

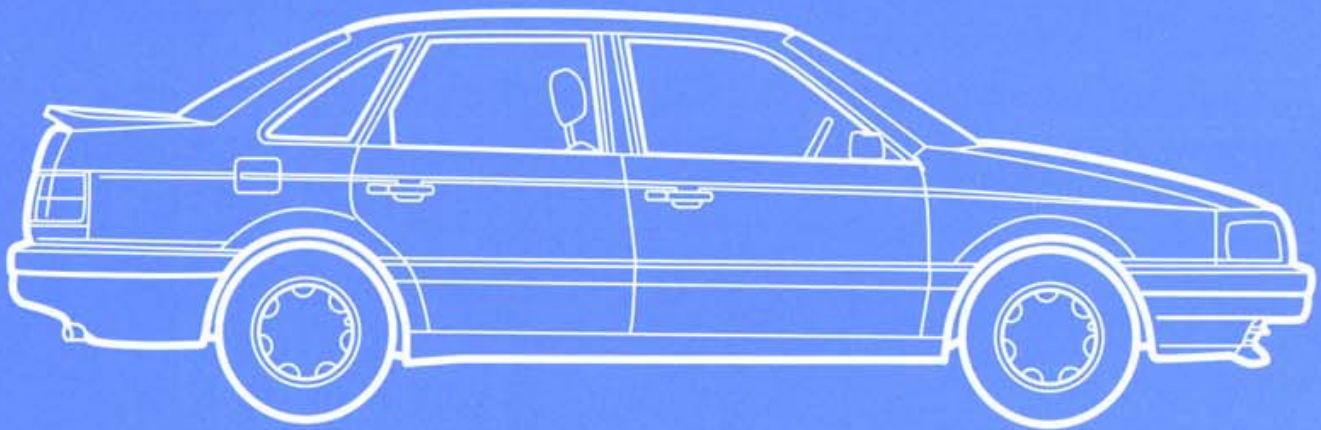


Volkswagen Passat

Official Factory Repair Manual

1990, 1991, 1992, 1993, 1994

4-cylinder (16V, G60, and diesel), 6-cylinder (VR6)
including wagon and Syncro



Bentley Publishers

Contents:

Version 96.01

General, Engine

- 2.0L 16V 4-cylinder (code 9A)
- 2.8L VR6 (code AAA)
- 1.9L Diesel (Canada) (code AAZ)
- 1.8L 4-cylinder G60 (code PG)
- Engine Electrical

Fuel Supply, Turbocharger, Fuel Injection, Exhaust, Ignition

- 2.0L 16V 4-cylinder (CIS-E Motronic)
- 2.8L VR6 (Motronic)
- 1.9L Diesel (Canada)
- 1.8L 4-cylinder G60 Syncro (Canada) (Digifant)

Transmission

- Manual Transmission 02A
- Manual Transmission 02C Syncro (Canada)
- Automatic Transmission 096

Suspension, Brakes, Wheels, Steering

- Suspension-Wheels-Brakes-Steering
- Suspension-Wheels-Brakes-Steering Syncro (Canada)

Body

- Body Exterior
- Body Interior

Heater & Air Conditioning

- Heater-Air Conditioner (R12)
- Air Conditioner (R-134a)

Electrical Equipment

- Radio-Wipers-Lights-Switches-Wiring

Troubleshooting

- Using VAG Diagnostic Testers

Wiring Diagrams

Volkswagen B3 Passat
General-Engine 4 CYL.
13 Engine - Crankshaft/Crankcase (Page GR-13)

Cam timing

- [adjusting](#)

Crankshaft

- [dimensions](#)
- [removing and installing](#)

Crankshaft O-ring (vibration damper side)

- [replacing](#)

Cylinder block, external components

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Cylinder head assembly

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Drive plate

- [removing and installing](#)

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Flywheel and sealing flange

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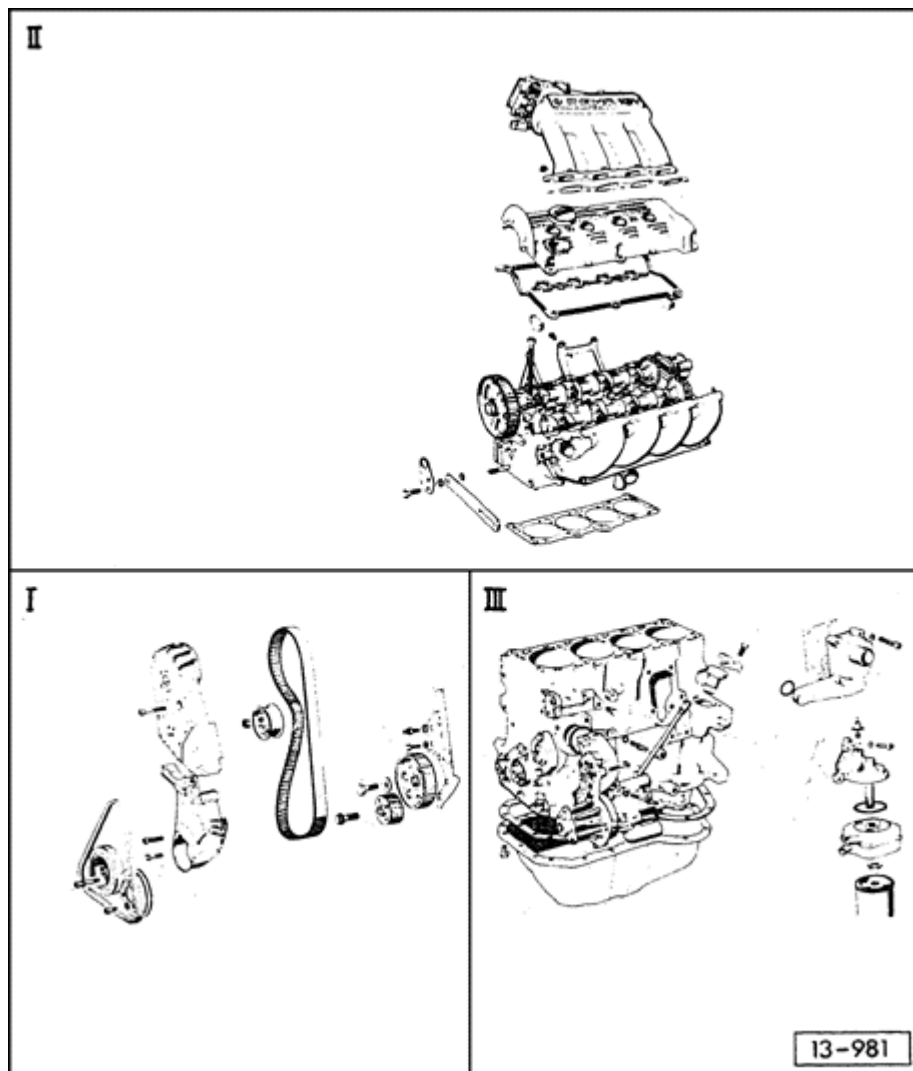
Pistons and connecting rods

- [diameter, measuring](#)
- [disassembling and assembling](#)

Pistons

- [diameter, measuring](#)
- [ring gap, checking](#)
- [ring groove clearance, checking](#)

**Volkswagen B3 Passat
General-Engine 4 CYL.
Engine, disassembling and assembling, key to exploded views (Page 13-1)**



Note

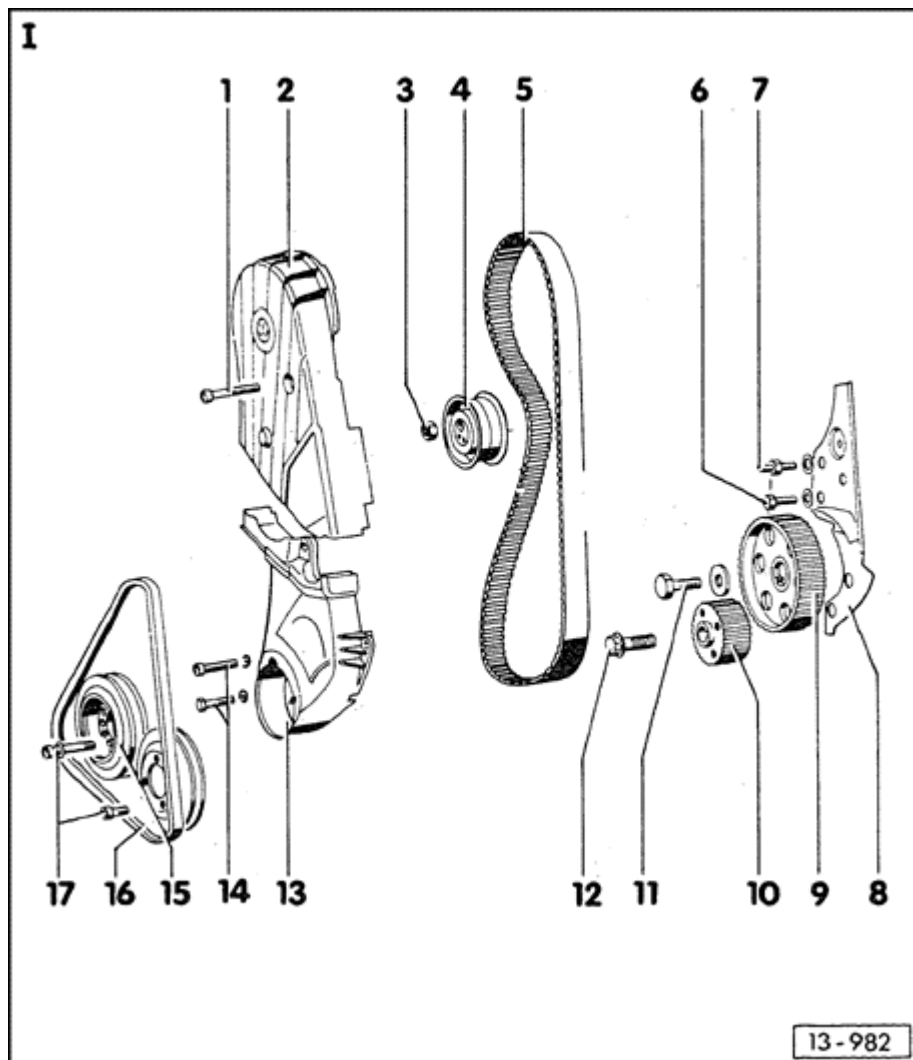
If, as a result of engine damage, quantities of metal powder or particles are found in the engine oil, thoroughly clean all of the oil passages, then replace the oil cooler.

I ⇒ [page 13-2](#)

II ⇒ [page 13-5](#)

III ⇒ [page 13-7](#)

Volkswagen B3 Passat
General-Engine 4 CYL.
I: Drive belts, component layout (Page 13-2)



1 - 6 Nm (53 in. lb)

2 - Upper cover for drive belt

3 - 45 Nm (33 ft lb)

4 - Belt tensioner

5 - Drive belt

- ◆ mark running direction before removing
- ◆ check for wear
- ◆ do not bend
- ◆ removing; installing, tensioning ⇒ [page 13-10](#)

6 - 30 Nm (22 ft lb)

7 - 30 Nm (22 ft lb)

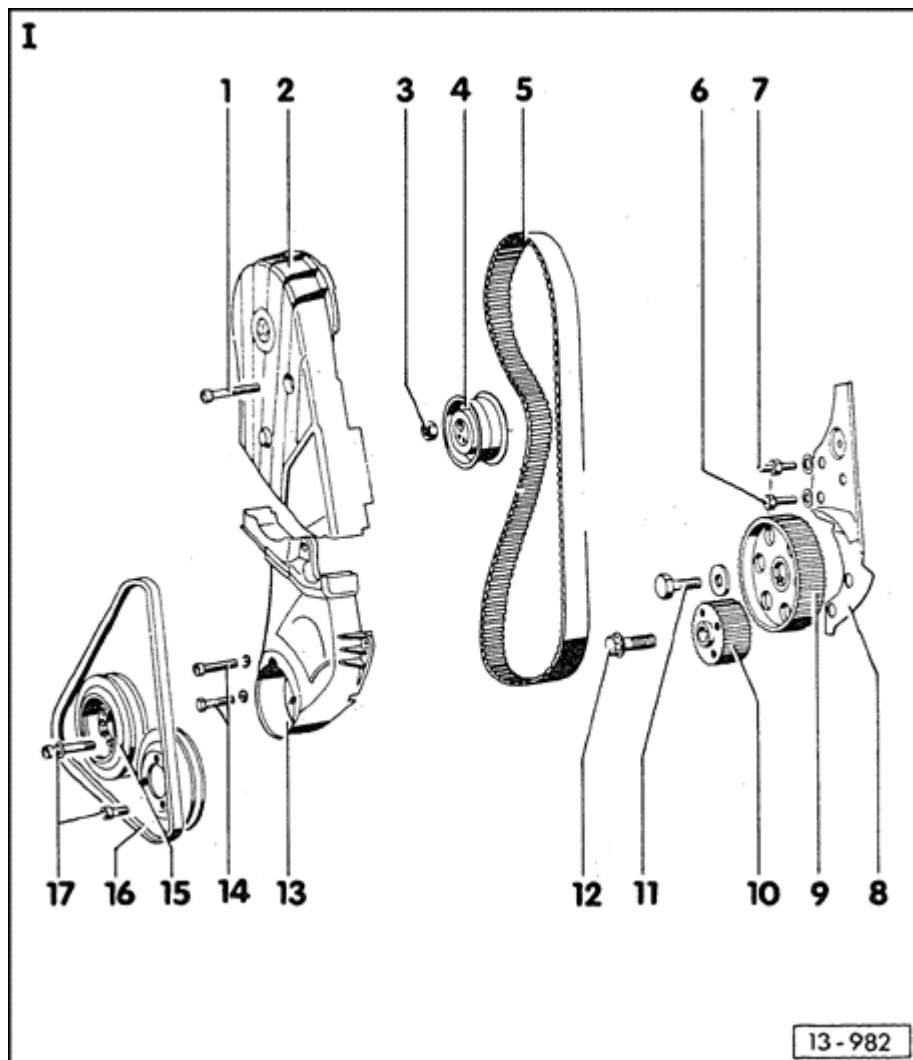
- ◆ install using D6

8 - Rear drive belt cover

9 - Intermediate shaft

10 - Drive belt sprocket for crankshaft

Volkswagen B3 Passat
General-Engine 4 CYL.
I: Drive belts, component layout (Page 13-3)



11 - 65 Nm (48 ft lb)

12 - 90 Nm = 1/4 turn

- ◆ loosen and tighten using tool 3099
- ◆ replace hex head bolt with 12 point bolt and do not use a washer
- ◆ oil threads before installing
- ◆ the extra 1/4 turn can be obtained in more than one motion

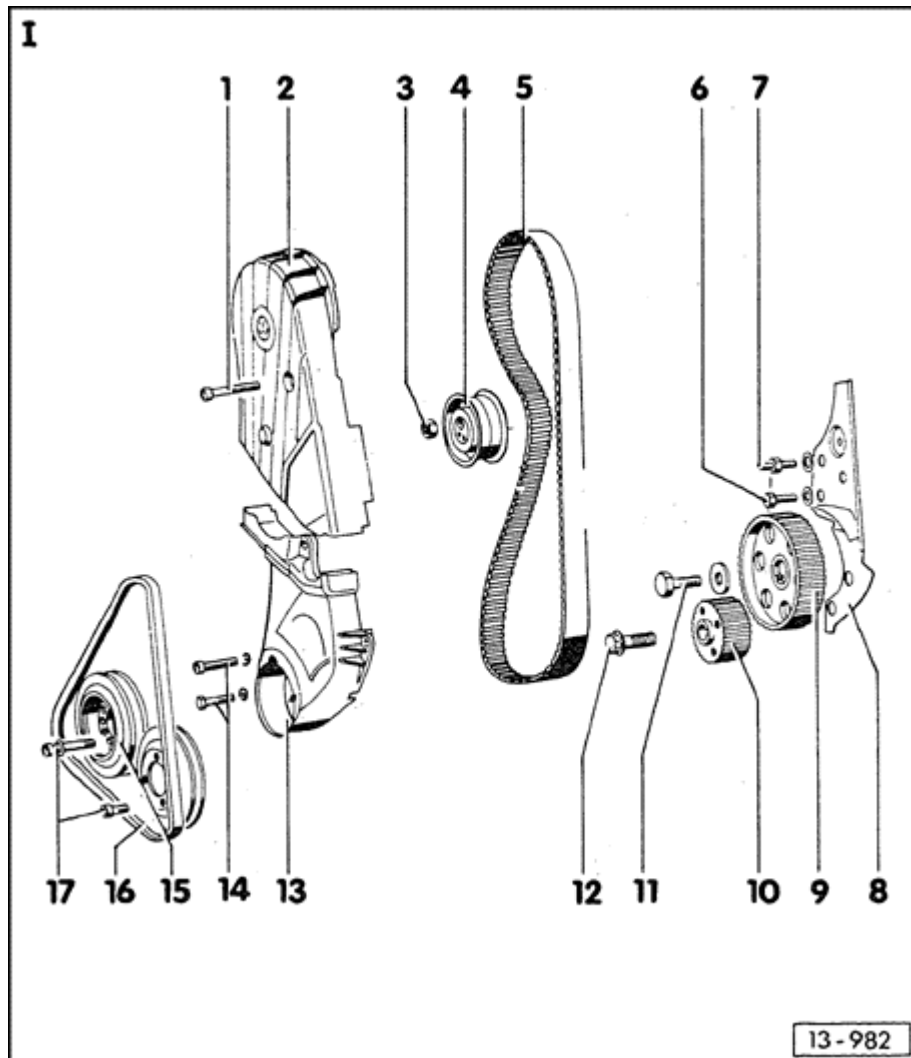
13 - Lower drive belt cover

14 - 10 Nm (7 ft lb)

15 - Vibration damper

- ◆ can only be installed one way
- ◆ note position when installing drive-belt, ⇒ [page 13-10](#)

Volkswagen B3 Passat
General-Engine 4 CYL.
I: Drive belts, component layout (Page 13-4)



16 - V-belt

- ♦ check tension between water pump and generator using thumb deflection method:

new belt = approx 2mm

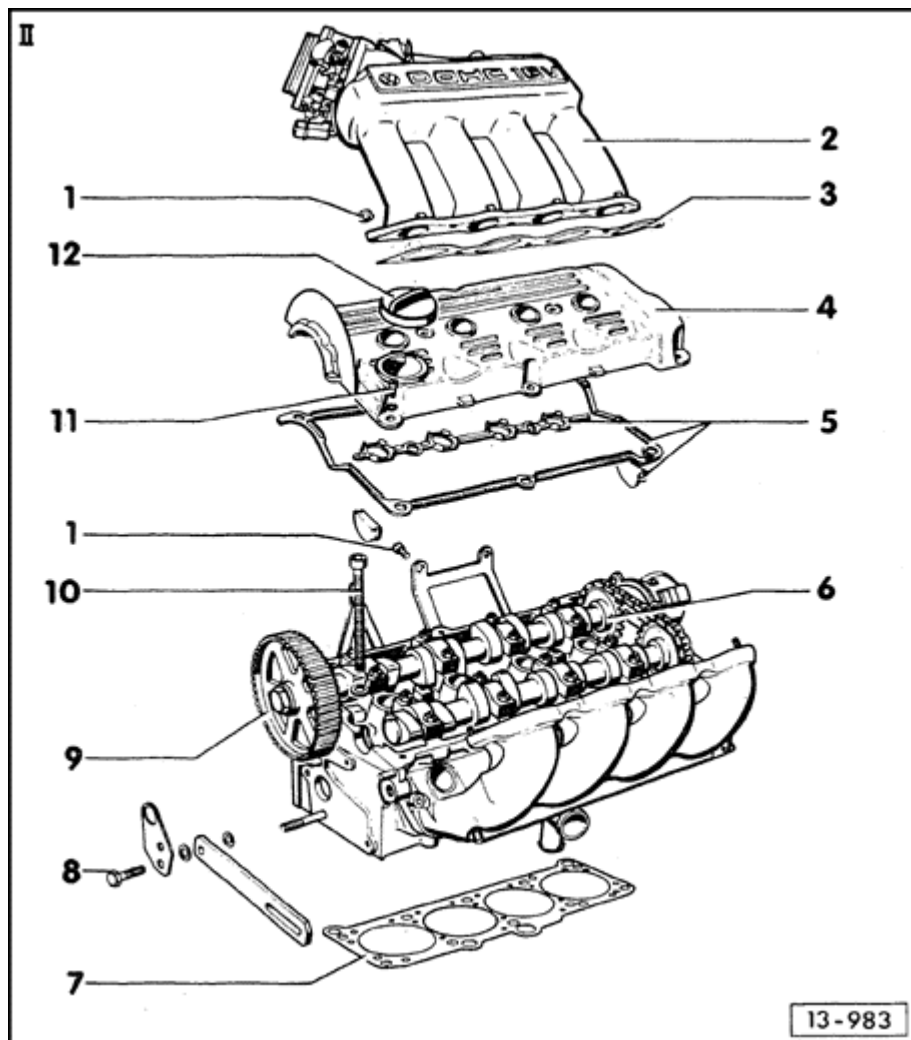
used belt = approx. 5mm

17 - 20 Nm (15 ft lb)

Volkswagen B3 Passat

General-Engine 4 CYL.

II: Cylinder head assembly, component layout (Page 13-5)



1 - 20 Nm (15 ft lb)

2 - Intake manifold, upper section

3 - Gasket

4 - Valve cover

5 - Valve cover gasket and seal

♦ replace if damaged

6 - Cylinder head assembly

♦ removing and installing, ⇒ [Repair Group 15](#)

7 - Cylinder head gasket

♦ replace

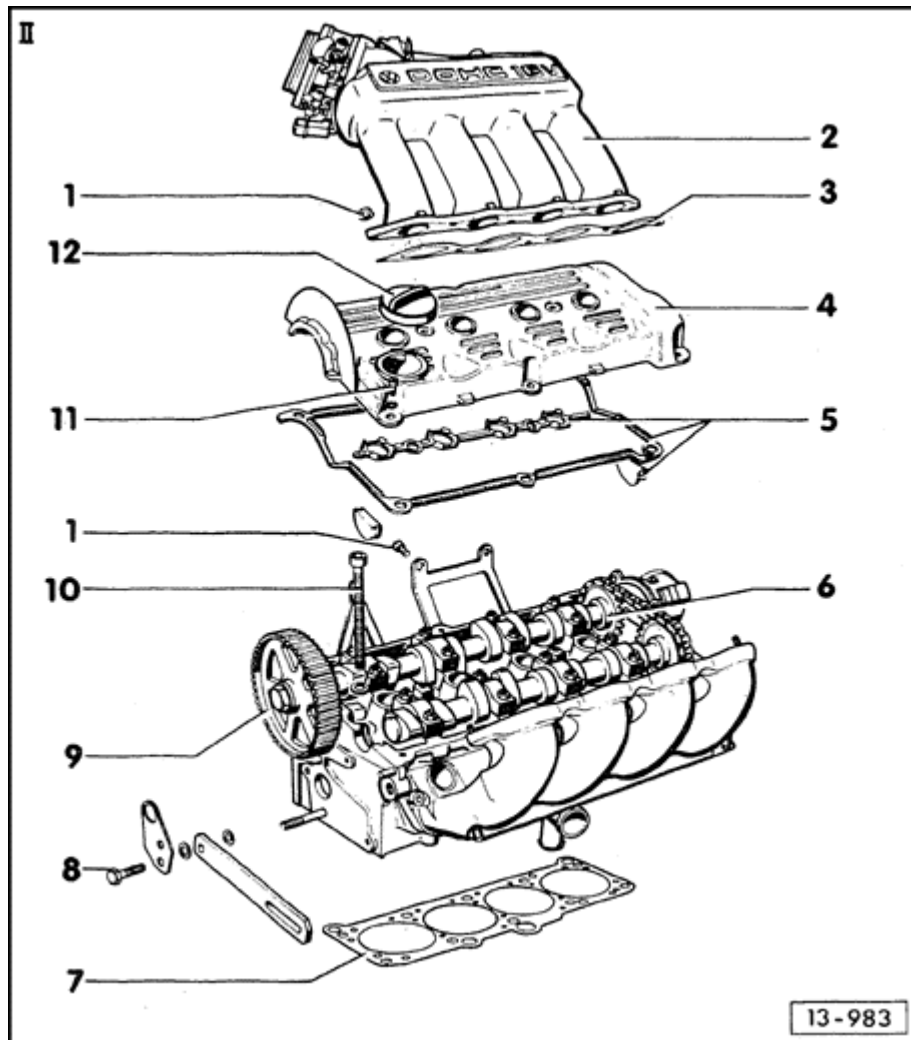
♦ after replacing fill system with new coolant mixture

8 - 45 Nm (33 ft lb)

Volkswagen B3 Passat

General-Engine 4 CYL.

II: Cylinder head assembly, component layout (Page 13-6)



9 - Camshaft drive sprocket

- ♦ note position when installing drive-belt, ⇒ [page 13-10](#)

10 - Cylinder head bolt

- ♦ observe assembly notes and sequence when loosening and tightening, ⇒ [Repair Group 15](#)

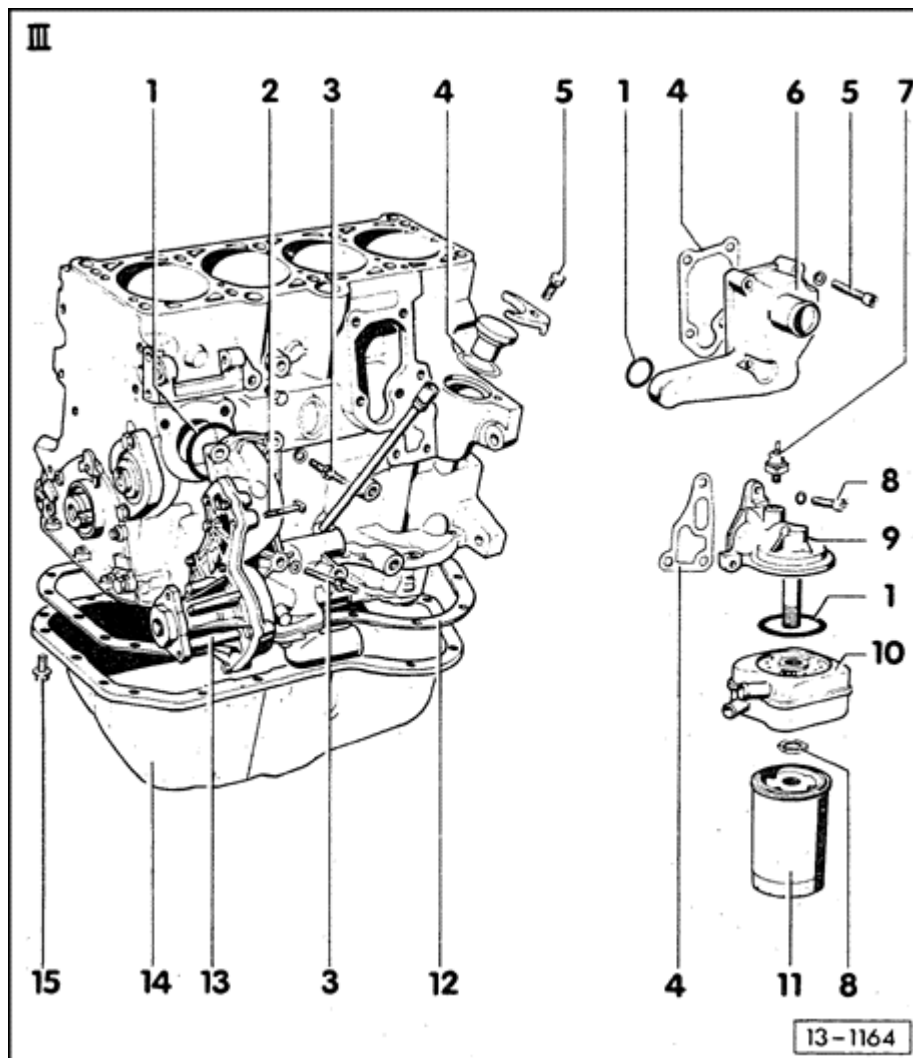
11 - 10 Nm (7 ft lb)

12 - Oil filler cap

- ♦ replace seal if damaged

**Volkswagen B3 Passat
General-Engine 4 CYL.**

III Cylinder block external components, component layout (Page 13-7)



Removing and installing sealing flange and flywheel, ⇒ [page 13-14](#)

Crankshaft, removing and installing, ⇒ [page 13-22](#)

Piston and connecting rod, disassembling and assembling ⇒ [page 13-25](#)

1 - O-ring

- ♦ replace if damaged

2 - T-head bolt

3 - Hex head bolt (support)

- ♦ 20 Nm (15 ft lb)

4 - Gasket

- ♦ replace

5 - 20 Nm (15 ft lb)

6 - Crankcase ventilation housing

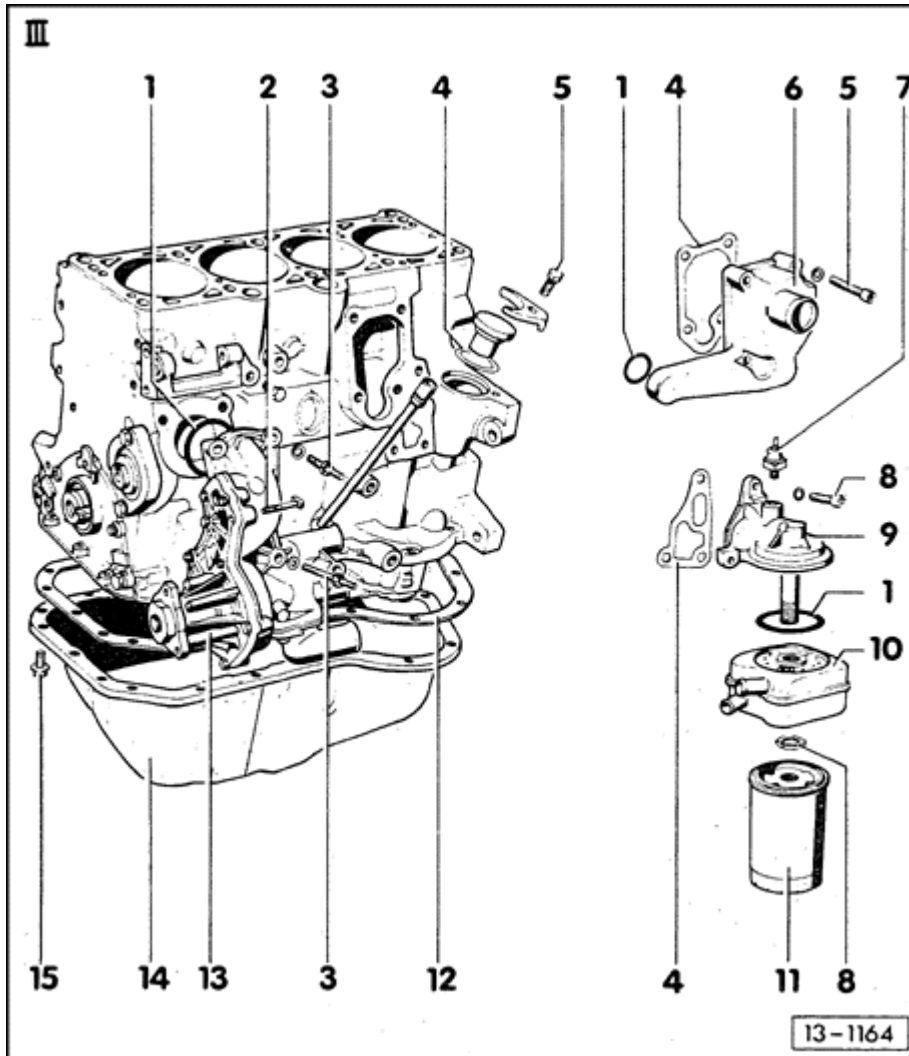
7 - Oil pressure switch

◆ 25 Nm (18 ft lb)

Volkswagen B3 Passat

General-Engine 4 CYL.

III Cylinder block external components, component layout (Page 13-8)



8 - 25 Nm (18 ft lb)

9 - Oil filter bracket

10 - Oil cooler

- ◆ coat contacting surfaces (except o-ring) with sealant AMV 188 100 02
- ◆ note clearances to surrounding components
- ◆ also see note about metal in oil on [page 13-1](#)

11 - Oil filter

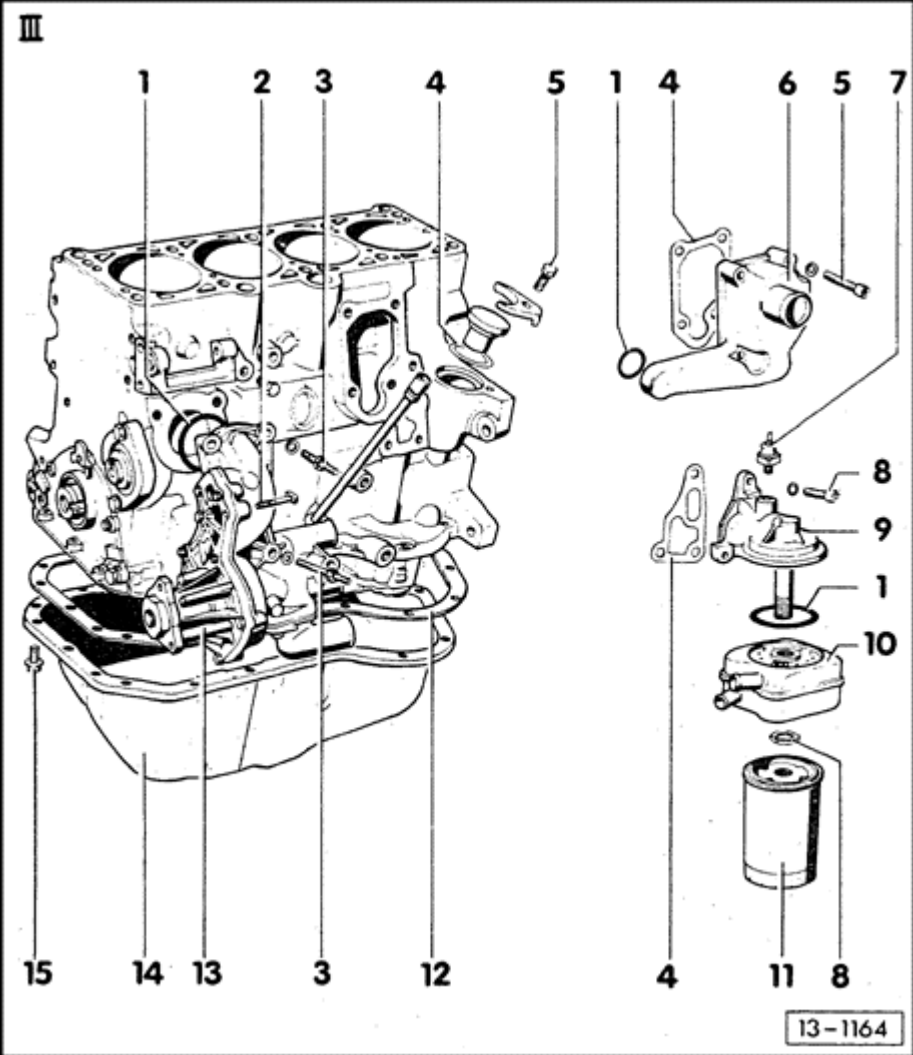
- ◆ loosen using wrench
- ◆ tighten by hand
- ◆ note installation instructions on oil filter

12 - Oil pan gasket

- ◆ before placing into position, coat the overlapping areas sealing the flange to the cylinder block with D2

13 - Coolant pump

Volkswagen B3 Passat
General-Engine 4 CYL.
III Cylinder block external components, component layout (Page 13-9)



14 - Oil pan

15 - 20 Nm (15 ft lb)

- ♦ loosen and tighten the flywheel side bolts using tool 3185

Volkswagen B3 Passat

General-Engine 4 CYL.

Drive belt, removing and installing (Cam timing, adjusting) (Page 13-10)

Removing

- Remove V-belt, vibration damper and upper and lower belt guards
- Loosen the tensioning roller and remove the drive belt
- mark running direction of belt

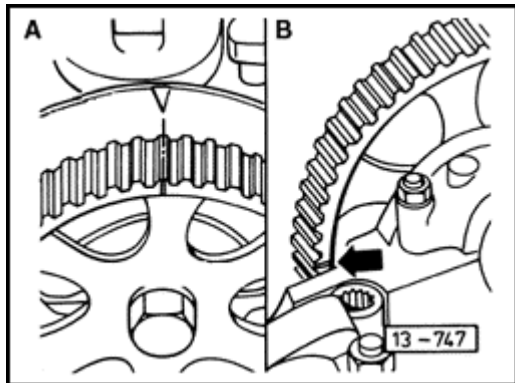
Installing

- Place drive belt on crankshaft and intermediate shaft sprockets
- ensure that belt is installed in correct running direction
- Install the lower belt guard
- Install the crankshaft vibration damper
- note the offset holes in the installed position

Volkswagen B3 Passat

General-Engine 4 CYL.

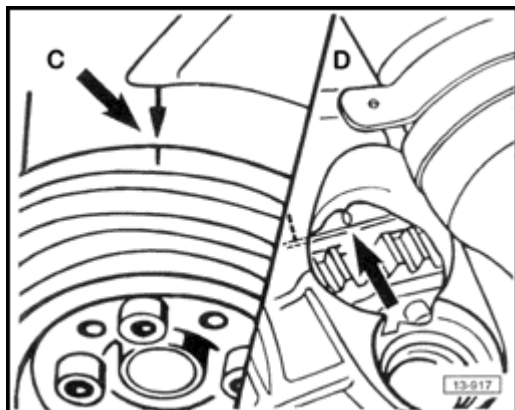
Drive belt, removing and installing (Cam timing, adjusting) (Page 13-11)



- Align camshaft sprocket to cylinder 1 TDC mark
- marking on camshaft must align with arrow on valve cover (view A)
- If valve cover is removed, (view B), marking on camshaft sprocket must align with machined surface of cylinder head (arrow)

Note

When turning the camshaft, ensure that the crankshaft is not in the TDC position or the valves could hit the pistons.



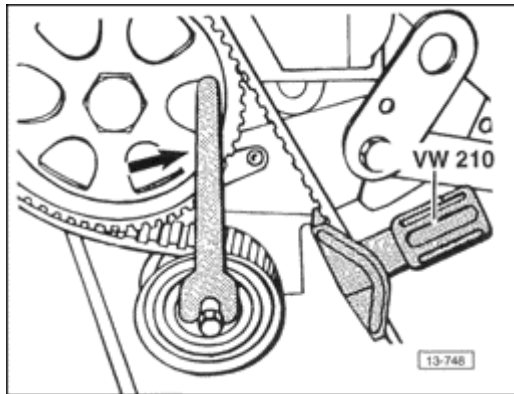
- Rotate crankshaft to cylinder 1 TDC position, TDC marking on flywheel must align with mark on bell housing (view D)
If engine is removed
- Align mark on vibration damper with arrow on belt cover (view C)

Volkswagen B3 Passat

General-Engine 4 CYL.

Drive belt, removing and installing (Cam timing, adjusting) (Page 13-12)

- Place drive belt on camshaft sprocket

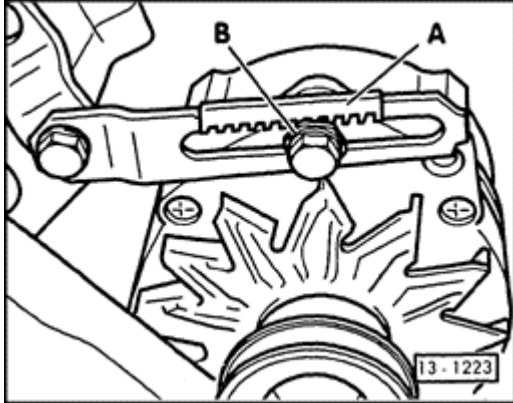


- tension belt using tensioning wrench (e.g. Matra V159) in direction of arrow
- Attach belt tension gauge VW 210 to drive belt as shown
- if properly tensioned, scale value must be between 13 and 14
- When proper tension is obtained, tighten nut to 45 Nm (33 ft lb)
- Rotate crankshaft two revolutions and recheck tension, adjust as necessary
- Install upper belt guard and V-belt
- Check ignition timing point and adjust if necessary, ⇒ [Repair Group 28](#)

Volkswagen B3 Passat

General-Engine 4 CYL.

Generator V-belt tension, checking (for vehicles with rack adjuster) (Page 13-13)

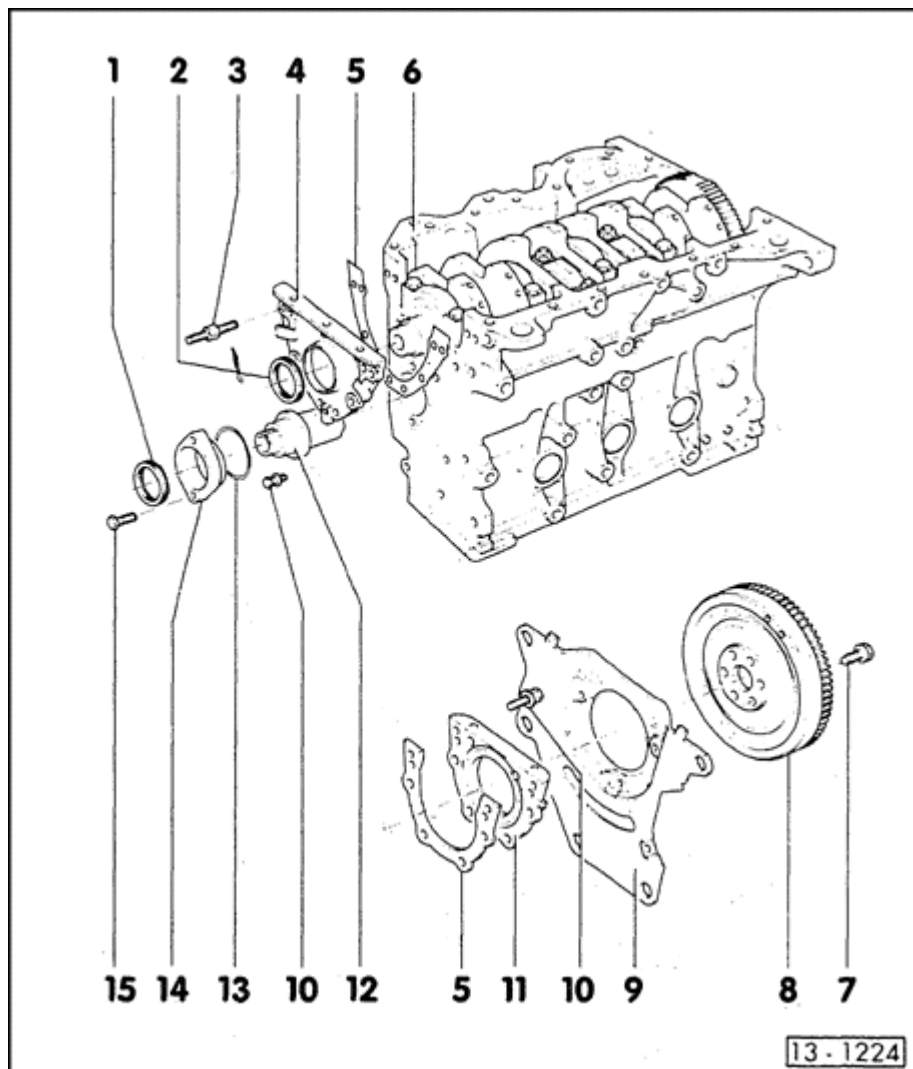


- loosen all mounting bolts for adjusting bracket -A- and generator such that the generator is free to swing under its own weight
- Tension belt by turning tensioning nut -B- with a torque wrench to 8 Nm (6 ft lb)
- When this value is obtained, tighten the tensioner mounting bolt to 30 Nm (22 ft lb)
- tighten mounting bolt for generator to bearing with 35 Nm (26 ft lb)
- Tighten tensioning bracket bolt to 45 Nm (33 ft lb)
- Start engine and let idle for 5 minutes
- Switch off ignition
- Loosen mounting bolts and re-tighten belt to 8 Nm (6 ft lb)

Note

Torque wrench VAG 1410 is especially suited for adjustment in conjunction with ring insert tool SW-VAG 1410/2.

Volkswagen B3 Passat
General-Engine 4 CYL.
Flywheel and sealing flange, removing and installing (Page 13-14)



Note

For clutch repairs ⇒ [Repair Group 30](#).

1 - O-ring

- ◆ to remove, remove sealing flange
- ◆ install using tool 10-203
- ◆ lightly oil the sealing lip

2 - O-ring

- ◆ to replace ⇒ [page 13-17](#)

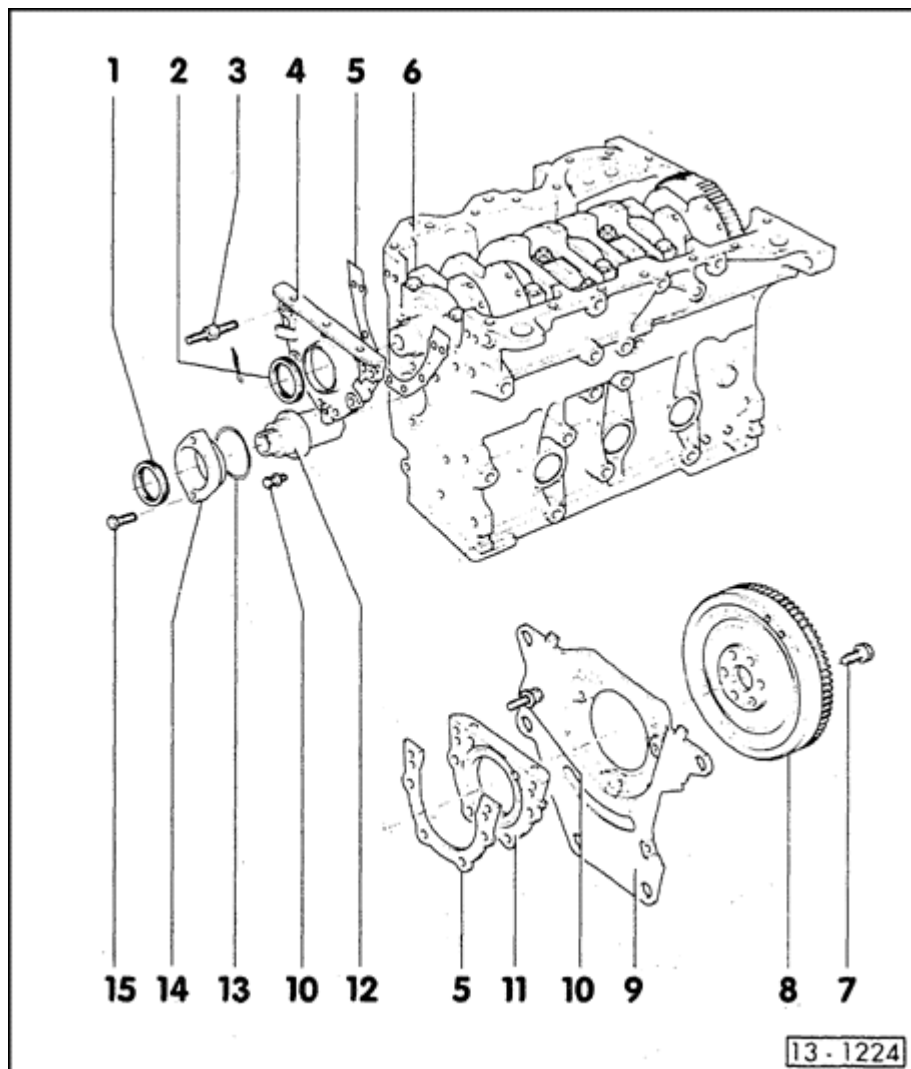
3 - 25 Nm (18ft lb)

4 - Sealing flange

5 - Gasket

- ◆ replace

Volkswagen B3 Passat
General-Engine 4 CYL.
Flywheel and sealing flange, removing and installing (Page 13-15)



6 - Cylinder block

- ♦ crankshaft, removing and installing ⇒ [page 13-22](#)
- ♦ pistons and connecting rods, disassembling and assembling ⇒ [page 13-25](#)

7 - 60 Nm (44 ft lb) + 1/4 turn

- ♦ replace

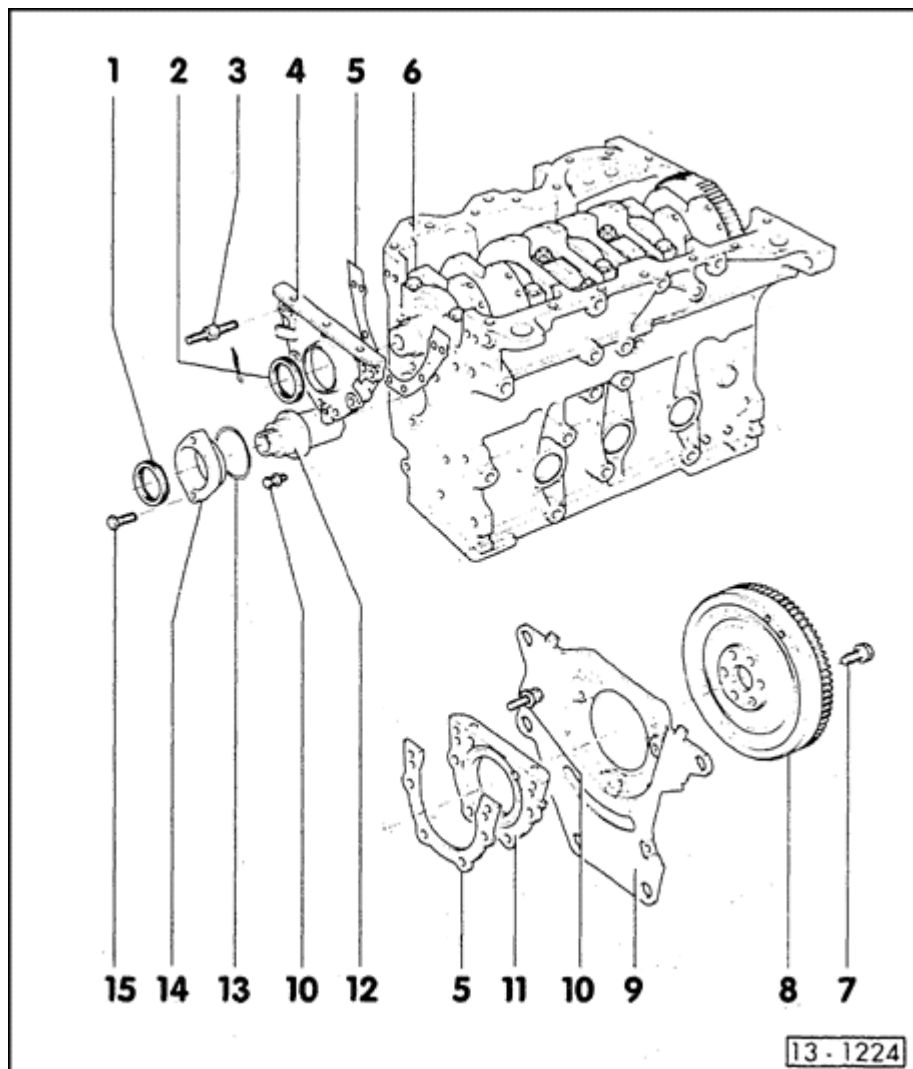
8 - Flywheel/drive plate

- ♦ to lock while removing or installing use tool 10-201
- ♦ to add an ignition timing mark ⇒ [page 13-21](#)
- ♦ to remove or install the drive plate for automatic transmission ⇒ [page 13-19](#)

9 - Intermediate plate

- ♦ must fit on sleeves
- ♦ do not damage or bend while assembling

Volkswagen B3 Passat
General-Engine 4 CYL.
Flywheel and sealing flange, removing and installing (Page 13-16)



10 - 10 Nm (7 ft lb)

11 - Sealing flange with O-ring

- ♦ replace as an assembly

12 - Intermediate shaft

- ♦ axial play: 0.25 mm maximum

13 - O-ring

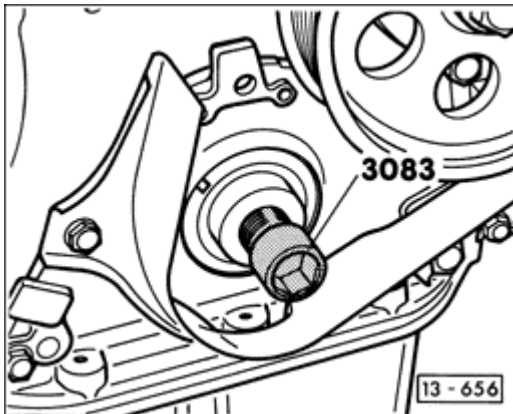
- ♦ replace if damaged

14 - Sealing flange intermediate shaft

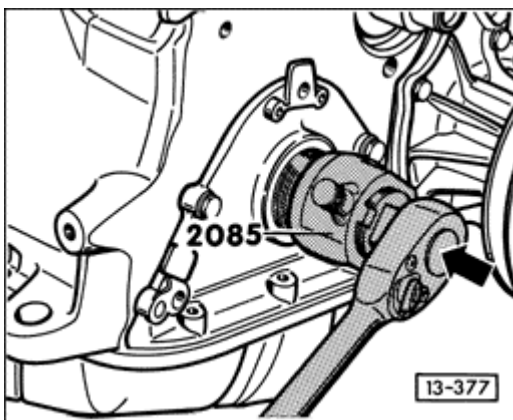
15 - 25 Nm (18 ft lb)

Volkswagen B3 Passat
General-Engine 4 CYL.
Crankshaft O-ring (vibration damper side), replacing (Page 13-17)

Removing



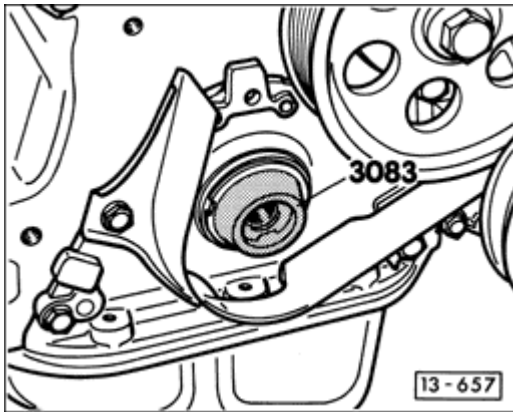
- Remove V-belt, vibration damper and upper and lower belt guards
- Mark running direction on drivebelt
- Loosen drivebelt tensioner and remove drivebelt
- Remove crankshaft drivebelt sprocket using securing tool 3099



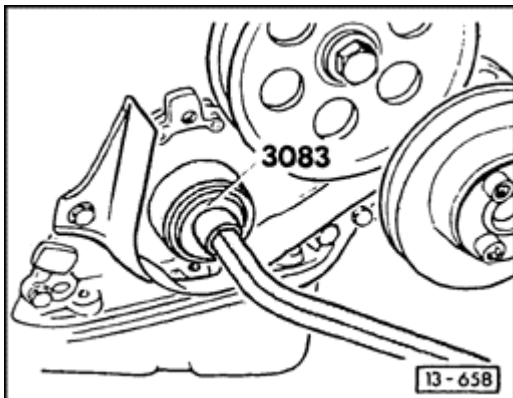
- To guide the O-ring extractor, screw bolt for 3083 up to the stop in the crankshaft
- Unscrew the inner part of extractor 2085 twice (approx. 3mm) from the outer section and secure using the knurled bolt
- Lubricate the threaded portion of the O-ring extractor, position it, and using high force screw into the O-ring as tight as possible
- Loosen the knurled bolt and turn the inner section against the crankshaft until the seal is pulled out

Volkswagen B3 Passat
General-Engine 4 CYL.
Crankshaft O-ring (vibration damper side), replacing (Page 13-18)

Installing



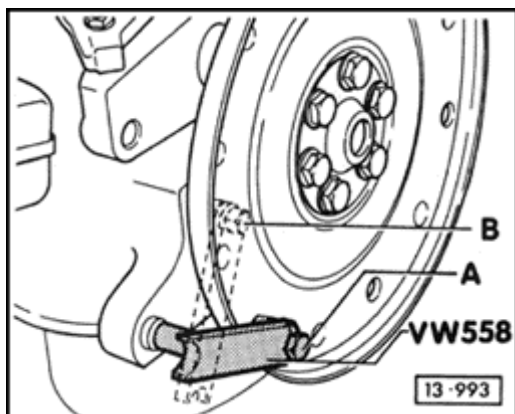
- Lightly grease the lip of the O-ring
- Position the guide sleeve from tool 3083 on the crankshaft stud
- Push the O-ring over the guide sleeve



- Press O-ring with sleeve from tool 3083 up to the stop
- Install the drivebelt, ⇒ [page 13-10](#)

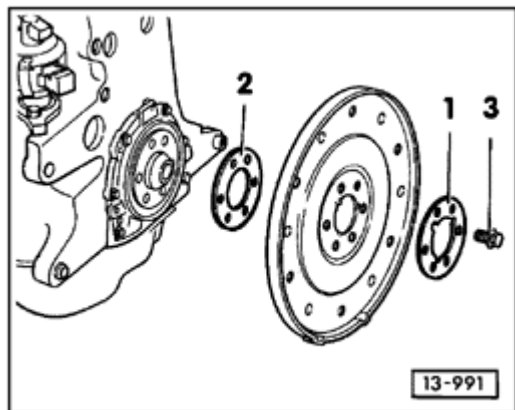
Volkswagen B3 Passat
General-Engine 4 CYL.
Drive plate, removing and installing (Page 13-19)

Removing



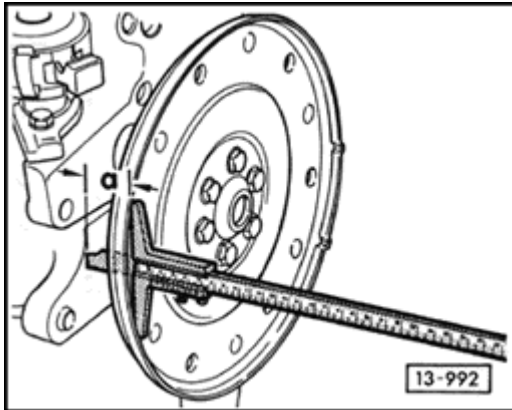
- Fasten counter-hold tool VW 558 to the drive plate using M8 x 45 hex bolt
- Installed position of holder
- A - to loosen
- B - to tighten

Installing



- Install shims -1- and -2- as shown
- note the indentations on shim -1-
- Insert new bolts -3- and tighten to 30 Nm (22 ft lb)
- Measure dimension -a- at three places and calculate the mean value
- must be between 19.5 and 21.1 mm

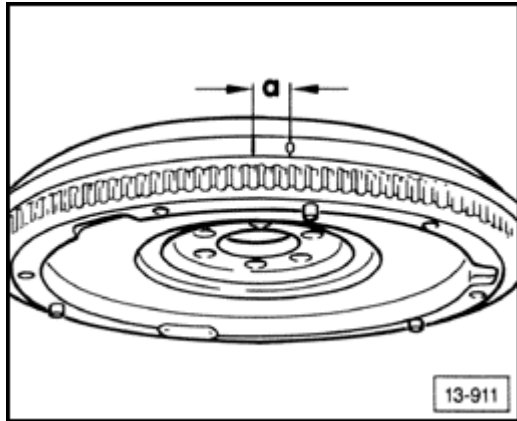
Volkswagen B3 Passat
General-Engine 4 CYL.
Drive plate, removing and installing (Page 13-20)



If measured value is less than specification

- Remove driving plate again and add another shim -2-, re-tighten to 30 Nm (22 ft lb) and re-measure dimension -a-
- measure and add shims as necessary until dimension -a- measurement is obtained
- Tighten screws -3- to 60 Nm (44 ft lb) + an additional 1/4 turn (the additional turn can be performed in stages)

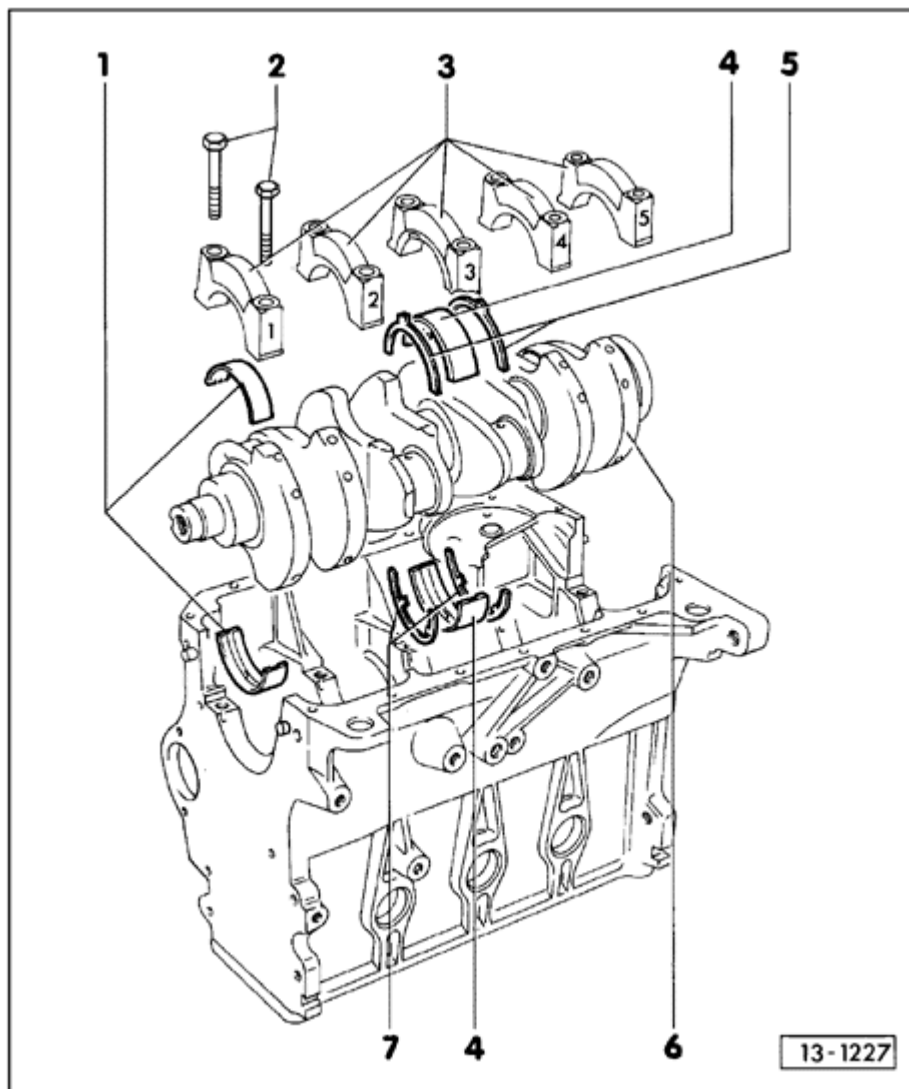
Volkswagen B3 Passat
General-Engine 4 CYL.
Ignition timing mark on flywheel, inscribing (Page 13-21)



Replacement flywheels and driveplates only have the TDC mark installed, it is therefore necessary to inscribe the ignition timing mark in the appropriate location when replacing either of these components.

- inscribe a mark 14.5mm (arc distance) to the left of the TDC mark as shown

Volkswagen B3 Passat
General-Engine 4 CYL.
Crankshaft, removing and installing (Page 13-22)



1 - Bearing shells 1, 2, 4, 5

- ◆ for caps 1, 2, and 5 without the oil groove
- ◆ for cap 4 and cylinder block with oil groove
- ◆ always return used bearings to their original location; do not interchange

2 - 65 Nm (48 ft lb)

3 - Bearing caps

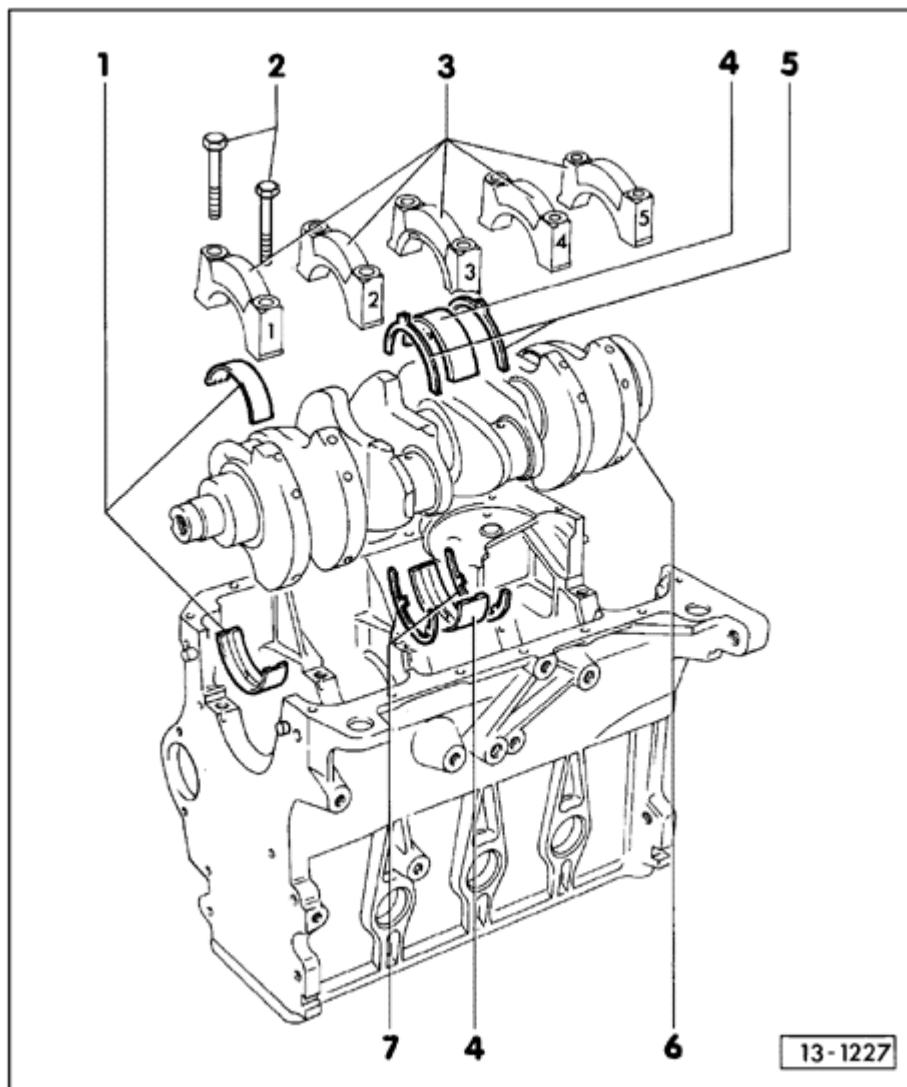
- ◆ cap 1: vibration damper side
- ◆ cap 2: has openings for thrust washer
- ◆ bearing shell retaining tabs in caps and cylinder block must be assembled on top of each other

4 - Bearing shell 3

- ◆ for cap without oil groove

◆ for cylinder block location with oil groove

**Volkswagen B3 Passat
General-Engine 4 CYL.
Crankshaft, removing and installing (Page 13-23)**



5 - Thrust washer

- ◆ for bearing cap 3
- ◆ note location

6 - Crankshaft

- ◆ axial play new: 0.07 to 0.17mm
wear limit: 0.25 mm
- ◆ measure radial play with Plastigage:
new: 0.02 to 0.06 mm
wear limit: 0.17 mm
- ◆ do not turn crankshaft while measuring radial play
- ◆ crankshaft measurements, ⇒ [page 13-24](#)

7 - Thrust washer

◆ for cylinder block, bearing 3

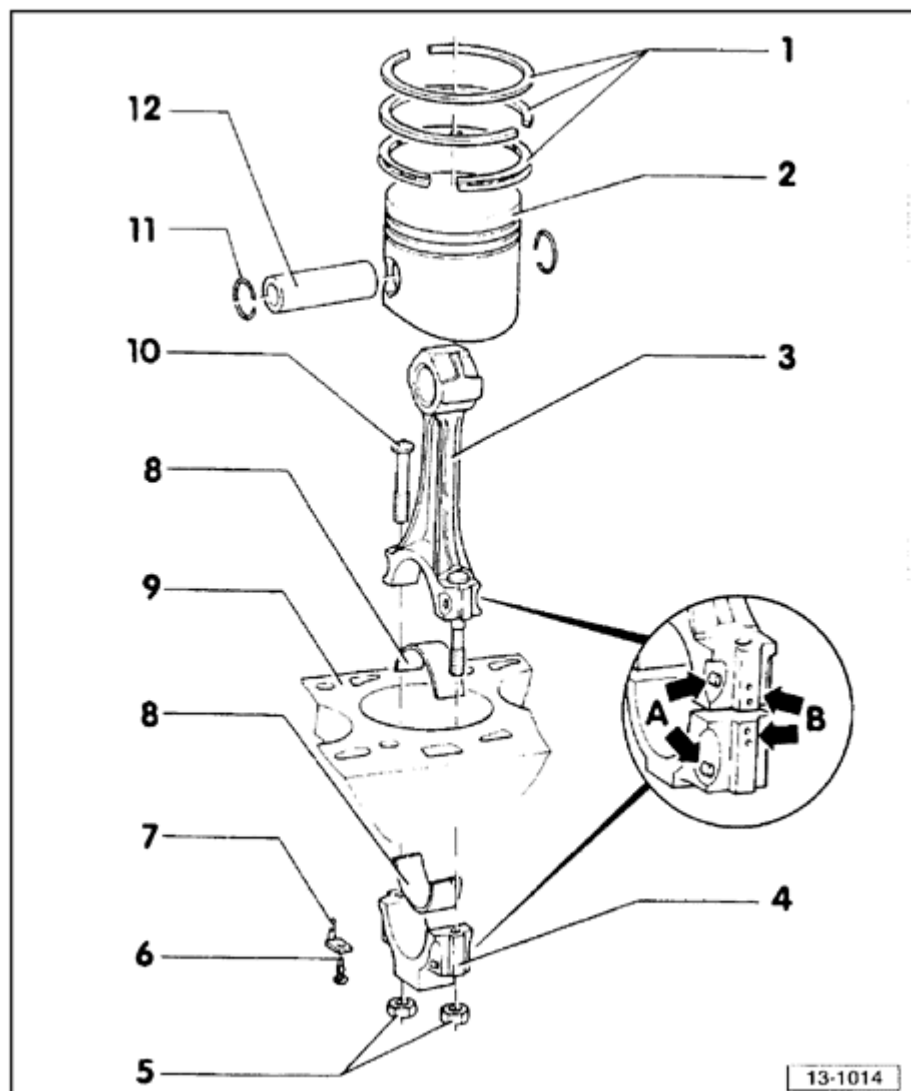
**Volkswagen B3 Passat
General-Engine 4 CYL.
Crankshaft, dimensions (Page 13-24)**

Crankshaft dimensions (mm)

Wear limit	Crankshaft bearing journals diameter	Connecting rod journals diameter
Standard	-0.022 54.00 -0.042	-0.022 47.80 -0.042
1st undersize	-0.022 53.75 -0.042	-0.022 47.55 -0.042
2nd undersize	-0.022 53.50 -0.042	-0.022 47.30 -0.042
3rd undersize	-0.022 53.25 -0.042	-0.022 47.05 -0.042

Volkswagen B3 Passat General-Engine 4 CYL.

Pistons and connecting rods, disassembling and assembling (Page 13-25)



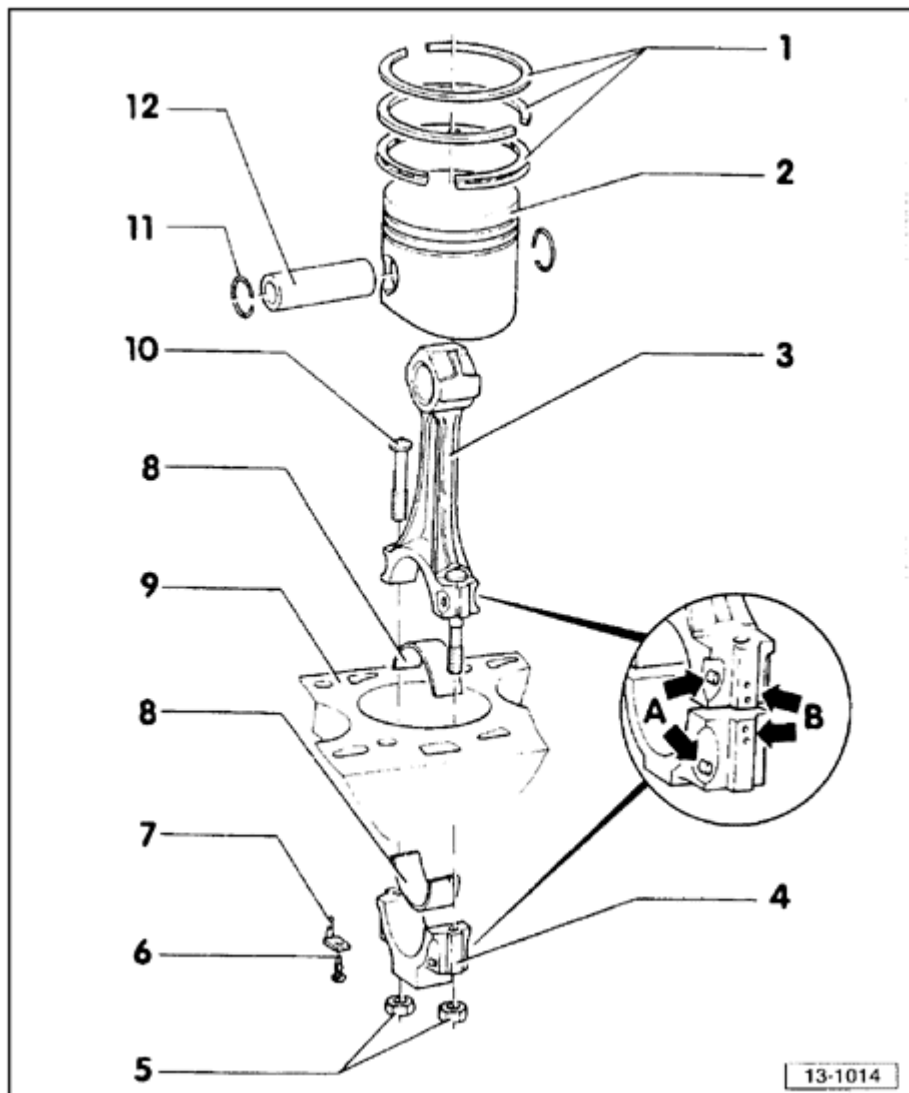
1 - Piston rings

- ◆ offset gaps by 120°
- ◆ remove and install using piston ring pliers
- ◆ install with word OBEN toward cylinder head
- ◆ check ring gap, ⇒ [Fig.1](#)
- ◆ ring land clearance, checking ⇒ [Fig. 2](#)

2 - Piston

- ◆ checking, ⇒ [Fig. 3](#)
- ◆ identify position and cylinder number
- ◆ arrow on piston crown points toward pulley side
- ◆ install using piston ring clamp

Volkswagen B3 Passat
General-Engine 4 CYL.
Pistons and connecting rods, disassembling and assembling (Page 13-26)



3 - Connecting rod

- ◆ replace only as a complete set
- ◆ mark cylinder number B
- ◆ installation position: marking A faces toward pulley end
- ◆ with oil passage for piston pin lubrication

4 - Connecting rod bearing cap

5 - 30 Nm (22 ft lb) + 1/4 additional turn

- ◆ oil threads and contacting surfaces before assembling
- ◆ to measure radial clearance, tighten to 30 Nm (22 ft lb) but no more

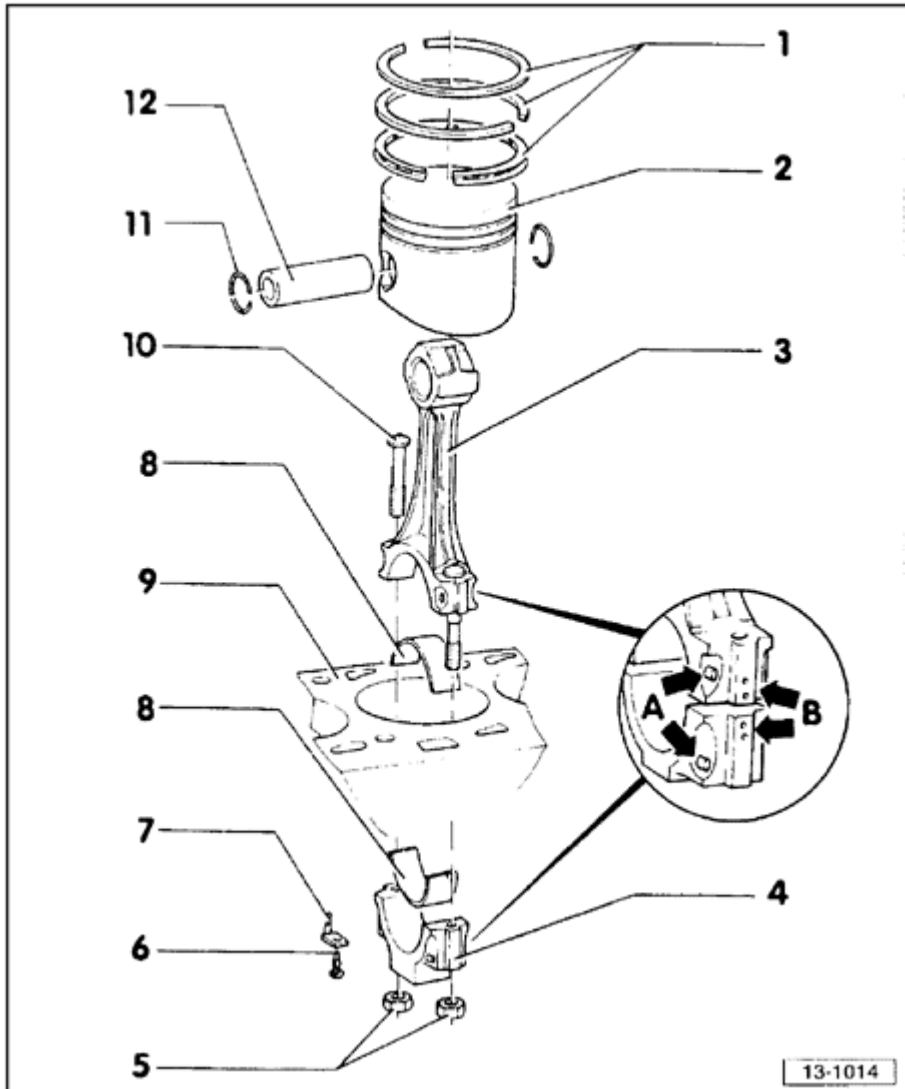
6 - Pressure relief valve

- ◆ 27 Nm (20 ft lb)
- ◆ opening pressure: 2.5 to 3.2 bar

Volkswagen B3 Passat

General-Engine 4 CYL.

Pistons and connecting rods, disassembling and assembling (Page 13-27)



7 - Oil jet spray

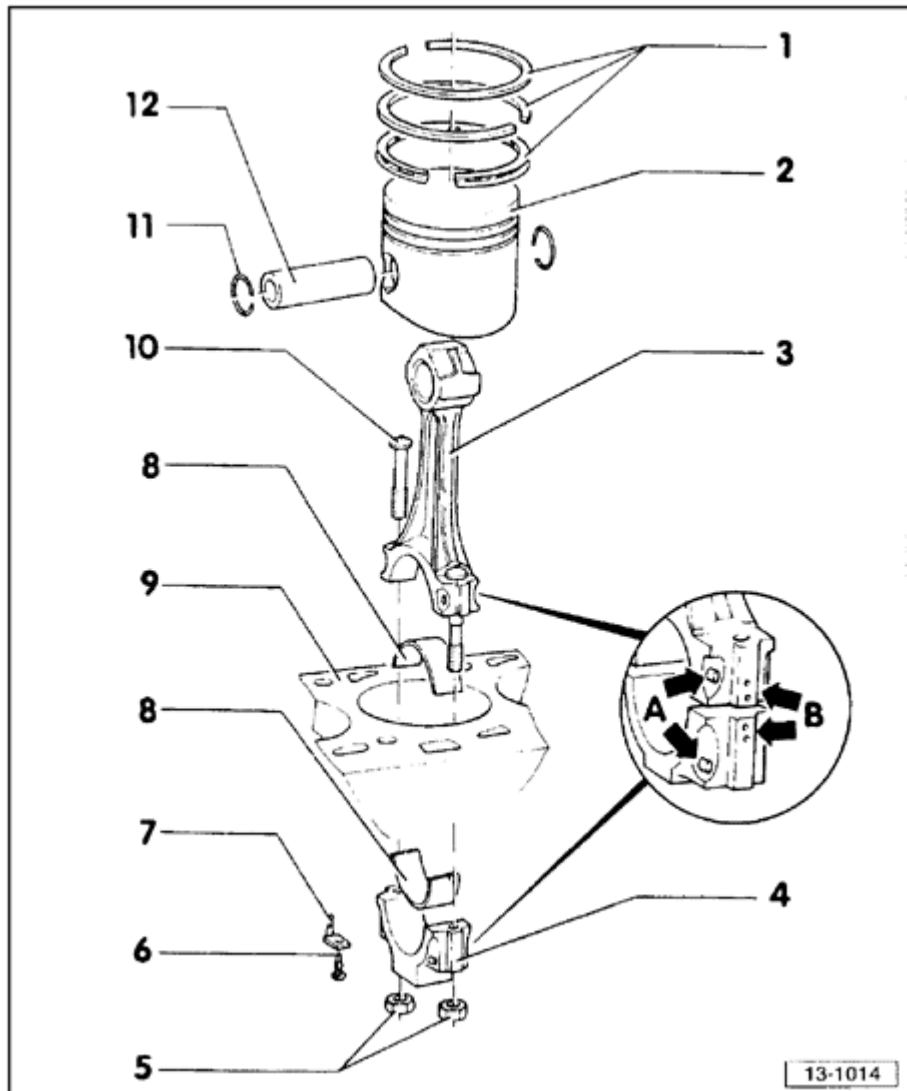
- ◆ for piston cooling

8 - Bearing shell

- ◆ note installed position
- ◆ do not interchange used bearing shells
- ◆ check for secure fit in retaining tabs
- ◆ axial play:
 - new: 0.05 to 0.31 mm
 - wear limit: 0.37 mm
- ◆ measure radial play with Plastigage:
 - new: 0.01 to 0.06
 - wear limit: 0.12 mm

- Do not turn crankshaft during radial play measurement
- ◆ with oil hole for piston lubrication

Volkswagen B3 Passat
General-Engine 4 CYL.
Pistons and connecting rods, disassembling and assembling (Page 13-28)



9 - Cylinder block

- ♦ check cylinder bore, ⇒ [Fig. 4](#)
- ♦ piston and cylinder dimensions, ⇒ [page 13-31](#)

10 - Connecting rod bolt

11 - Circlip

12 - Wrist pin

- ♦ if difficult to move: heat piston to: 140° F
- ♦ remove and install using VW 222A

**Volkswagen B3 Passat
General-Engine 4 CYL.
Pistons, ring gap/ring groove clearance, checking (Page 13-29)**

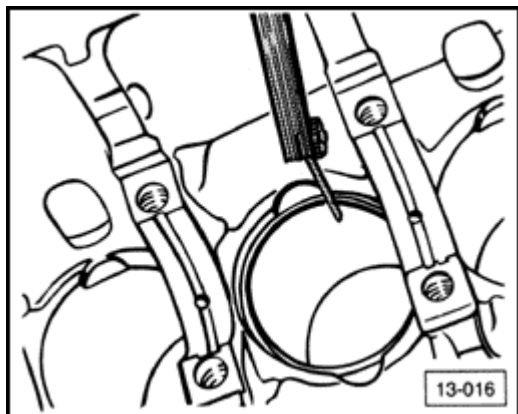


Fig. 1 Piston ring gap, checking

- install ring in cylinder approx. 15 mm from lower edge, push squarely into position using a piston (without rings installed)

Piston ring	Gap	Gap
	New	Wear limit
Compression rings	0.20 to 0.40 mm	1.0 mm
Oil scraper ring	0.25 to 0.50 mm	1.0 mm

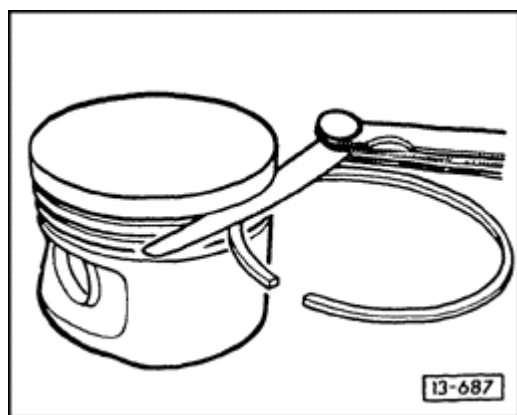


Fig. 2 Piston ring groove clearance, checking

- clean groove, insert ring as shown and measure gap using feeler gauges

Piston ring	Clearance	Clearance
	New	Wear limit
Compression rings	0.02 to 0.07 mm	0.15 mm
Oil scraper ring	0.02 to 0.06 mm	0.15 mm

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Cylinder block, external components, bore, measuring/Pistons and connecting rods, diameter, measuring (Page 13-30)

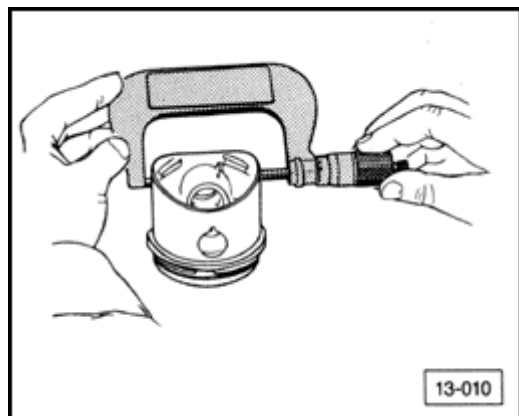


Fig. 3 Piston diameter, measuring

- Measure at a point approx. 10 mm from the lower edge and 90° to the wrist pin axis
- ♦ allowable deviation to nominal dimension: 0.04 mm

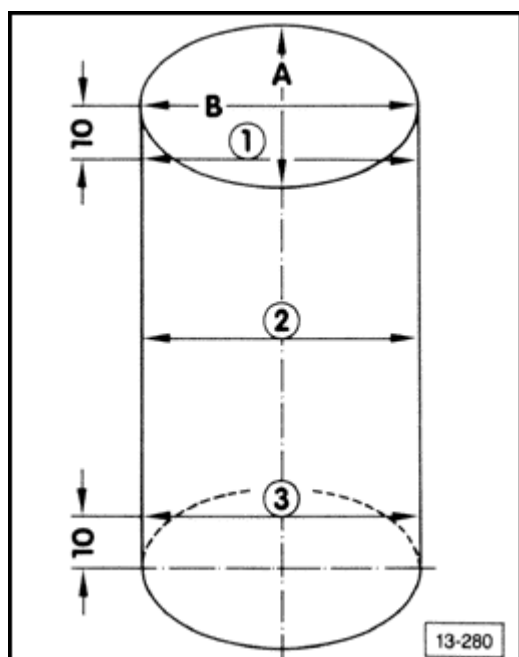


Fig. 4 Cylinder bore, measuring

- ♦ Measure at three different points in both direction -A- and -B-
- ♦ Use a 50 to 100 mm inside micrometer
- ♦ allowable deviation to nominal dimension: 0.08 mm

Note

Do not measure the bore while the block is attached to an engine stand using engine mount VW 540. The one sided mounting will cause uneven weight distribution along the block which in turn will cause dimensional distortions.

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Cylinder block, external components, bore, dimensions (Page 13-31)

Honing dimension	Piston diameter	Cylinder bore diameter
Basic dimension	82.485 mm	82.51 mm
1st undersize	82.735 mm	82.76 mm
2nd undersize	82.985 mm	83.01 mm