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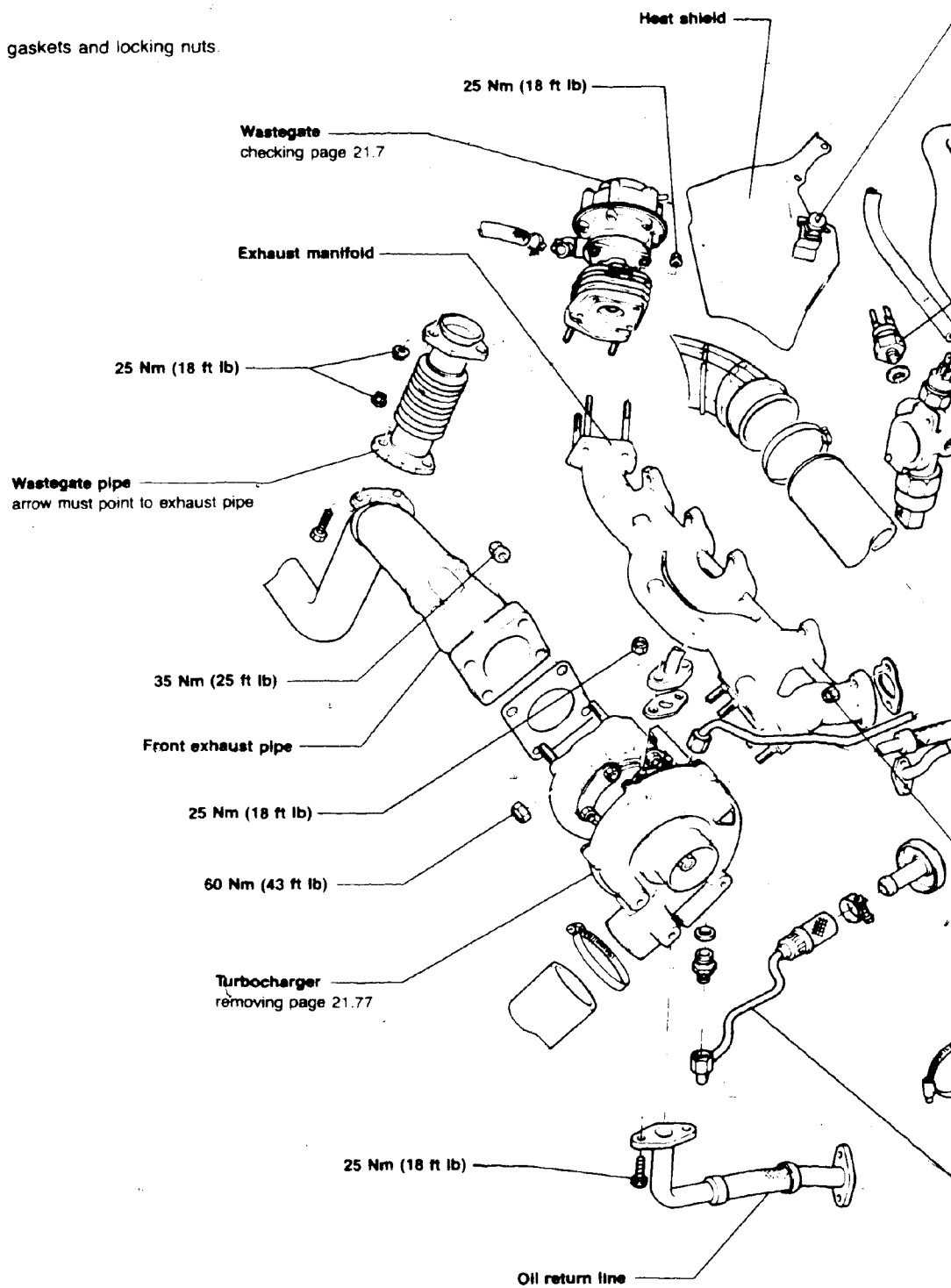
Wastegate

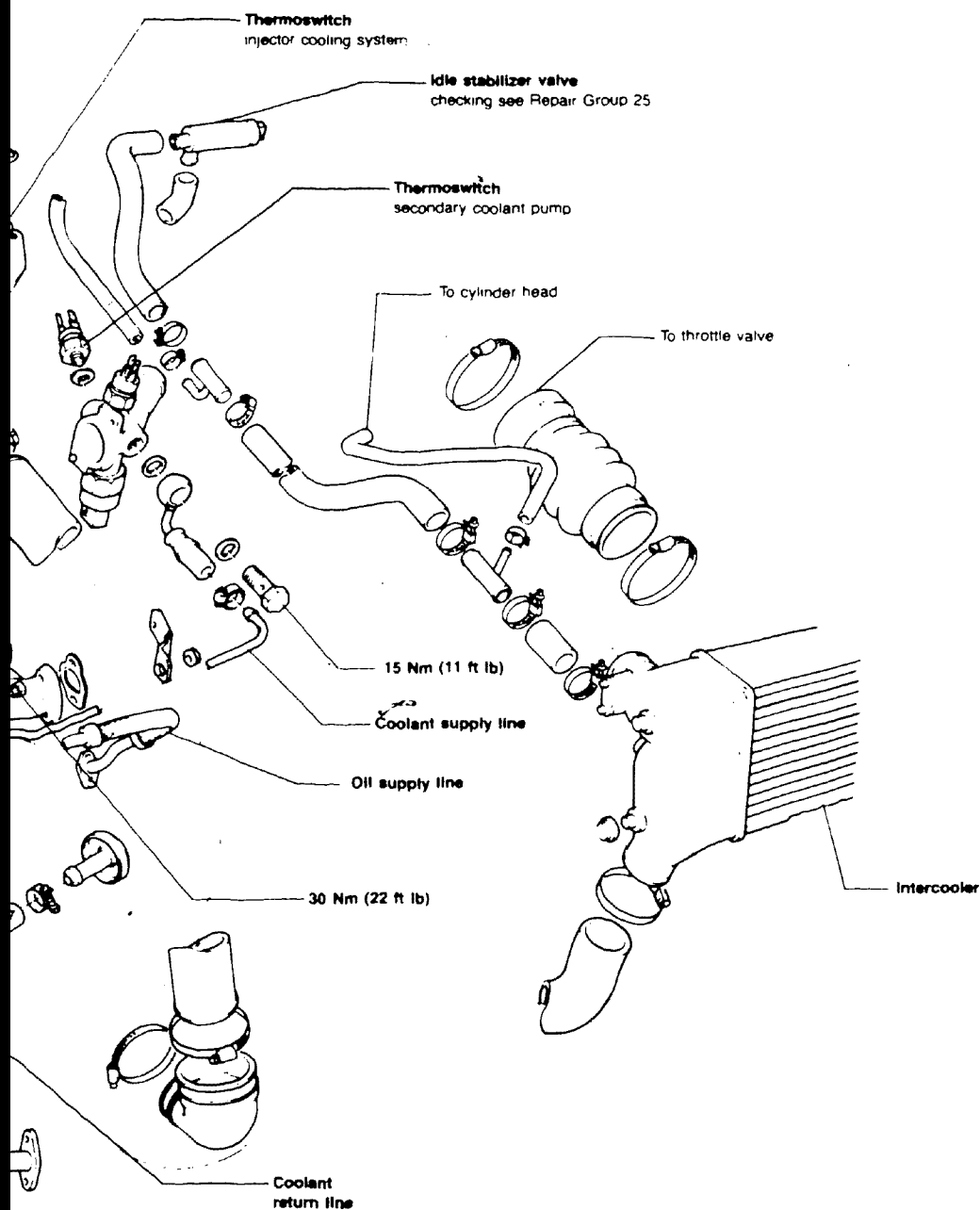
- ★ ■ checking using VAG 1397 21.25
- ★ ■ checking using VAG 1397A 21.27

- ★ **NEW INFORMATION** since last filming

Note

Always replace all seals, gaskets and locking nuts.



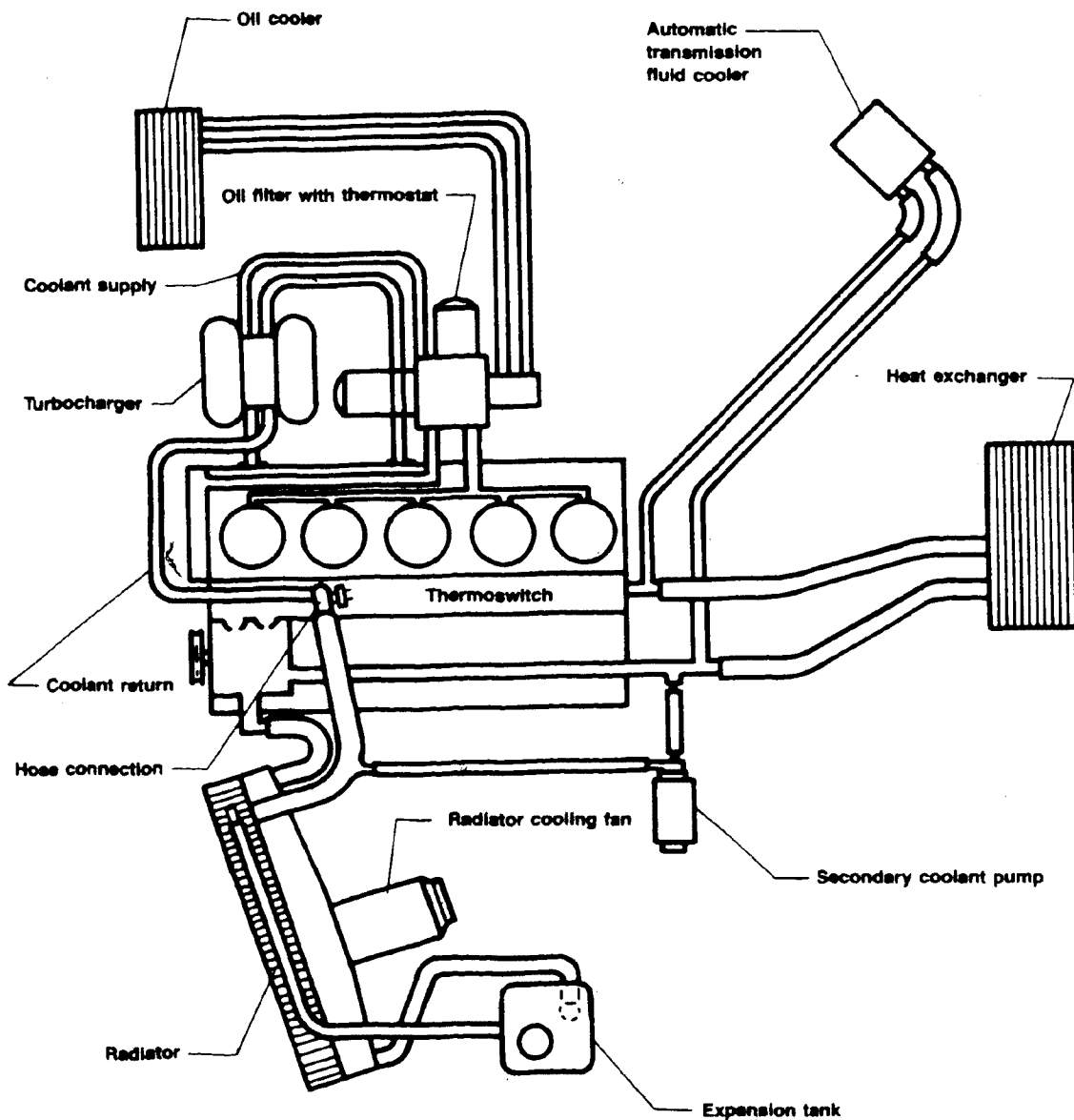


21-043

Engine code MC

Turbocharger, component layout

21.3



21-042

Turbocharger and wastegate, checking

Perform this test if vehicle performance is unsatisfactory.

Check these first:

- engine oil temperature 80°C (176°F) minimum
- no leakage at vacuum connections

Note

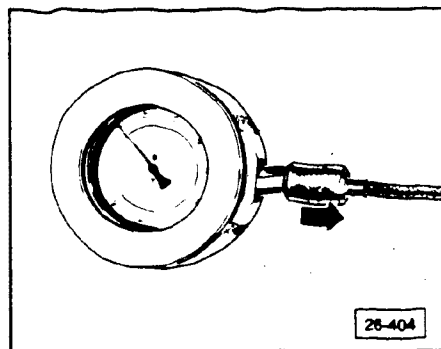
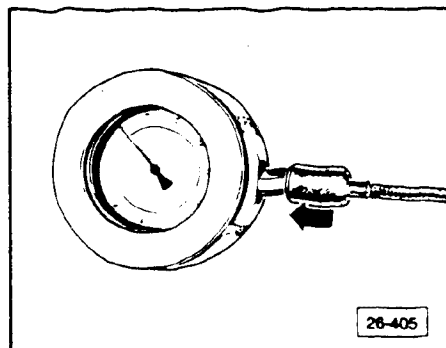
To check the turbocharger and wastegate you must first measure boost pressure, which is performed while driving. For safety reasons, it is necessary to take along a second person to read the gauge.

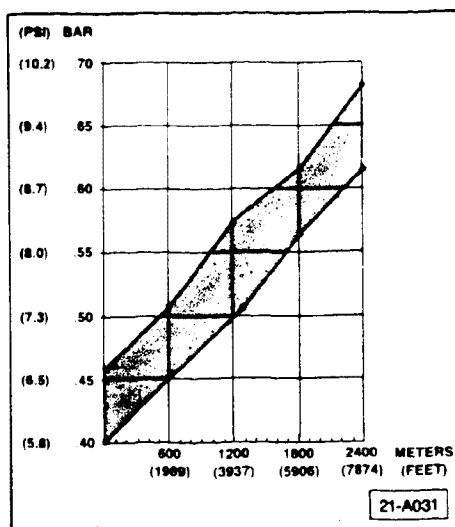
- remove kick panel trim on right side of footwell
- remove vacuum hose from vacuum port on ignition control unit
- connect pressure gauge **VW 1397** between previously removed vacuum hose and vacuum port on ignition control unit
- open shut-off valve on pressure gauge **VW 1397**
- starting at a speed of approximately 35 mph, accelerate vehicle with full throttle
 - manual transmission in 3rd gear
 - automatic transmission in 2nd gear

Note

Automatic transmission must **NOT** be in kickdown mode while measurement is being performed.

- when vehicle reaches 55 mph close shut-off valve on pressure gauge **VW 1397**
- read pressure on gauge
 - correct pressure values are based on altitude, see chart





If boost pressure values are **OK**, but performance is still unacceptable

- check CIS system
- check ignition system and
- check fault code system for stored faults (Repair Group 28)
- make repairs as necessary

If boost pressure values are **NOT OK**

- check wastegate valve control function (Group 28), perform trial replacement if necessary

If proper value is still **NOT** obtained

- perform trial replacement of blow-off valve
- measure boost pressure

If an acceptable value is still **NOT** obtained

- replace turbocharger

Turbocharger and wastegate, checking

Perform this check if vehicle performance is unsatisfactory.

Check these first:

- engine oil temperature 80°C (176°F) minimum
- all vacuum connections must be tight (no leaks)

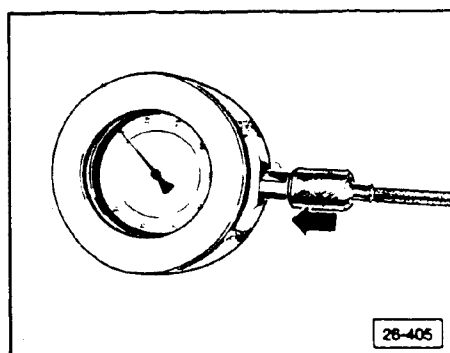
Note

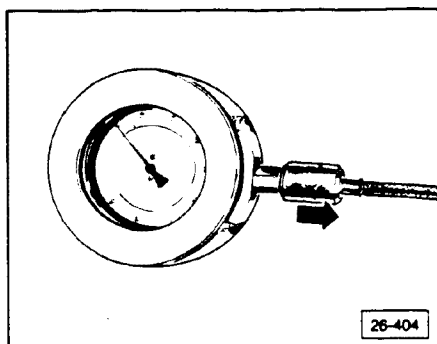
To check the turbocharger and wastegate you must first measure boost pressure, which is performed while driving. For safety reasons, it is necessary to take along a second person to read the gage.

- remove kick panel trim on right side of footwell
- remove vacuum hose from vacuum port on ignition control unit
- connect pressure gauge **VW 1397** between previously removed vacuum hose and vacuum port on ignition control unit
- open shut-off valve on pressure gauge **VW 1397** in direction of **arrow**
- starting from a speed of approximately 35 mph, accelerate vehicle with full throttle
 - manual transmission in 3rd gear
 - automatic transmission in 2nd gear

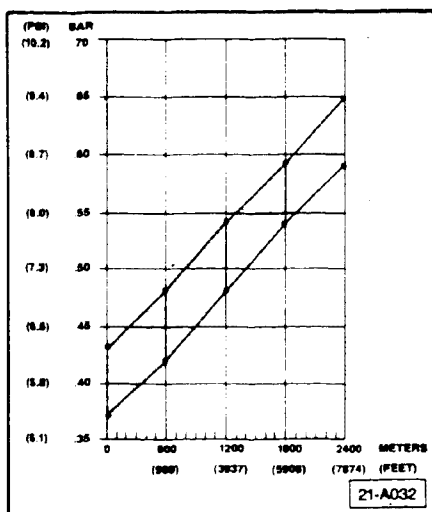
Note

Automatic transmission must **NOT** be in kickdown mode while measurement is being performed.





- when vehicle reaches 55 mph, close shut-off valve on pressure gauge **VW 1397**



- read pressure on gauge
 - correct pressure values are based on altitude, see shaded area of chart

If boost pressure values are **OK**, but performance is still unacceptable

- check CIS system
- check ignition system and
- check fault code system for stored faults (Repair Group 28) make repairs as necessary

If boost pressure values are **NOT OK**

- check wastegate valve control function (Repair Group 28), perform trial replacement if necessary

If proper value is still not obtained

- perform trial replacement of wastegate valve
- measure boost pressure

CAUTION

If trial replacements do **NOT** result in acceptable measurements, re-install the original component.

If an acceptable value is still **NOT** obtained

- replace turbocharger

Wastegate frequency valve, checking Output diagnosis

Note

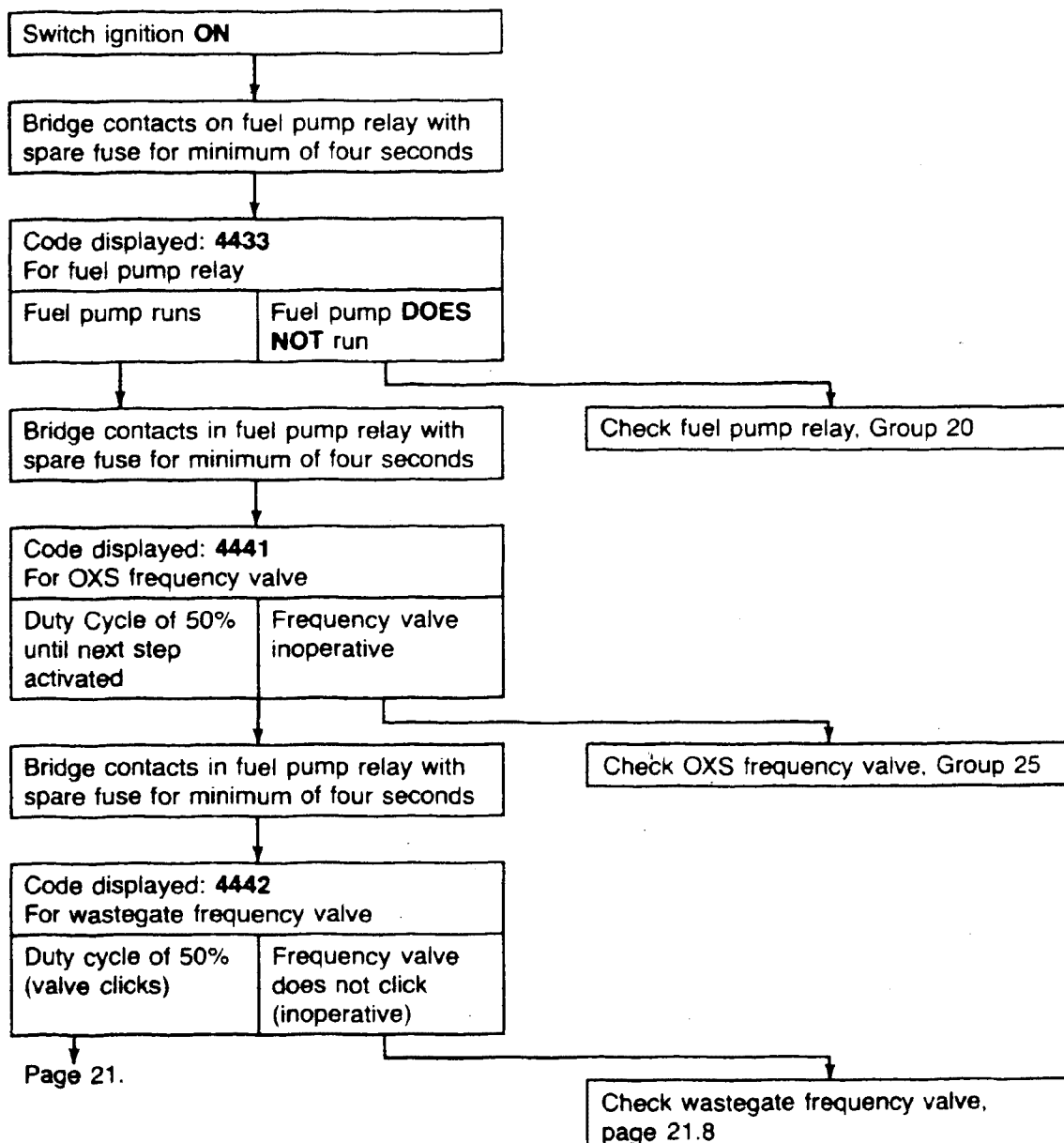
The sequence of this diagnosis **MUST** be followed in order.

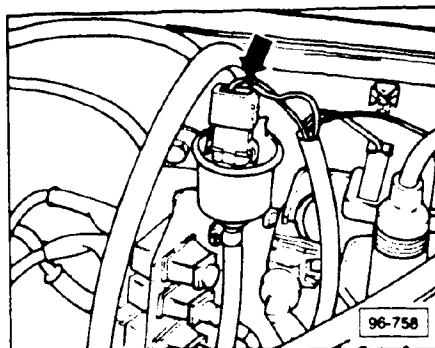
- switch ignition **OFF** to erase input signals from memory

Note

If fuel pump relay or another component fails to operate during diagnosis, entire output diagnosis must be repeated after necessary repairs are made.

Do **NOT** crank or start the engine during the output diagnosis. This would automatically switch the system to the **INPUT** tests when the diagnosis procedure is activated.

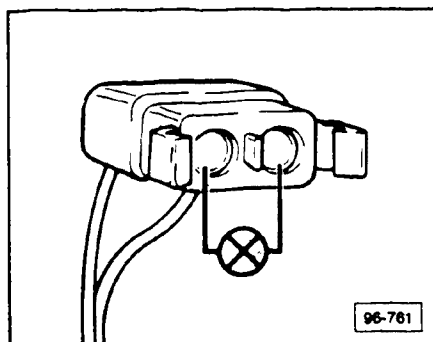




Wastegate frequency valve, checking

If valve does not click during output diagnosis:

- unplug harness connector from wastegate frequency valve (arrow)



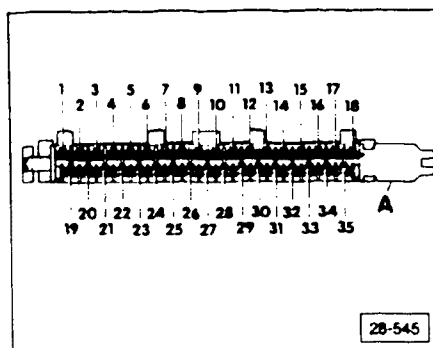
- using LED tester **US 1115**, connect red test lead to blue/black wire and black test lead to green/yellow wire of frequency valve harness connector
- initiate output diagnosis sequence until code **4442** for wastegate frequency valve is displayed
 - LED tester must be **ON** (or flickering)

If test lights up

- replace wastegate frequency valve

If tester is **OFF**

- connect multimeter **US 1119** between blue/black wire of frequency valve harness connector and ground
 - approximately 12 volts

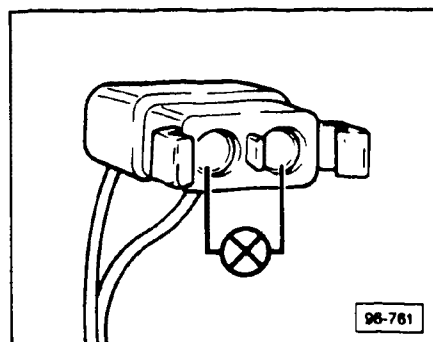


If measurement **NOT OK**

- check for open circuit in wiring using wiring diagram

If measurement **OK**

- remove cover for control unit located in front passenger footwell
- unplug control unit harness connector



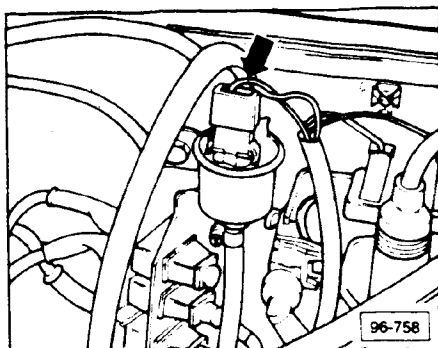
- using multimeter **US 1119**, check for continuity between terminal 19 of control unit harness connector and green/yellow wire of frequency valve harness connector
 - approximately 0.2 Ω

If measurement **NOT OK**

- check for open circuit in wiring between connectors using wiring diagram

If wiring **OK**

- replace control unit



Check this first:

- wastegate frequency valve must click **ON** during output diagnosis

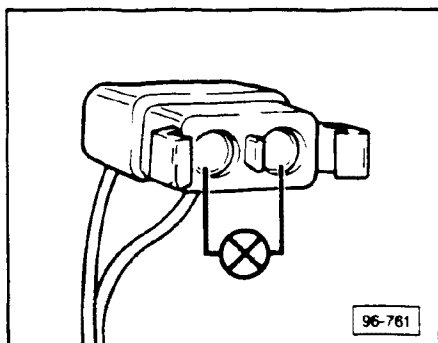
If **NO**

- see page 21.8

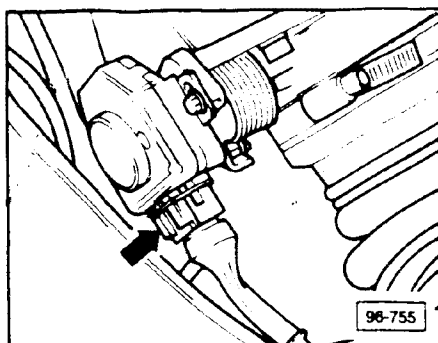
If **YES**

- proceed as follows

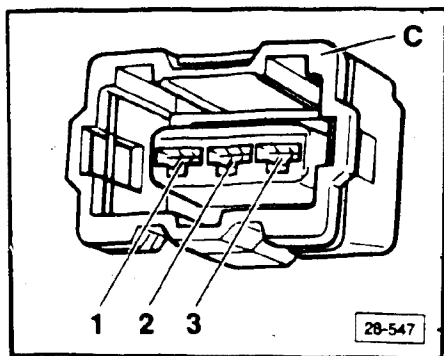
- unplug harness connector from wastegate frequency valve (**arrow**)



- using LED tester **US 1115**, connect red test lead to blue black wire and black test lead to green yellow wire
- run engine at idle



- unplug throttle switch harness connector at throttle body (**arrow**)



- using jumper cable, briefly jump terminals 2 and 3 of open throttle body switch connector C
 - LED tester must turn **ON** for approximately two seconds (or at least flicker)

Note

Boost pressure from the turbocharger is electronically controlled. The control unit operates the wastegate frequency valve.

To prevent engine damage from overboost the system will **NOT** operate when:

- engine temperature **exceeds** 119°C (247°F)
- a fault develops in manifold pressure sensor circuit
- a specified boost value has not been reached **within** 3 seconds of system operation
- ignition timing is being retarded the maximum amount (7.8) due to engine knock (detonation)

Secondary coolant pump, checking

- run engine until radiator cooling fan switches **ON** at **HIGH** speed
- turn **OFF** engine and wait five minutes
 - secondary coolant pump and radiator cooling fan must switch **ON**

Note

Radiator cooling fan will run on **LOW** speed.

If coolant pump and radiator fan **DO NOT** run:

- remove harness connector from secondary coolant pump thermo-switch and bridge terminals
 - coolant pump and radiator fan **must** run

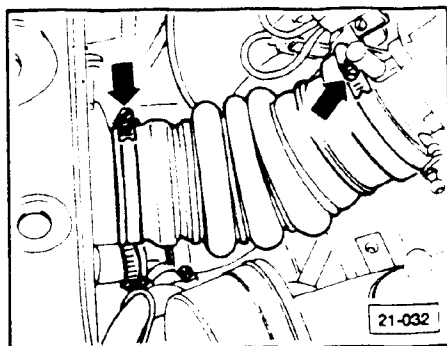
If YES

- replace secondary coolant pump thermo-switch

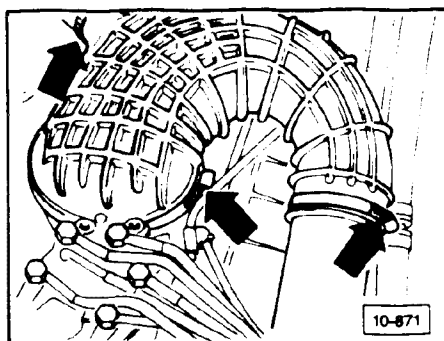
If NO

- check for open circuit in coolant pump circuit, using wiring diagram

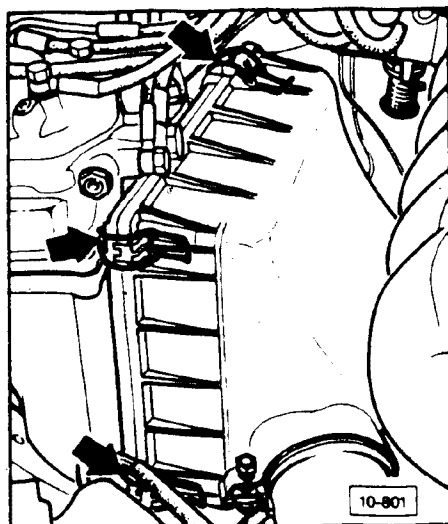
Turbocharger, removing



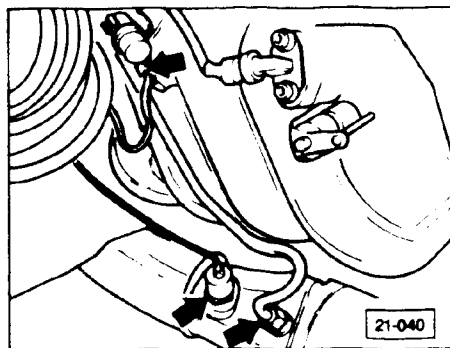
- disconnect battery ground cable
- remove intake air boot between intercooler and throttle valve body (**arrows**)



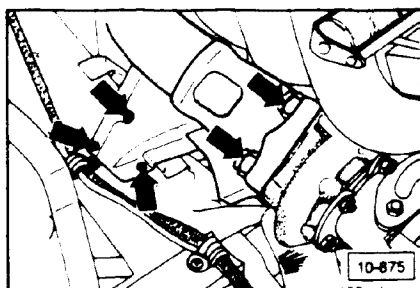
- remove air intake boot (**right arrows**)
- remove vacuum hose between turbocharger and air intake duct (**left arrow**)



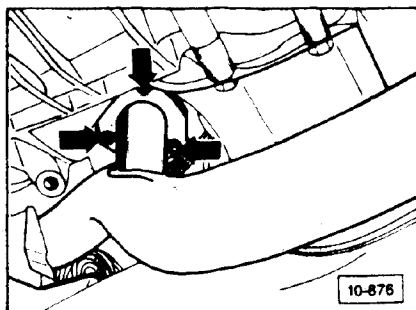
- unclip air filter cover (**arrows**)



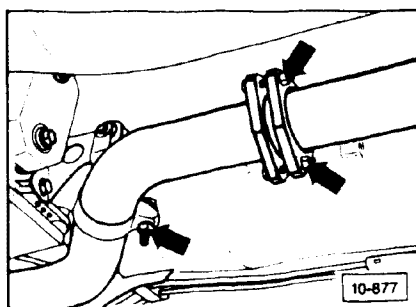
- remove oxygen sensor and CO measuring tube (**arrows**)



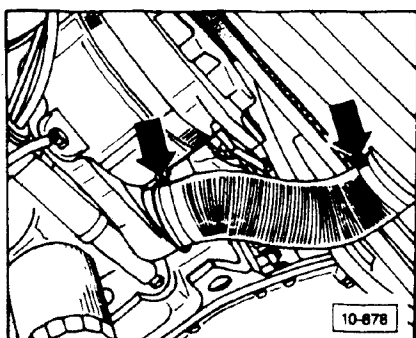
- unscrew and remove cover plate (left arrow)
- disconnect exhaust pipe from turbocharger (right arrows)



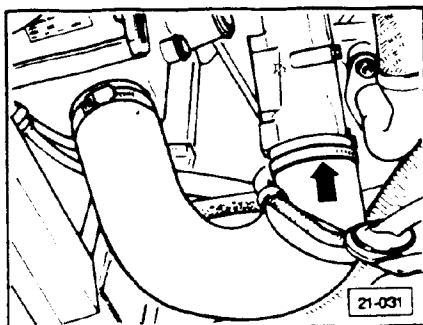
- disconnect exhaust pipe from wastegate pipe (arrows)



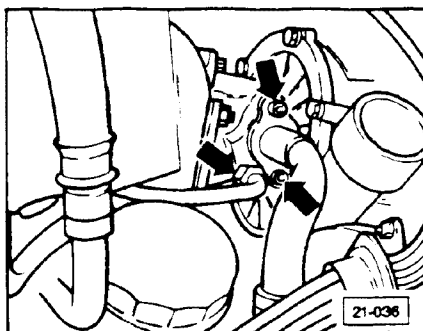
- disconnect exhaust pipe from transmission mount and front muffler (arrows)
- remove exhaust pipe



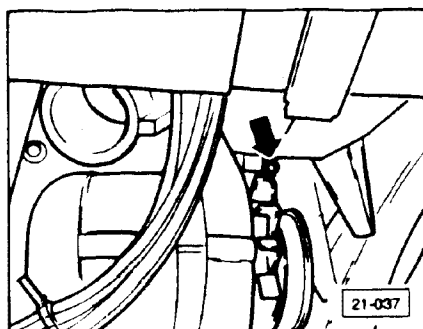
- remove alternator cooling air hose (arrows)
- disconnect right engine mount cooling air hose



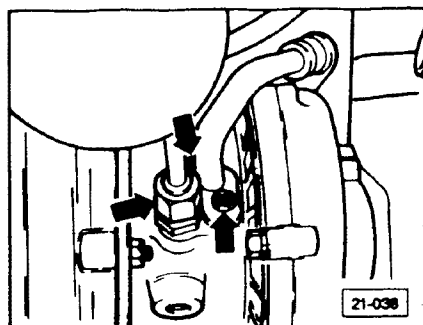
- disconnect intercooler hose from turbocharger (**arrow**)



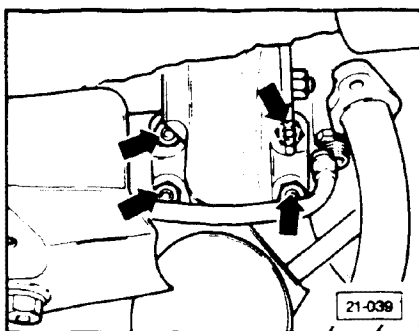
- disconnect lower coolant line (**left arrow**)
- disconnect oil return line from turbocharger (**right arrows**)



- loosen alternator V-belt (**arrow**)
- remove alternator

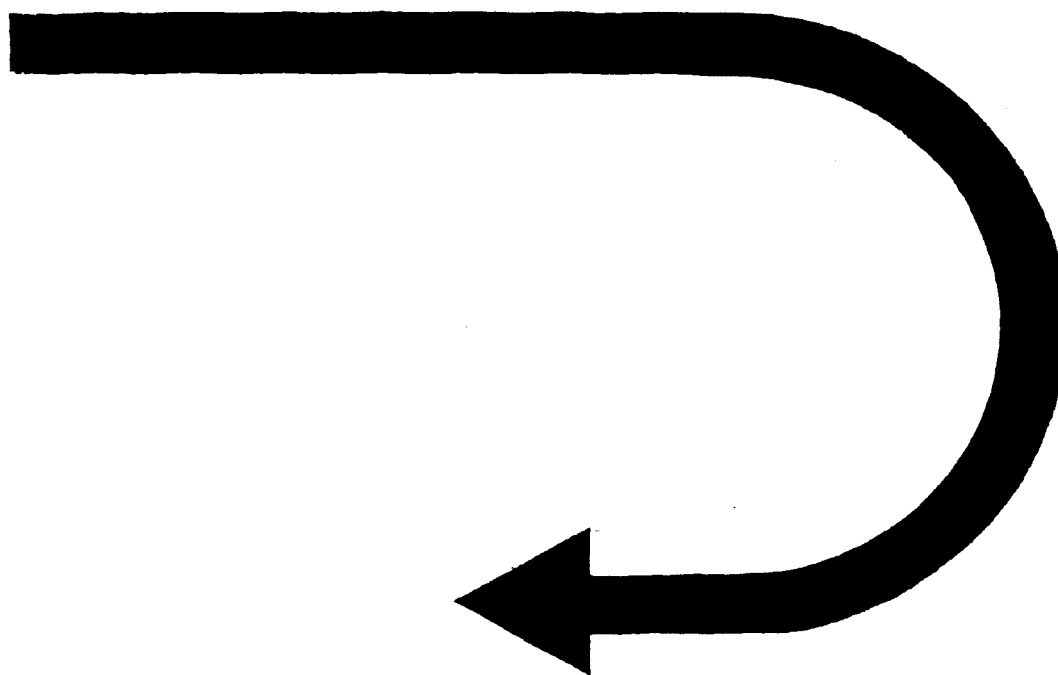


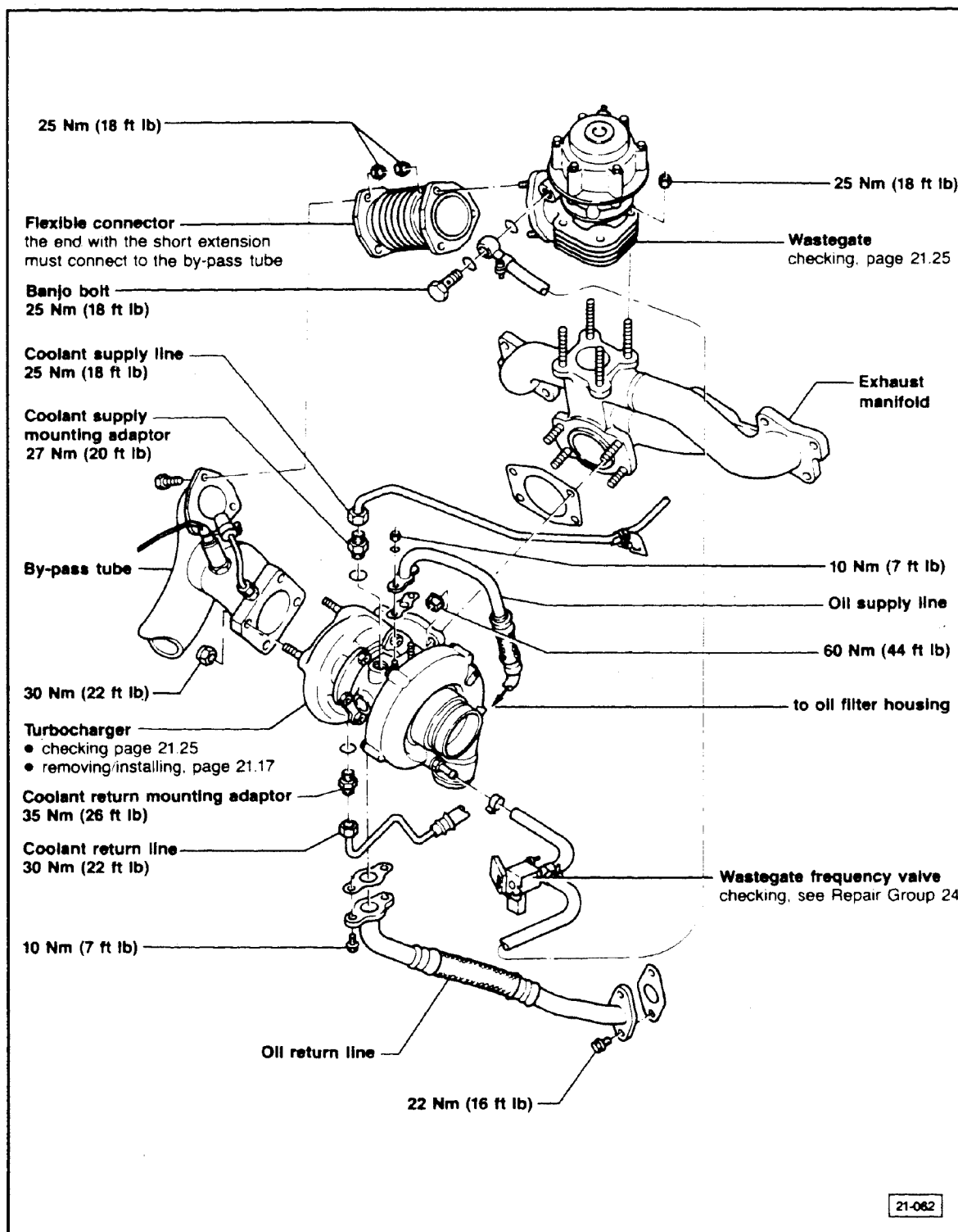
- disconnect upper coolant line (**right arrows**)
- disconnect oil supply line from turbocharger (**left arrow**)

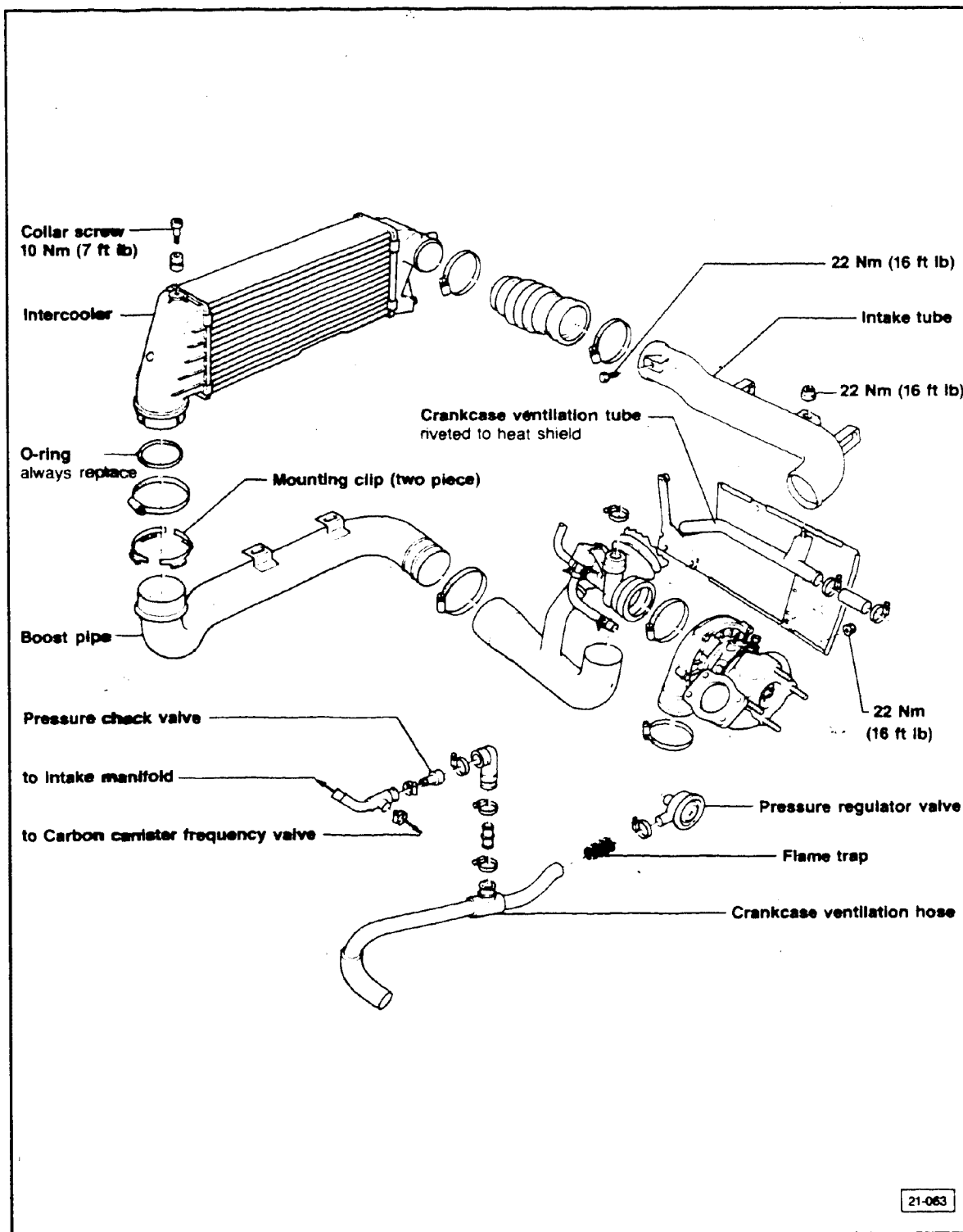


- disconnect and remove turbocharger (arrows)

CONTINUED IN THE
BEGINNING OF NEXT ROW







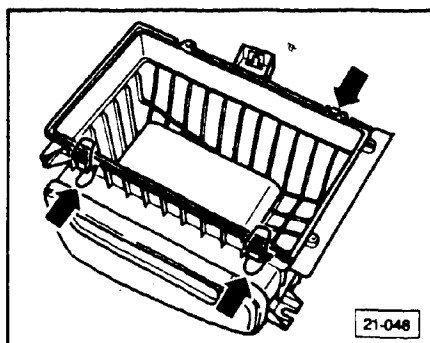
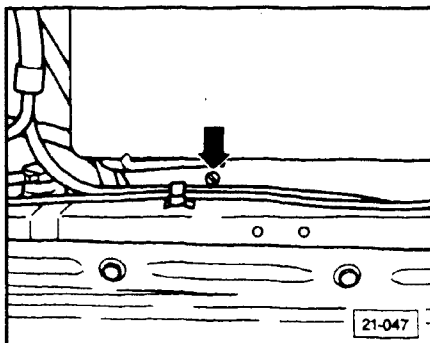
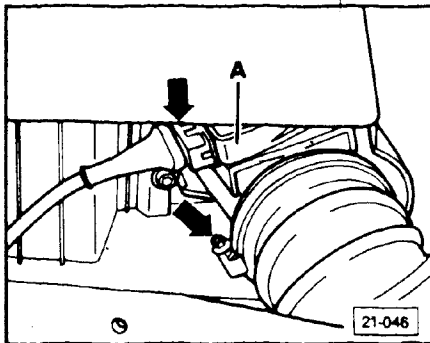
Turbocharger, removing/installing

Note

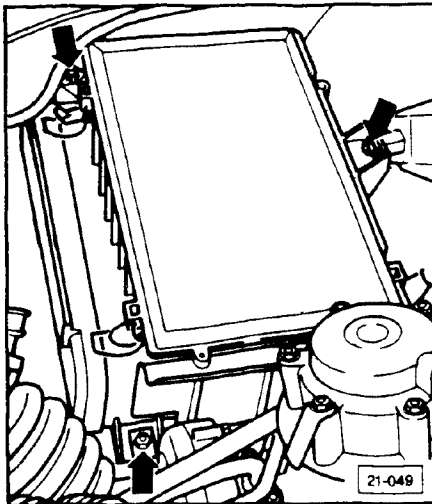
Always replace all seals, gaskets and lock-nuts.

Turbocharger, removing

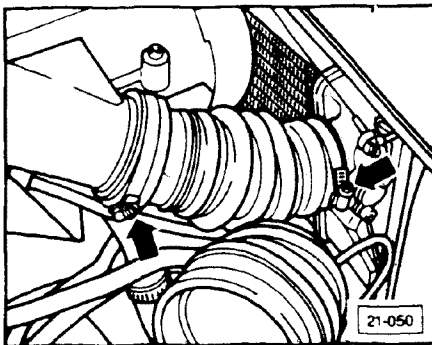
- disconnect battery
- remove air filter as follows
- disconnect (A) air mass sensor harness connector (**upper arrow**)
- loosen hose clamp (**lower arrow**)
- remove hose from (A) air mass sensor



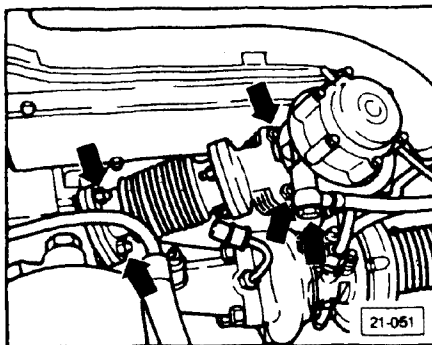
- loosen mounting screw for upper section of air filter (**arrow**)
- release spring clips securing upper and lower air filter sections (**arrows**)



- remove lower section of air filter



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

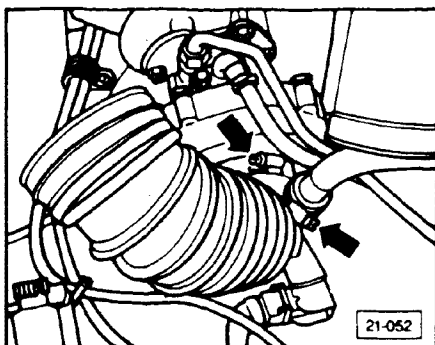


- remove wastegate as follows
- remove banjo bolt and disconnect wastegate control line (**lower right arrow**)

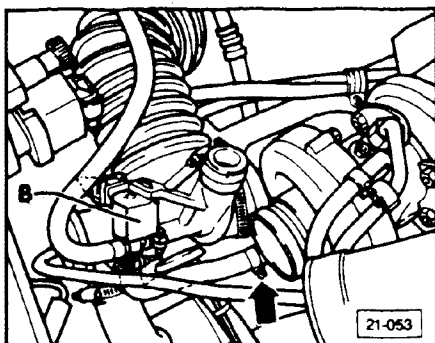
CAUTION

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

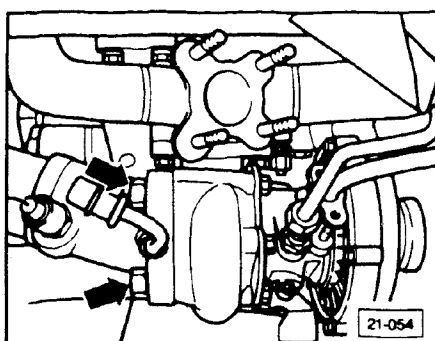
- unbolt flexible pipe from exhaust pipe (**left arrows**)
- unbolt wastegate from exhaust manifold (**remaining arrows**)



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



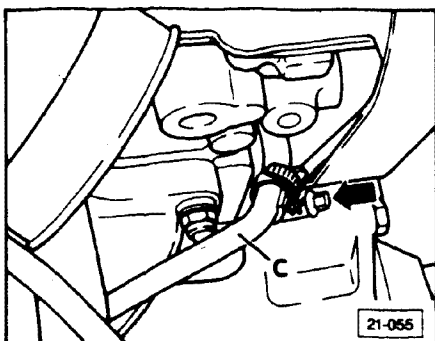
- remove connecting hose (between turbocharger and wastegate frequency solenoid **B**) from turbocharger



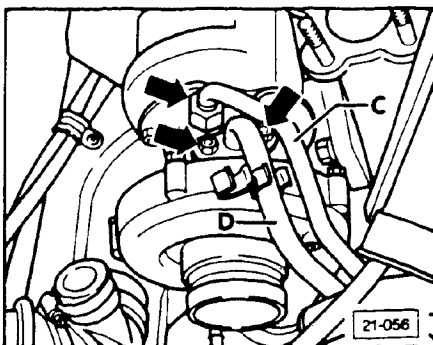
- remove turbocharger mounting nuts from exhaust pipe (**arrows**)

Note

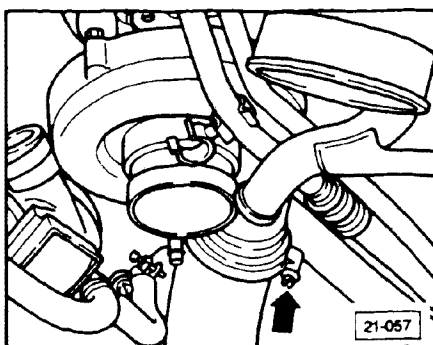
The nut is difficult to access and measures 15 mm from flat to flat.



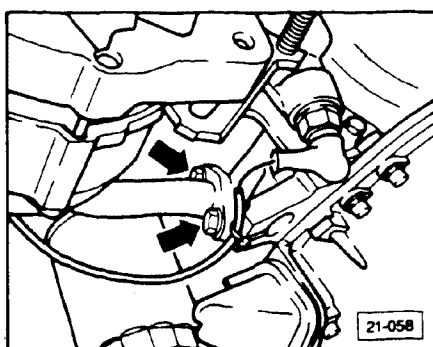
- loosen hose clamp (**arrow**) securing (**C**) coolant supply line (to turbocharger)



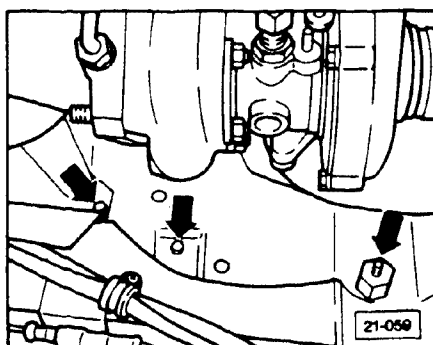
- disconnect coolant supply line (C) from turbocharger (**upper arrow**)
- remove oil supply line mounting nuts (**lower arrows**)
- remove oil supply line (D) from turbocharger



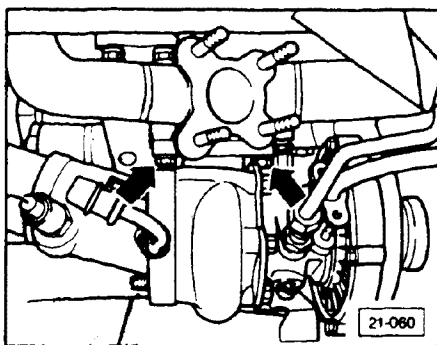
- loosen hose clamp (**arrow**) and disconnect hose (between turbocharger and intercooler) at turbocharger



- 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
 - mounted on right side member below turbocharger



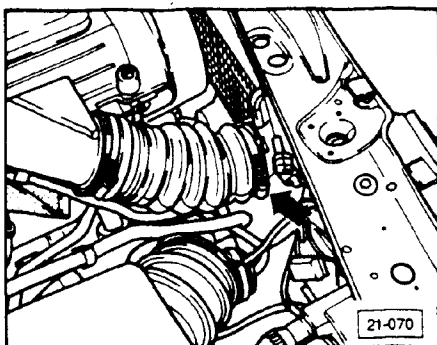
- remove turbocharger mounting bolts (arrows) from exhaust manifold

Turbocharger, installing

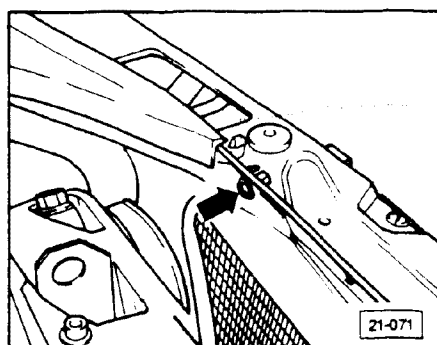
Note

Installation of the turbocharger assembly is the reverse of the removal procedures.

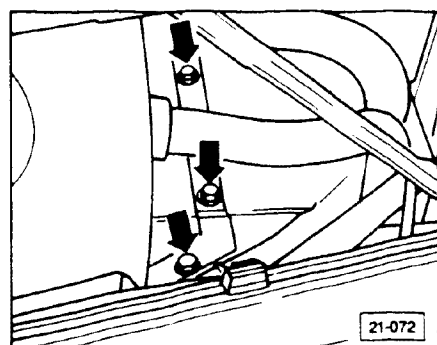
Intercooler, removing/installing



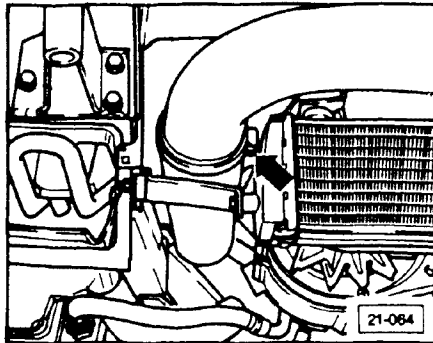
- remove front bumper. see Repair Group 63
- remove and install radiator grill. see repair Group 50
- loosen hose clamp (**arrow**) securing connector hose to intercooler
- remove connector hose from intercooler



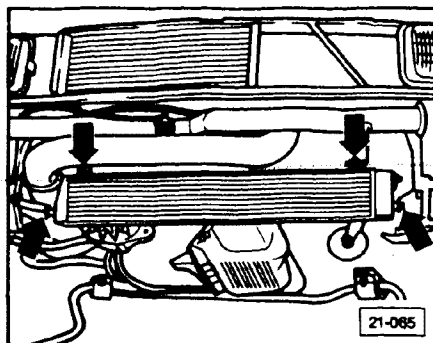
- unscrew (**arrow**) side air ducts from front panel



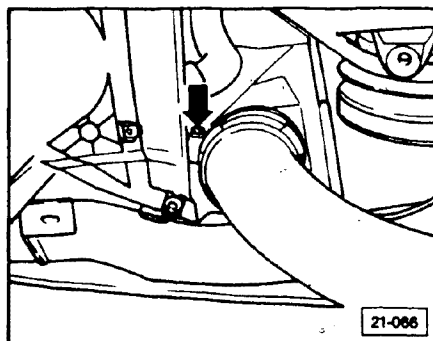
- unscrew side air duct from bottom air duct (**arrows**)



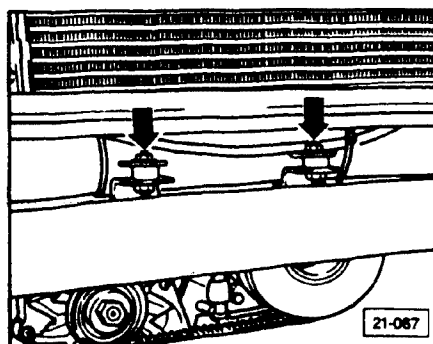
- loosen hose clamp (**arrow**) securing hose to boost pipe
- detach hose (between turbocharger and boost pipe) from boost pipe



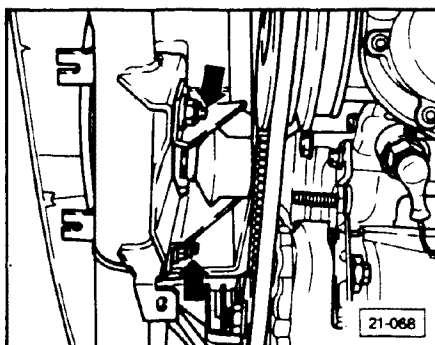
- remove mounting bolts (**arrows**) from auxiliary radiator



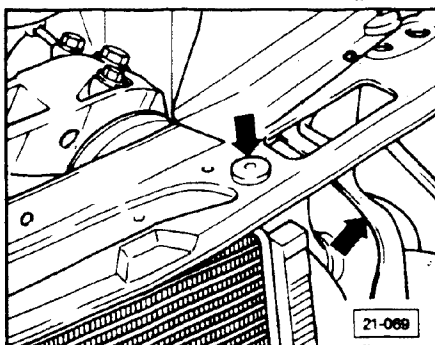
- remove boost pipe from intercooler by releasing hose clip (**arrow**) and two-piece mounting clip



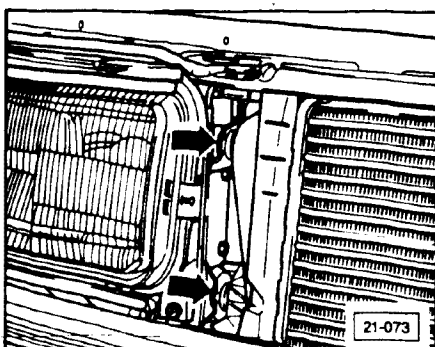
- unbolt boost pipe from crossmember (**arrows**) complete with mounting bushings
- pull boost pipe downward and away from intercooler



- remove nuts (**arrows**) securing torque plate to crossmember



- unbolt intercooler from front panel (**arrow**)
- push side air duct to the left



- push intercooler to the left and out of its rubber mounting
- remove intercooler by pulling unit forward and out of engine compartment

Intercooler, installing

Note

Installation of the intercooler assembly is the reverse of the removal procedures.

Turbocharger and wastegate, checking using VAG 1397

Requirements

- engine coolant temperature 30°C (86°F) minimum
- all vacuum connections must be leak tight
- expose Motronic control unit in A pillar of passenger side footwell

- disconnect vacuum hose from control unit
- connect **VAG 1397** boost pressure gauge between vacuum hose and control unit (**arrows**)

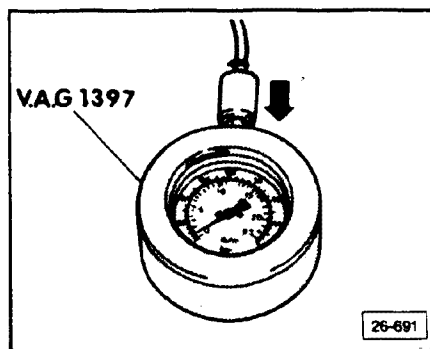
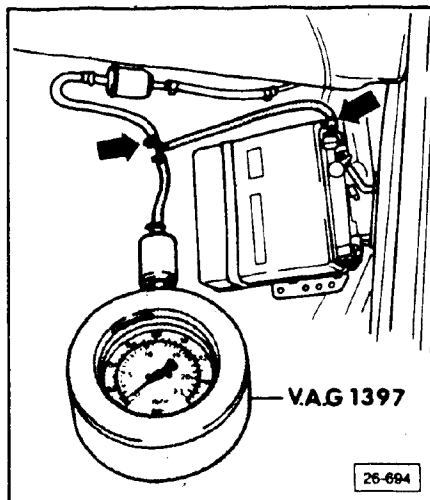
Note

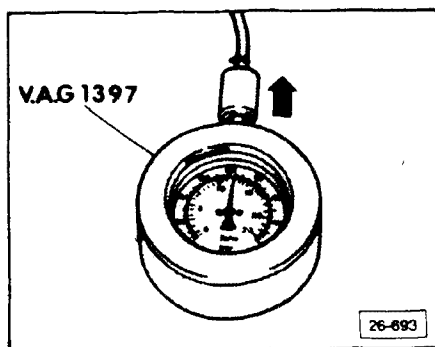
Before measuring boost pressure, drive the vehicle for approximately 2 miles on uninterrupted road (highway, etc.) at a minimum speed of 40 mph.

For safety reasons a second technician must be in car to observe the tachometer and take pressure readings. The tachometer can be accurately and safely observed from the rear seat behind the driver.

While still on the road and after the above driving condition has been met:

- **OPEN** pressure gauge by moving sliding collar **TOWARD** gauge (**arrow**)
- fully depress accelerator pedal in fourth gear starting at a speed of 37 mph
- observe tachometer via second technician





- slide collar of pressure gauge **AWAY** from gauge (to **CLOSE**) at moment when engine speed reaches 3000 rpm via second technician
 - pressure reading must fall within the appropriate altitude on following chart

Pressure (bar)	at	Altitude (feet)
0.78 to 0.85		Sea Level
0.84 to 0.91		1969
0.90 to 0.95		3937
0.94 to 0.98		5906
0.97 to 1.03		7874

If OK

- call up fault memory using **VAG 1551** Diagnostic tester and check for stored faults. repair as necessary. see Repair Group D2 for additional information
- check fuel and ignition systems for problems

If boost pressure reading **NOT OK**

- check wastegate frequency valve using Output check diagnosis. see Repair Group D2 for additional information
- or, trial replace wastegate frequency valve and recheck boost pressure
- check by-pass valve. see page 21,29

If wastegate frequency valve **OK** and boost pressure still **NOT OK**

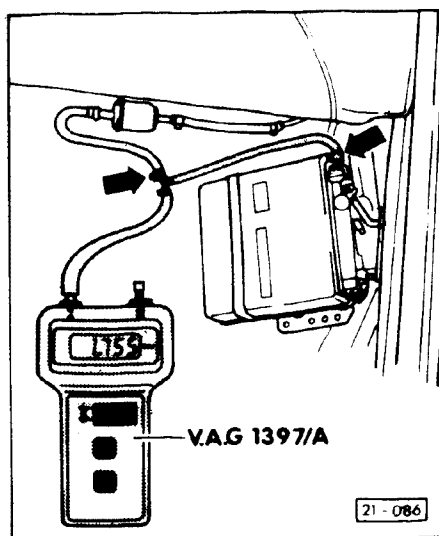
- replace ~~turbo~~ turbocharger

Turbocharger and wastegate, checking using VAG 1397/A

With the introduction of the **VAG 1397/A** pressur tester, boost pressure is no longer measured as relative value (as with the **VAG 1397**) but rather an absolute value. Use the following procedure whenever using the **VAG 1397/A**.

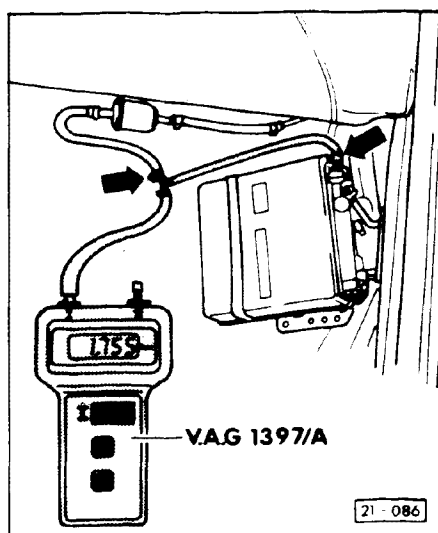
Requirements

- engine coolant temperature 30°C (86°F) minimum
- all vacuum connections must be leak tight
- remove covering from Motronic control unit in passenger side lower A-pillar
- disconnect vacuum hose from control unit
- connect **VAG 1397/A** between removed vacuum hose and control unit by connecting tee adaptor (arrows) at port I of tester
- switch tester to position I
 - to measure absolute pressure
- switch **ON** tester



Note

- by pushing **M** button (memory) on tester, the last displayed value will be stored until the **M** button is pushed again
- memory storage is indicated by flashing commas in the display
- if tester battery becomes weak, an arrow will appear in the upper left corner of the display
- drive the vehicle before testing for a minimum of 2 uninterrupted miles (no traffic lights etc.)
- a second person is required to observe the tester display since the boost pressure is measured while driving
- accelerate vehicle in 4th gear starting at approx. 40 mph using full throttle while watching vehicle tachometer



- at 3000 rpm, push **M** button (memory) on tester
 - based on altitude, display must be:

Altitude in meters:	bars:
Sea level to 1200 m	1.825
1300 m	1.785
1600 m	1.755
2300 m	1.755
2600 m	1.715

If specification is obtained but power drop occurs lower than 2500 rpm

- check for wrong or poor quality fuel (wrong octane: 95 RON minimum), replace if necessary
- check throttle potentiometer (**G 69**) for deceleration fuel shut-off function, see Repair Group 24, section 24-130

If specification not obtained

- read fault memory and perform self-diagnosis, see Repair Group D2
- replace wastegate valve and repeat test

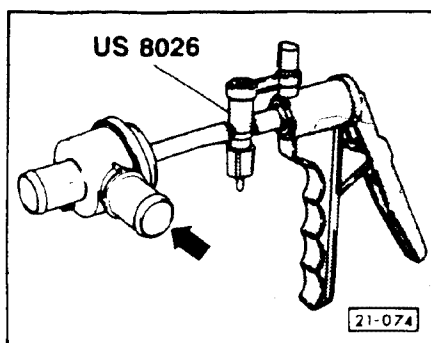
If specification still not obtained

- replace turbo-charger

Bypass valve, checking

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.



- attach hand vacuum pump **US 8026** to by-pass valve as shown
- operate vacuum pump to apply vacuum
 - by-pass valve (**arrow**) must open
- after 30 seconds, release vacuum on tool
 - by-pass valve (**arrow**) must close

If by-pass valve does NOT open or close or if valve leaks

- replace by-pass valve
- ensure that all hose connections to valve are secure and leak-tight