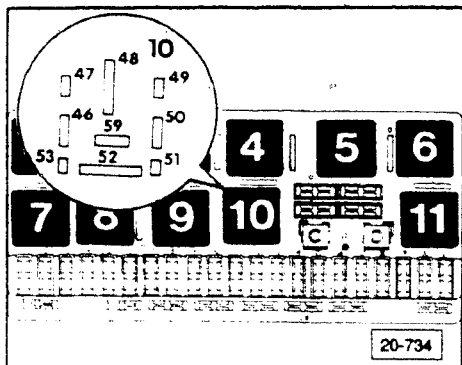
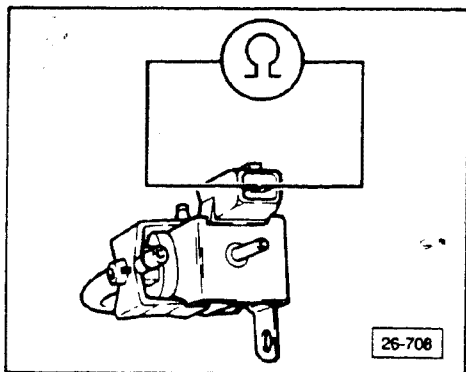
- connect **US 1115** LED tester between terminal 1 of harness connector and ground using **VW 1594** adaptor kit
- activate starter for several seconds
 - LED tester must light up

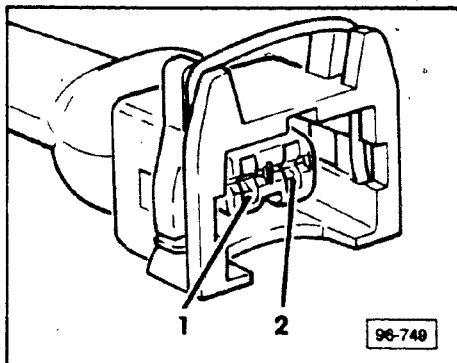
If NO

- check fuse **28**, replace if necessary
- check continuity of wiring between terminal **1** of harness connector and fuse **28** using wiring diagram
 - resistance must **NOT** be greater than 0.5 ohms
- check continuity of wiring between fuse **28** and terminal **59** of fuel pump relay socket
 - resistance must **NOT** be greater than 0.5 ohms

If NO

- check fuel pump relay and triggering, see Repair Group 24 for additional information





- connect **US 1115** LED tester between terminals 1 and 2 of EGR valve harness connector using **VW 1594** adaptor kit
- perform Output check diagnosis using **VAG 1551** diagnostic tester, see Repair Group D2 for additional information
 - when the step for checking the EGR valve is reached the LED tester must begin to flash

If **NO** or if it lights up constantly (instead of flashing)

- connect **VAG 1598** Test box to harness connector **D** of MPI control unit using adaptor cable **VAG 1598/12**
 - control unit is left disconnected

If LED tester does **NOT** flash

- check continuity of wire between terminal 2 of EGR valve harness connector and terminal 14 of test box
 - resistance must **NOT** be greater than 0.5 ohms

If LED tester is constantly **ON**

- check for short to ground between terminal 2 of EGR valve harness connector and terminal 14 of test box
- replace or repair wiring as necessary

If wiring **OK**

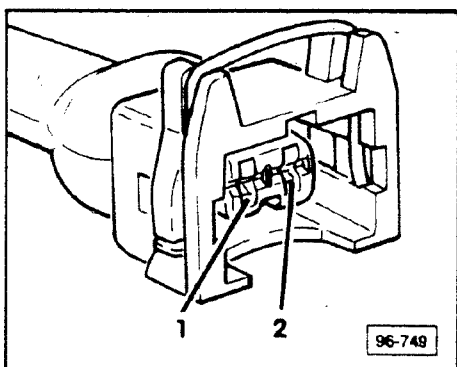
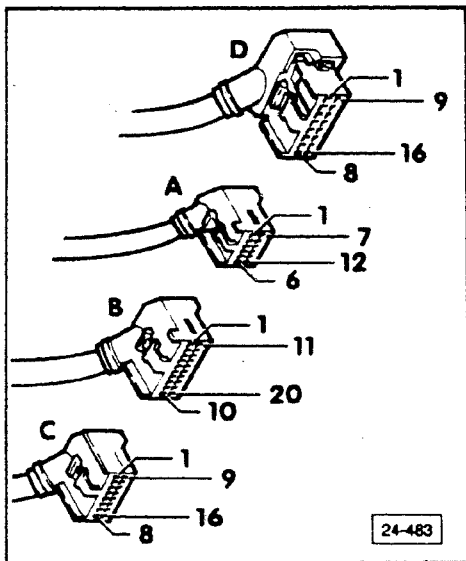
- replace MPI control unit

Temperature sensor for EGR (G 98), checking

- disconnect EGR temperature sensor harness connector
- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminals 1 and 2 of harness connector
- switch **ON** ignition
 - must be between 4.5 and 5 volts

If **NO**

- use wiring diagram to determine where open circuit exists and correct as necessary



If voltage obtained

- disconnect multimeter from harness connector
- switch **OFF** ignition
- remove EGR temperature sensor from EGR valve
- switch multimeter **US 1119** to 200 K ohm range
- attach multimeter to temperature sensor terminals using **VW 1594** adaptor kit
- immerse temperature sensor in boiling water
 - resistance must change

If **NO**

- replace temperature sensor

EGR valve (mechanical), checking

Requirement

- vacuum lines and connections must be **OK**
 - EGR frequency valve (N 18) **OK**
 - disconnect vacuum hose from mechanical EGR valve (coming from EGR frequency valve)
 - connect hand vacuum pump **US 8026** to mechanical EGR valve
 - start engine and let idle
 - pump hand vacuum pump
 - engine must vibrate and run rough
 - release vacuum at vacuum pump
 - engine must restore itself to a smooth idle
- If engine runs smooth after applying vacuum
- replace mechanical EGR valve

Evaporative system leakage, troubleshooting

WARNING

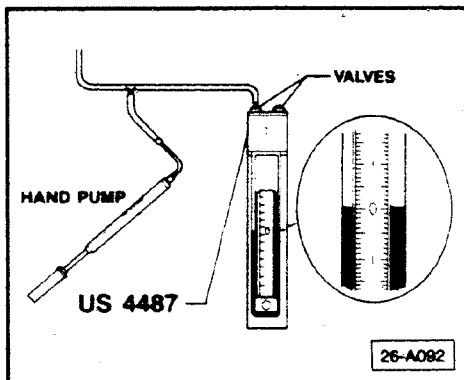
These tests involve the use of equipment that contain mercury.

Mercury is a toxic and hazardous material.

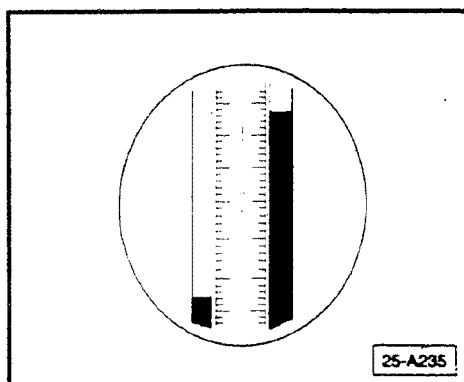
- exercise extreme care when handling
- do **NOT** allow to come in contact with eyes, nose, skin, etc.
- when not in use, store carefully in a properly designated area
- be sure both valves are closed when storing tester

Check these first:

- fuel filler cap securely closed
- fuel level at least 2/3 full (otherwise it will require excessive pumping to pressurize the system)



- disconnect small hose from carbon canister
- vertically connect slack tube tester **US 4487** at disconnected hose from charcoal canister
- open both slack tube valves a 1/2 turn
- move scale on tester such that the zero line is even with the tops of the mercury columns
- pressurize the system to 1.3 inches of mercury, using the handpump



- pressurize the system to 1.3 inches of mercury, using the handpump

Note

If the system reaches the 1.3 inches of mercury soon after you begin pumping, there is reason to suspect that the gravity valve or, hoses to it, might be pinched or blocked.

With 2/3 of a tank of fuel it should take considerably more pumping to achieve the 1.3 inches of mercury.

Exhaust System – Emission Controls

After reaching 1.3 inches of mercury on scale; wait 5 minutes:

- system **OK** if pressure is 1.2 inch of mercury or greater

If pressure drops below 1.2 inch of mercury:

- check fuel filler cap for leakage using soap solution, replace if necessary
- pressurize system to 1.3 inches of mercury, wait 5 minutes

If pressure still drops below 1.2 inch of mercury:

- disconnect hose from top of gravity valve (between gravity valve and carbon canister) and plug hose
- pressurized system to 1.3 inches of mercury, wait 5 minutes

If pressure still drops below 1.2 inch of mercury:

- the leak is between the gravity valve and carbon canister

If pressure does **NOT** drop below 1.2 inch of mercury:

- re-connect gravity valve and re-pressurize system
- check hoses/connections at expansion tanks and fuel tank by applying a soap solution
- seal, repair or replace as necessary

After you have repaired the leak(s):

- repeat test to verify that you have fixed all of the leakage
- after tests are completed, close both valves on the tester then properly store