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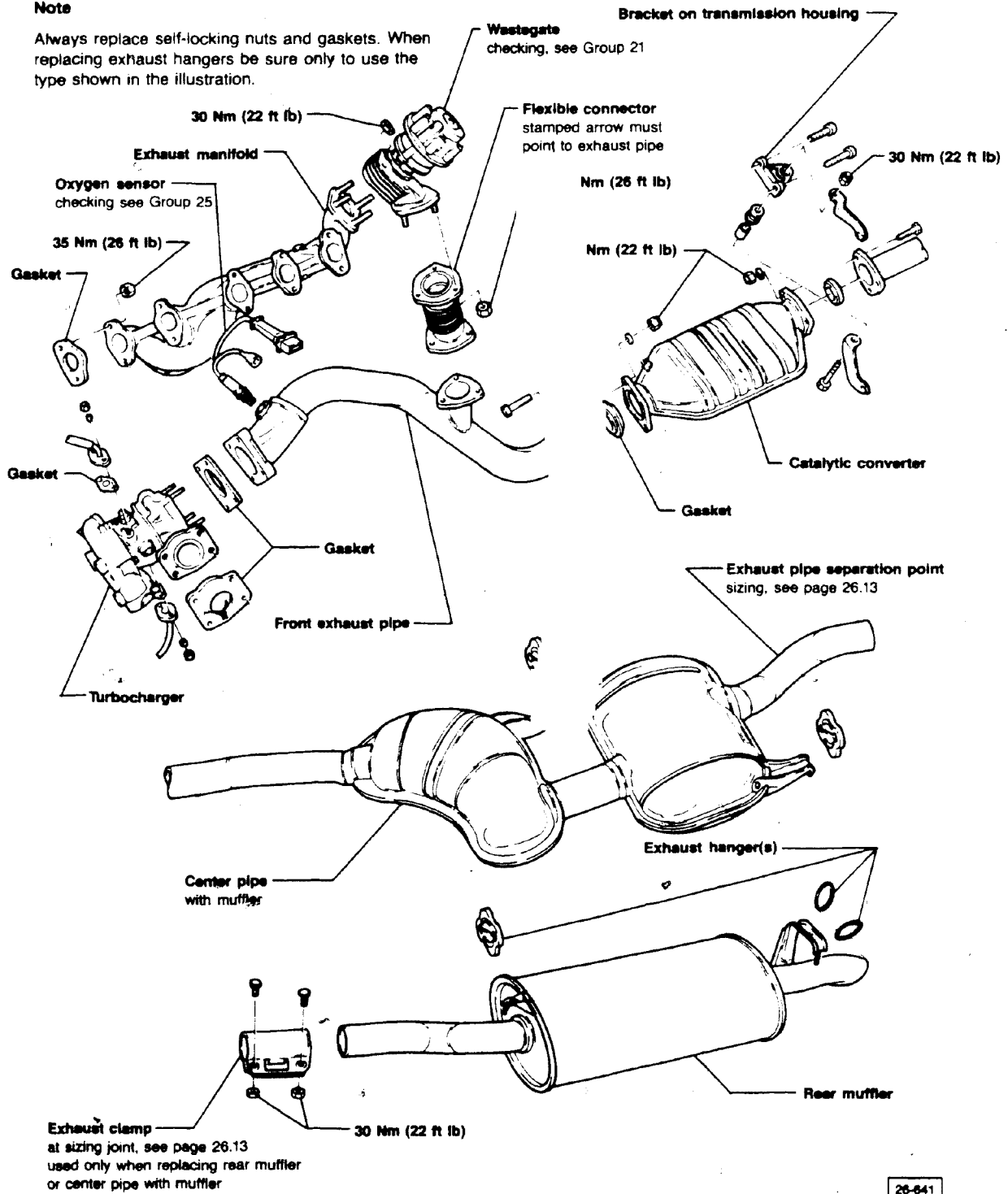
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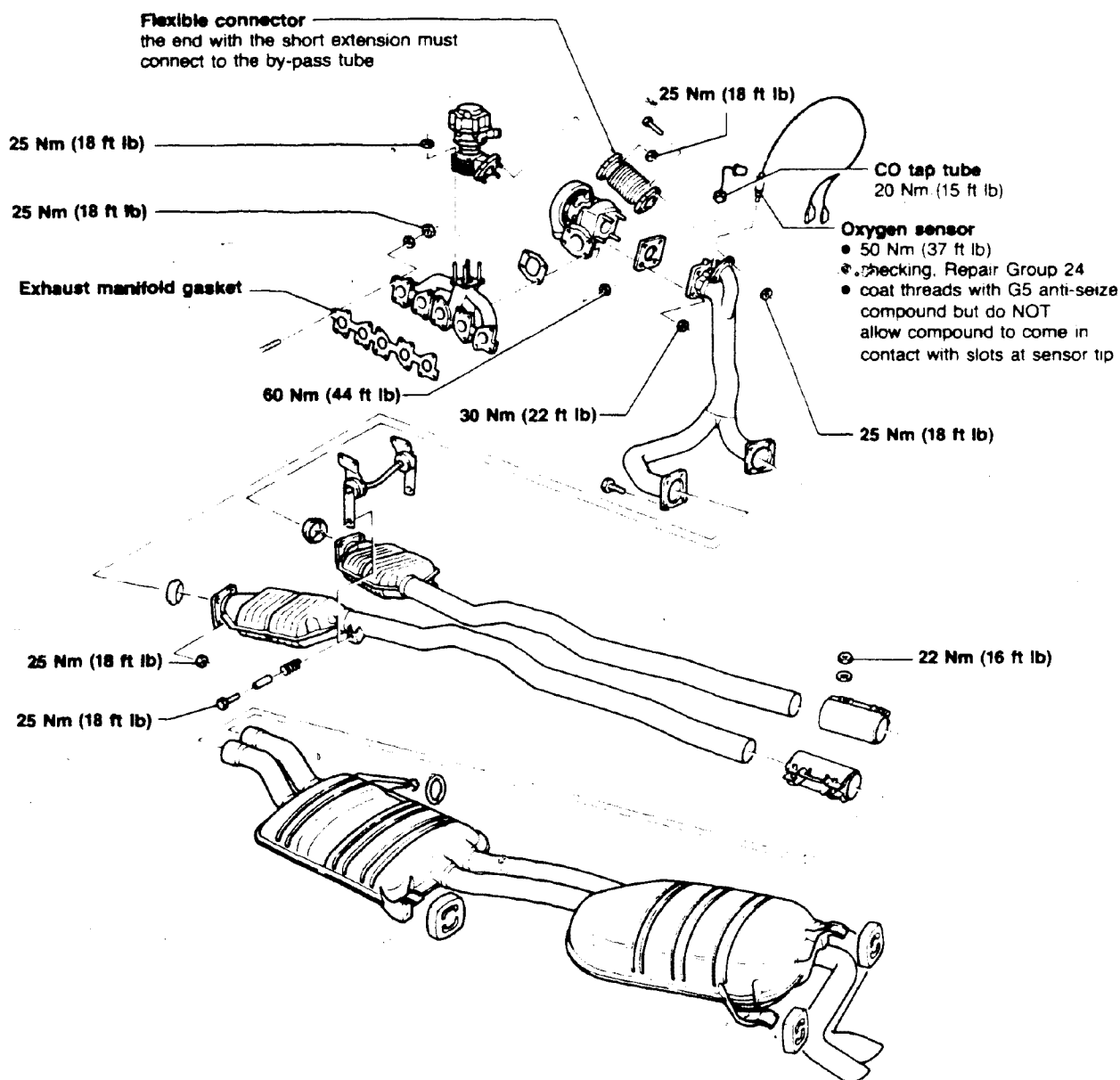
Exhaust System – Emission Controls

Note

Always replace self-locking nuts and gaskets. When replacing exhaust hangers be sure only to use the type shown in the illustration.



Exhaust System – Emission Controls



Note

See page 26.14 for illustration showing sawcut location between mufflers, if replacing only one of the mufflers.

Note

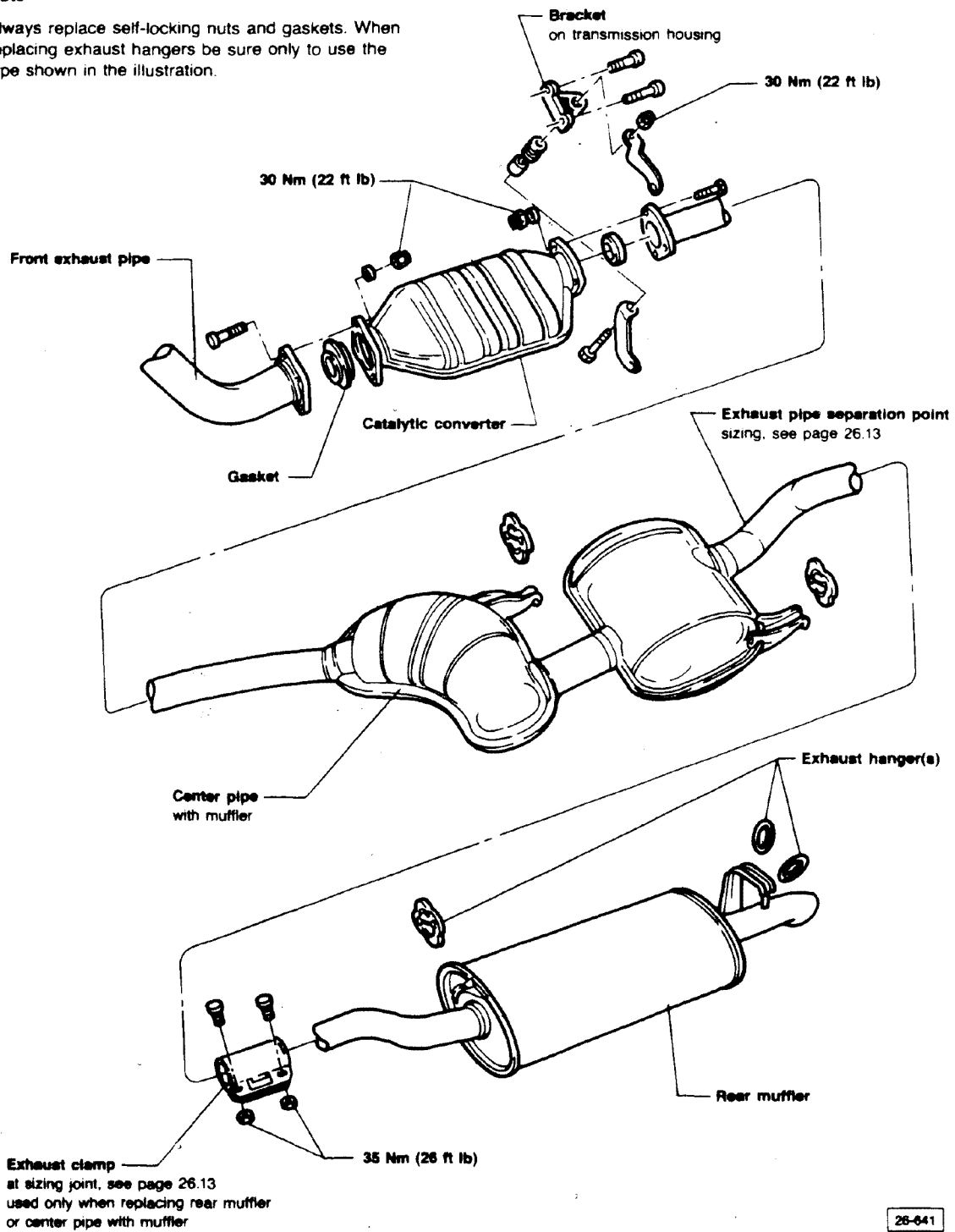
See page 26.14.

26-090

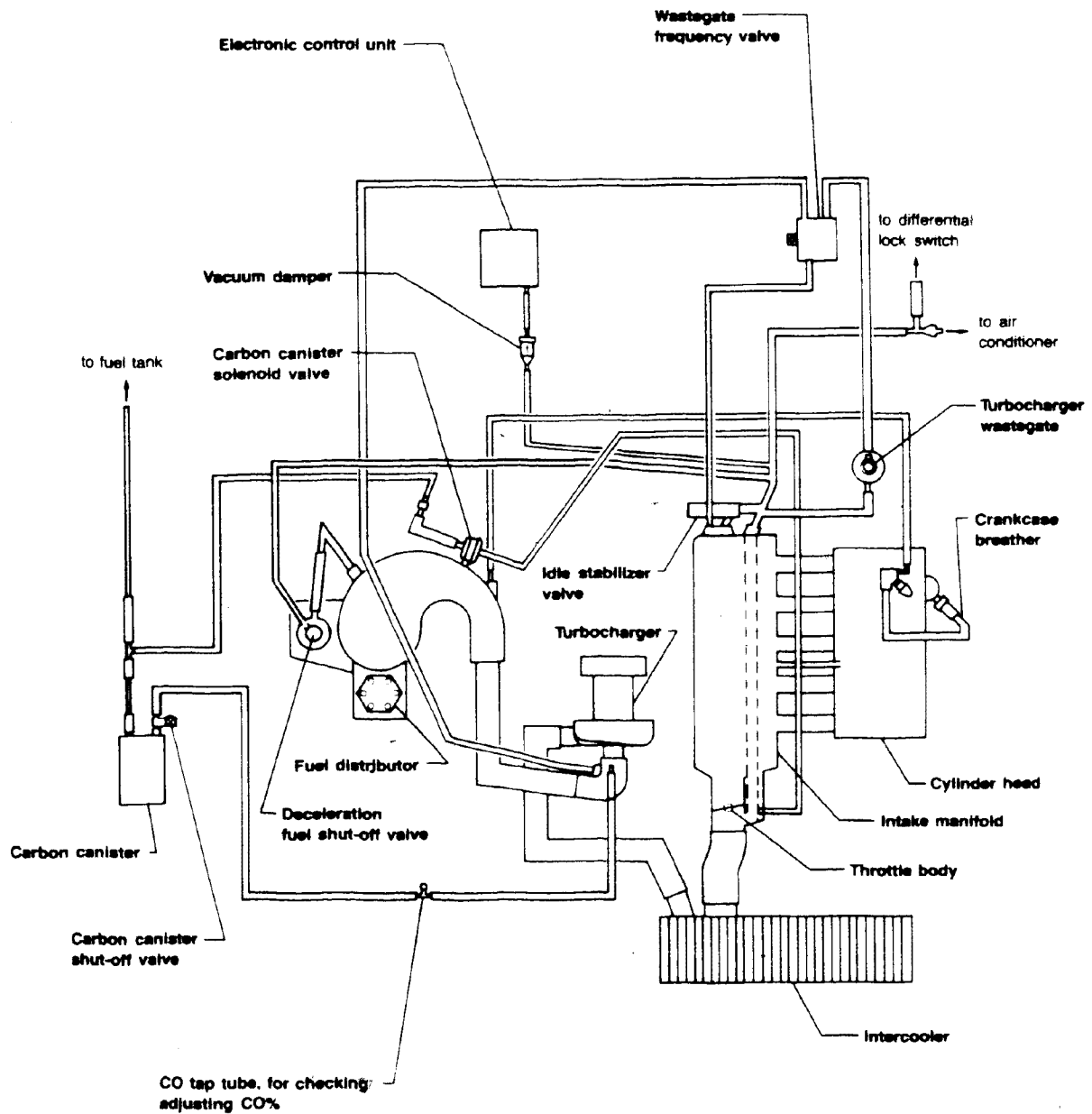
Exhaust System – Emission Controls

Note

Always replace self-locking nuts and gaskets. When replacing exhaust hangers be sure only to use the type shown in the illustration.

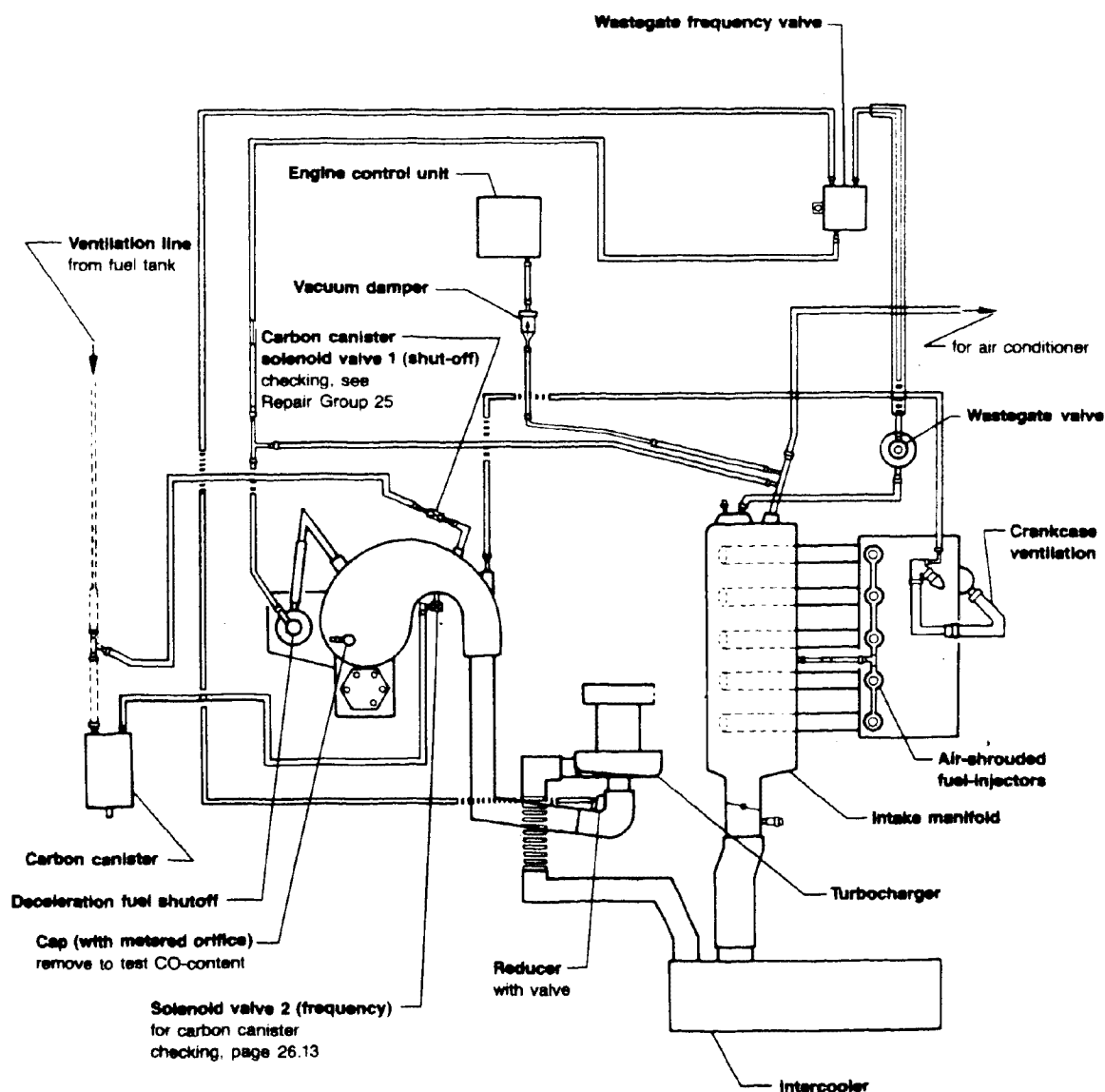


Exhaust System – Emission Controls



26-647

Exhaust System — Emission Controls

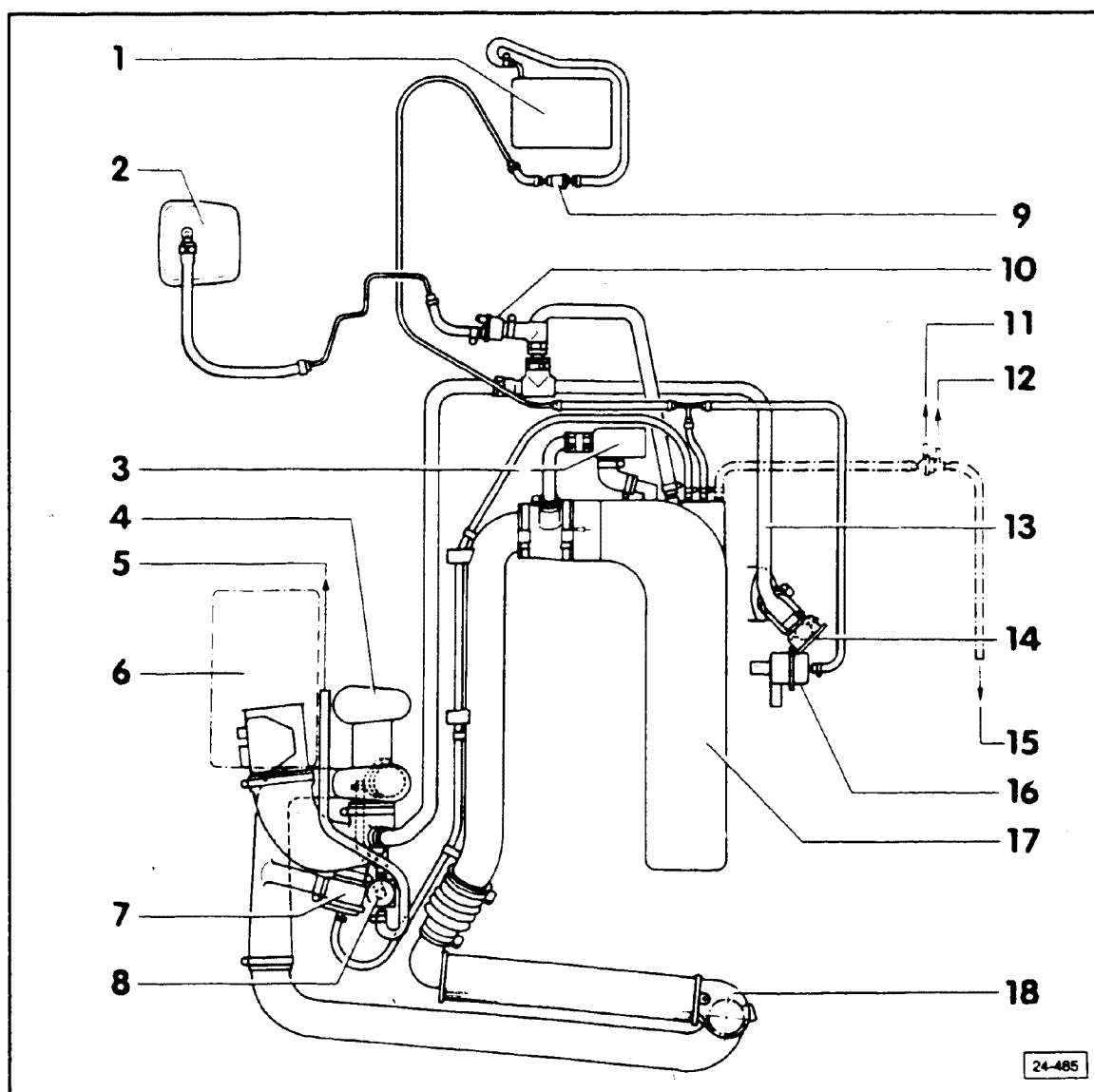


25-1196

THIS FRAME INTENTIONALLY LEFT

BLANK

Exhaust System – Emission Controls



- 1 — CIS-E Motronic control unit
located behind A pillar trim in passenger side
footwell
- 2 — Carbon canister
- 3 — Idle stabilizer valve (N 71)
- 4 — Turbocharger
- 5 — Control pressure connection from wastegate
frequency valve to wastegate
- 6 — Air filter housing

7 — By-pass valve

Note

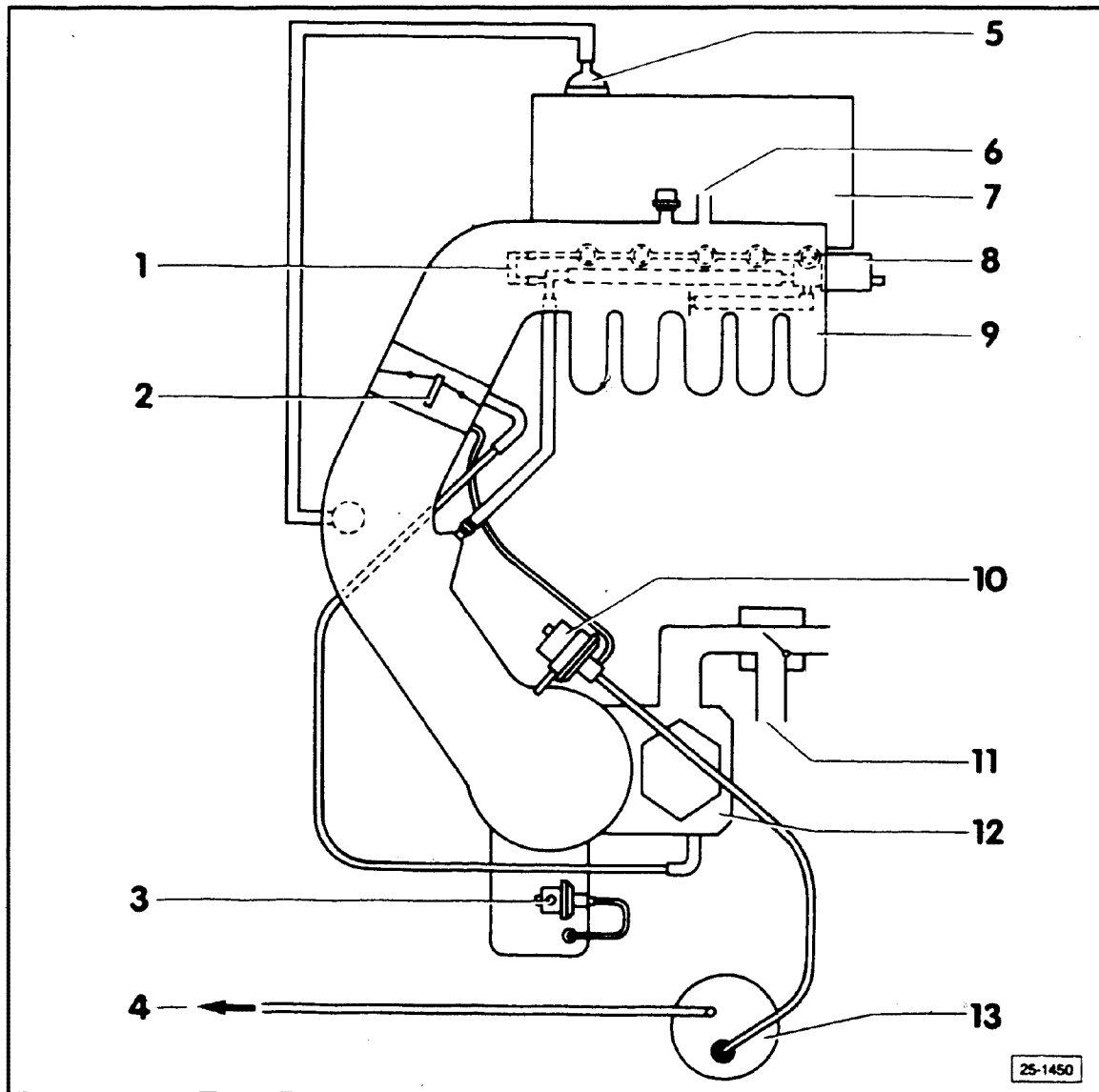
The by-pass valve operates during idle and deceleration when the throttle valve is closed (high vacuum condition). The valve, which opens at high vacuum, allows air to circulate without increasing boost pressure. This feature improves acceleration response and reduces turbo-lag by allowing the turbine to freely rotate until the throttle is opened again.

- checking, see Repair Group 21

Exhaust System – Emission Controls

- 8 — Wastegate frequency valve (N 75)
- 9 — Condenser
- 10 — Carbon canister frequency valve (N 80)
- 11 — Differential lock connection
- 12 — A/C connection
- 13 — Crankcase breather
- 14 — Pressure regulator valve for crankcase breather
- 15 — Vacuum reservoir connection
- 16 — Pressure regulator
- 17 — Intake manifold
- 18 — Intercooler

Exhaust System – Emission Controls



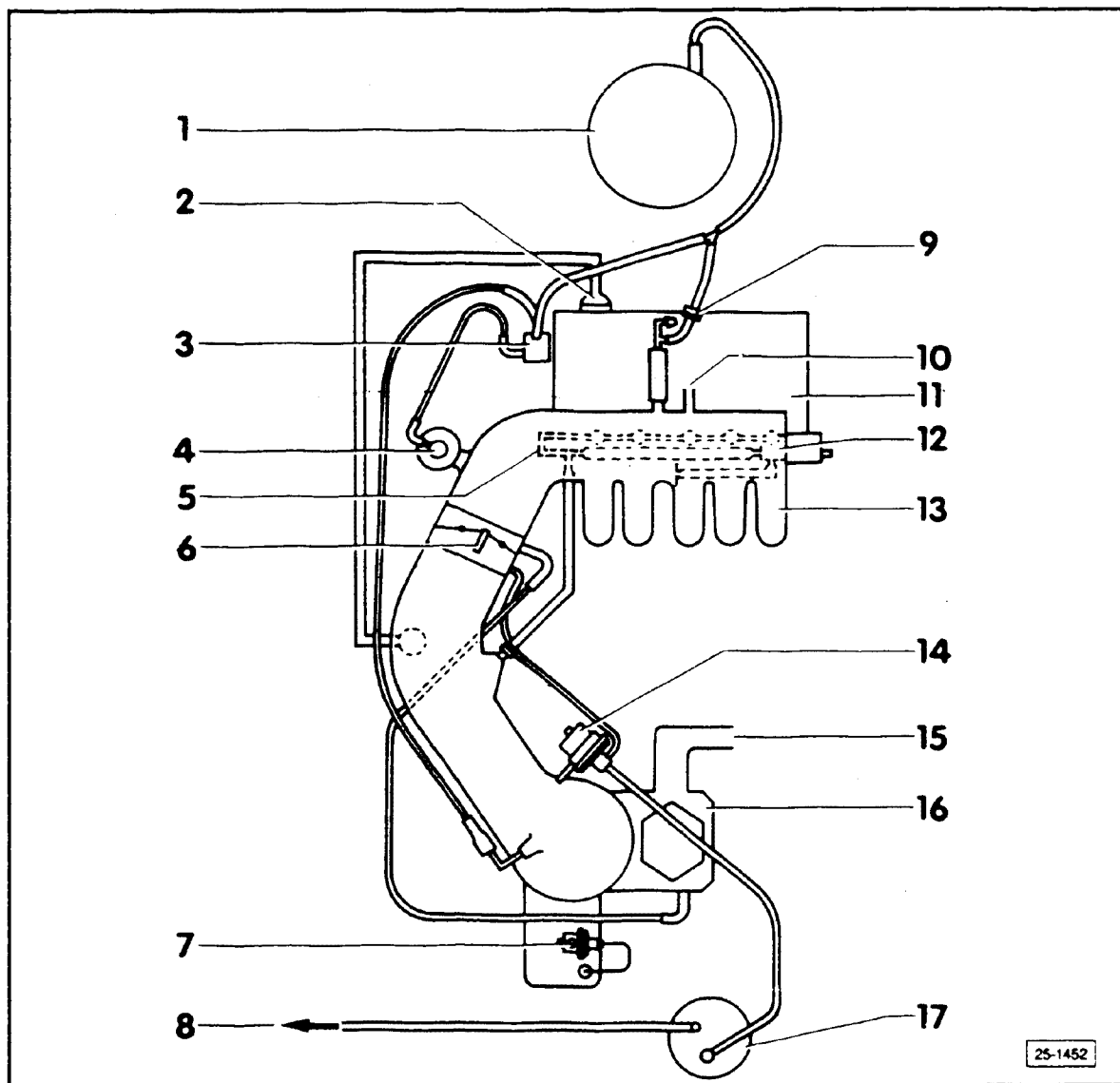
49 state system, NO EGR

- 1 — to the fuel injector air shroud
- 2 — Throttle plate
- 3 — to pressure regulator
- 4 — to fuel reservoir
- 5 — Crankcase ventilation
- 6 — A/C and differential lock connection
- 7 — Cylinder head
- 8 — Idle stabilizer valve (N 71)

9 — Intake manifold

- 10 — Solenoid valve (N 80) for carbon canister
- 11 — Intake air pre-heater stove
- 12 — Fuel distributor
- 13 — Carbon canister

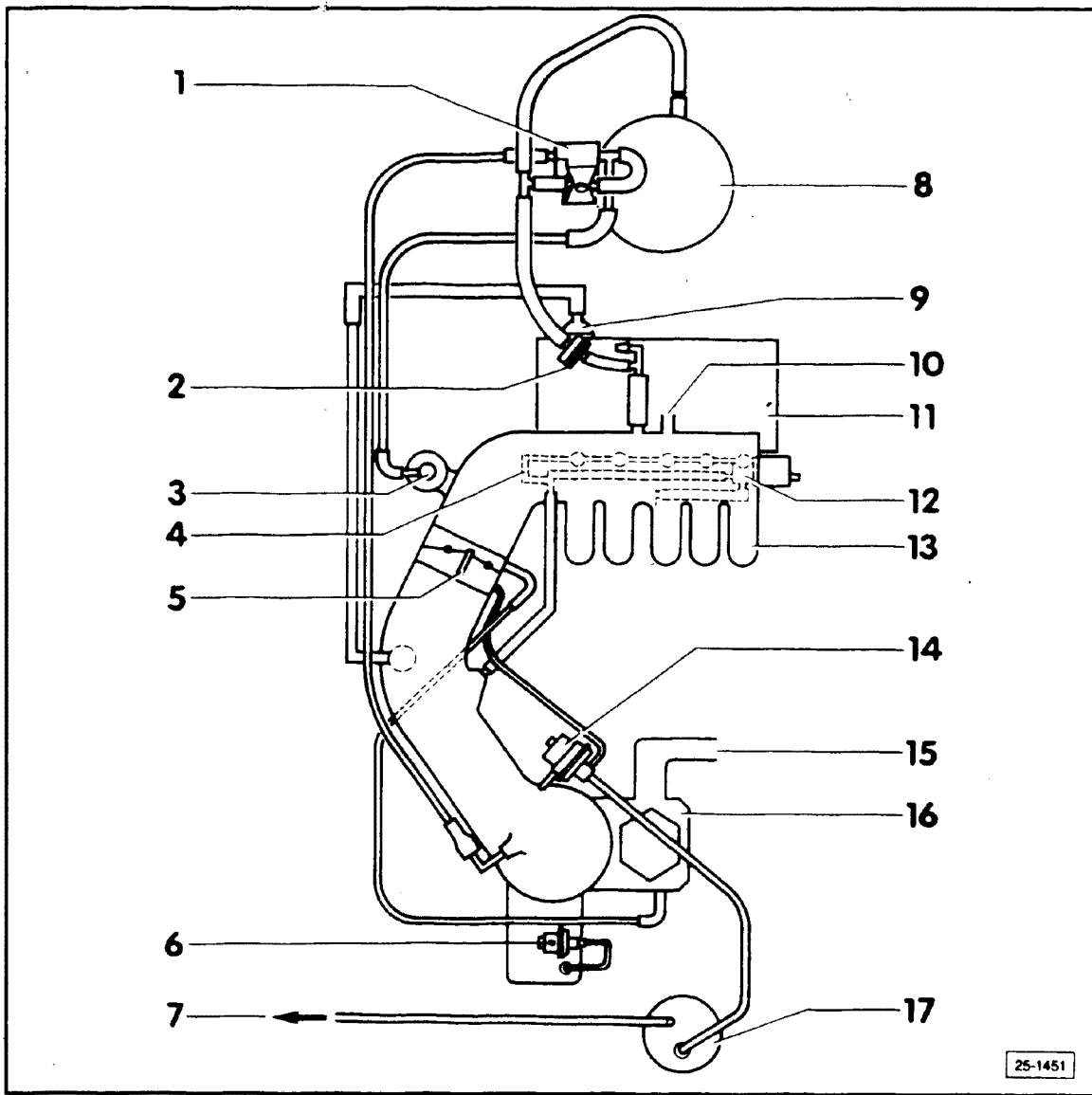
Exhaust System – Emission Controls



California system with EGR:

- | | |
|-------------------------------------|--|
| 1 — Vacuum reservoir | 10 — A/C and differential lock connection |
| 2 — Crankcase ventilation | 11 — Cylinder head |
| 3 — EGR frequency valve (N 121) | 12 — Idle stabilizer valve (N 71) |
| 4 — EGR valve | 13 — Intake manifold |
| 5 — to the fuel injector air shroud | 14 — Solenoid valve (N 80) for carbon canister |
| 6 — Throttle plate | 15 — Air filter housing |
| 7 — Pressure regulator | 16 — Fuel distributor |
| 8 — to fuel reservoir | 17 — Carbon canister |
| 9 — Check valve | |

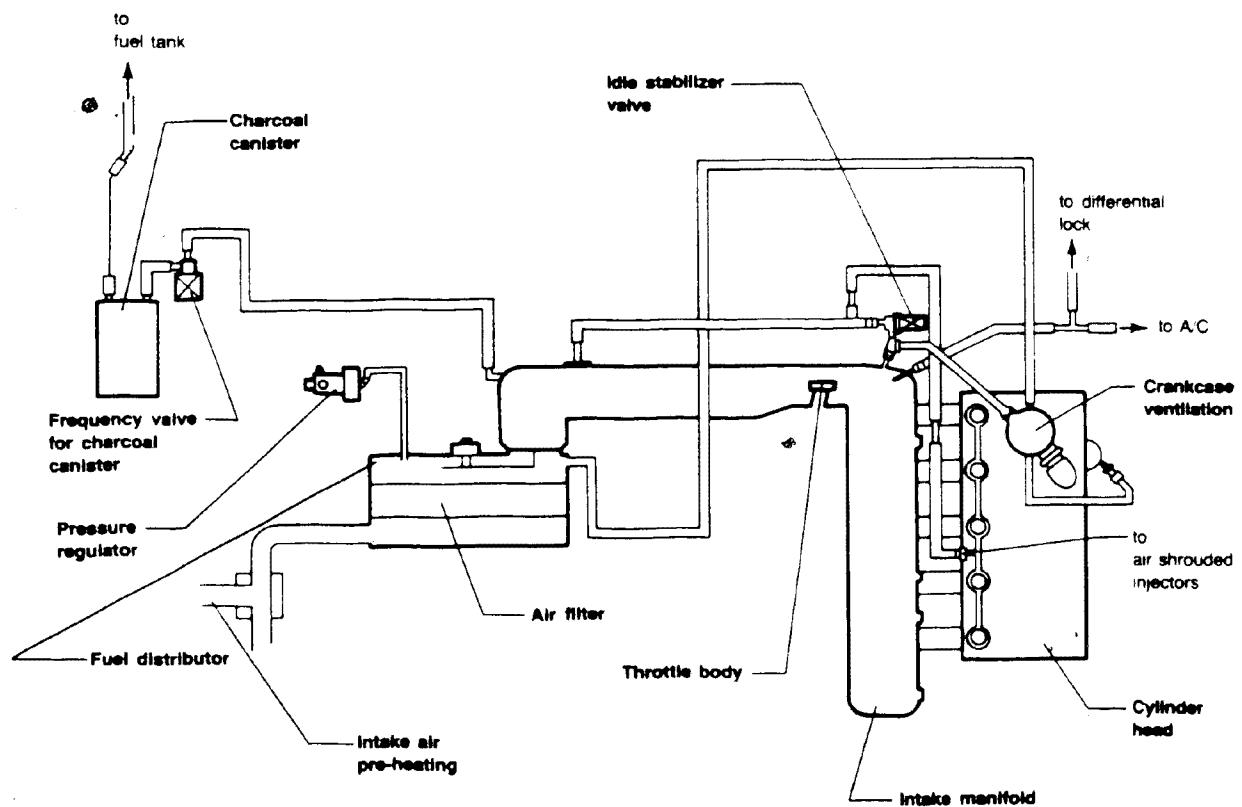
Exhaust System – Emission Controls



California system with EGR:

- California system with EGR:
- | | |
|-------------------------------------|--|
| 1 — EGR frequency valve (N 121) | 10 — A/C and differential lock connection |
| 2 — Check valve | 11 — Cylinder head |
| 3 — EGR valve | 12 — Idle stabilizer valve (N 71) |
| 4 — to the fuel injector air shroud | 13 — Intake manifold |
| 5 — Throttle plate | 14 — Solenoid valve (N 80) for carbon canister |
| 6 — Pressure regulator | 15 — Air filter housing |
| 7 — to fuel reservoir | 16 — Fuel distributor |
| 8 — Vacuum reservoir | 17 — Carbon canister |
| 9 — Crankcase ventilation | |

Exhaust System – Emission Controls



26-660

Exhaust System – Emission Controls

Evaporative system leakage, troubleshooting

WARNING

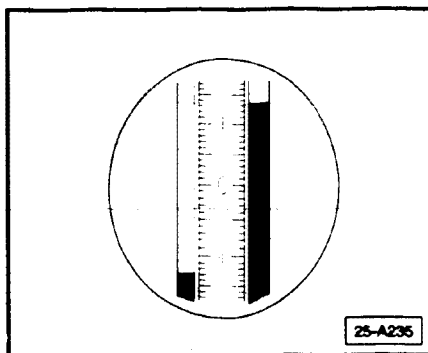
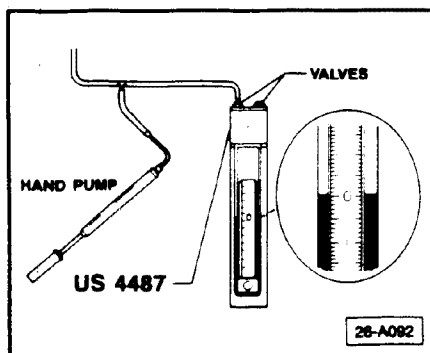
These tests involve the use of equipment that contain mercury.

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 filter 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 carbon 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

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

Exhaust System – Emission Controls

Exhaust system, installing

CAUTION

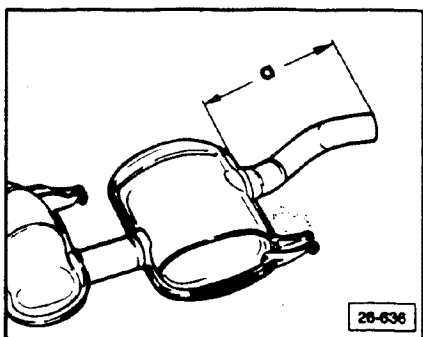
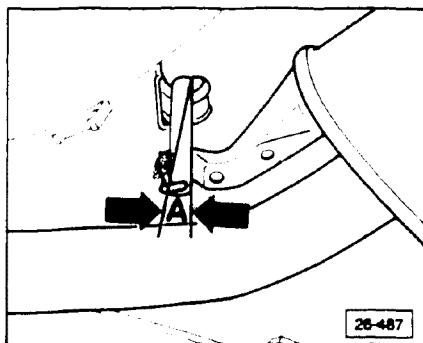
Install exhaust system cold (room temperature). Metal expansion due to heating can cause distortion and improper fit.

- remove all mounting bolts and exhaust clamps
- tighten fasteners between exhaust manifold and muffler

Note

Take care to ensure that there is adequate clearance between the exhaust system and the body and that the exhaust hangers are equally tensioned.

- tighten main muffler and rear muffler securely
- tension main muffler until the exhaust hanger is stretched forward
 - dimension **a** = 7 mm (0.275 in.)



► Fig. 1 Exhaust system, sizing

- a. Turbo Quattro vehicles (CIS)
 - engine code **MC**
- b. Quattro vehicles (CIS-E III)
 - engine code **NF**

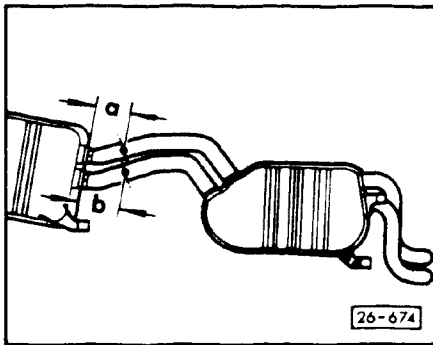
When replacing the center pipe **WITH** muffler:

- a** = 307 mm (12.08 in.)
- b** = 299 mm (11.80 in.)

When replacing the rear muffler **ONLY**:

- a** = 291 mm (11.46 in.)
- b** = 299 mm (11.80 in.)

Exhaust System – Emission Controls



Exhaust system, installing

Exhaust system, sizing

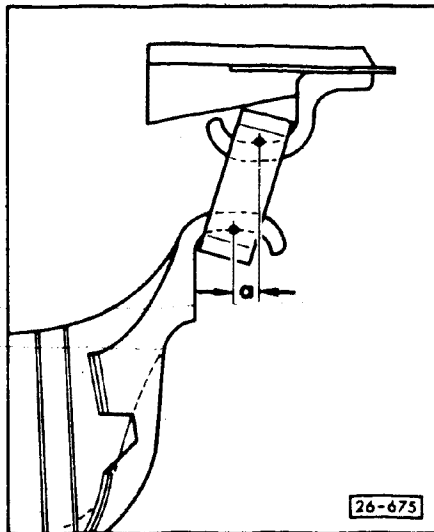
Use the following procedure to determine the sawcut location if replacing only one of the mufflers.

- measure center of pipe distance "a" as shown then make mark perpendicular to pipe at measured point
 - "a" = 126.5 mm (5 in.)
- carefully saw pipe square with mark
- file or sand any burrs to allow smooth fit
- measure center of pipe distance "b" as shown then make mark perpendicular to pipe at measured point
 - "b" = 142.5 mm (5.6 in.)
- carefully saw pipe square with mark
- file or sand any burrs to allow smooth fit

Exhaust system, aligning

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
- pay particular attention to the following points
 - clearance between exhaust system and transmission in the crossmember area
 - clearance between exhaust system and rear axle crossmember
 - pre-stress (a = 10 mm approximately) at the rear muffler, rear mounting point



Exhaust System – Emission Controls

Exhaust system, leak checking

Exhaust system leaks upstream from the Oxygen sensor can cause:

- difficult starting
- engine to cut out
- choppy idle
- uneven acceleration
- poor engine response

Before beginning system troubleshooting as outlined in Repair Groups D2, 24 and 28, check for exhaust leaks as follows:

Requirements

- engine must be cold or hand-warm
- ignition must be switched OFF
- insert compressed air line into exhaust pipe and seal with a rag
- seal off other exhaust opening using a rag
- turn on air and adjust pressure to approximately 6 bar (87 psi)
- check system for leaks by spraying/ applying a soap solution to
 - cylinder head
 - exhaust manifold
 - manifold to downpipe joint
 - catalytic converter
 - joints downstream from converter

If bubbles appear

- replace or repair as necessary
- recheck system

Exhaust System – Emission Controls

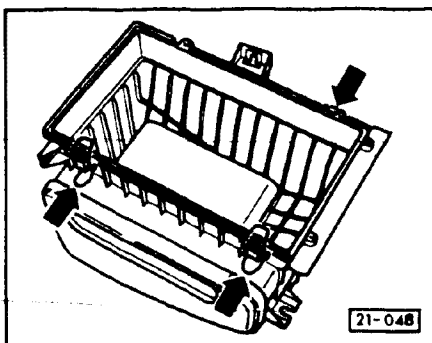
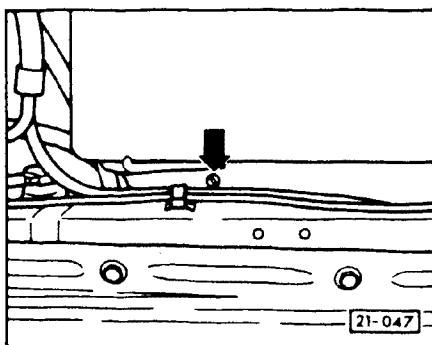
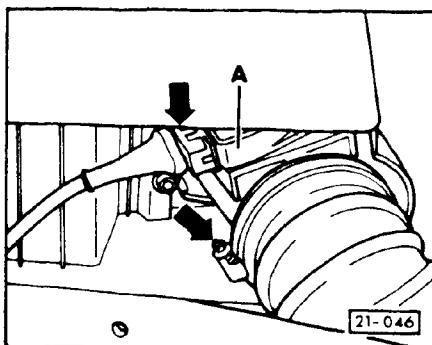
Exhaust manifold, removing/ installing

Note

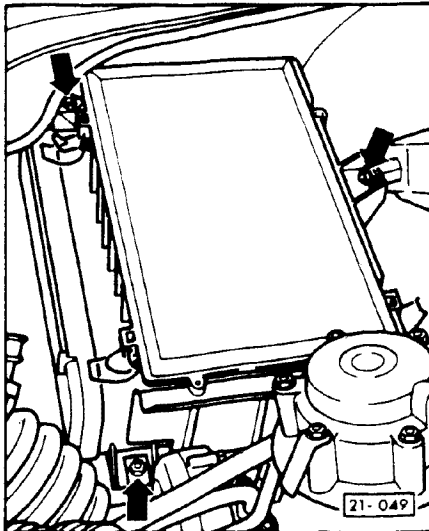
Always replace all seals, gaskets and lock-nuts.

Exhaust manifold, removing

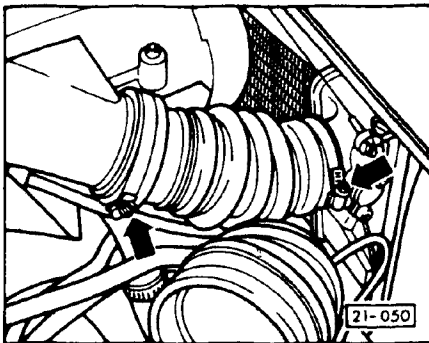
- disconnect battery
- remove air filter as follows
- disconnect (A) air mass sensor harness connector (**upper arrow**)
- loosen hose clamp (**lower arrow**)
- remove hose from (A) air mass sensor
- loosen mounting screw for upper section of air filter (**arrow**)
- release spring clips securing upper and lower air filter sections (**arrows**)



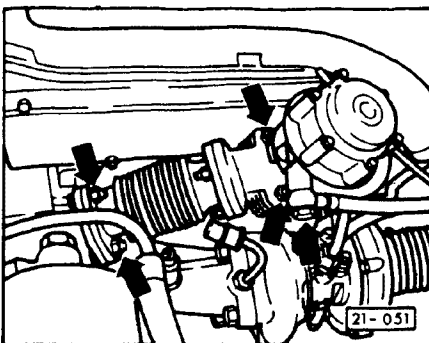
Exhaust System – Emission Controls



- remove lower section of air filter



- loosen hose clamps (**arrows**) securing connector hose
- remove connector hose (between intercooler and intake tube)



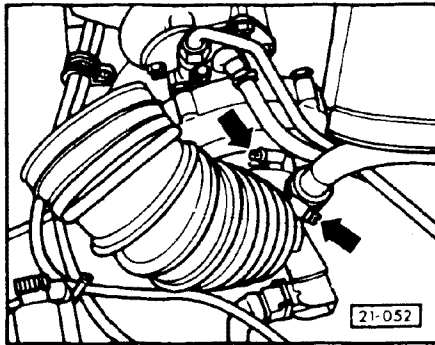
- remove wastegate as follows
- remove banjo bolt and disconnect wastegate control line (**lower right arrow**)

CAUTION

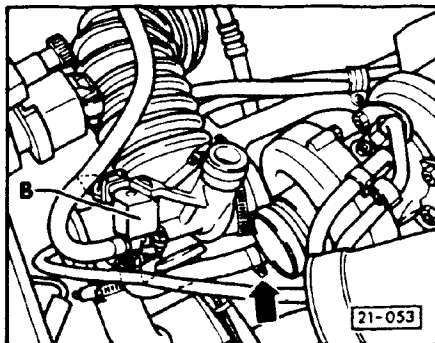
Exercise care when removing and installing the banjo bolt. Keep it clean and protected while performing repairs.

- unbolt flexible pipe from exhaust pipe (**left arrows**)
- unbolt wastegate from exhaust manifold (**remaining arrows**)

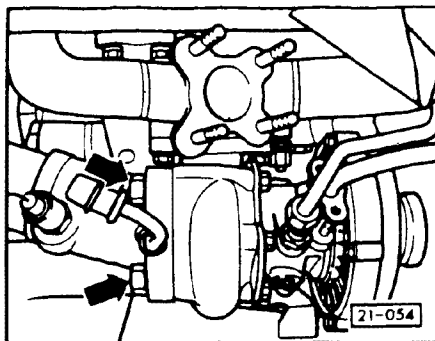
Exhaust System – Emission Controls



- remove connector hose (between air mass sensor and turbocharger) from crankcase ventilation hose and turbocharger by loosening hose clamps (**arrows**)



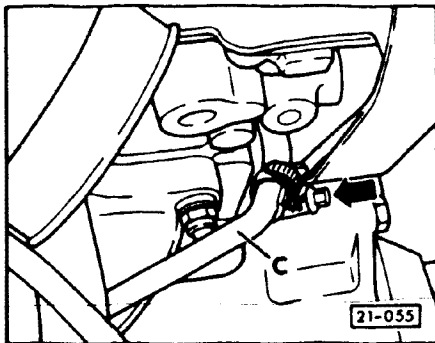
- remove connecting hose (between turbocharger and wastegate frequency solenoid **B**) from turbocharger



- remove turbocharger mounting nuts from exhaust pipe (**arrows**)

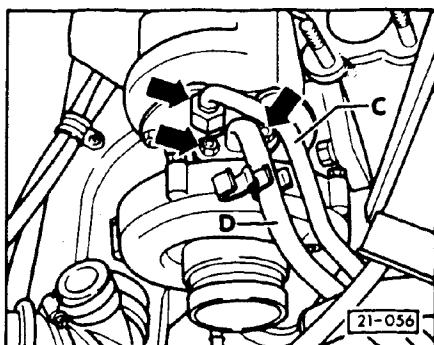
Note

The nut is difficult to access and measures 15 mm from flat to flat.

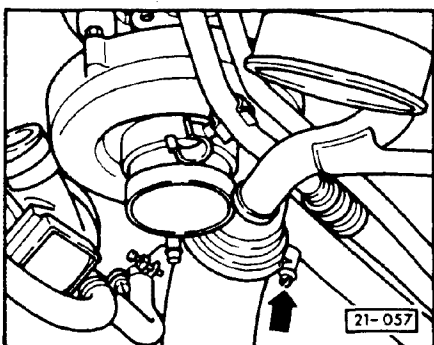


- loosen hose clamp (**arrow**) securing (**C**) coolant supply line (to turbocharger)

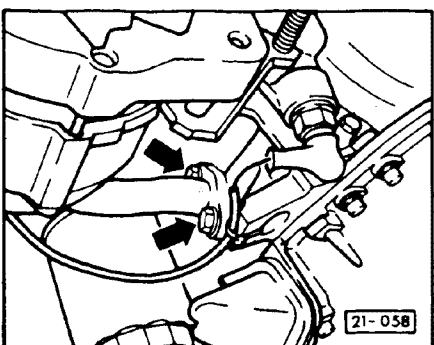
Exhaust System – Emission Controls



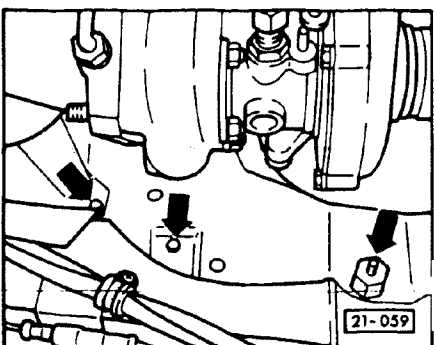
- disconnect coolant supply line (C) from turbocharger (**upper arrow**)
- remove oil supply line mounting nuts (**lower arrows**)
- remove oil supply line (D) from turbocharger



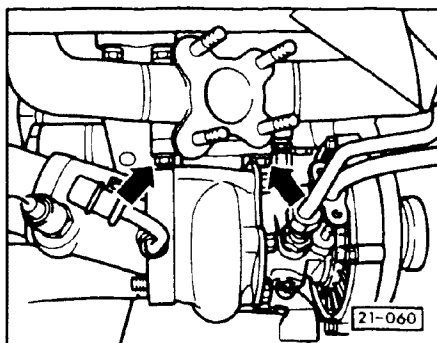
- loosen hose clamp (**arrow**) and disconnect hose (between turbocharger and intercooler) at turbocharger



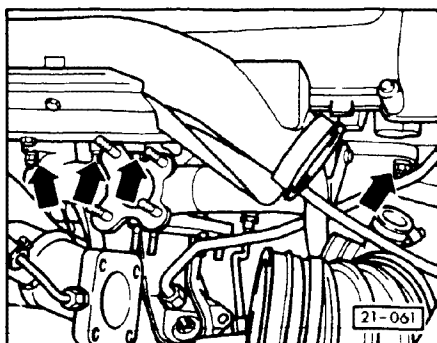
- remove mounting bolts (**arrows**) securing oil return line to crankcase
- immediately plug oil line after disconnecting
- disconnect coolant return line from turbocharger



- remove heat shield (**arrows**)
 - mounted on right side member below turbocharger



- remove turbocharger mounting bolts (**arrows**) from exhaust manifold
- remove turbocharger



- remove manifold mounting nuts (**arrows**)
- remove exhaust manifold gasket from cylinder head

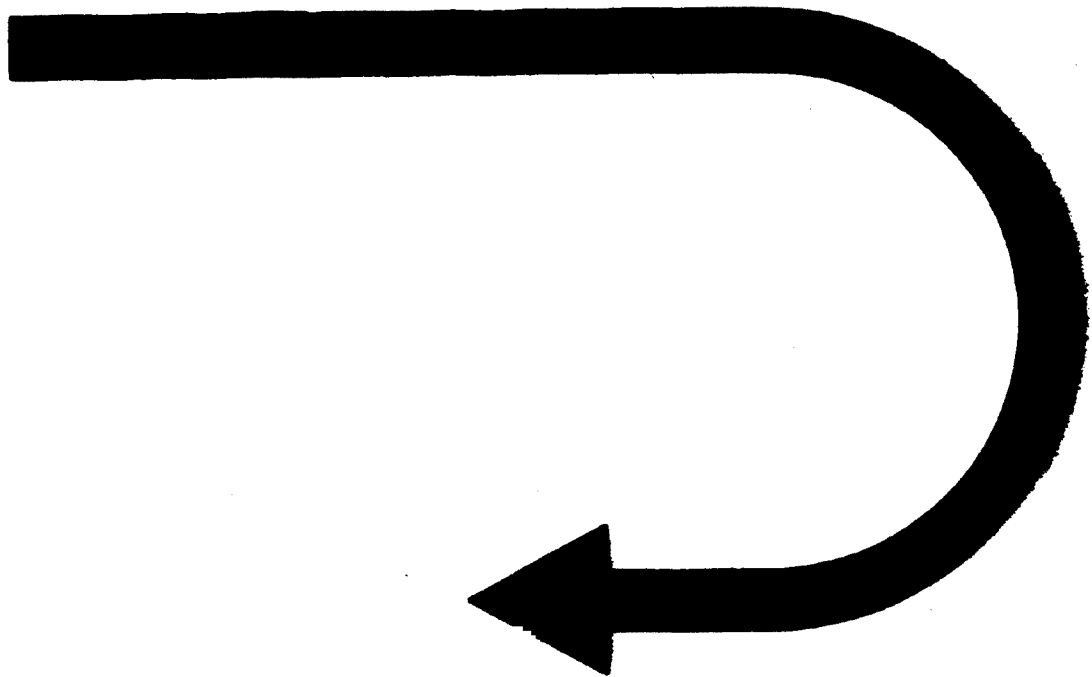
Exhaust manifold, installing

- install manifold in reverse sequence of removal procedure

Note

Install the exhaust manifold gasket with the beaded side facing the manifold.

CONTINUED IN THE
BEGINNING OF NEXT ROW



Exhaust Gas Recirculation system (EGR), checking

(California ONLY)

Note

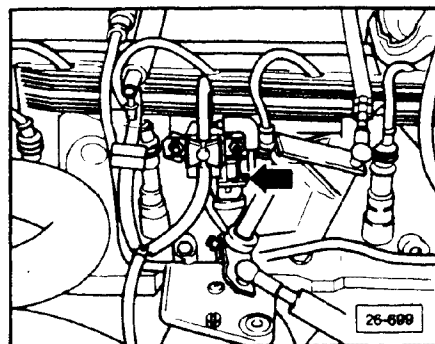
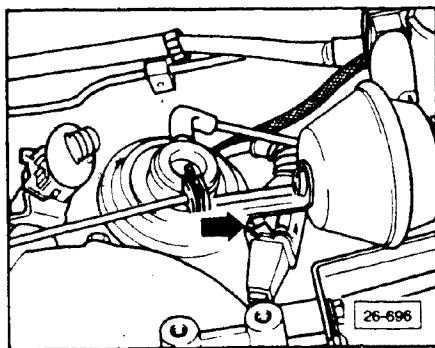
EGR system function is monitored by the CIS-E III control unit.

Conduct the following check only if Fault code 2411 "EGR System" is displayed.

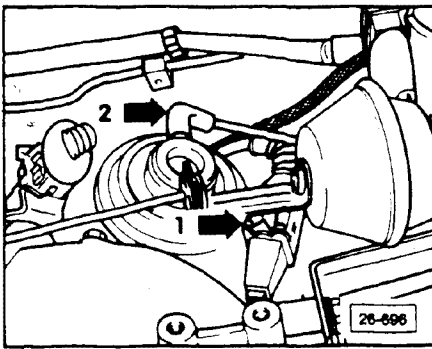
Repair as necessary; THEN conduct the functional test on page 26.26.

Requirements:

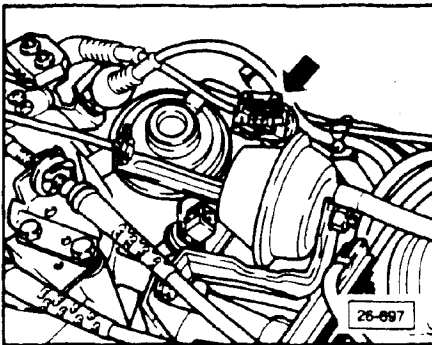
- engine coolant temperature 80°C (176°F) minimum
 - A/C switched **OFF**
 - all electrical consumers switched **OFF**
 - vacuum connections tight and leak-free
 - vacuum lines **NOT** plugged or pinched
 - radiator cooling fan must **NOT** be running while taking measurements
-
- ensure that harness 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, see page 26.9 for Automatic transmission or page 26.10 for Manual transmission



Exhaust System – Emission Controls



- disconnect harness connector (**arrow 1**) 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

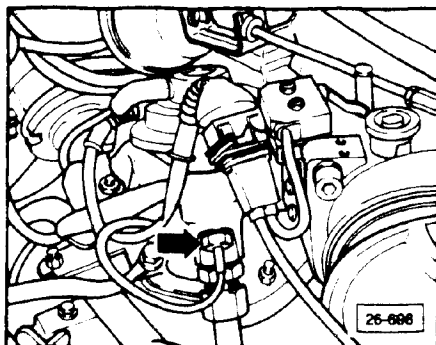
If voltage **NOT** obtained

- check wiring using wiring diagram and repair as necessary

If voltage obtained

- switch **OFF** ignition and disconnect multimeter

Exhaust System – Emission Controls



- remove EGR temperature sensor from EGR valve (**arrow**)
- switch multimeter **US 1119** to resistance range
- connect multimeter across temperature sensor terminals
- submerge sensor in boiling water (100°C)
 - multimeter must read between 80 K and 160 K Ohms

If **NO**

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

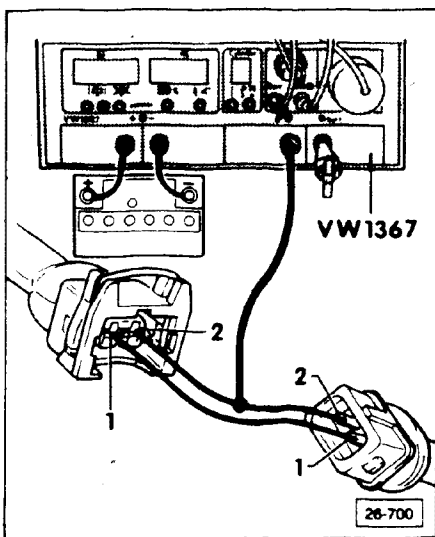
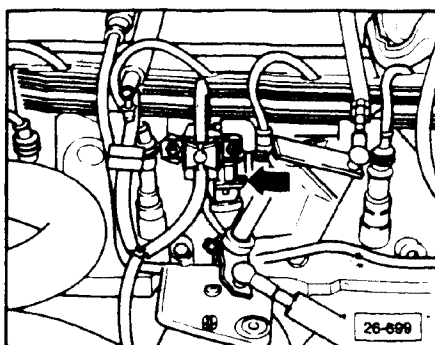
If **YES**

- 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 other connector using **VAG 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

Exhaust System – Emission Controls

- start engine and raise engine speed to approximately 2000 RPM's (use vehicle tachometer if necessary)
- record duty cycle as displayed on **VAG 1367**
 - 22 to 42% at 2000 RPM

Note

Duty cycle threshold is 1800 RPM, it will **NOT** register below that speed.

If specified value **NOT** obtained

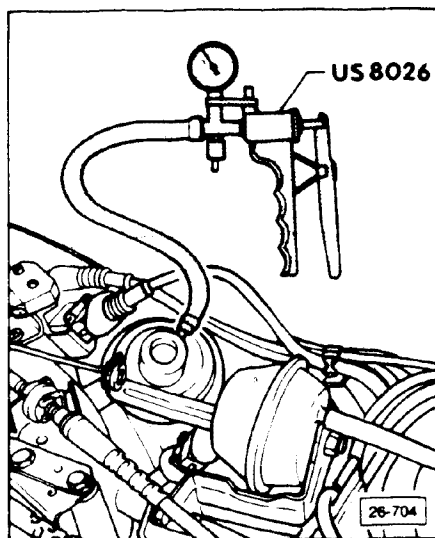
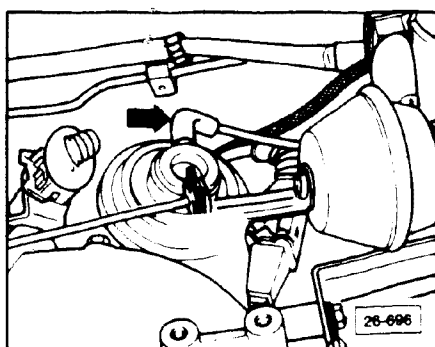
- check test connections

If **OK**

- check wiring using wiring diagram, replace or repair as necessary

If specified value is obtained

- switch **OFF** ignition
- disconnect **VAG 1367** engine tester and **VAG 1594** adaptors
- re-connect EGR frequency valve harness connector
- disconnect vacuum connector (**arrow**) from EGR valve



- connect hand vacuum pump **US 8026** to EGR valve vacuum port

CAUTION

Do **NOT** run the engine while performing 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

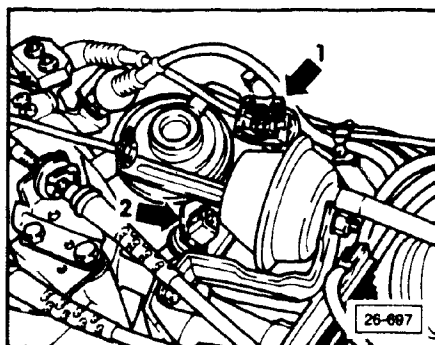
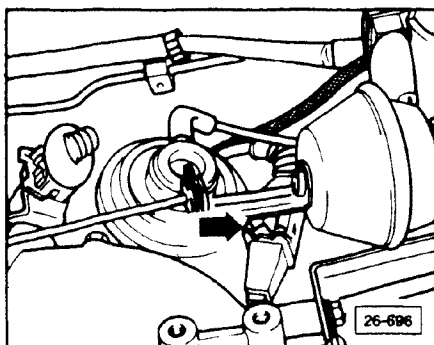
If **OK**

- replace EGR valve

If specified vacuum is maintained continue with following steps

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 2**)
- 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 1000 and 19,000 Ohms

If **NO**

- replace EGR valve

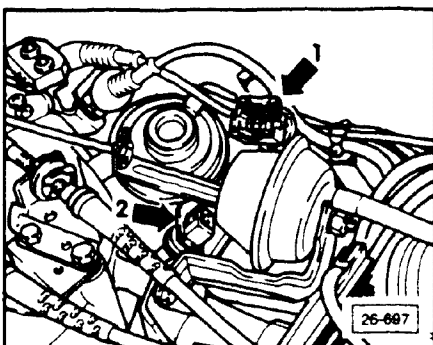
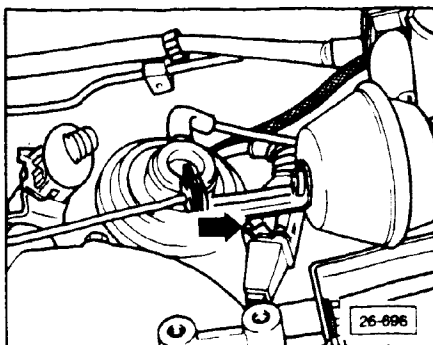
If **OK**

- replace EGR frequency valve
- disconnect multimeter and vacuum pump
- reconnect hoses and connectors

Exhaust Gas Recirculation system, functional check

Requirement:

- EGR system vacuum connections OK
- switch **OFF** ignition
- disconnect temperature sensor harness connector (**arrow**)



- switch multimeter **US 1119** to resistance range (2 megOhm scale)
- connect multimeter to terminals 1 and 2 of temperature sensor connector (**arrow 2**) using long adaptor wires from **VW 1594** adaptor kit
- pass multimeter and wires through passenger side window and place on seat, fasten meter 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 20,000 Ohms

If **NO**

- replace EGR temperature sensor

Exhaust System – Emission Controls

- start engine and let idle for at least three minutes
- switch multimeter **US 1119** to 200 K Ohm 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 gear for manual
- while test driving keep an eye on the **OBD** warning light; when the light comes **ON**: read the resistance display on the multimeter
 - must **NOT** be less than 50,000 K Ohms

If **LESS**

- check EGR system vacuum connections using vacuum diagram, repair or replace as necessary

Exhaust System Emission Controls

Fault Code	Possible Cause of Fault	Effect	Repair
1231	Wiring between instrument panel insert and CIS-E III control unit is shorted or disconnected 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 CIS-E III control unit, using wiring diagram Check speed sender (G 68) wiring, replace or repair as necessary.
2411 (California ONLY)	Vacuum lines disconnected or pinched EGR temp. sensor (G 98) faulty EGR valve faulty EGR system Frequency valve (N 121) faulty Disconnected wire between Speed sender (G 98) or Frequency valve (N 121) and CIS-E III control unit	OBD light ON Driving fault, e.g. vibration, poor idle Poor starting	Check EGR system, page 26.16 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.