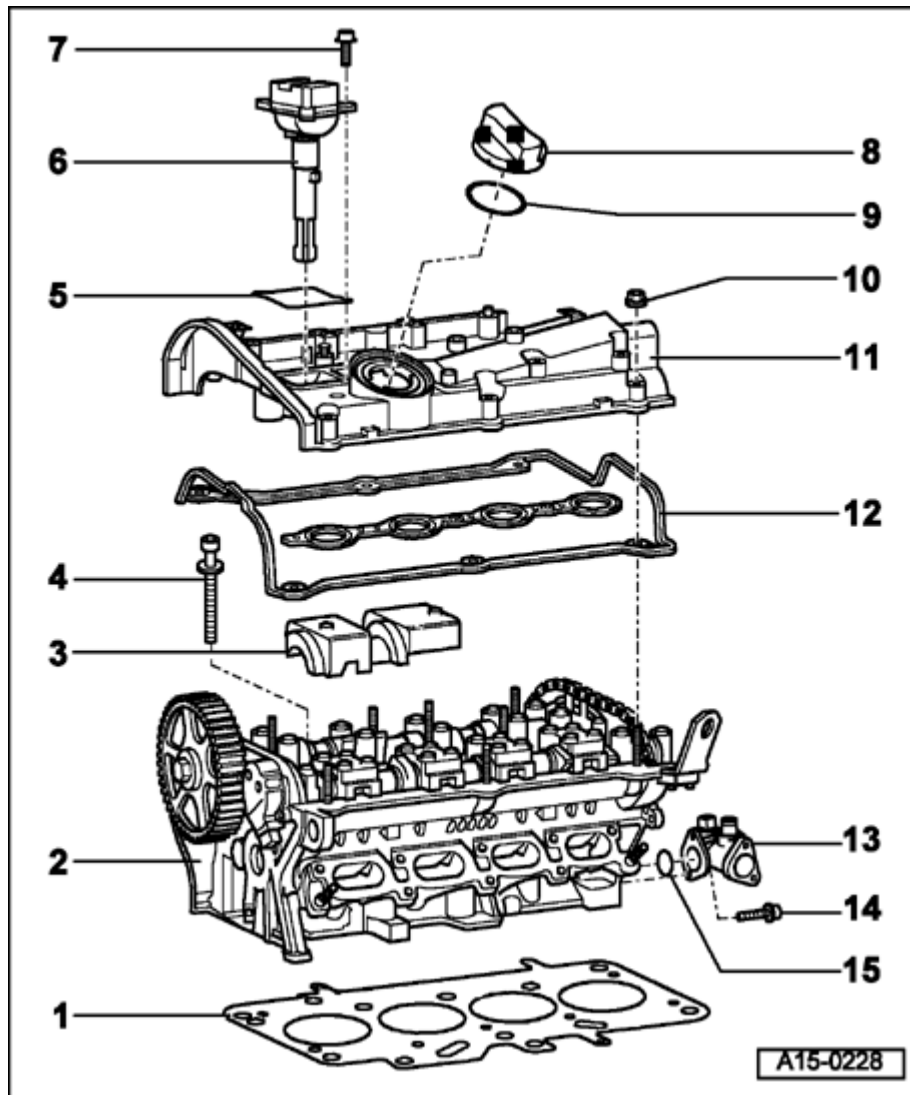


Cylinder head, removing and installing

Note:

- ◆ *Replace cylinder head bolts.*
- ◆ *Always replace self-locking nuts, bolts as well as gaskets and O-rings.*
- ◆ *After installing a replacement cylinder head with camshafts attached, grease contact surfaces between valve lifters and cam lubricating surfaces.*
- ◆ *Do not remove plastic covers protecting exposed valves until immediately before installing cylinder head.*
- ◆ *When replacing the cylinder head or cylinder head gasket, coolant must be completely replaced.*
- ◆ *Cylinder heads with small cracks between the valve seats that are less than 0.3 mm (0.012 in.) wide and/or between one valve seat and only the first 4 threads of the spark plug thread, can continue to be used without reduced service life.*



Part I

1 - Cylinder head gasket

- ◆ Replacing ⇒ [page 15-20](#) cylinder head, removing
- ◆ Installed position: part number faces cylinder head
- ◆ After replacing, replace coolant

2 - Cylinder head

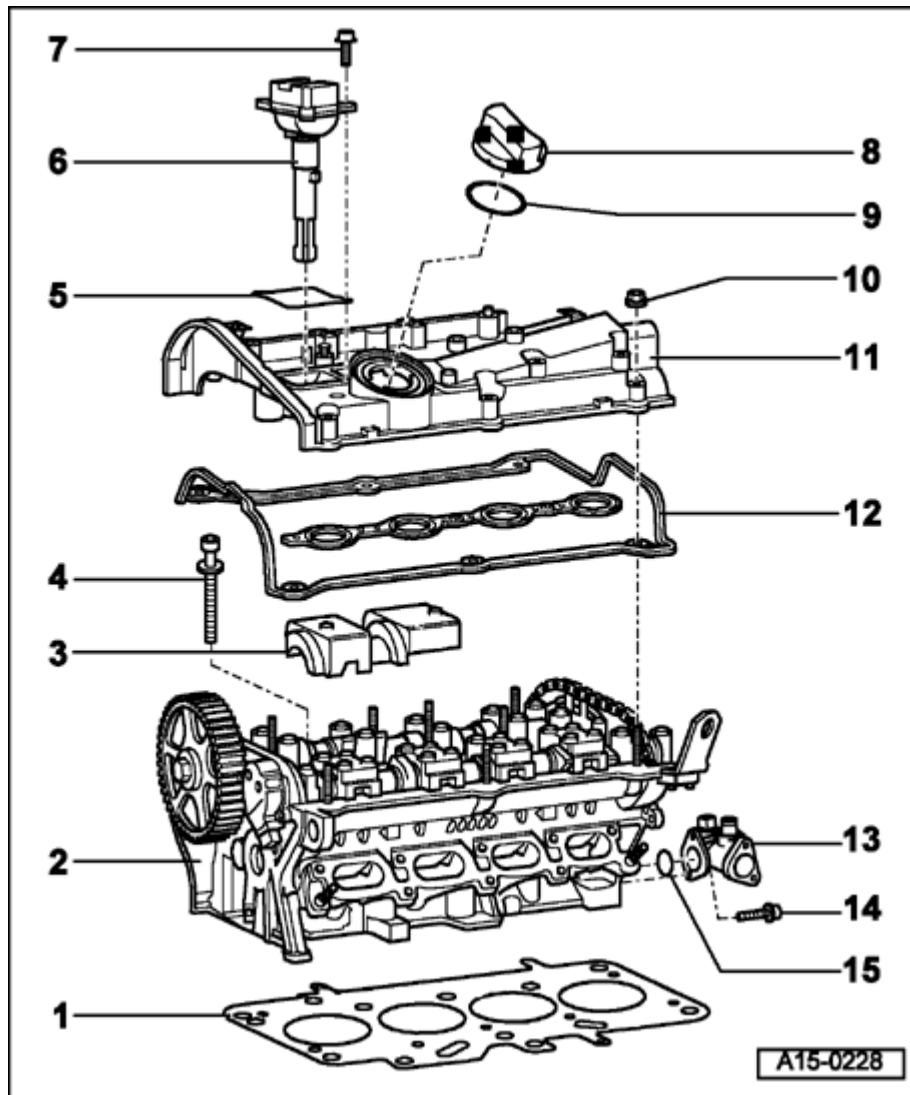
- ◆ Removing ⇒ [Page 15-20](#)
- ◆ Check for distortion ⇒ [Page 15-8](#) , Fig. ⇒ [1](#)
- ◆ Refacing measurement ⇒ [Page 15-8](#) , Fig. ⇒ [2](#)
- ◆ Installing ⇒ [Page 15-25](#)
- ◆ After replacing, replace coolant

3 - Oil deflector

- ◆ Verify correct installation position above intake camshaft between cylinders 1 and 2

4 - Cylinder head bolt

- ◆ Always replace
- ◆ Follow sequence of removal ⇒ [Page 15-20](#)
- ◆ Follow torque sequence ⇒ [Page 15-25](#)

**5 - Gasket**

- ◆ For ignition coil
- ◆ Replace if damaged

6 - Ignition Coil

- ◆ Check

⇒ *Repair Manual, 1.8 Liter 5V Turbo Fuel Injection & Ignition, Repair Group 28*

7 - Bolt

- ◆ 10 Nm (7 ft lb)

8 - Oil filler cap**9 - Gasket**

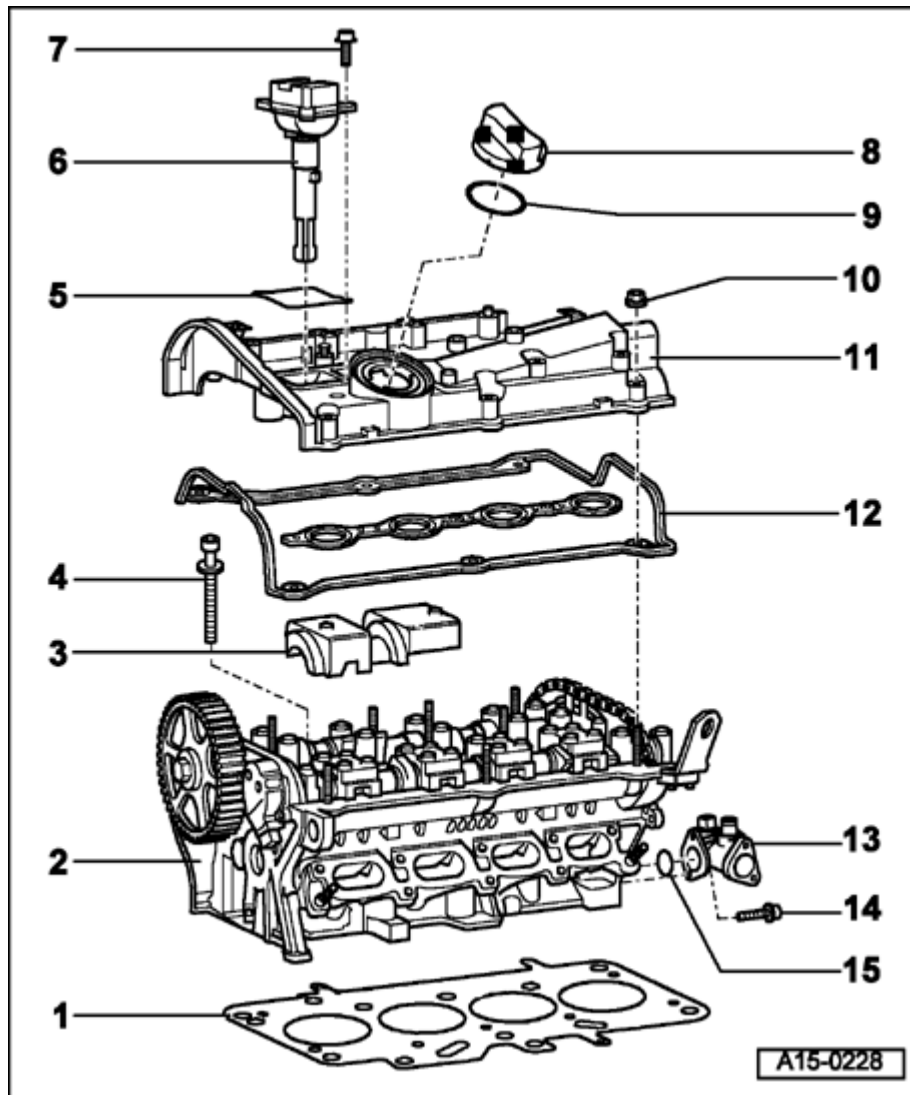
- ◆ Replace if damaged or leaking

10 - Nut

- ◆ 10 Nm (7 ft lb)

11 - Cylinder head cover

- ◆ Removing and installing ⇒ [Page 15-17](#)



12 - Cylinder head cover gaskets

- ◆ Replace if damaged or leaking
- ◆ Before installing, seal contact surfaces with sealant D 454 300 A2 ⇒Fig. ⇒ [3](#) and ⇒Fig. ⇒ [4](#)

CAUTION!

Part numbers are listed here for reference only. Always check with your Parts department for the latest information.

13 - Coolant flange

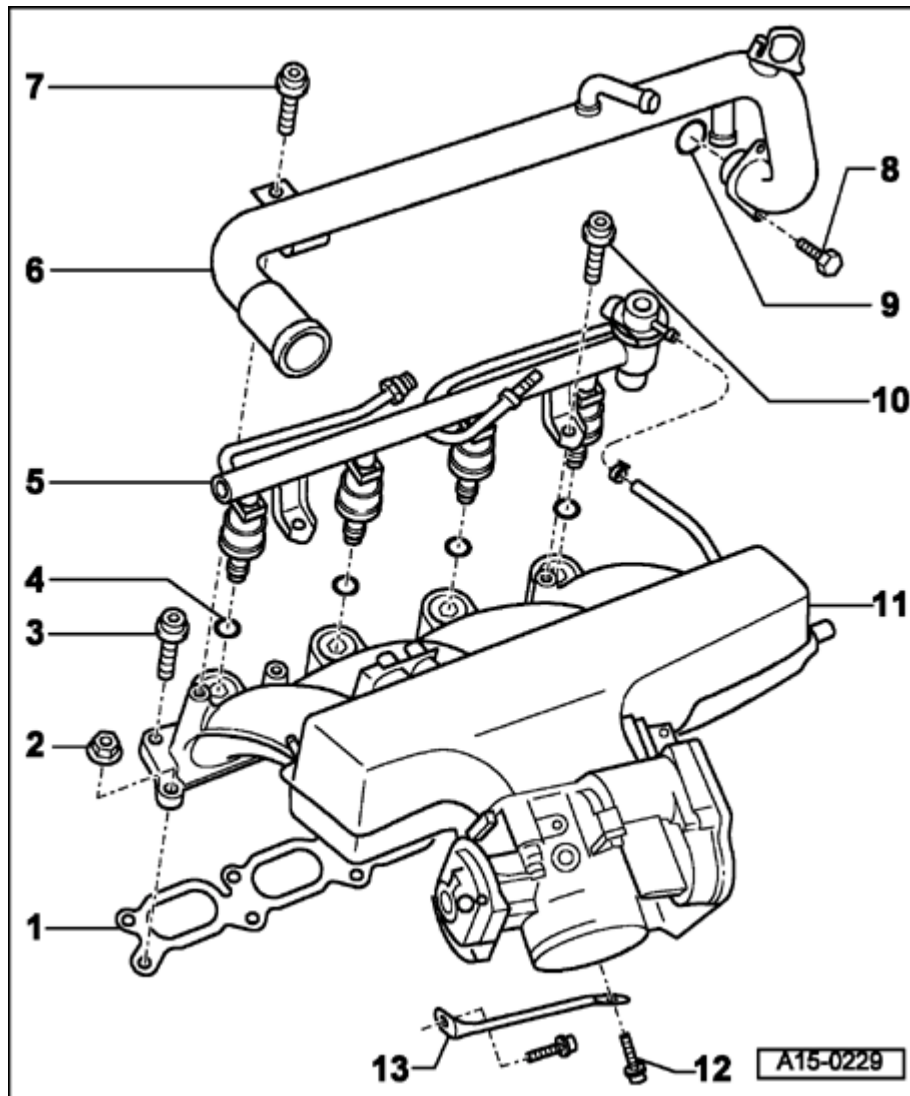
- ◆ With coolant temperature sensor

14 - Bolt

- ◆ 10 Nm (7 ft lb)

15 - O-Ring

- ◆ Always replace



Part II

1 - Gasket

- ◆ Always replace

2 - Nut

- ◆ 10 Nm (7 ft lb)

3 - Socket-head bolt

- ◆ 10 Nm (7 ft lb)

4 - O-Ring

- ◆ For injector
- ◆ Always replace

5 - Fuel rail

- ◆ With injectors

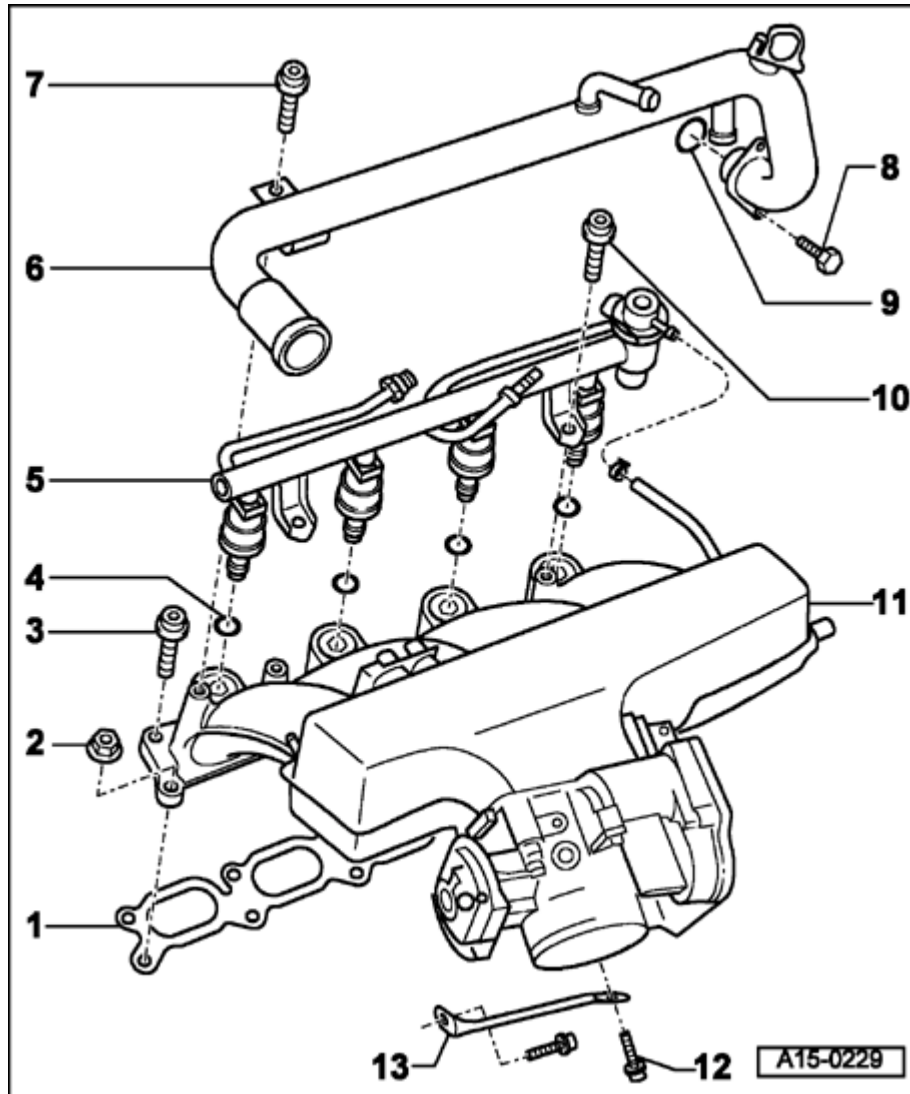
6 - Upper coolant line

7 - Socket-head bolt

- ◆ 10 Nm (7 ft lb)

8 - Bolt

- ◆ 10 Nm (7 ft lb)

**9 - O-Ring**

- ◆ For upper coolant line
- ◆ Always replace

10 - Socket-head bolt

- ◆ 10 Nm (7 ft lb)

11 - Intake plenum

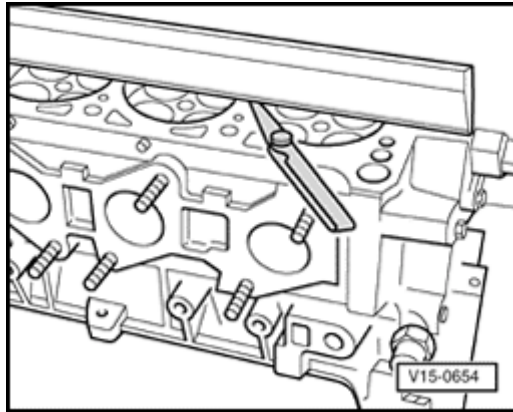
- ◆ Removing and installing ⇒ [Page 15-10](#)

12 - Socket-head bolt

- ◆ 20 Nm (15 ft lb)

13 - Brace

- ◆ For intake manifold

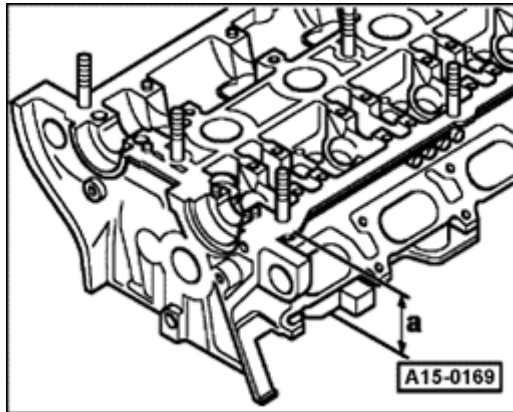


A

Fig. 1 Check cylinder head for distortion

- Using straightedge and feeler gauge, check cylinder head for distortion at multiple points.

Cylinder head distortion must not exceed 0.1 mm (0.004 in.)

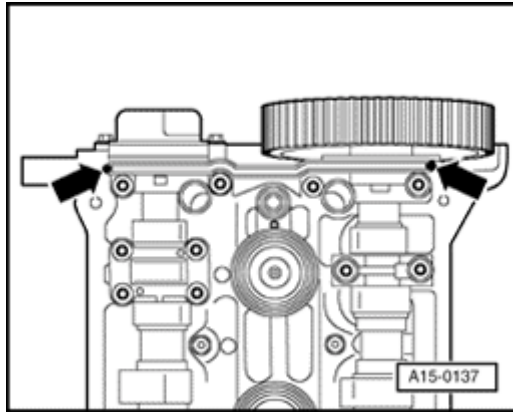


A

Fig. 2 Refacing cylinder head

Refacing cylinder head can only be done to a minimum dimension -a-.

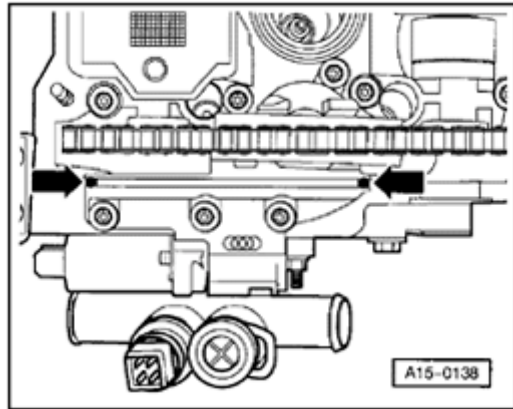
Minimum dimension -a-: 139.25 mm (5.482 in.)



A

Fig. 3 Sealing contact surfaces between double bearing cap and cylinder head

- Using small screwdriver, carefully apply thin layer of sealant D 454 300 A2 to both corners of sealing surface between double bearing cap and cylinder head (arrows).



A

Fig. 4 Sealing contact surfaces between hydraulic chain tensioner and cylinder head

- Using small screwdriver, carefully apply thin layer of sealant D 454 300 A2 to both corners of sealing surface between hydraulic chain tensioner and cylinder head (arrows).

Intake manifold, removing and installing

Removing

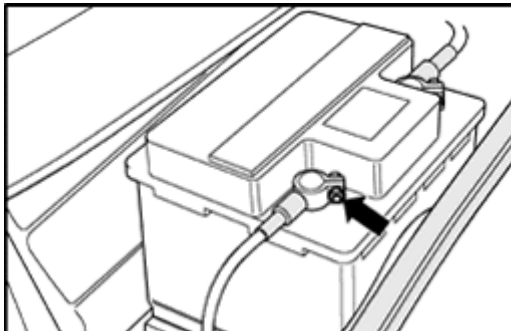
Note:

All tie wraps opened or cut during removal must be reinstalled at the same locations.

CAUTION!

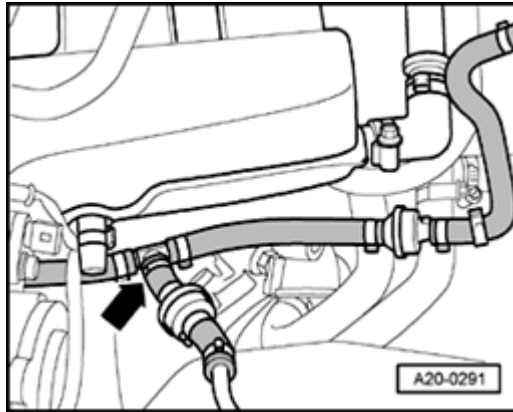
BEFORE disconnecting the battery:

- ◆ **Stop the engine.**
- ◆ **Be sure the ignition is switched OFF (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).**
- ◆ **Determine the correct coding for the anti-theft radio.**



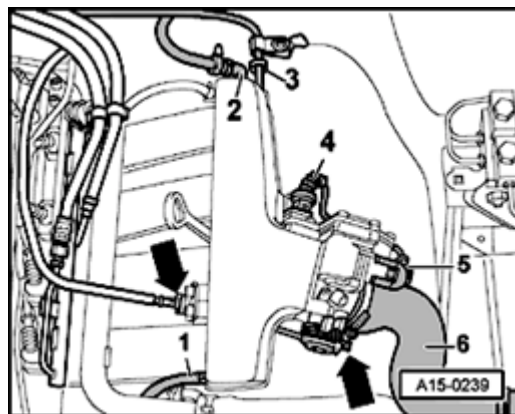
A

- Disconnect battery Ground (GND) strap.
- Remove engine covers.
- Drain coolant ⇒ [Page 19-4](#) .



- A
- Remove hose (arrow) for Leak Detection Pump (LDP) -V144-.

15-12



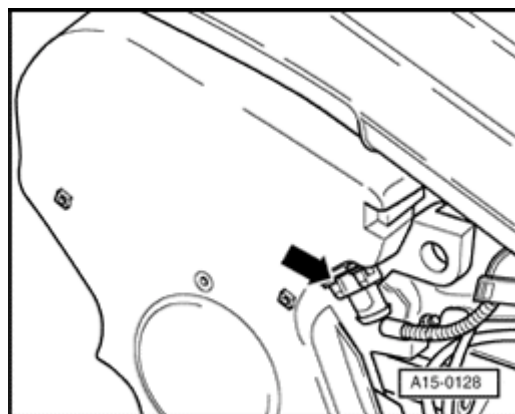
A

- Disconnect Accelerator Pedal (AP) cable from throttle valve control module -J338- and mounting flange (arrows) without removing positioning clip.
- Remove air guide hose -6- at throttle valve control module.
- Remove vacuum hose -1-.
- Disconnect vacuum line -3- to Evaporative Emissions (EVAP) canister.
- Disconnect vacuum hose -2- at brake servo.

Note:

For vehicles with automatic transmission, remove vacuum hose -2- from behind vacuum booster.

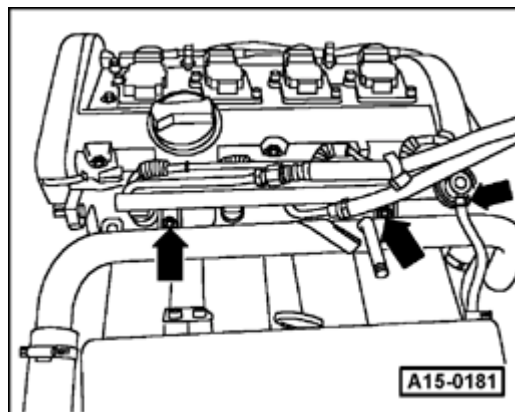
- Disconnect the following harness connectors:
- 4 - For Intake Air Temperature (IAT) sensor -G42-
- 5 - For throttle valve control module -J338-



A

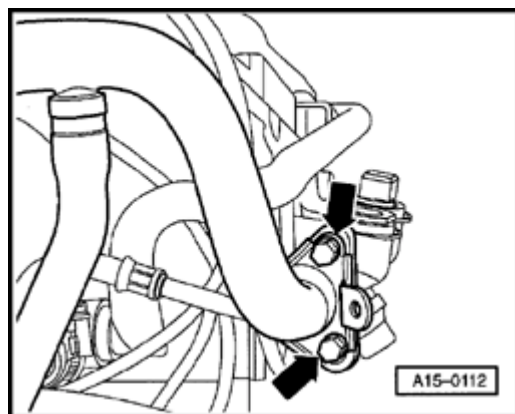
- Disconnect harness connector from Camshaft Position (CMP) sensor -G40- (arrow).

15-13



A

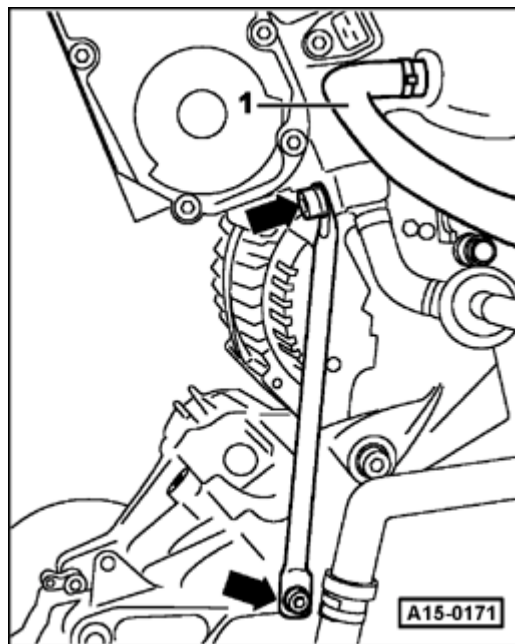
- Unbolt fuel supply rail retaining bolts and disconnect vacuum line at fuel pressure regulator (arrows).
- Disconnect fuel supply rail with injectors from intake manifold and lay aside in rear of engine compartment on clean cloth.
- Disconnect coolant hoses at upper coolant line.



A

- Disconnect upper coolant line at intake line and rear coolant flange at rear of cylinder head (arrows).

15-14



- A**
- Disconnect crankcase ventilation hose -1- at intake manifold.
 - Remove intake manifold brace (arrows).
 - Remove dipstick.
 - Unbolt intake manifold at flange and remove.

Note:

Stuff clean cloths into cylinder head intake ports.

Installing

Installation is the reverse of removal, noting the following:

Note:

Replace gaskets and O-rings.

- Adjust Accelerator Pedal (AP) cable.

⇒ [Repair Manual, Fuel Supply System, Repair Group 20](#)

- Top up coolant ⇒ [Page 19-6](#) .

CAUTION!

Be sure the ignition is switched OFF. Failure to do so may damage the Engine Control Module (ECM).

- Switch ignition off and reconnect battery Ground (GND) strap.
- After connecting battery, enter anti-theft code for radio

⇒ *Radio operating manual*

- Fully close power windows to stop.

- Operate all power window switches again for at least one second in "close" direction to activate "one touch" opening/closing function.

- Set clock to correct time.

- Perform throttle valve control module adaptation to Engine Control Module (ECM).

⇒ *Repair Manual, 1.8 Liter 5V Turbo Fuel Injection & Ignition, Repair Group 24*

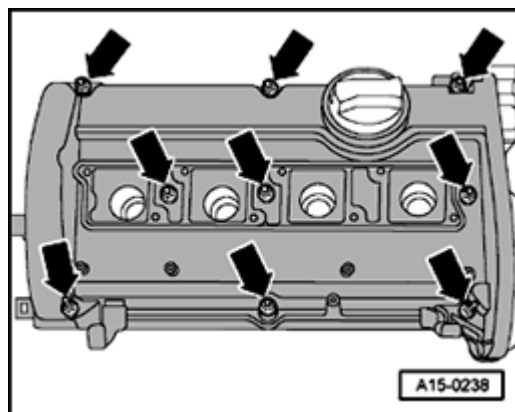
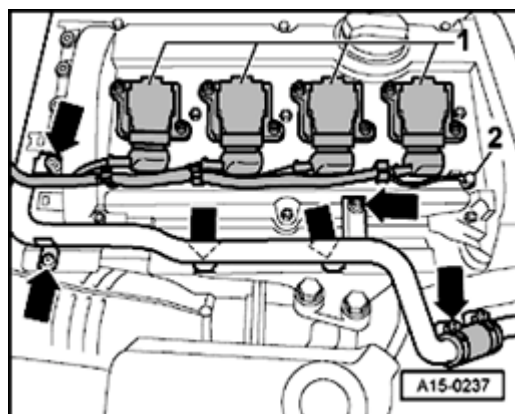
Tightening torques

Component	Tightening torques
Intake manifold to cylinder head	10 Nm (7 ft lb)
Intake manifold brace to intake manifold	20 Nm (15 ft lb)
Intake manifold to bracket	20 Nm (15 ft lb)
Fuel supply rail to intake manifold	10 Nm (7 ft lb)
Coolant line to coolant flange	10 Nm (7 ft lb)
Coolant line to intake manifold	10 Nm (7 ft lb)

Cylinder head cover, removing and installing

Removing

- Remove engine covers.
- A - Unbolt crankcase ventilation line from heatshield and cylinder head cover and disconnect line from front hose (arrows).
- Swing crankcase ventilation line to side.
- Remove 2 retaining clamps for upper toothed belt cover.
- Disconnect harness connectors at ignition coils -1- and unbolt Ground (GND) connection -2-.
- Unbolt ignition coils.



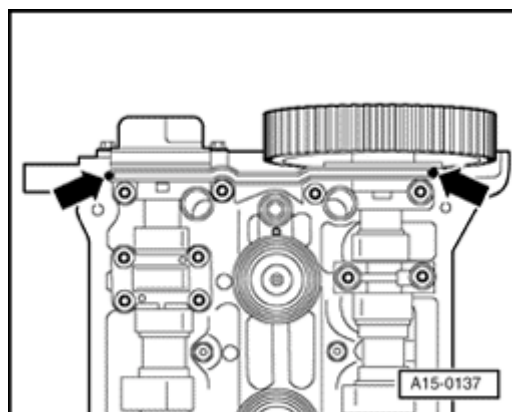
- A - Remove cylinder head cover nuts (arrows) and remove cylinder head cover.

Installing

Installation is the reverse of removal, noting the following:

Note:

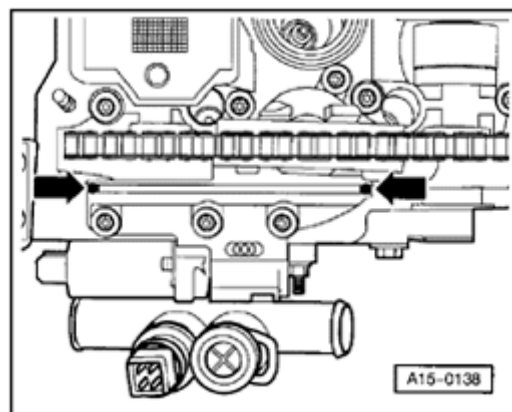
Replace cylinder head cover gaskets if damaged.

**A**

- Using small screwdriver, carefully apply thin layer of sealant D 454 300 A2 to both corners of sealing surface between double bearing cap and cylinder head (arrows).

CAUTION!

Part numbers are listed here for reference only. Always check with your Parts department for the latest information.

**A**

- Using small screwdriver, carefully apply thin layer of sealant D 454 300 A2 to both corners of sealing surface between hydraulic chain tensioner and cylinder head (arrows).
- Tighten cylinder head cover nuts alternately in diagonal sequence.
- Make sure toothed belt cover is installed properly.

Tightening torques

Component	Tightening torques
Cylinder head cover to cylinder head	10 Nm (7 ft lb)
Ignition coils to cylinder head cover	10 Nm (7 ft lb)
Crankcase ventilation line to cylinder head cover	10 Nm (7 ft lb)

Cylinder head, removing

- Engine installed
- Lock carrier in service position ⇒ [Page 13-1](#)

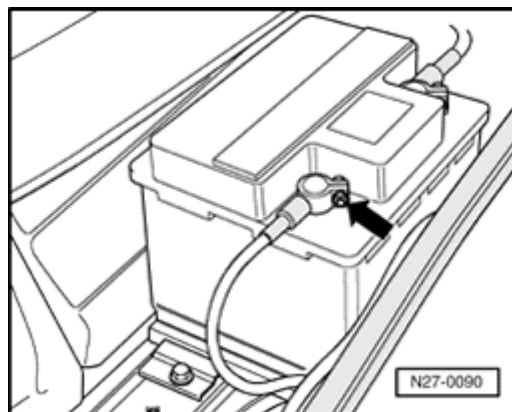
Note:

- ◆ *Secure all hose connections with original equipment clamps ⇒ parts catalog.*
- ◆ *All tie wraps opened or cut during removal must be reinstalled at the same locations.*

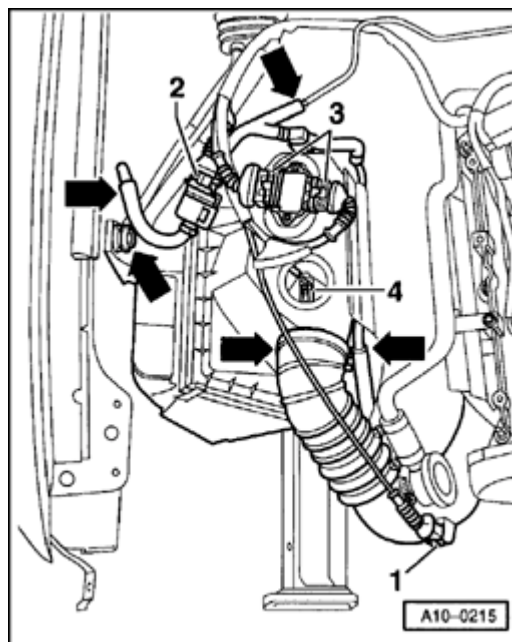
CAUTION!

BEFORE disconnecting the battery:

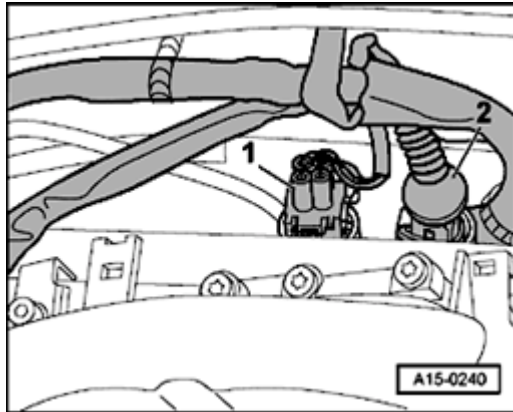
- ◆ **Stop the engine.**
- ◆ **Be sure the ignition is switched OFF (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).**
- ◆ **Determine the correct coding for the anti-theft radio.**



- A**
- Remove Ground (GND) connection.
 - Drain coolant ⇒ [Page 19-4](#) .
 - Remove intake manifold ⇒ [Page 15-10](#) .
 - Remove ribbed belt and ribbed belt tensioner ⇒ [Page 13-15](#) .

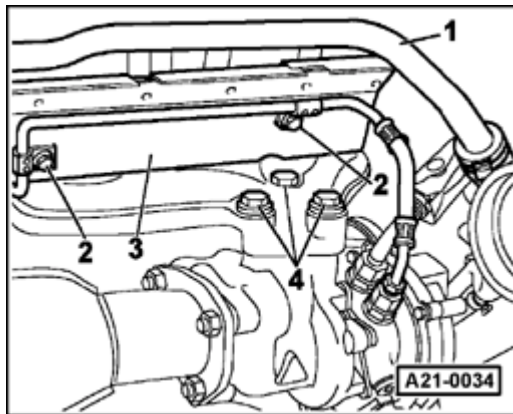


- A**
- Remove the following lines/harness connectors:
 - 1 - At Wastegate Bypass Regulator Valve -N75-
 - 2 - At Evaporative Emission (EVAP) Canister Purge Regulator Valve - N80-
 - 3 - At Power outage stage -N122-
 - 4 - At Mass Air Flow (MAF) sensor -G70-
 - Pull off hose connections and remove air cleaner element housing (arrows).



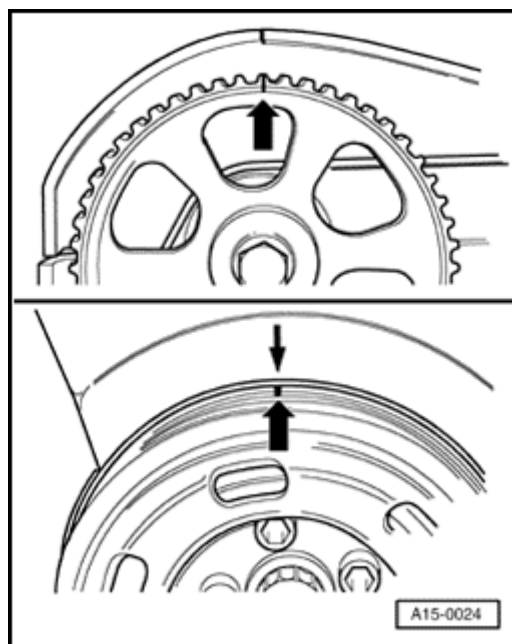
A

- Disconnect harness connector -1- at Engine Coolant Temperature (ECT) sensor -G2-/-G62-.
- Disconnect harness connector -2- at temperature sensor II -G18-.
- Unclip all connections from cylinder head and move clear.



A

- Remove crankcase ventilation line -1-.
- Remove oil supply line at cylinder head -2-.
- Remove heat shield -3-.
- Unbolt turbocharger from exhaust manifold -4-.
- Disconnect coolant hose to heat exchanger at rear of cylinder head, also detach retaining clamps at connecting flange.
- Remove upper toothed belt cover ⇒ [Page 13-29](#) .

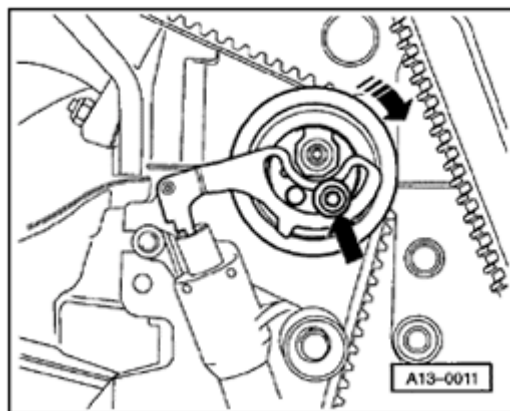


- A
- Turn crankshaft at central bolt of toothed belt gear in direction of engine rotation to TDC Cyl. 1 marking (arrows).

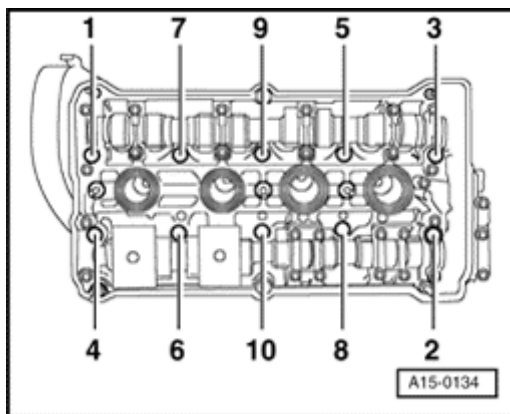
CAUTION!

Before removing toothed belt, note direction of rotation with chalk or felt-tip marker. Reversing the direction of rotation of a used belt can destroy the belt.

15-24



- A**
- Using Torx[®] wrench T45, loosen toothed belt tensioner (lower arrow).
 - Push down on toothed belt tensioner.
 - Remove toothed belt from camshaft gear.
 - Remove TORX[®] bolt and swing belt tensioner assembly bracket forward.
 - Remove cylinder head cover ⇒ [Page 15-17](#) .

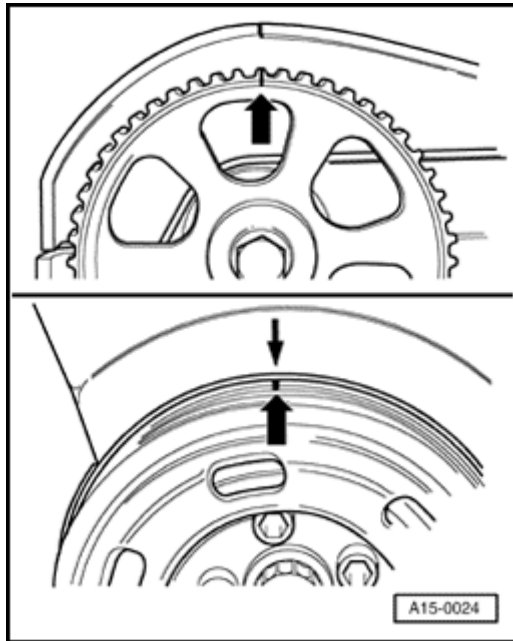


- A**
- Remove cylinder head bolts in sequential order as shown in illustration.
 - Remove cylinder head.

Cylinder head, installing

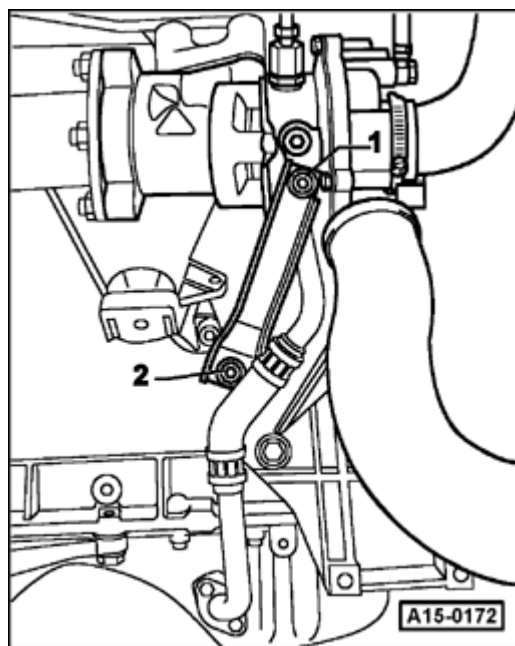
Note:

- ◆ *Always replace cylinder head bolts.*
- ◆ *Note inner 12-point or Polydrive versions of cylinder head bolts ⇒ [Page 15-1](#) .*
- ◆ *Always replace self-locking nuts, bolts, gaskets and O-rings.*
- ◆ *Carefully remove any sealant residue from cylinder head or engine block repairs. Avoid any scratches or scoring.*
- ◆ *Thoroughly remove all sanding and grinding residue.*
- ◆ *Do not remove new cylinder head gasket from package until immediately before installing.*
- ◆ *Handle gasket with extra care. Silicon layer and grooved areas can be damaged leading to leakage.*
- ◆ *Pocket holes in engine block for cylinder head bolts must be free of oil and coolant.*



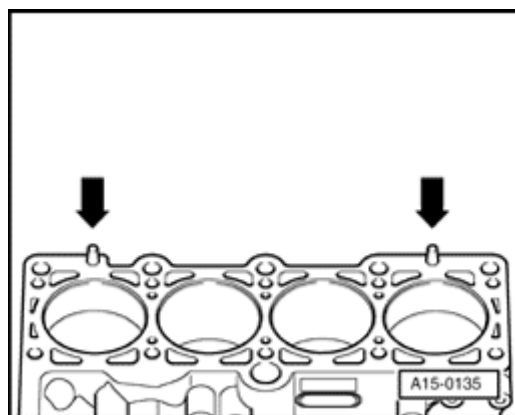
A

- Before installing cylinder head, set crankshaft and camshaft to TDC Cyl. 1 marking (arrows).



A

- Loosen bolts -1- and -2- at turbocharger bracket two turns to reduce likelihood of any tension while installing cylinder head.

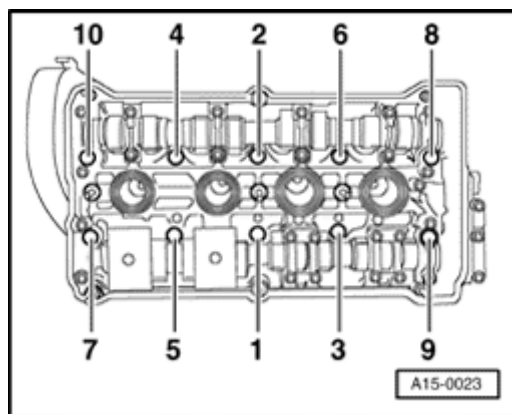


A

- Install cylinder head gasket.

Note:

- ◆ Pay close attention to pilot pins (arrows) in engine block.
 - ◆ Pay attention to installation position marking for cylinder head gasket: Part number must be visible from intake side.
- Install cylinder head.



A

- Insert cylinder head bolts and hand tighten.
- Tighten cylinder head bolts in sequential order, in two stages:
 - ◆ Step 1 = 60 Nm (44 ft lb)
 - ◆ Step 2 = additional 1/2 turn using rigid wrench (180° is equivalent to two 90° turns)

Note:

It is not necessary to re-tighten the bolts.

- Using new gasket, bolt turbocharger to exhaust manifold and bolt bracket to engine block ⇒ [Page 21-24](#) .
- Install cylinder head cover ⇒ [Page 15-18](#) .
- Install toothed belt (adjust valve timing) ⇒ [Page 13-32](#) .

Note:

Follow all procedures for removing and installing toothed belt ⇒ [Page 13-29](#) .

- Install ribbed belt and ribbed belt tensioner ⇒ [Page 13-15](#) .

Note:

When installing ribbed belt, make sure it is seated correctly on the pulleys.

- Adjust Accelerator Pedal (AP) cable.

⇒ [Repair Manual, Fuel Supply System, Repair Group 20](#)

- Replace coolant ⇒ [Page 19-6](#) .

CAUTION!

Be sure the ignition is switched OFF. Failure to do so may damage the Engine Control Module (ECM).

- Switch ignition off and reconnect battery Ground (GND) strap.
- After connecting battery, enter anti-theft code for radio.

⇒ *Radio operating manual*

- Using power window switch, raise windows to stop.

- Operate all power window switches again for at least one second in "close" direction to activate "one touch" opening/closing function.

- Set clock to correct time.

- Perform throttle valve control module adaptation to Engine Control Module (ECM).

⇒ *Repair Manual, 1.8 Liter 5V Turbo Fuel Injection & Ignition, Repair Group 24*

Tightening torques

Component	Tightening torque
Intake manifold brace to intake manifold	20 Nm (15 ft lb)
Intake manifold brace to bracket	20 Nm (15 ft lb)
Turbocharger to exhaust manifold	35 Nm (26 ft lb)
Turbocharger bracket to turbocharger (bolt and washer assembly M8)	40 Nm (30 ft lb)
Turbocharger bracket to cylinder block	45 Nm (33 ft lb)
Retainer straps for oil supply line to cylinder head	20 Nm (15 ft lb)

Compression, checking

Special tools and equipment

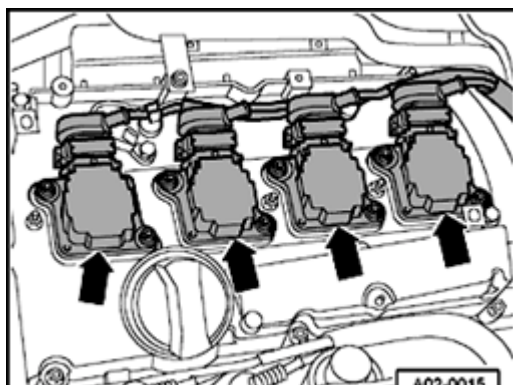
- ◆ VAG1381 or VAG1763 compression tester
- ◆ 3122B spark plug removal tool

Test condition

- Minimum engine oil temperature: 30 ° C (86 ° F)

Test procedure

- Remove engine covers.
- Switch ignition off and remove harness connectors to ignition coils.
- Unbolt ignition coils (arrows).
- Remove all harness connectors to fuel injectors.
- Using 3122B spark plug removal tool, remove all spark plugs.
- Open throttle to Wide Open Throttle (WOT) position.
- Using VAG1381 or VAG1763 compression tester, test engine compression.



Note:

Use VAG1381 or VAG1763 compression tester ⇒ user manual.

- Activate starter until no further pressure increases are indicated by VAG1381 or VAG1763 compression tester.

Compression pressure

Engine code	New	Wear limit
AEB	10.0-13.0 bar (145-188.5 psi)	7.0 bar (101.5 psi)

Permissible difference between all cylinders: 3 bar (43 psi)

- Install spark plugs and ignition coils.
- Check DTC memory.

⇒ *Repair Manual, 1.8 Liter 5V Turbo Fuel Injection & Ignition, Repair Group 01*

Note:

Diagnostic Trouble Codes (DTCs) are stored when harness connectors are disconnected. After testing, check DTC memory and erase.

Tightening torques

Component	Tightening torques
Spark plugs into cylinder head	30 Nm (22 ft lb)
Ignition coils to cylinder head cover	10 Nm (7 ft lb)