

Engine, disassembling and assembling

Note:

- ◆ Use engine stand and bracket 3269 or equivalent.
- ◆ From engine number: AES-003279 a single chain with modified tensioning plate is installed instead of double chain. For this reason chain tensioner has been changed.

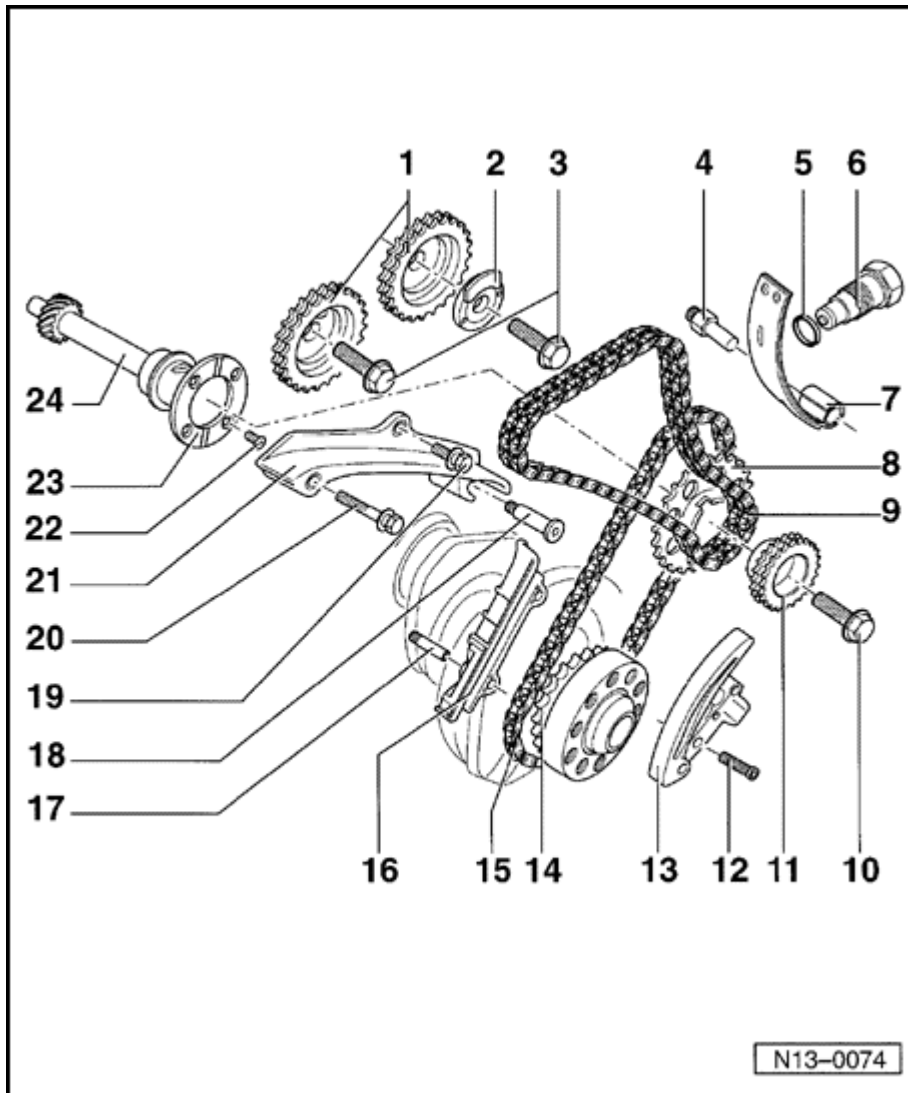
CAUTION!

When there is internal engine damage and if you find metal chips or metal powder in engine oil, thoroughly clean all engine oil passages, replace all oil spray jets, oil check-valve and oil cooler.

I ⇒ [Page 13-2](#)

II ⇒ [Page 13-9](#)

III ⇒ [Page 13-15](#)



Part I

1 - Camshaft sprocket

- ◆ For upper chain (item 18)
- ◆ Removing and installing ⇒ [Page 15-30](#)

2 - Sensor wheel

- ◆ For Camshaft Position sensor -G40-
- ◆ Contact surfaces of timing chain and sensor wheel must be dry when installing.
- ◆ Removing and installing ⇒ [Page 15-30](#)

3 - 100 Nm (74 ft lb)

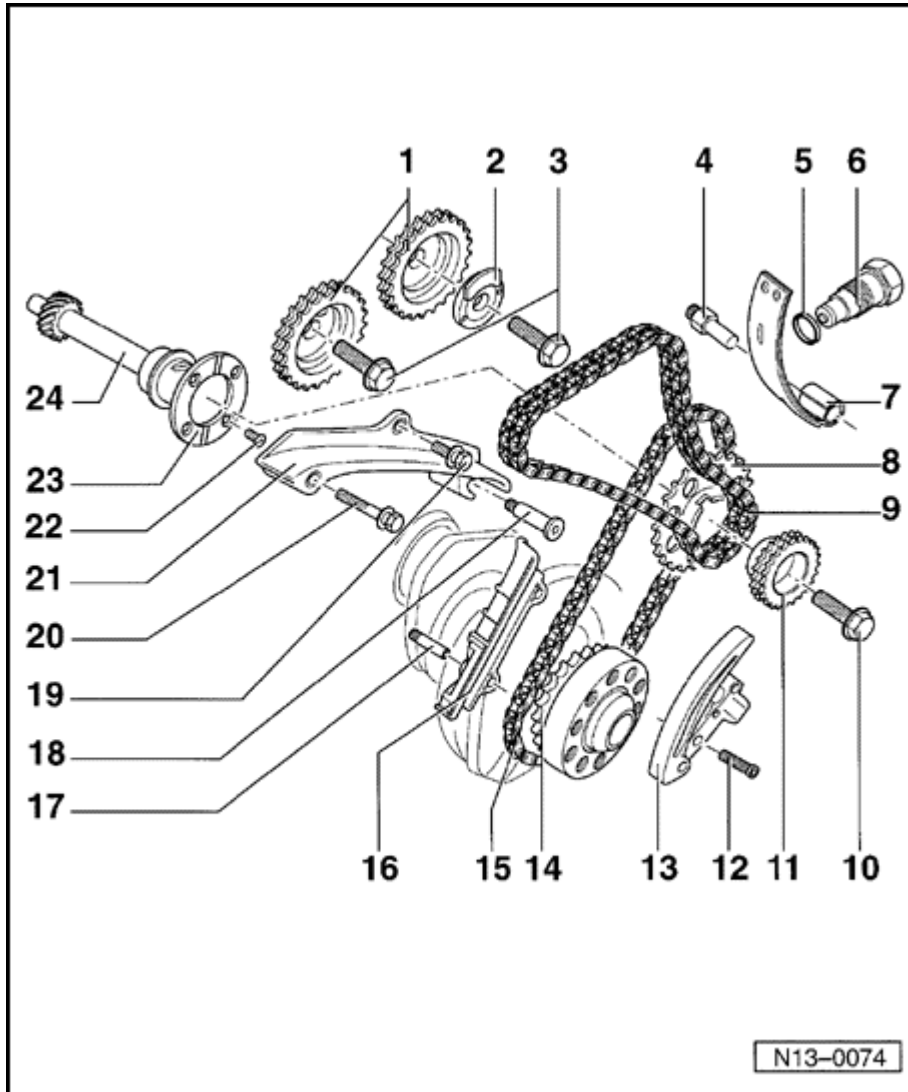
- ◆ Oil bolt head contact surface when installing.
- ◆ To remove and install: counter-hold with 24 mm open wrench on camshaft ⇒ [Page 15-30](#)

4 - Pivot pin

- ◆ 25 Nm (18 ft lb)
- ◆ For tensioning plate (item 16)

5 - Seal

- ◆ Replace



6 - Chain tensioner

- ◆ 30 Nm (22 ft lb)
- ◆ For upper chain (item 18)
- ◆ Up to engine number AES 003278 with oil hole for double chain.
- ◆ Bleed before installing ⇒ [Fig. 3](#)
- ◆ Beginning with engine number AES-003279 only single chains for camshaft drive are installed. Therefore the tensioner does not have an oil bore and can no longer be bled ⇒ [Fig. 2](#) .

CAUTION!

Only turn engine with chain tensioner installed!

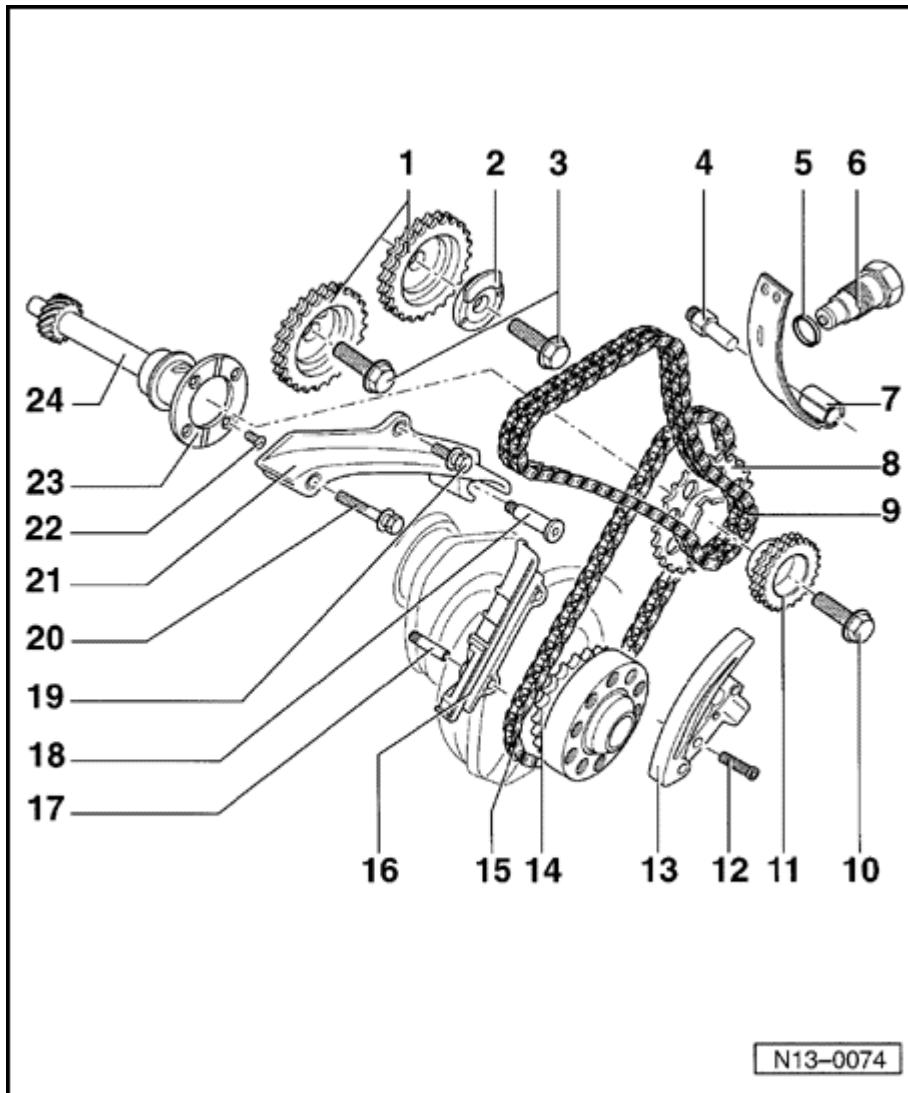
7 - Tensioning plate

- ◆ For camshaft chain (item 18)
- ◆ Up to engine number AES 003278 for double chain
- ◆ As of engine number AES 003279 for single chain

8 - Sprocket

- ◆ For single chain (item 24)

◆ Installing ⇒ [Page 13-25](#)



9 - Upper chain

- Mark direction of rotation before removing ⇒ [Fig. 1](#) .

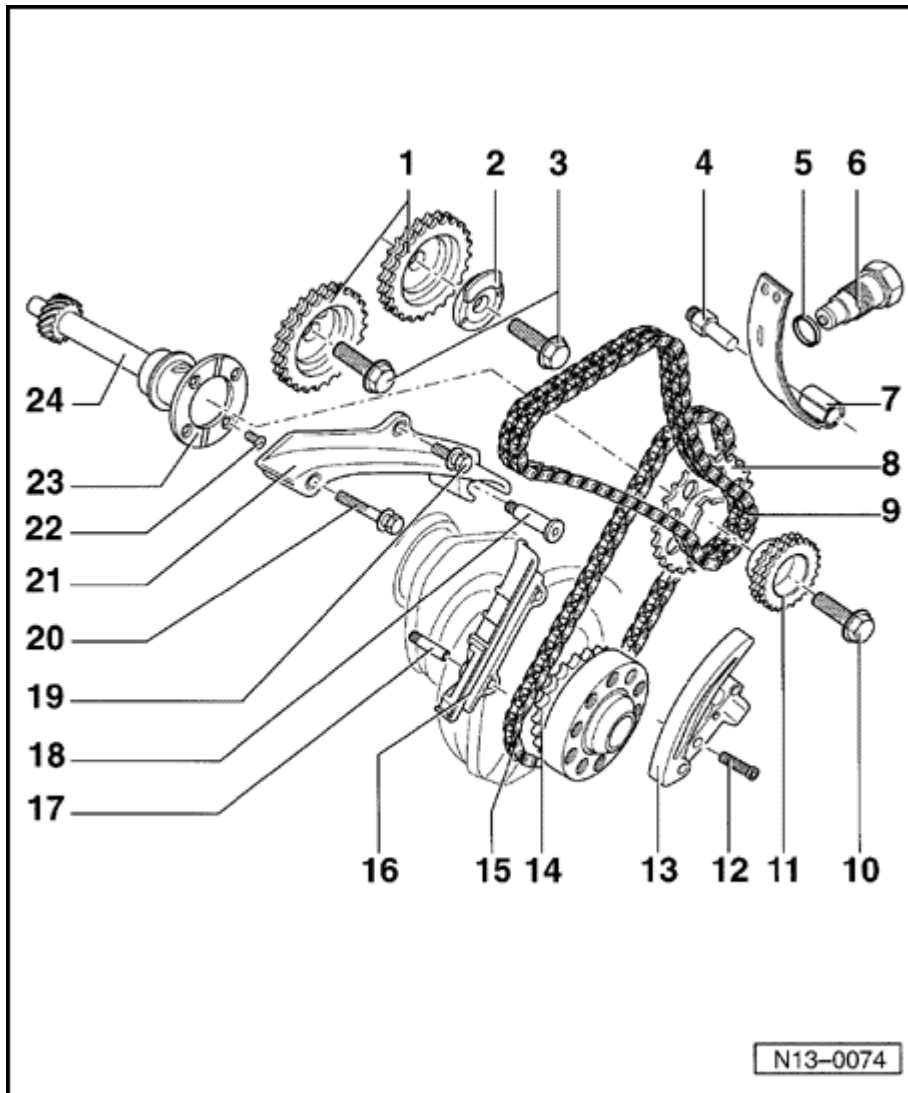
- ◆ Installing ⇒ [Page 13-25](#)
- ◆ Up to engine number AES 003278 for double chain
- ◆ As of engine number AES 003279 for single chain

10 - 100 Nm (74 ft lb)

11 - Sprocket

- ◆ For upper chain (item 18)
- ◆ Installing ⇒ [Page 13-25](#)

12 - 10 Nm (7 ft lb)



13 - Chain tensioner with tensioning plate

- ◆ For lower chain (item 24)
- ◆ Before installing: release locking spline in chain tensioner with a small screwdriver and press tensioning plate against tensioner.

CAUTION!

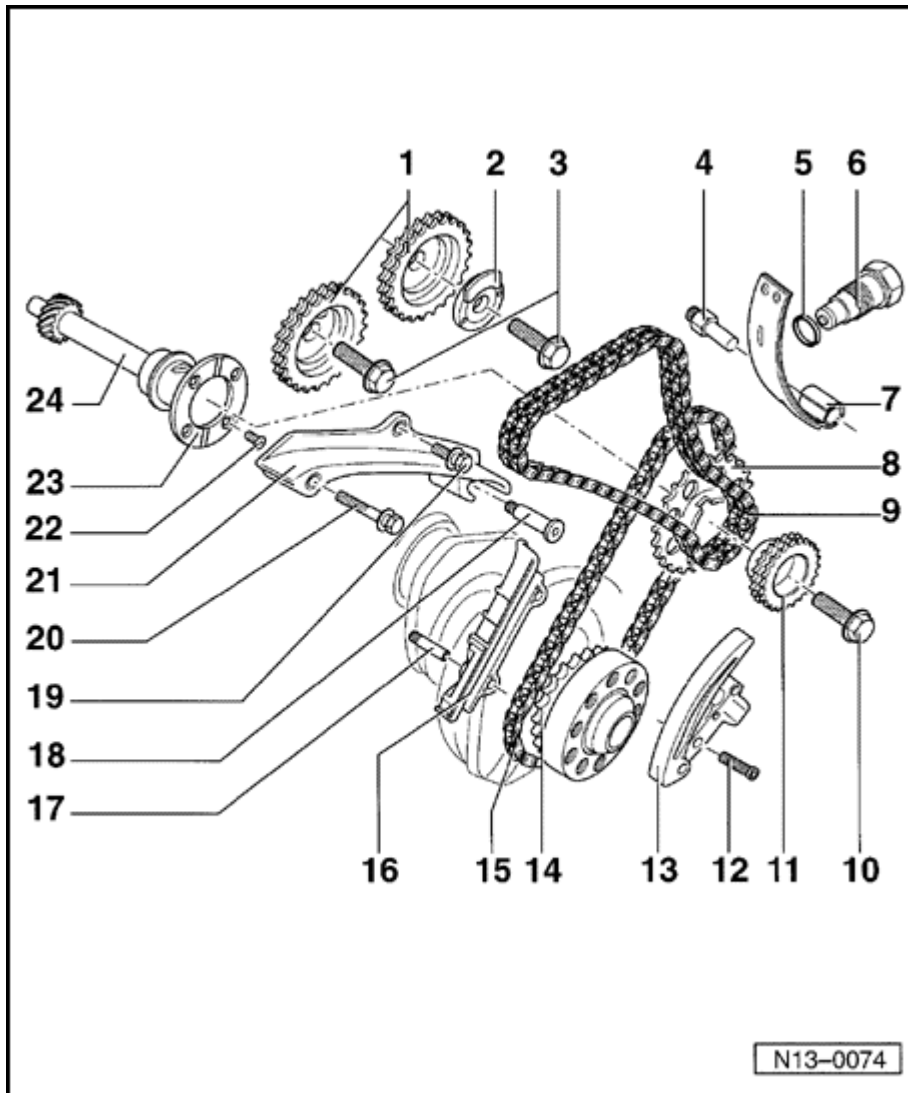
Only turn engine with chain tensioner installed!

14 - Crankshaft sprocket

- ◆ Part of crankshaft
- ◆ Ground down tooth aligned with main bearing joint: = TDC for Cyl No. 1 ⇒ [Page 13-25](#)

15 - Lower chain

- ◆ Mark direction of rotation before removing ⇒ [Fig. 1](#) .
- ◆ Installing ⇒ [Page 13-25](#)



16 - Guide rail

- ◆ For lower chain (item 24)
- ◆ Remove together with lower chain ⇒ page . ⇒ [Page 13-25](#)

17 - Locating pin w/out collar

- ◆ 25 Nm (18 ft lb)
- ◆ For guide rail (item 25)

18 - Locating pin with collar

- ◆ 25 Nm (18 ft lb)
- ◆ For guide rail (item 30)

19 - 20 Nm (15 ft lb)

- Insert using D6 locking fluid .

20 - 20 Nm (15 ft lb)

- Insert using D6 locking fluid.

21 - Guide rail

- ◆ For upper chain (item 18)

22 - 10 Nm (7 ft lb)

23 - Thrust washer

24 - Intermediate shaft

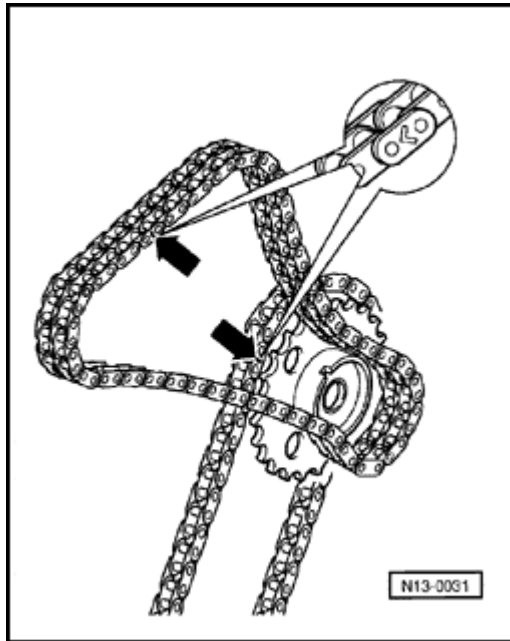


Fig. 1 Marking single and double chains

- Mark single and double chains before removing (with mark pointing in direction of rotation).

CAUTION!

Do NOT mark timing chains using a punch or any other mechanical device that could cause damage.

Note:

- ◆ As of engine number AES 003279 only single-link chains are used. As a result, chain tensioner has no oil hole and does not have to be bled ⇒ [Fig. 2](#).
- ◆ Only use single link chain with tensioning bar.

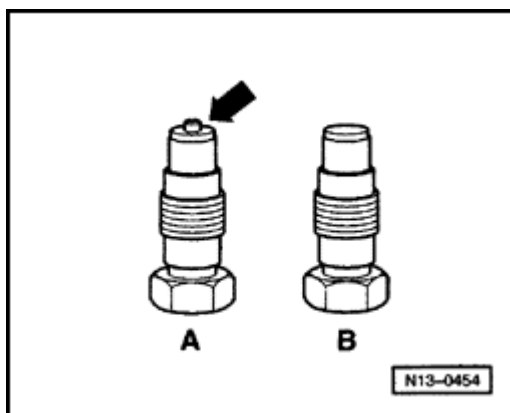


Fig. 2 Chain tensioner for camshaft chain

- ◆ Install chain tensioner -A- with oil hole (arrow) only with double link chain.
- ◆ Install chain tensioner -B- only with single link chain.

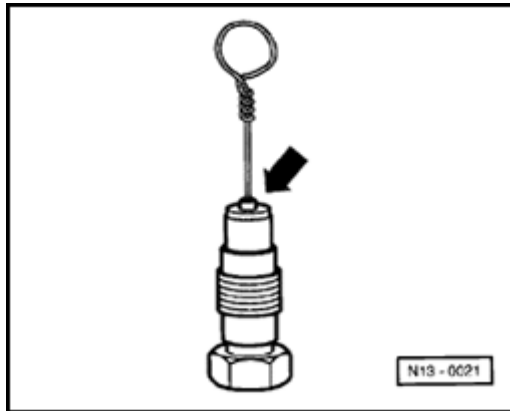


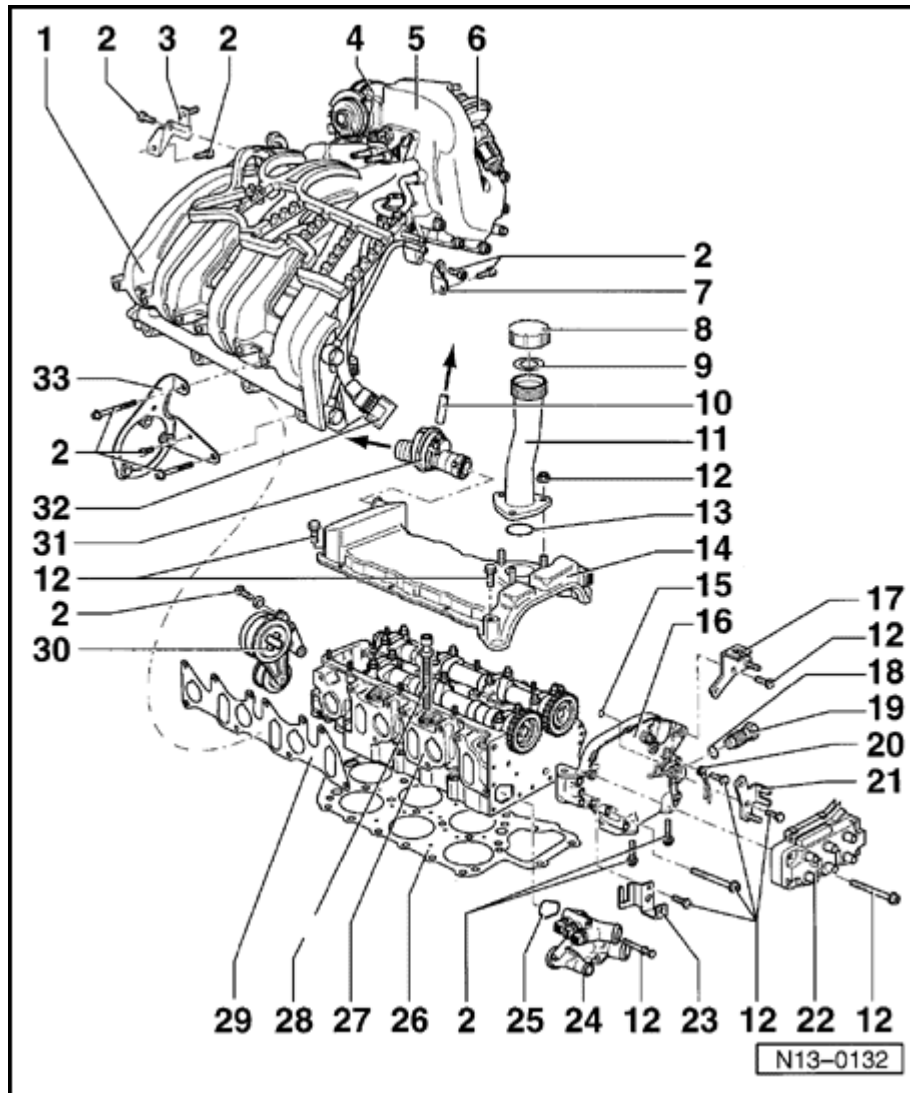
Fig. 3 Chain tensioner for double chain, bleeding

Special tools and equipment

- ◆ Wire (diameter: 0.8 mm)
- Push piece of wire (diameter: 0.8 mm) through pressure piston hole (arrow) up to ball valve and press piston and housing together onto stop.

Note:

If piston moves out again, repeat bleeding procedure.



Part II

1 - Intake manifold

- ◆ Removing and installing cylinder head cover ⇒ [Page 15-9](#)

- Torque to lower intake manifold on cylinder head, then to two rear supports, (items 7 and 3)

- ◆ Disassembly and assembly

⇒ [Repair Manual, 2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code\(s\): AES, Repair Group 24](#)

2 - 25 Nm (18 ft lb)

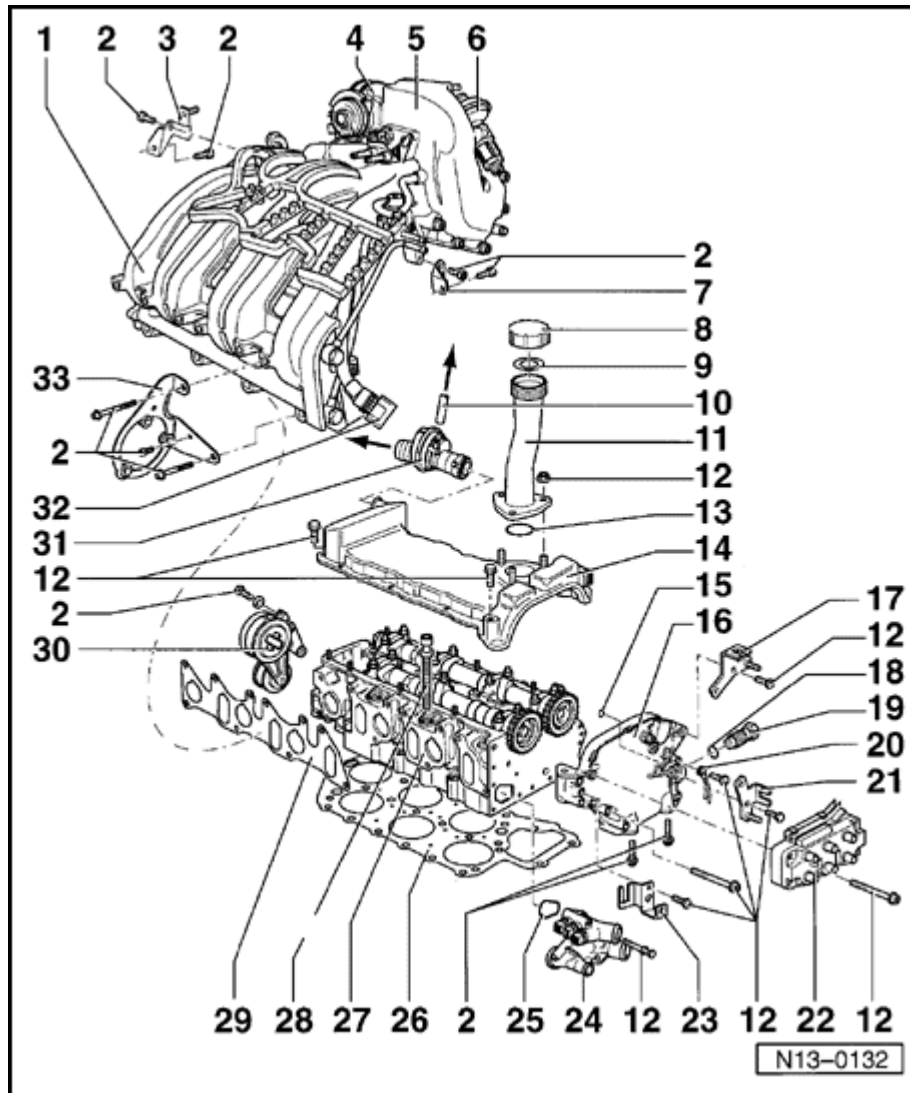
3 - Right rear support

- ◆ Between intake manifold and cylinder head

4 - Throttle Valve Control Module -J338-

- ◆ Heated by coolant
- ◆ Removing and installing:

⇒ [Repair Manual, 2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code\(s\): AES, Repair Group 24](#)



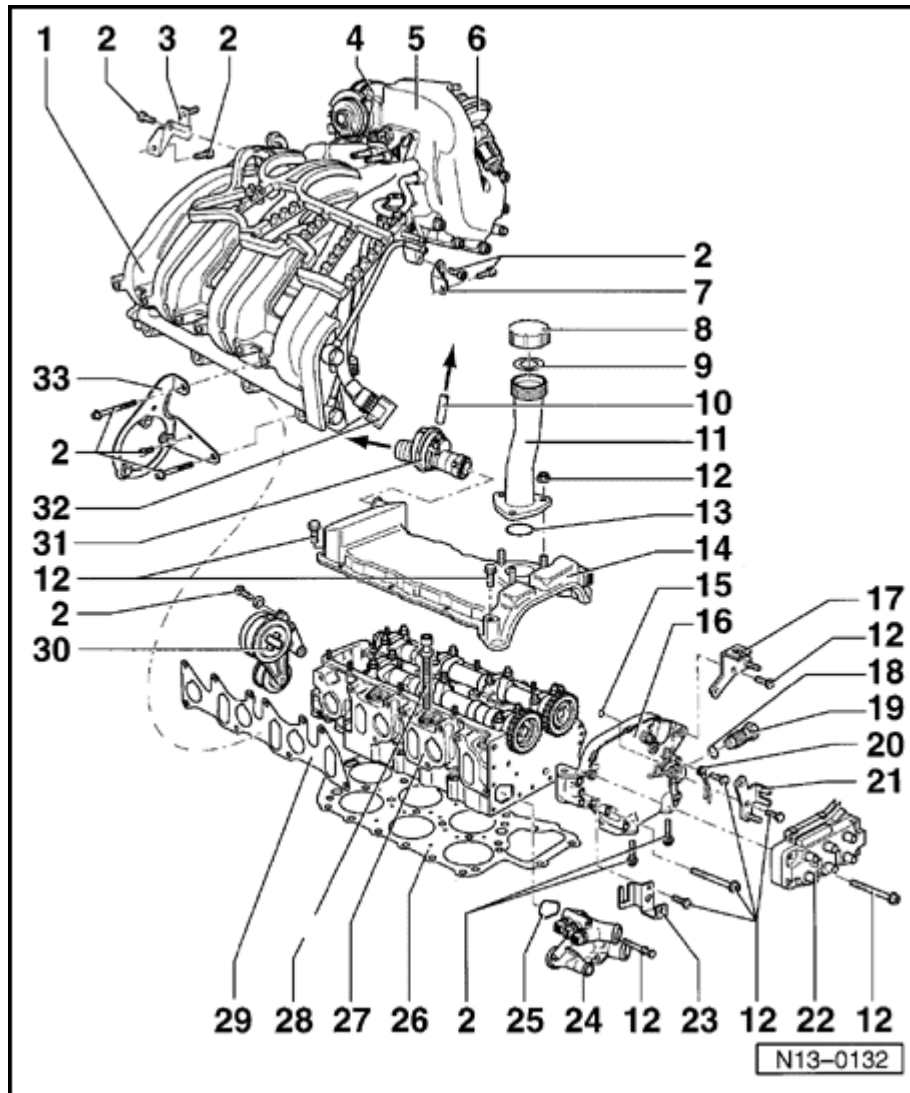
5 - Connection

- ◆ Removing and installing:

⇒ [Repair Manual, 2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code\(s\): AES, Repair Group 24](#)

6 - Exhaust Gas Recirculation (EGR) valve

- ◆ For EGR system ⇒ [Page 26-9](#) , item - 6 -



7 - Left rear support

- ◆ Between intake manifold and cylinder head

8 - Cap

9 - Gasket

- Replace if damaged.

10 - Vacuum hose

- ◆ To EGR valve/intake manifold junction piece ⇒ [Page 26-8](#)

11 - Oil fill pipe

12 - 10 Nm (7 ft lb)

13 - O-ring

- Replace if damaged.

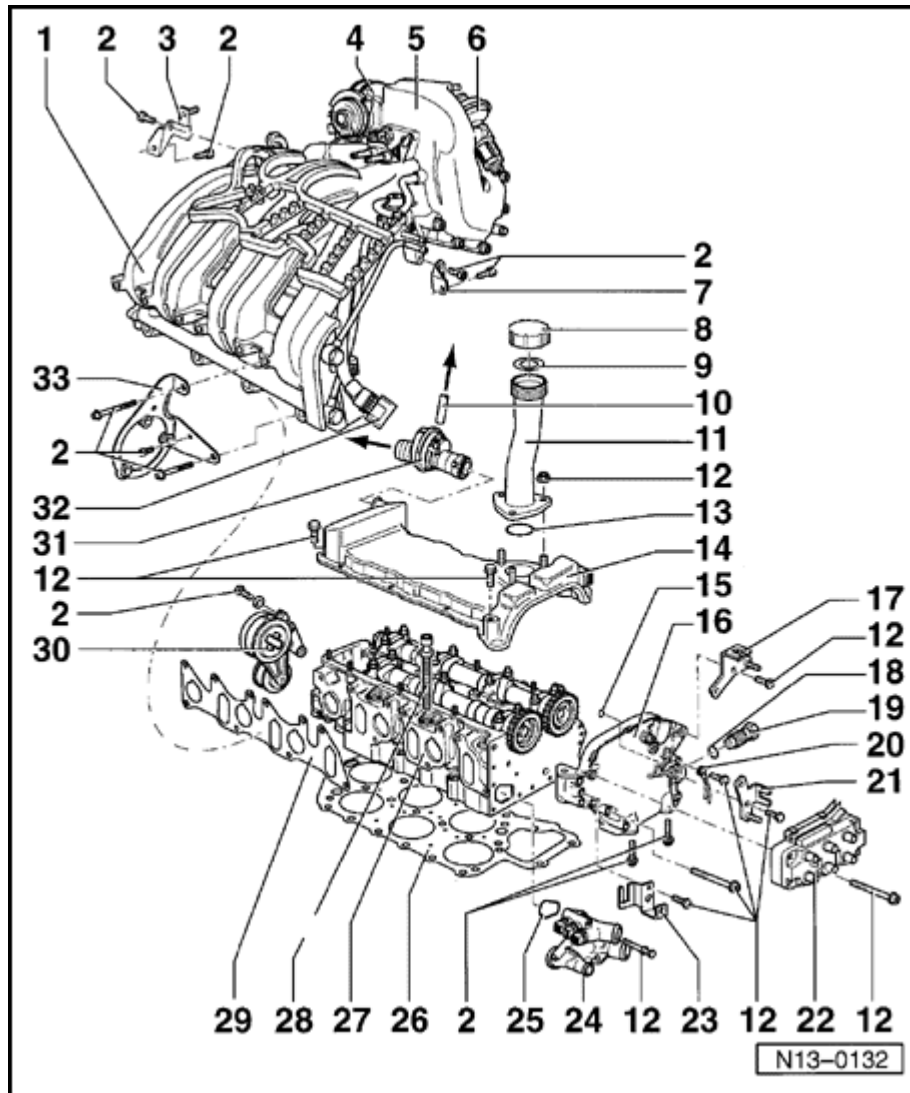
14 - Cylinder head cover

- ◆ Removing and installing ⇒ [Page 15-9](#)

- Replace if damaged or leaking.

15 - O-ring

- Always replace.
- Coat with oil before assembly.
- Insert in camshaft sprocket cover (item 16).



16 - Camshaft sprocket cover

- ◆ Can be removed/installed with cylinder head installed.
 - Coat sealing surfaces with AMV 188 001 02.
- ◆ If only camshaft sprocket cover has been removed, prepare cylinder head gasket for assembly ⇒ [Page 15-8](#) , ⇒ [Fig. 2](#) .

17 - Bracket

- ◆ For -G98- 2-pin EGR Temp. sensor harness connector ⇒ [Page 26-8](#)

18 - Seal

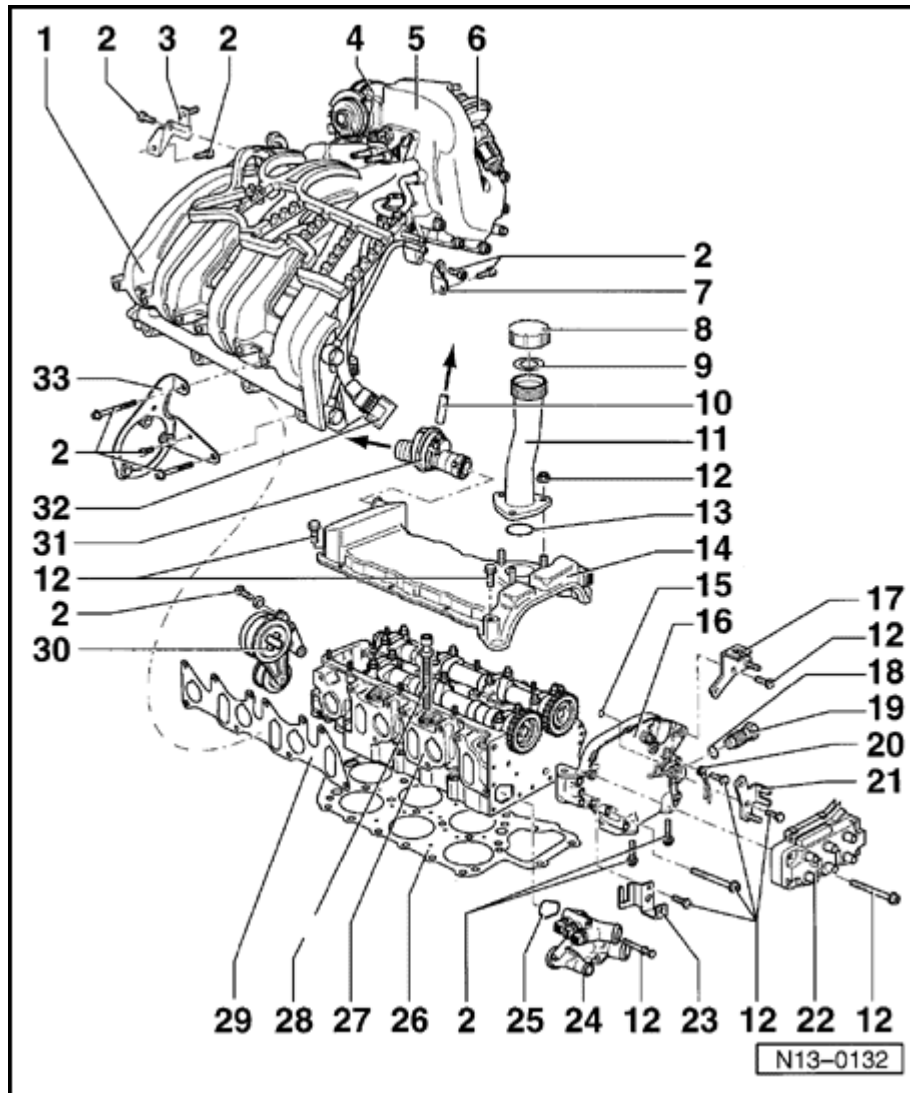
- Always replace,

19 - Chain tensioner

- ◆ 30 Nm (22 ft lb)
- ◆ For upper chain
 - Bleed before installing ⇒ [Page 13-8](#)
- ◆ Beginning with engine number AES-003279 only single chains for camshaft drive are installed. Therefore the tensioner does not have an oil bore and can no longer be bled.

Only turn engine if chain tensioner is

installed!



20 - Ground connection

21 - Bracket

22 - Ignition coil -N152-*

◆ Checking:

⇒ [Repair Manual, 2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code\(s\): AES, Repair Group 28](#)

23 - Bracket

◆ For fuel injector connectors (item 32)

24 - Thermostat housing

◆ Disassembly and assembly ⇒ [Page 19-12](#)

25 - O-ring

- Always replace

26 - Cylinder head gasket

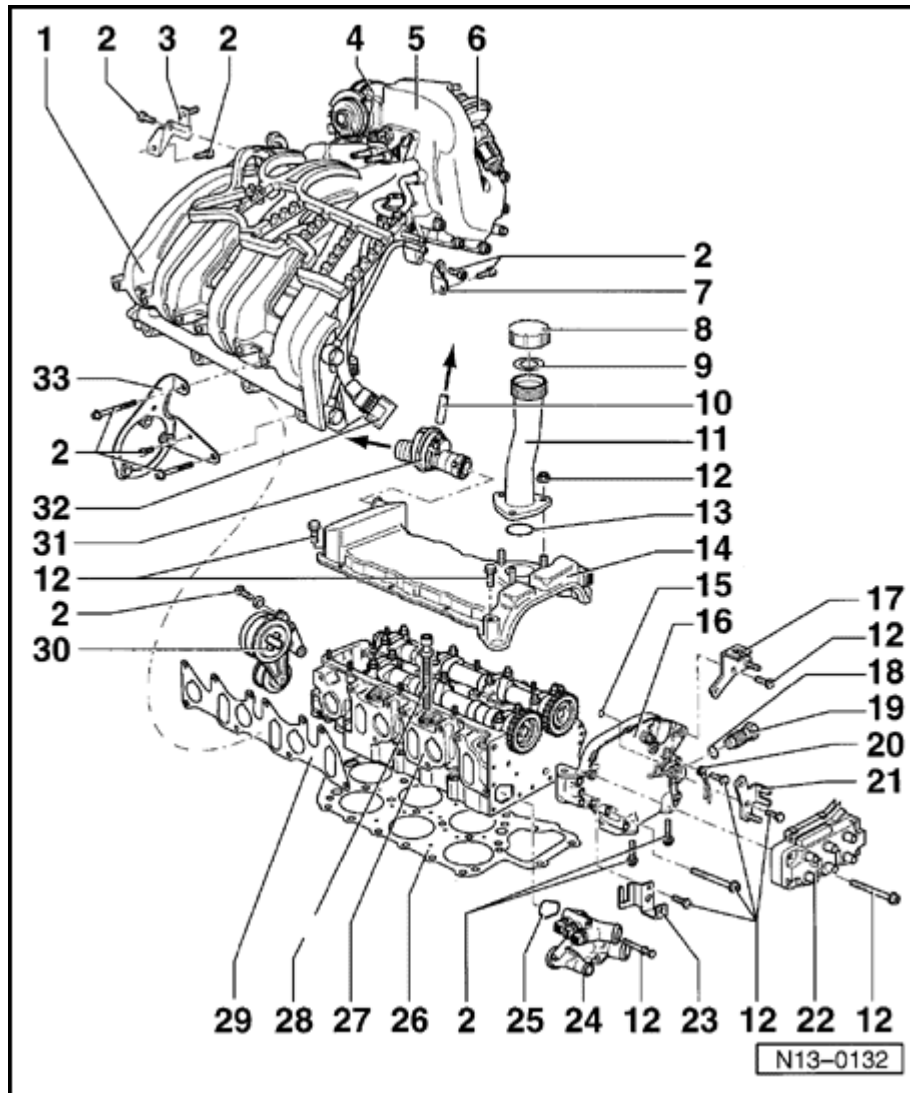
- Always replace.

- If replaced; completely replace engine coolant.

27 - Cylinder head

◆ Removing and installing ⇒ [Page 15-1](#)

- If replaced; completely replace engine coolant.



28 - Cylinder head bolt

- Always replace.
- Follow sequence when loosening and tightening ⇒ [Page 15-17](#) .

29 - Lower intake manifold gasket

- Always replace.

- ◆ Note installed position.

30 - Ribbed belt tensioner

- ◆ Removing and installing ribbed belts ⇒ [Page 13-22](#)

31 - Positive Crankcase Ventilation valve

- ◆ Arrow on crankcase breather valve points to intake hose.

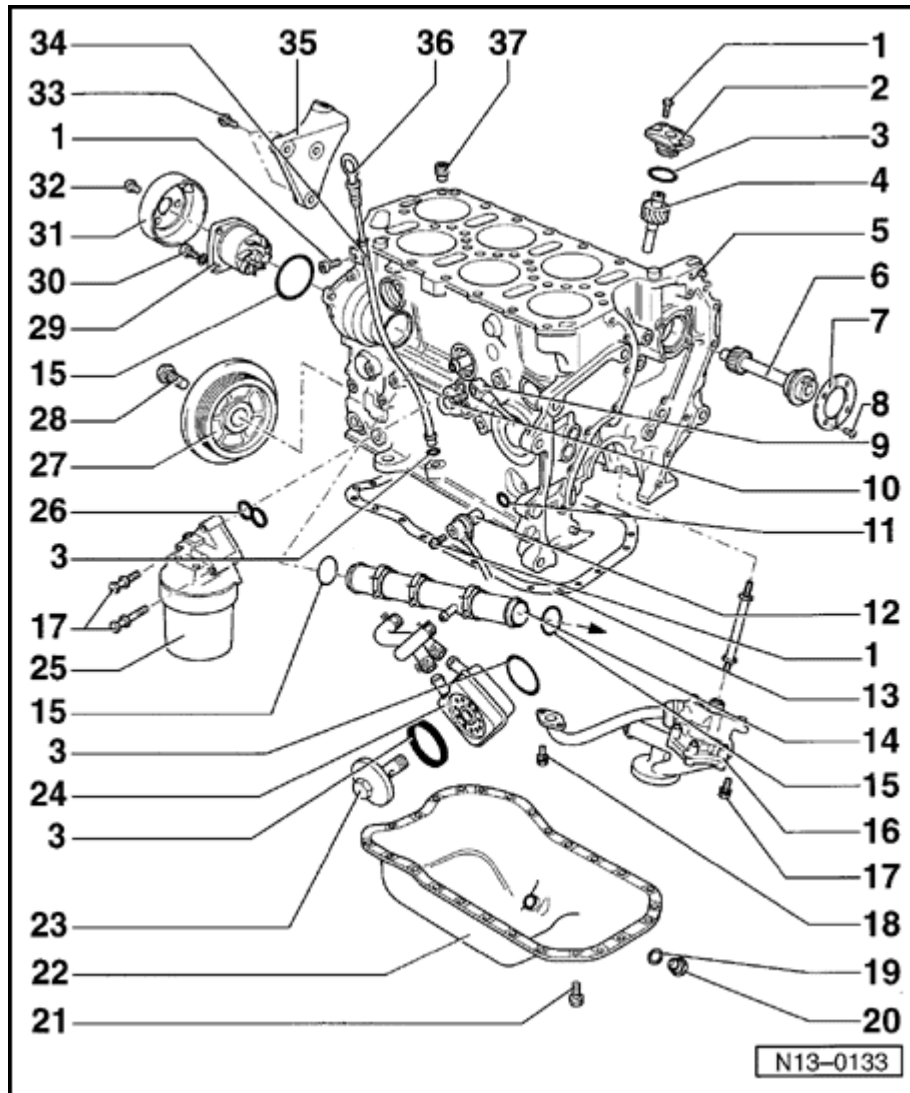
⇒ [Repair Manual, 2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code\(s\): AES, Repair Group 24](#)

32 - Harness connector

- ◆ For injectors -N30-, -N31-, -N32-, -N33-, -N83-, -N84-
- ◆ Mounted to bracket (item 23) .

33 - Retainer

- ◆ For Secondary Air Injection pump motor ⇒ [Page 26-14](#)



Part III

1 - 10 Nm (7 ft lb)

2 - Oil pump drive cover

3 - O-ring

- Always replace.

- Oil before assembling.

4 - Oil pump drive

5 - Cylinder block

◆ Removing and installing sealing flange and flywheel/drive plate ⇒ [Page 13-34](#)

◆ Removing and installing crankshaft ⇒ [Page 13-53](#)

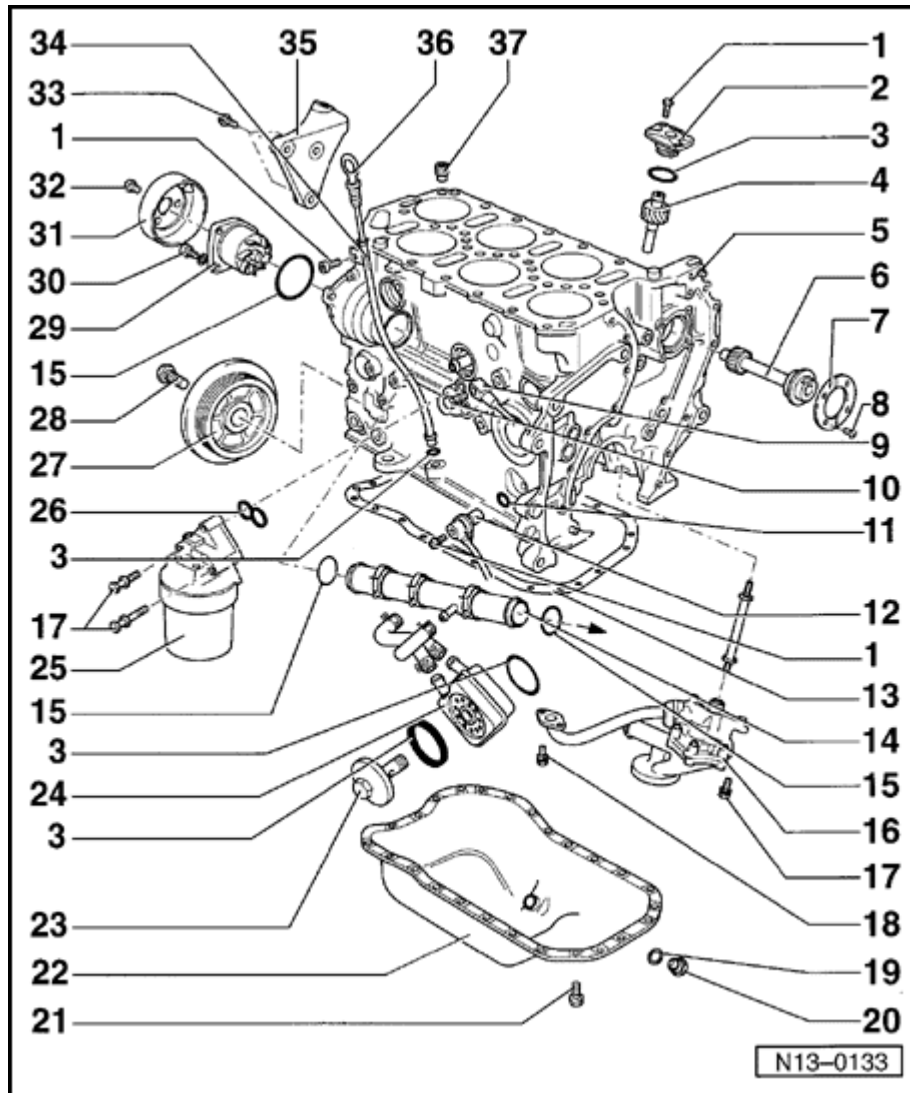
◆ Disassembling and assembling pistons and connecting rods ⇒ [Page 13-44](#)

6 - Intermediate shaft

7 - Thrust washer

8 - 10 Nm (7 ft lb)

- Install with D6 locking fluid.



9 - Knock sensor (KS) 2 -G66-

◆ Checking:

⇒ [Repair Manual, 2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code\(s\): AES, Repair Group 01](#)

10 - 20 Nm (15 ft lb)

◆ Tightening torque influences knock sensor function

11 - O-ring

- Replace if damaged.

12 - Engine Speed (RPM) sensor -G28-

◆ Checking:

⇒ [Repair Manual, 2.8 Liter VR6 2V Fuel Injection & Ignition, Engine Code\(s\): AES, Repair Group 01](#)

13 - Gasket

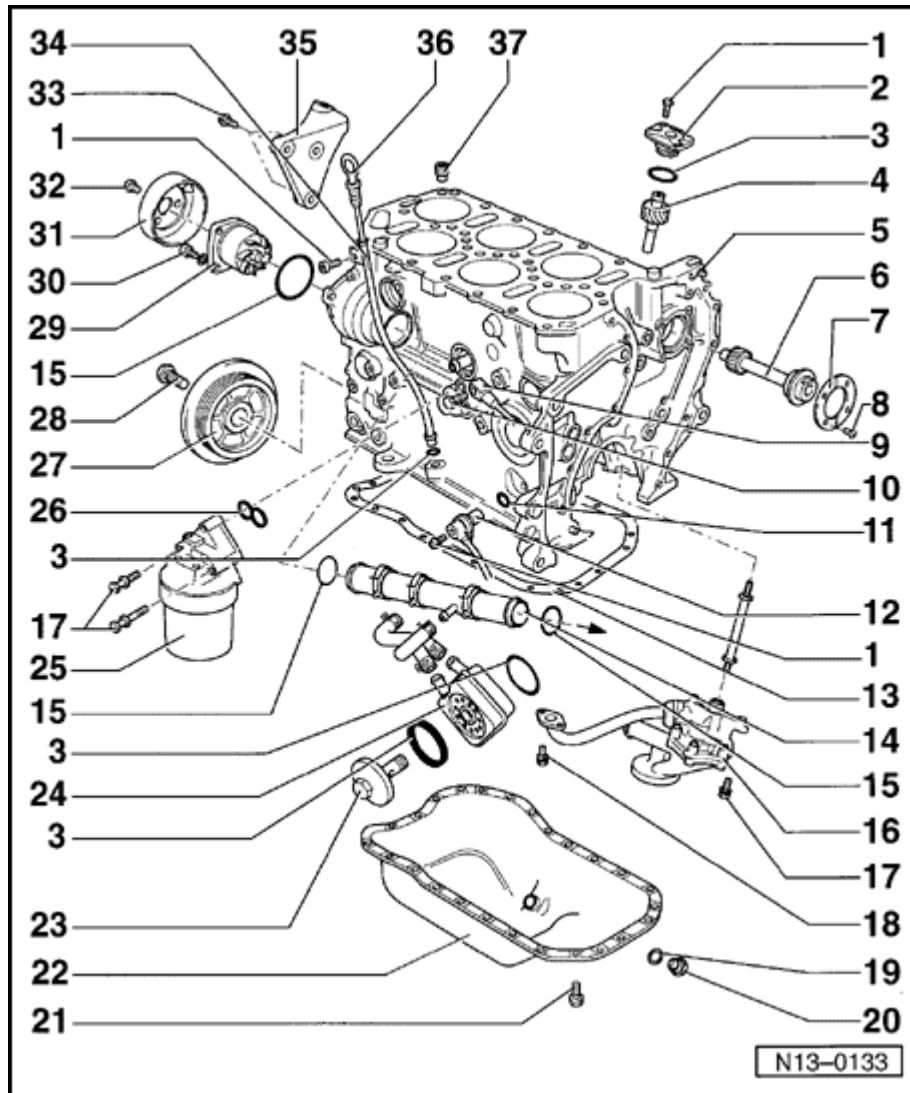
- Replace if damaged.

- Coat sump flange/cylinder block flange with D2 before installing gasket.

14 - Coolant line

◆ To thermostat housing ⇒ [Page 13-13](#) , item 24

◆ Removing and installing ⇒ [Page 19-6](#)



15 - O-ring

- Replace

16 - Oil pump

◆ Disassembling and assembling ⇒ [Page 17-10](#)

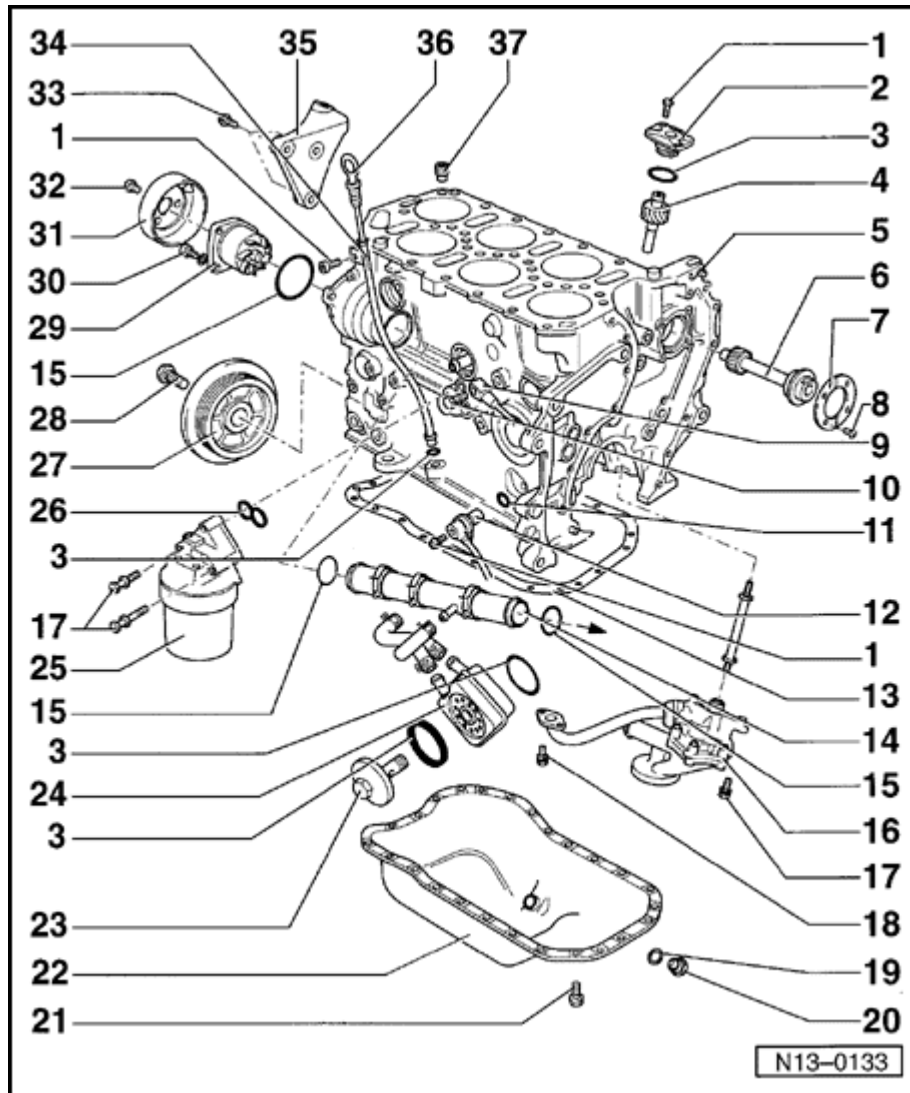
- Coat oil pressure line on block and oil pump housing with AMV 188 001 02.

17 - 25 Nm (18 ft lb)

18 - 10 Nm (7 ft lb)

- Replace

- Install with D6 locking fluid.



19 - Seal

- Always replace

20 - Oil drain plug

- ◆ 30 Nm (22 ft lb)
- ◆ Replace if leaking. See Parts Catalog for correct application. In some cases, seal and drain plug are combined; do not interchange with separate seal and drain plug.

21 - 15 Nm (11 ft lb)

- Remove and install using 3249 socket.
- With flywheel installed, turn flywheel until recess aligns with bolts.

22 - Oil pan

- Clean sealing surfaces before installing.

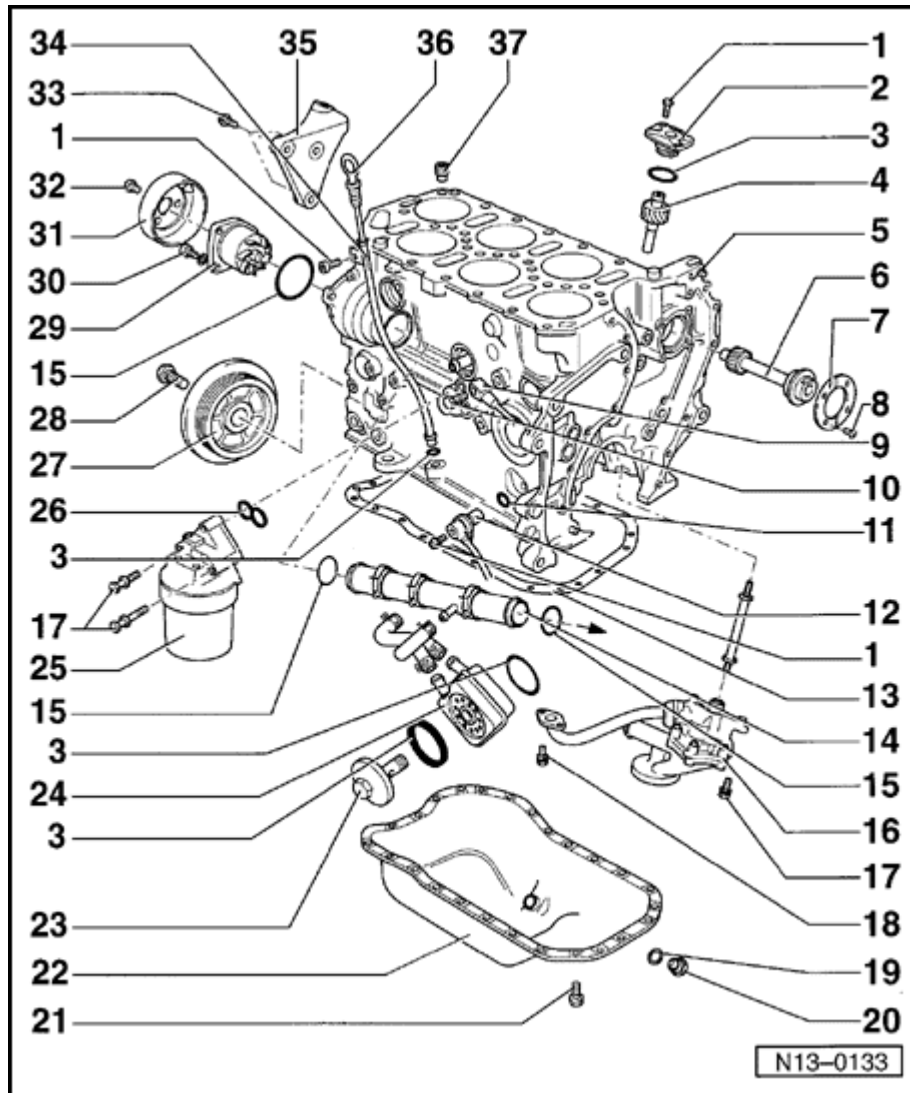
23 - Oil cooler cover

- ◆ 25 Nm (18 ft lb)

24 - Oil cooler

- Coat contact area outside seal with AMV 188 100 02
- Make sure clearance with any adjacent components.

◆ See note ⇒ [Page 13-1](#)



25 - Oil filter housing

- ◆ Disassembling and assembling ⇒ [Page 17-8](#)

26 - Gasket

- Replace
- Note installed position.
- Oil before installing.

27 - Vibration damper

- ◆ Ribbed belt, removing and installing ⇒ [Page 13-22](#)

28 - 120 Nm (89 ft lb) plus additional $\frac{1}{4}$ turn

- Replace
- Counter-hold using 3406 to loosen and tighten ⇒ [Fig. 1](#).

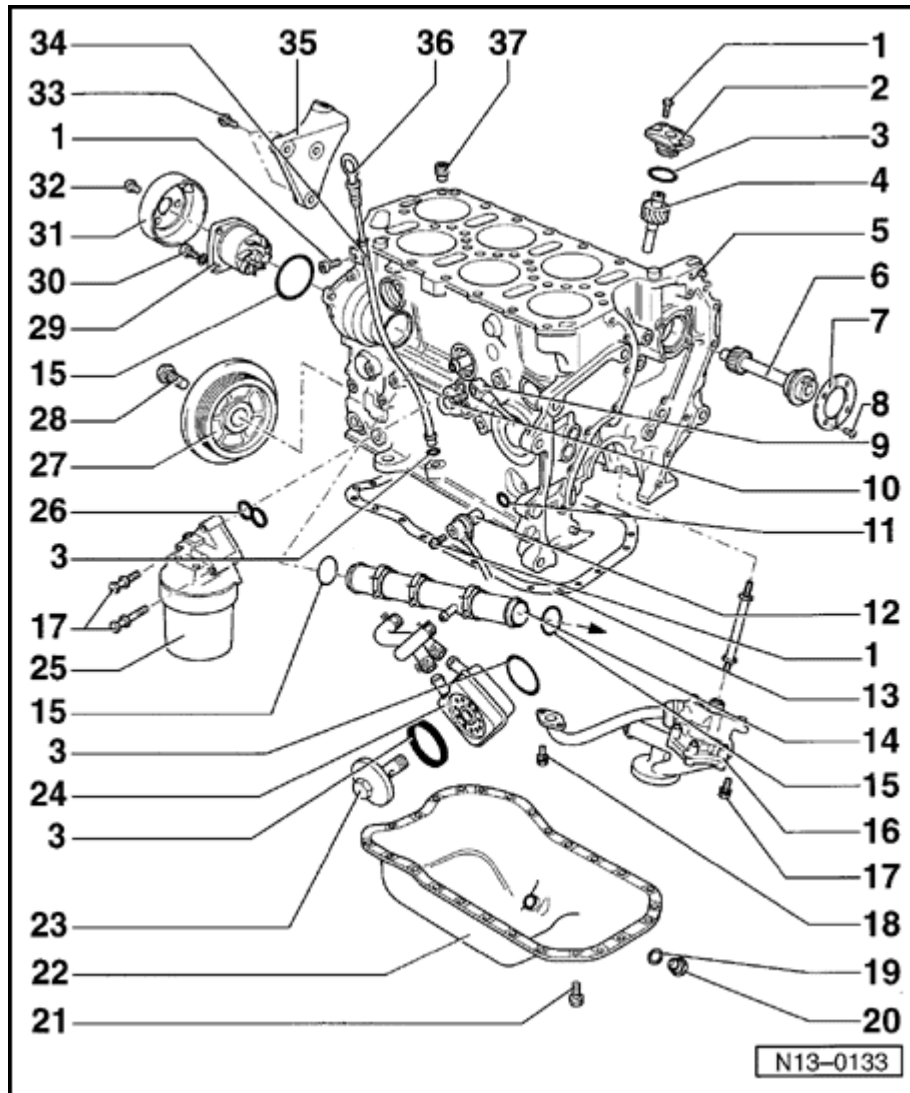
29 - Coolant pump

- Check shaft for ease of movement.
- ◆ Removing and installing ⇒ [Page 19-25](#)

30 - 20 Nm (15 ft lb)

31 - Pulley

- ◆ For coolant pump



32 - 25 Nm (18 ft lb)

- ◆ Loosening and tightening: counterhold using a punch fed through the holes.

33 - 55 Nm (41 ft lb)

34 - Guide tube

- ◆ For dipstick
- ◆ Bolted to intake manifold

35 - Right engine bracket

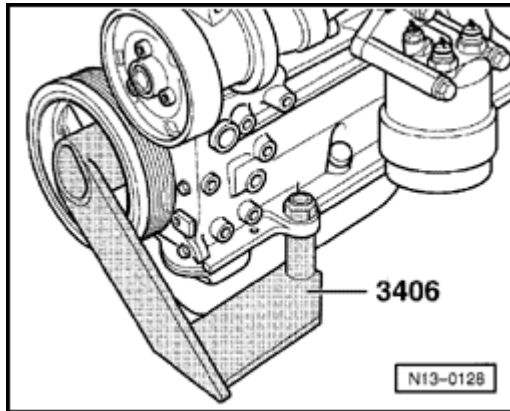
36 - Dipstick

CAUTION!

Oil must NOT be above MAX mark on dipstick!

37 - Oil check valve

- ◆ 5 Nm (44 in. lb)
 - Note installed position
 - Clean if contaminated.
 - See note ⇒ [Page 13-1](#)



A

Fig. 1 Holding vibration damper using 3406 counter-hold tool to loosen or tighten mounting bolt

- Replace mounting bolt.

CAUTION!

Do not allow crankshaft to turn while tightening mounting bolt!



Ribbed belt, removing and installing

Special tools and equipment

- ◆ M8 x 80 hex bolt

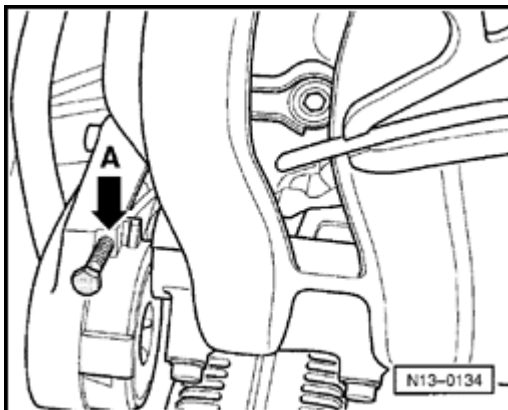
Note:

When installing belt, be sure it is correctly seated in pulley.

Removing

- Remove sound tray.

⇒ [Repair Manual, Body Exterior, Repair Group 50](#)



A

- Screw M8 x 80 bolt into tensioner hole -A- until ribbed belt is no longer under tension.

CAUTION!

Only thread in bolt until belt can be removed, otherwise tensioner housing can be damaged!

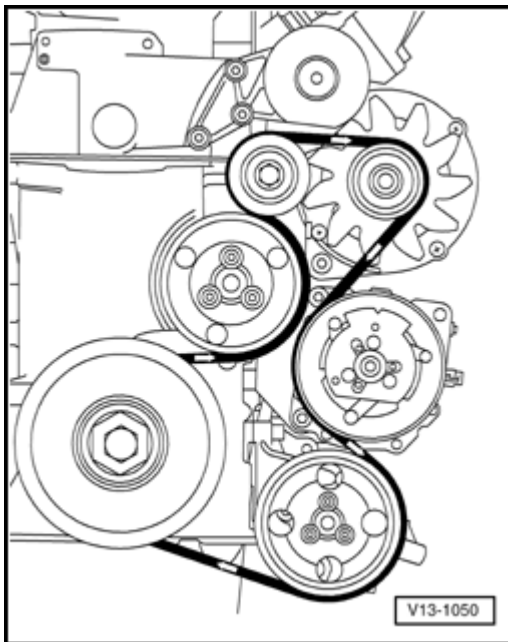
- Remove ribbed belt.



Installing

Note:

Before installing ribbed belt, generator, A/C compressor, and power steering pump sub-assemblies must be tight.



- Install ribbed belt.
- Remove M8 bolt from tensioner.
- Start engine and check belt.

Note:

Vehicles with A/C have a double ribbed belt.



Valve timing, checking

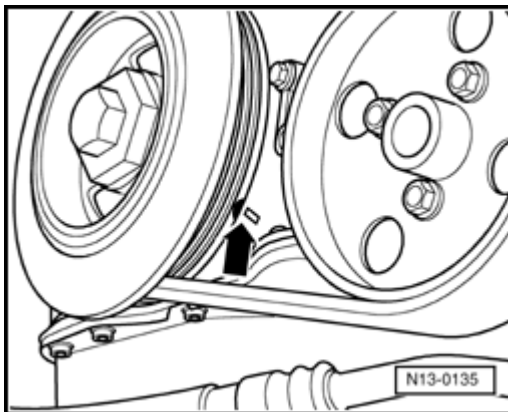
Special tools and equipment

- ◆ 3268 Camshaft bar

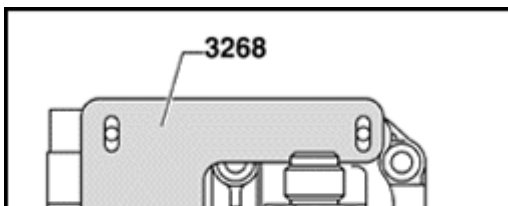
Test sequence

- Remove sound dampening tray.

⇒ [Repair Manual, Body Exterior, Repair Group 50](#)

**A**

- Set crankshaft to TDC cyl. 1 mark -arrow- by turning crankshaft in direction of engine rotation using vibration damper bolt.
- Remove cylinder head cover ⇒ [Page 15-9](#) .

**A**

- ◆ 3268 Camshaft bar must fit into both shaft grooves.

Note:

This position is only possible every 2nd TDC position.



Valve timing, adjusting

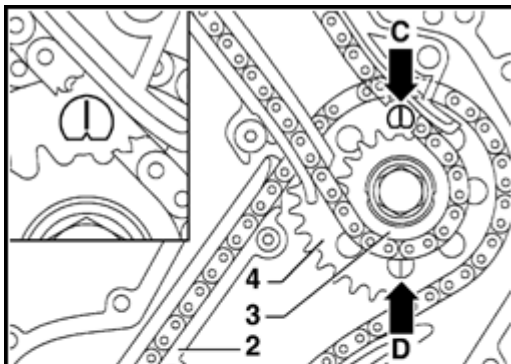
With timing chains removed

Special tools and equipment

- ◆ 3406 Counter-hold tool
- ◆ 3268 Camshaft setting bar
- ◆ VAG 1331 Torque wrench (5 to 50 Nm)
- ◆ VAG 1332 Torque wrench (40 to 200 Nm)

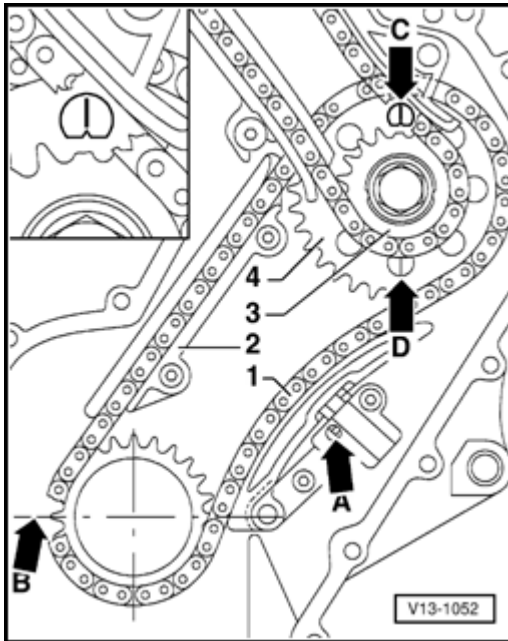
Work sequence (with engine removed)

- Install lower chain and chain tensioner with tensioning plate.

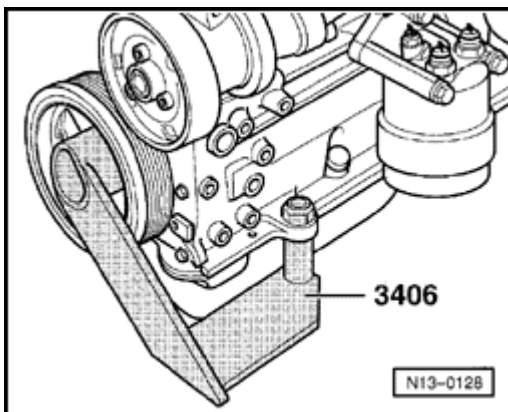


A

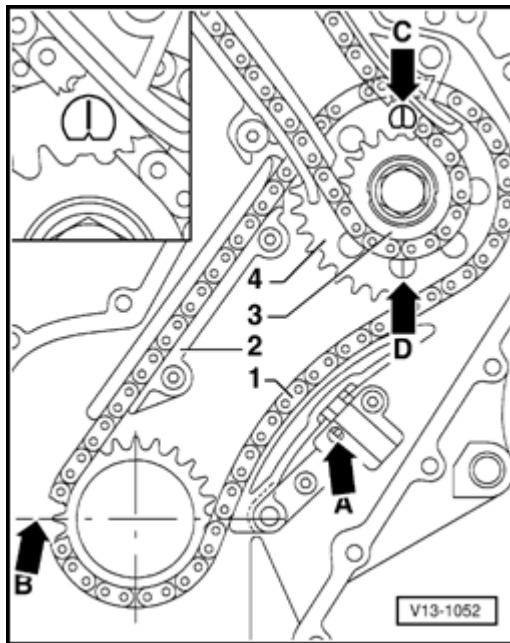
- Set/check position of crankshaft to intermediate shaft.
 - ◆ Ground down tooth on crankshaft sprocket -B- must align with the main bearing joint (= TDC for cyl. 1).
- Install pin (without collar) for guide rail -2- and tighten.
 - ◆ 25 Nm (18 ft lb)



- A**
- Install guide rail -2- with lower chain -1- and both sprockets -3- and -4-.
 - Note direction of rotation for lower chain ⇒ [Page 13-7](#) , ⇒ [Fig. 1](#) .
 - ◆ Mark on lower chain sprocket -4- must align with notch -C- or -D- on thrust washer.
 - Release locking spline in chain tensioner with small screwdriver -A-.
 - Press chain tensioner against tensioner plate, then tighten chain tensioner.
 - ◆ 10 Nm (7 ft lb)

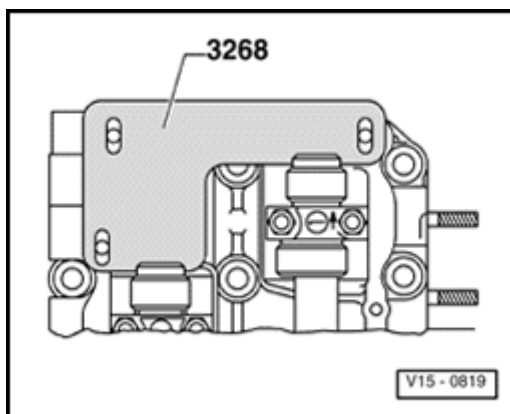


- A**
- Lock vibration damper using 3406 counter-hold tool.



A

- Tighten intermediate shaft sprockets 3 and 4.
 - ◆ 100 Nm (74 ft lb)
- Check position of crankshaft relative to intermediate shaft.
 - ◆ Ground down tooth on crankshaft sprocket -B- must align with main bearing joint (= TDC for cyl. 1).
- Install upper chain and chain tensioner with tensioning plate.



A

- Position camshafts using 3268 camshaft ruler.
- Install tensioning plate pivot pins and tighten.
 - ◆ 25 Nm (18 ft lb)
- Install tensioning plate for chain tensioner (upper chain).
- Install locating pin with collar for guide rail and tighten.
 - ◆ 25 Nm (18 ft lb)

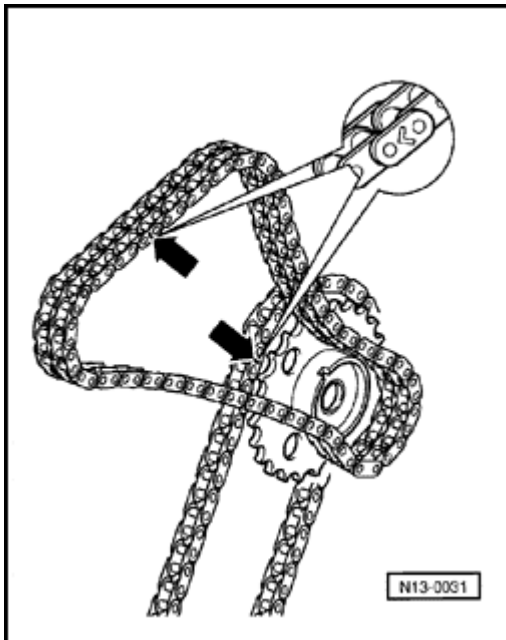


With cylinder head removed

Cylinder head, installing ⇒ [Page 15-17](#)

- Place guide rail on locating pin, insert short mounting bolt using D6 locking fluid and tighten both bolts.

◆ 20 Nm (15 ft lb)



A

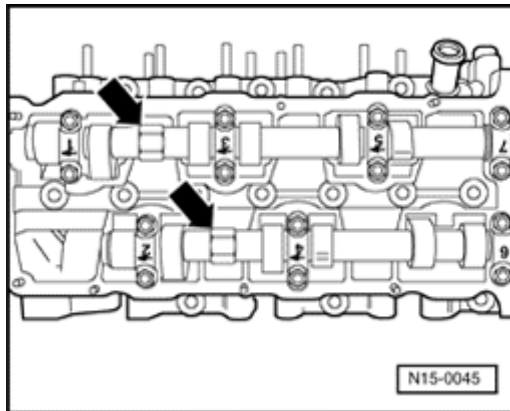
- Place upper chain on intermediate shaft.
 - ◆ Note direction of engine rotation for upper chain.
- Install camshaft sprocket and upper chain to camshaft for cylinders 2, 4 and 6 (short camshaft) and hand tighten.
- Install camshaft sprocket (with sensor wheel for Camshaft Position sensor) and upper chain on camshaft for cylinders 1, 3 and 5 and tighten by hand.

Note:

- ◆ *Contact surfaces of timing chain and sensor wheel must be dry when installing.*
- ◆ *Oil bolt head contact surfaces when installing.*
- Remove 3268 camshaft bar.
- Tighten camshaft sprocket mounting bolts.

100 Nm (74 ft lb)





Note:

⚠ Only counter-hold using a 24 mm open end wrench on camshaft -arrow-. 3268 camshaft bar must not be installed when tightening or loosening sprockets.

- Coat sealing flange surface with AMV 188 001 02 and install.
- Tighten mounting bolt.
 - ◆ 10 Nm (7 ft lb)
- Replace sealing flange oil seal ⇒ [Page 13-34](#) .
- Prepare cylinder head gasket for assembly ⇒ [Page 15-8](#) , ⇒ [Fig. 2](#) .
- Coat camshaft sprocket cover sealing flange with AMV 188 001 02.
- Oil O-ring and insert in camshaft sprocket cover ⇒ [Page 13-11](#) , item 15 .
- Install cylinder head cover, insert bolts and lightly tighten.
- Tighten M8 mounting bolt.
 - ◆ 25 Nm (18 ft lb)
- Tighten M6 mounting bolts
 - ◆ 10 Nm (7 ft lb)



- Install chain tensioner and tighten.

◆ 30 Nm (22 ft lb)

Note:

◆ *If chain tensioner has been pulled apart, bleed before installing ⇒ [Page 13-8](#) , ⇒ [Fig. 3](#) .*

◆ *Beginning with engine number AES-003279 only single chains for camshaft drive are installed. Therefore, chain tensioner does not have oil bore and is no longer bled.*

◆ *Only turn engine with chain tensioner installed! Otherwise lower or upper chain will jump sprockets.*

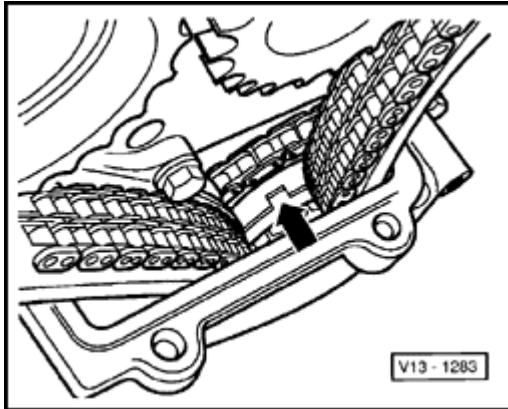
- Turn crankshaft two full turns in direction of engine rotation and check valve timing ⇒ [Page 13-24](#) .

Engine installed, cylinder head removed



A

- Set crankshaft to TDC (cyl. 1) mark -arrow- by turning crankshaft in direction of engine rotation using vibration damper bolt.



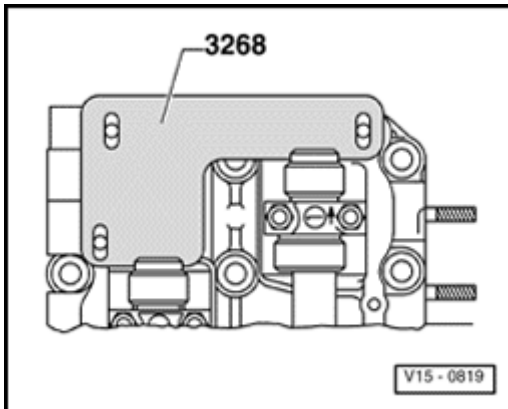
- ▲ If TDC cyl. 1 setting is correct, a notch is visible on intermediate shaft sprockets -arrow-.

If notch is not visible:

- Turn crankshaft one full turn in direction of engine rotation.

Note:

If crankshaft must be turned with cylinder head removed, use a 2nd technician to guide upper chain to prevent it from jamming.



- ▲
 - Position camshafts using 3268 camshaft tool
 - Prepare cylinder head gasket for assembly ⇒ [Page 15-8](#) , ⇒ [Fig. 2](#) .
 - Install cylinder head ⇒ [Page 15-17](#) .
 - Place guide rail on locating pin.
 - Insert short mounting bolt using D6 locking fluid and tighten.
 - ◆ 20 Nm (15 ft lb)
 - Install camshaft sprocket and upper chain to camshaft for cylinders 2, 4 and 6 (short camshaft), hand-tighten.



- Install camshaft sprocket (with trigger wheel for Camshaft Position sensor) and upper chain on camshaft for cylinders 1, 3 and 5, hand-tighten.

Note:

- ◆ *Contact surfaces of timing chain and sensor wheel must be dry when installing.*
- ◆ *Oil bolt head contact surfaces when installing.*

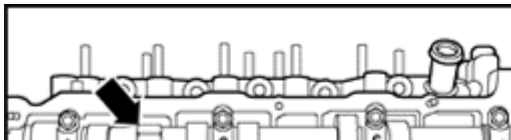
- Remove 3268 camshaft tool.

- Tighten camshaft sprocket mounting bolts.

- ◆ 100 Nm (74 ft lb)

Note:

Only counter-hold using a 24 mm open end wrench on camshaft -arrow-. 3268 camshaft tool must not be installed when tightening or loosening sprockets.



A

- Coat sealing flange sealing surface with AMV 188 001 02.
- Oil O-ring and insert in camshaft sprocket cover ⇒ [Page 13-11](#) (item

15).

- Install camshaft cover.
- install all bolts and lightly tighten.
- Tighten M8 bolt.
 - ◆ 25 Nm (18 ft lb)



- Tighten M6 bolts.
 - ◆ 10 Nm (7 ft lb)
- Install upper chain, chain tensioner and tighten.
 - ◆ 30 Nm (22 ft lb)

Note:

- ◆ *If chain tensioner has been pulled apart, bleed before installing ⇒ [Page 13-8](#) , ⇒ [Fig. 3](#) .*
- ◆ *Beginning with engine number AES-003279 only single chains for camshaft drive were installed. Therefore, chain tensioner does not have an oil bore and is no longer bled.*

CAUTION!

Only turn engine with chain tensioner installed! Otherwise chain (single or double) will jump track!

- Turn crankshaft two full turns in direction of engine rotation and check valve timing ⇒ [Page](#)

[13-24](#) .