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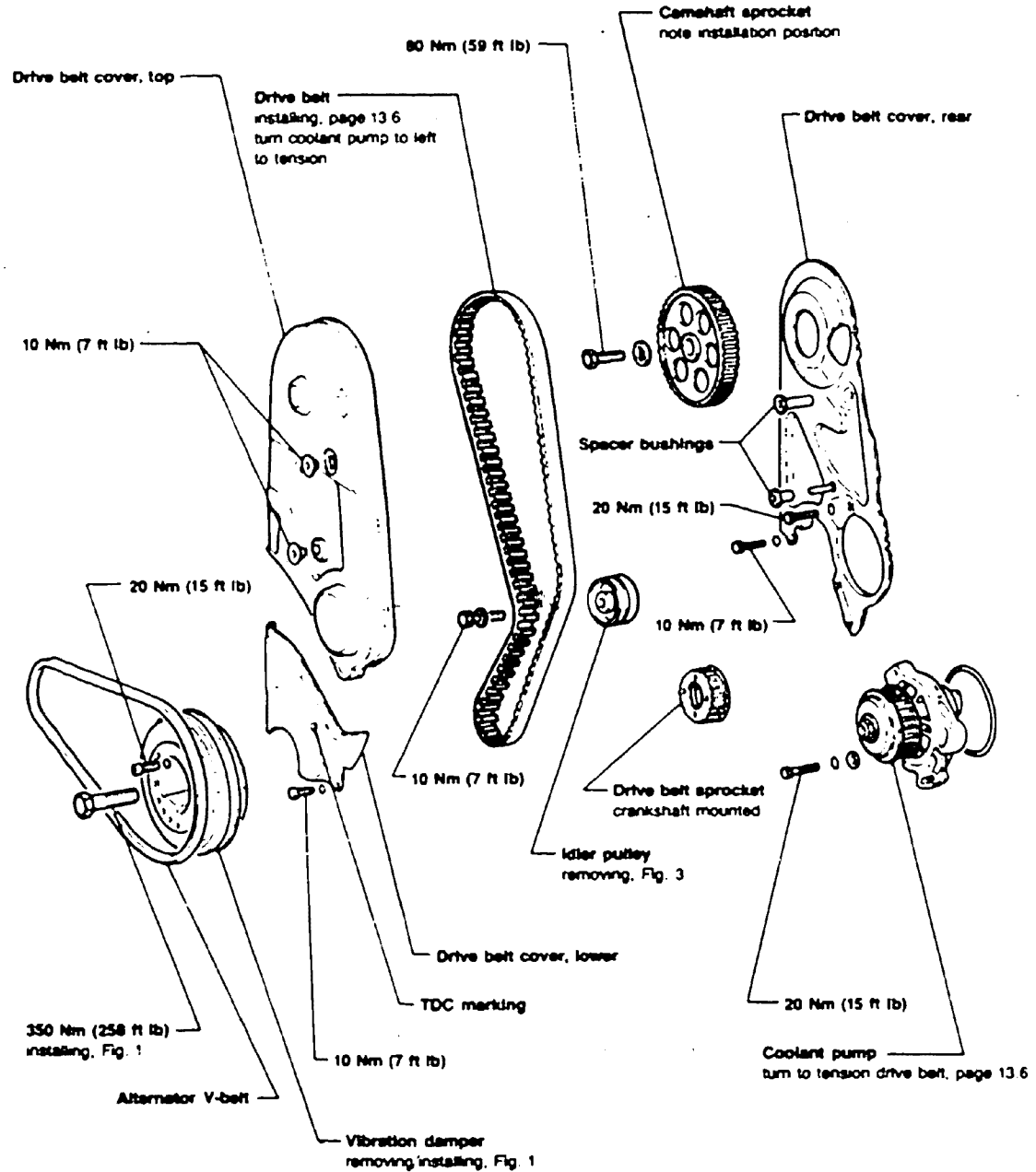
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Engine – Crankshaft, Crankcase

Note

Always replace seals and gaskets. See Repair Group 30 for clutch repairs

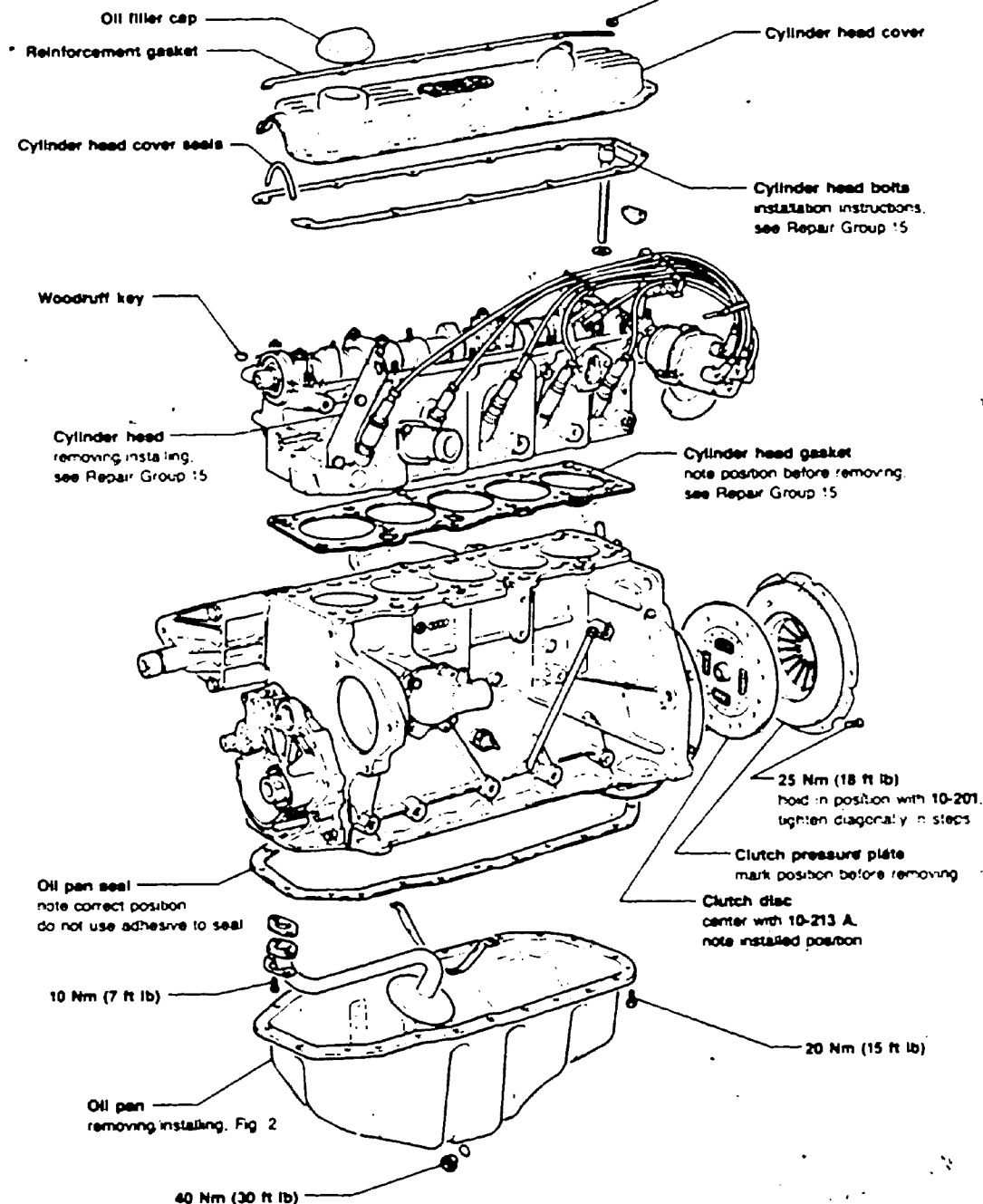


13-481

Engine – Crankshaft, Crankcase

Note

Always replace seals and gaskets.



13-482

Engine – Crankshaft, Crankcase

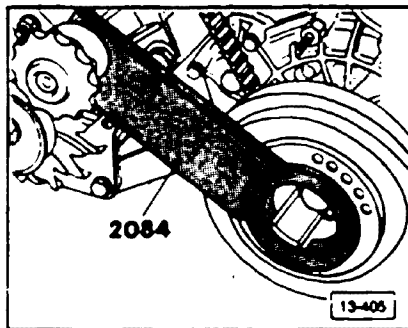
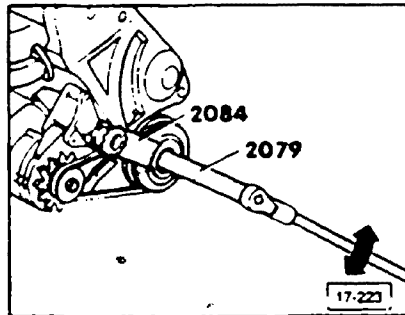


Fig. 1 Vibration damper, removing/Installing

Removing

- insert holder 2084 in vibration damper



- loosen and remove vibration damper with extension 2079 in alignment with torque wrench

Installing

- coat threads and contact surfaces of bolt head with anti-corrosion compound
AMV 188 100 02
- torque 350 Nm (258 ft lb)

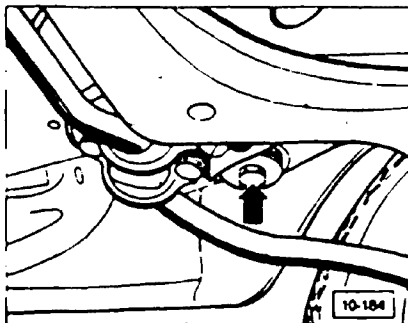


Fig. 2 Oil pan, removing/Installing

Removing

- drain oil
- remove both subframe bolts (arrow)
- remove oil pan

Installing

- install in reverse order, noting:
 - do not install with adhesive

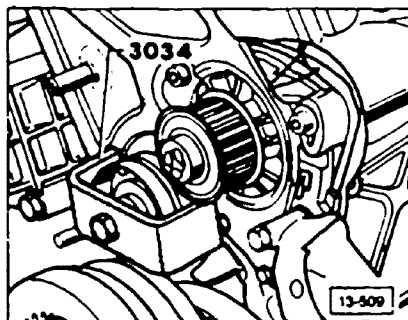


Fig. 3 Idler pulley, removing

- use tool 3034

CAUTION

Part numbers are listed for reference only. Always consult with the Parts Department for latest information.

Engine – Crankshaft, Crankcase

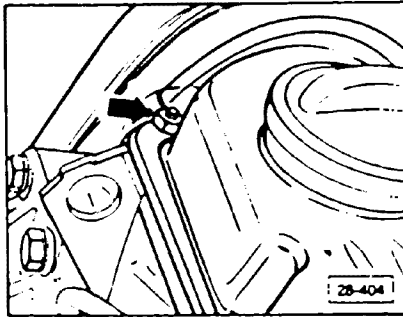


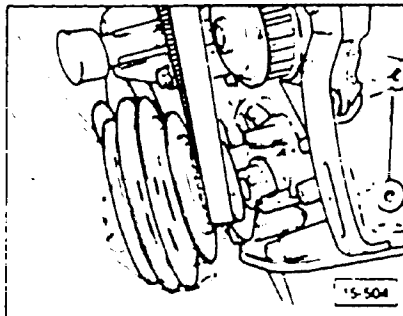
Fig. 4 Drive belt, installing

(Setting valve timing)

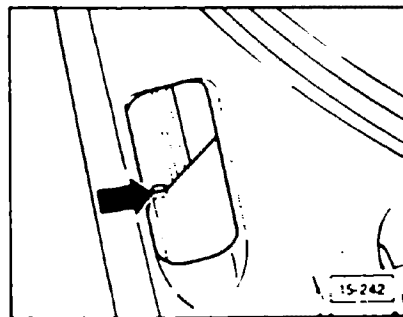
- align mark on camshaft sprocket with upper edge of cylinder head cover gasket (arrow)

CAUTION

Toothed belt must not be jammed between oil pump and sprocket when installing vibration damper.



- install belt and sprocket on crankshaft with vibration damper

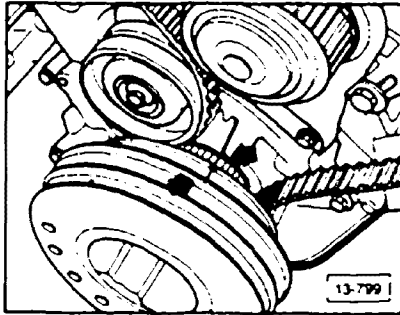


- set crankshaft at TDC

With engine installed:

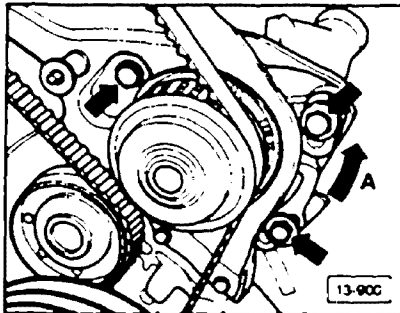
- align TDC mark 0 with cast mark (arrow) on bell housing

Engine – Crankshaft, Crankcase

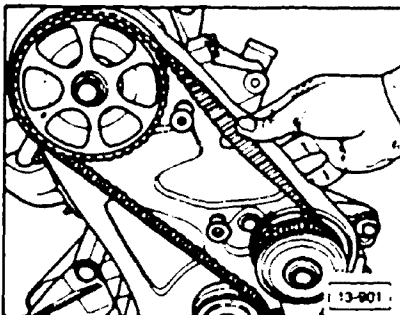


With engine removed

- align notch on pulley with reference mark on oil pump housing (**arrows**)



- loosen coolant pump mounting bolts (**arrows**)
- install drive belt
- adjust drive belt tension by turning coolant pump counter clockwise (**arrow A**)
- tighten coolant pump mounting bolts



- drive belt is tensioned correctly when belt can be twisted 90° with thumb and index finger mid-way between camshaft and coolant pump
- recheck adjustment
- install drive belt cover
- tighten vibration damper, page 13.4
- install power steering pump (see Repair Group 48)
- check ignition timing

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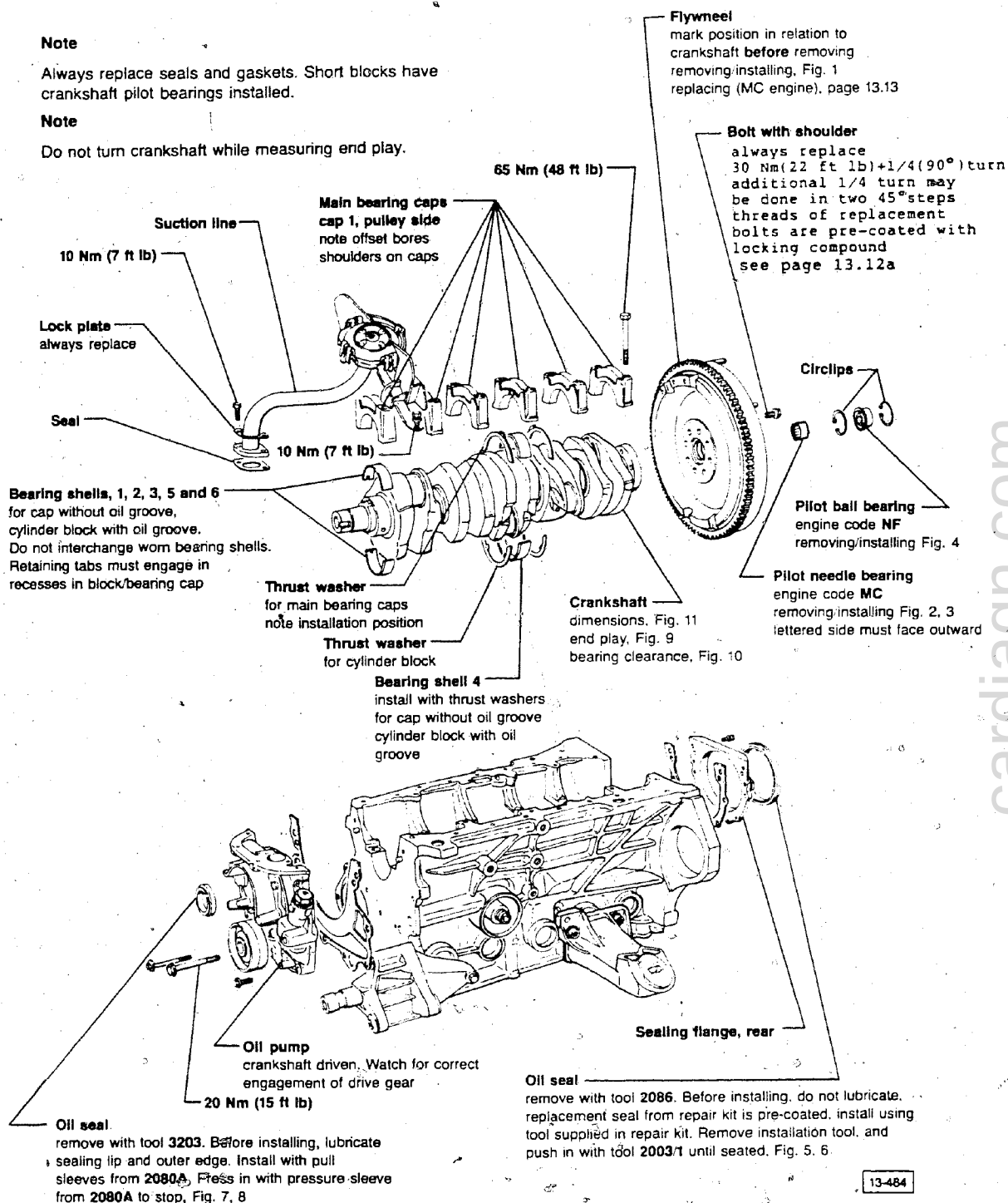
Engine – Crankshaft, Crankcase

Note

Always replace seals and gaskets. Short blocks have crankshaft pilot bearings installed.

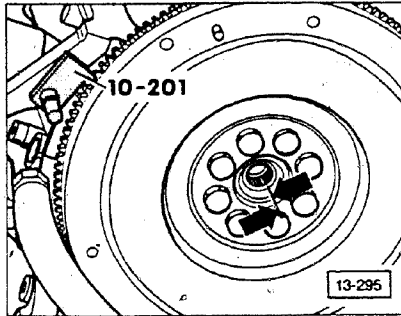
Note

Do not turn crankshaft while measuring end play.



13-484

Engine – Crankshaft, Crankcase



► Fig. 1 Flywheel, removing/installing

Removing

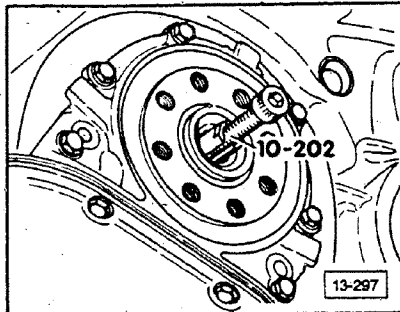
- mark relationship to crankshaft (as shown), before removing

Installing

CAUTION

Use dial type torque wrench.
Damage may result from use of a "click" type wrench.

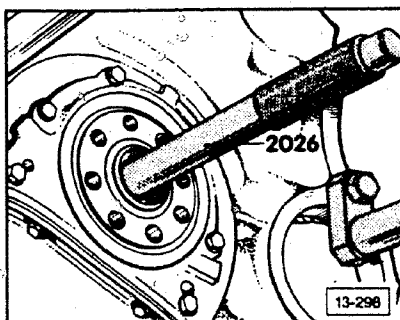
- always use bolt with shoulder (see page 13.12a)
- always replace bolts, do not reuse
- threads of replacement bolts are pre-coated with locking compound
- torque 30 Nm (22 ft lb) + 1/4 (90°) turn
 - additional 1/4 (90°) turn may be done in two 45° steps



► Fig. 2 Pilot needle bearing, removing

Engine code MC

- remove needle bearing with extractor (as shown)

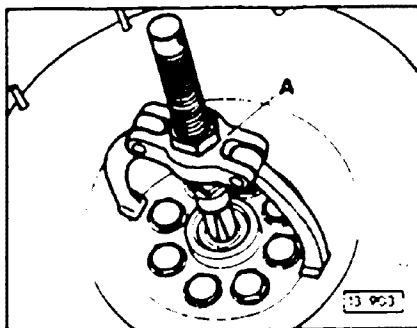


► Fig. 3 Pilot needle bearing, installing

Engine code MC

- lubricate with oil
- install to depth of $a = 5.5 \text{ mm}$ (7/32 in.)
 - letters on bearing must face outward

Engine – Crankshaft, Crankcase



► Fig. 4 Pilot ball bearing, removing

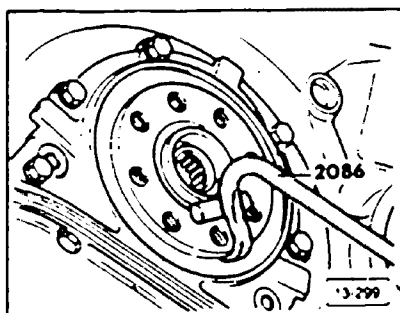
Engine code NF

- remove circlips
- remove bearing with extractor (as shown)

Pilot ball bearing, installing

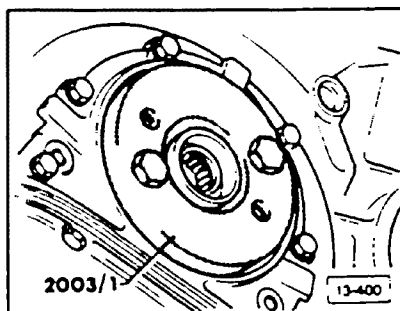
Engine code NF

- reinstall in reverse order using tools 30-505, 506b noting to properly seat circlips



► Fig. 5 Crankshaft oil seal (flywheel side), removing

- remove with tool 2086

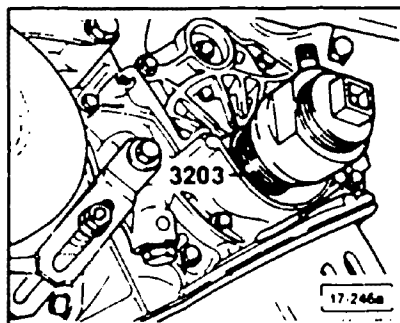


► Fig. 6 Crankshaft oil seal (flywheel side), installing

Note

Replacement seal in repair kit is pre-coated
Do NOT lubricate

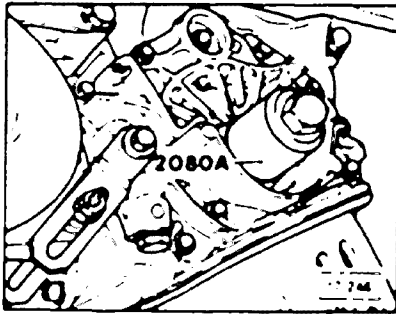
- install with tool supplied in repair kit
- remove installation tool and press oil seal in until fully seated



► Fig. 7 Crankshaft oil seal (pulley side), removing

- remove V-belt pulley with drive
- remove with tool 3203

Engine – Crankshaft, Crankcase

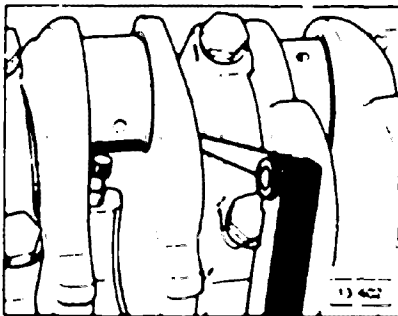


► Fig. 8 Crankshaft oil seal (pulley side), installing

- attach guide to crankshaft
- coat oil seal lip and outer surface lightly with oil
- push oil seal over oil seal guide
- slide sleeve over seal guide
- tighten sleeve with drive belt sprocket bolt until seal is seated

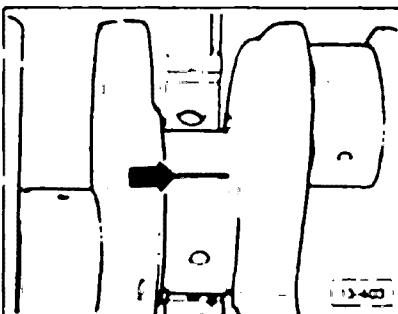
Note

If wear marks show on crankshaft, press gasket in to stop



► Fig. 9 Crankshaft end play, checking

- check with feeler gauge on main bearing No. 4
 - new part 0.07-0.23 mm (0.003-0.009 in.)
 - wear limit 0.29 mm (0.011 in.)



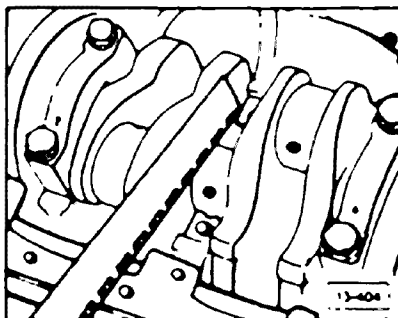
► Fig. 10 Main bearing clearance, checking

Crankshaft bearing clearance can also be checked with engine installed

- remove bearing caps
- clean shells and journals
- lay Plastigage® across journal (arrow)
- install bearing caps
 - tighten to 65 Nm (48 ft lb)

CAUTION

Do not turn crankshaft



- remove bearing caps again
- compare flattened width of Plastigage® with measuring scale
 - new part 0.018-0.058 mm (0.001-0.002 in.)
 - wear limit 0.16 mm (0.006 in.)

Engine – Crankshaft, Crankcase

► Fig. 11 Crankshaft dimensions (mm)

Engine code: MC

	Main bearing journal dia.	Connecting rod journal dia.
Standard	57.958 — 57.978	45.958 — 45.978
1st undersize	57.708 — 57.728	45.708 — 45.728
2nd undersize	57.458 — 57.478	45.458 — 45.478
3rd undersize	57.208 — 57.228	45.208 — 45.228

Engine code: NF

	Main bearing journal dia.	Connecting rod journal dia.
Standard	57.958 — 57.978	47.758 — 47.778
1st undersize	57.708 — 57.728	47.508 — 47.528
2nd undersize	57.458 — 57.478	47.258 — 47.278
3rd undersize	57.208 — 57.228	47.008 — 47.028

Engine – Crankshaft, Crankcase

New flywheel mounting bolts, revised tightening torque

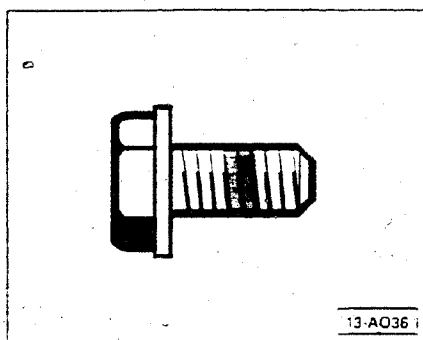
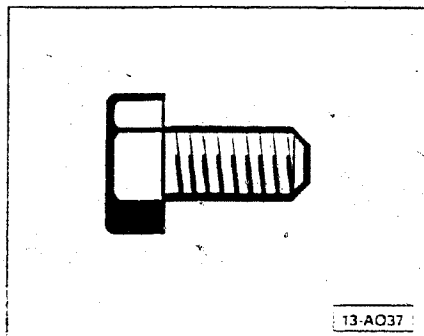
CAUTION

Part numbers are for reference only. Always check with your Parts Department for latest information.

Effective immediately, flywheel bolt, Part No. N 902 061 01 without shoulder is no longer available.

Old:

100 Nm (74 ft lb)



The replacement bolt Part No. N 902 061 03 with shoulder, requires a revised tightening torque for installation.

New:

30 Nm (22 ft lb) + 1/4 (90°) turn

CAUTION

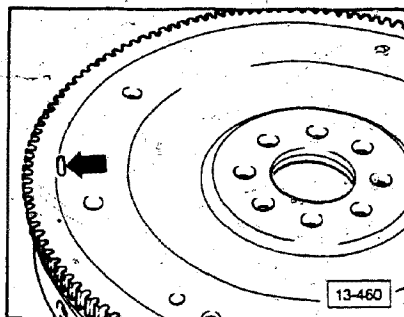
Use dial type torque wrench. Damage may result from use of a "click" type wrench.

- additional 1/4 (90°) turn may be done in two 45° steps
- always replace bolts, do not reuse
- threads of replacement bolts are pre-coated with locking compound

Engine – Crankshaft, Crankcase

CAUTION

If the pin for ignition timing reference sensor is not installed when replacing flywheel, the electronic ignition system will obtain no control impulse and engine will not start.



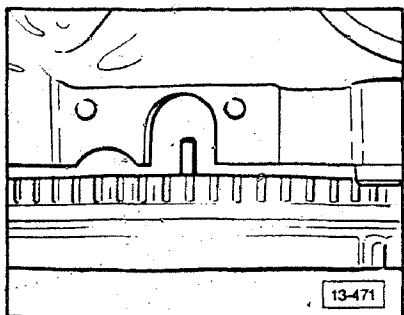
Flywheel, replacing

Engine code MC

CAUTION

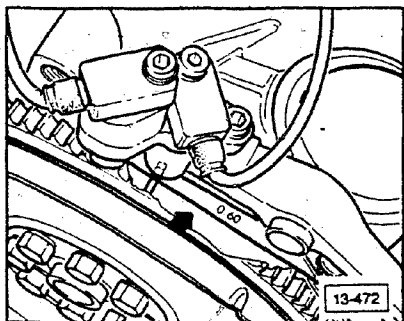
Do not bend pins when replacing flywheel.

- insert pin for ignition timing point (arrow)
 - pin height
 $11.8 \pm 0.1 \text{ mm}$ (.46 $\pm$.004 in.)



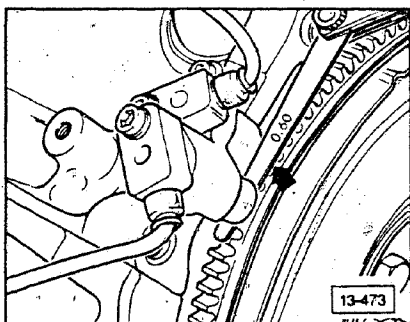
Ignition timing reference sensor, installing

- turn flywheel until pin for ignition timing point is below opening for ignition timing reference sensor

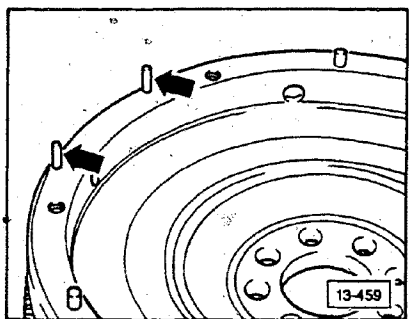


- install sensor
- insert feeler gauge (arrow) between pin and ignition point sensor
 - specified value: 0.45-1.25 mm
(0.017-0.049 in.)

Engine – Crankshaft, Crankcase



- insert feeler gauge (**arrow**) between splines of the flywheel and sensor for engine RPM
 - specified value: 0.51-1.24 mm (0.020-0.49 in.)

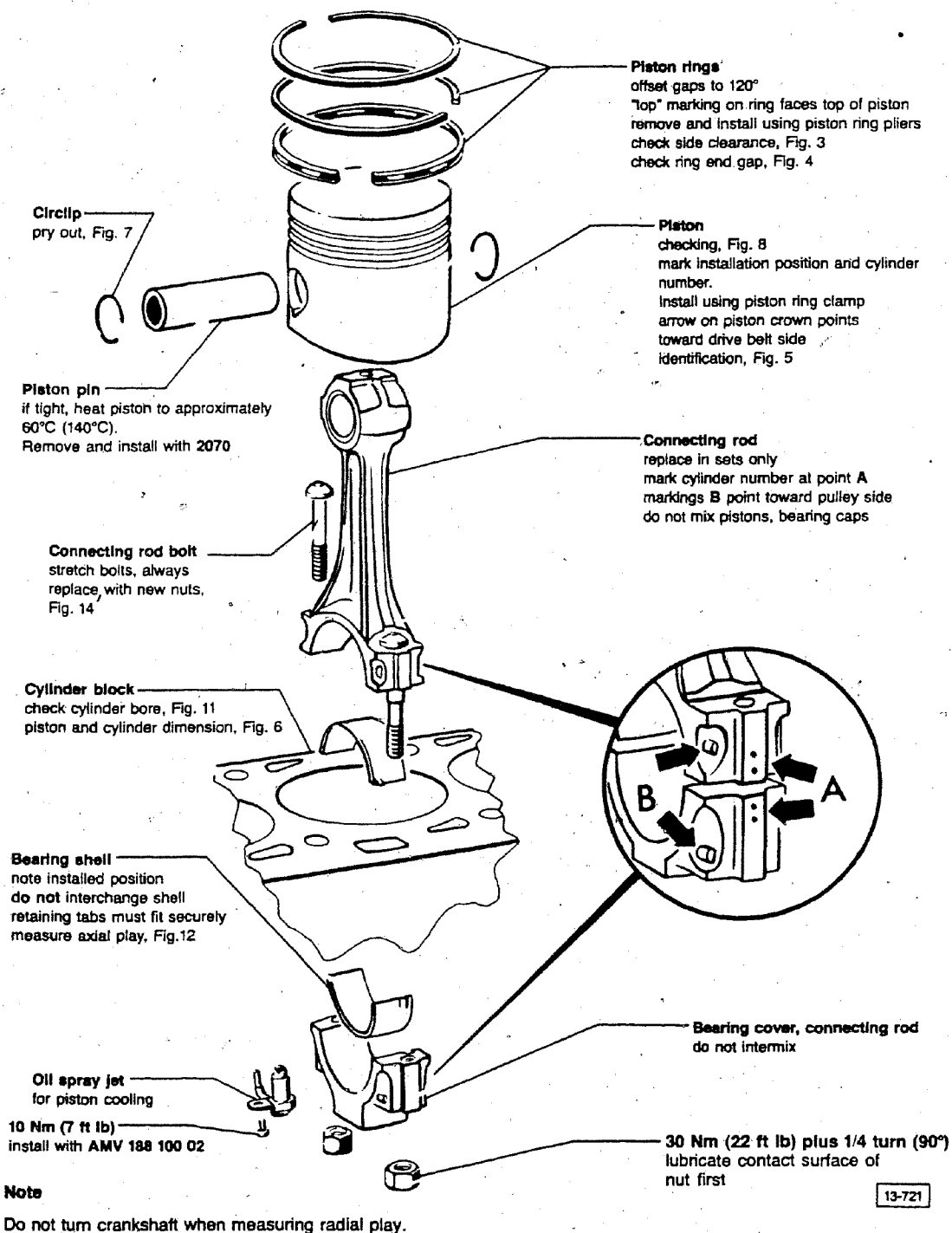


Engine tester magnetic pick-up pins, checking

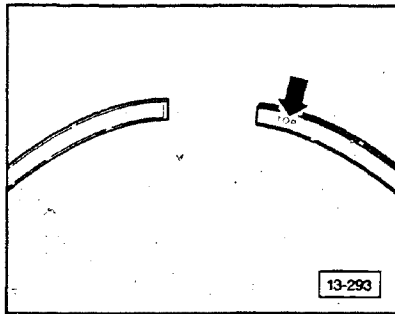
- pin height
13.5-14.0 mm (0.53-0.56 in.)

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Engine – Crankshaft, Crankcase

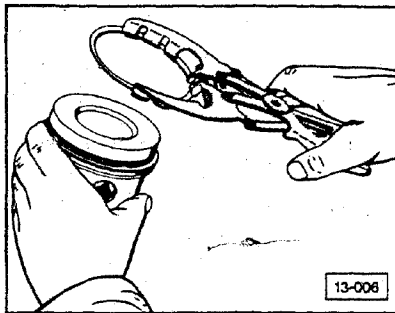


Engine – Crankshaft, Crankcase

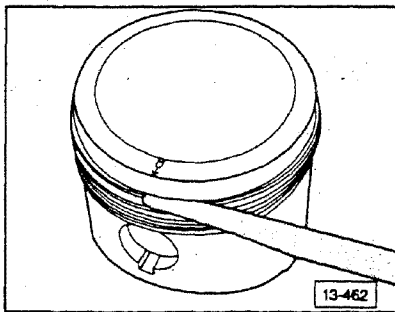


► Fig. 1 Piston rings, installed position

- Marking on ring, "TOP", faces toward top of piston
- chamfer on plain compression ring must point to piston crown
- indentation on stepped scraper ring must point to connecting rod bolt

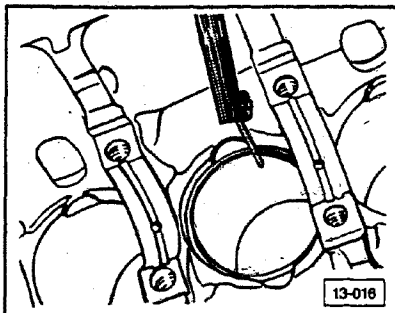


► Fig. 2 Piston rings, installing



► Fig. 3 Piston ring, side clearance, checking

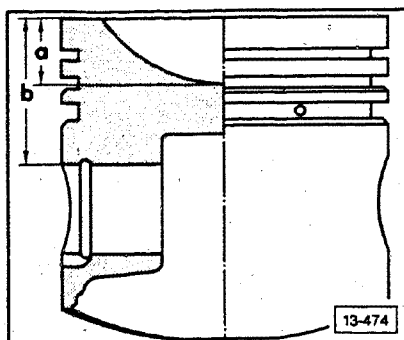
- new: 0.02-0.08 mm (0.001-0.003 in.)
- wear limit: 0.1 mm (0.004 in.)



► Fig. 4 Piston ring end gap, checking

- insert ring squarely into cylinder until it is approximately 15 mm (19/32 in.) from edge of cylinder
- new: 0.2-0.5 mm (0.008-0.020 in.)
- wear limit: 1.0 mm (0.04 in.)

Engine – Crankshaft, Crankcase



► Fig. 5 Piston identification (mm)

engine code **NF** (CIS-E III)

a = 4.4 mm

b = 33.3 mm

engine code **MC** (CIS Turbo)

a = 15.0 mm

b = 31.5 mm

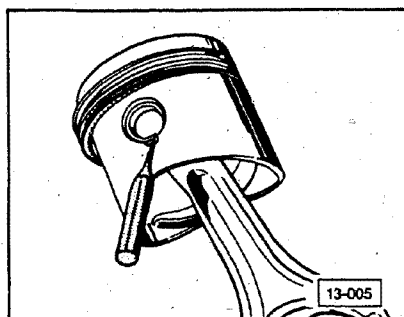
Note

Recess depth **a** is measured at deepest point.

Engine Code MC	Piston dia.	Cylinder bore
Standard	80.98	81.01
1 st oversize	81.23	81.26
2 nd oversize	81.48	81.51

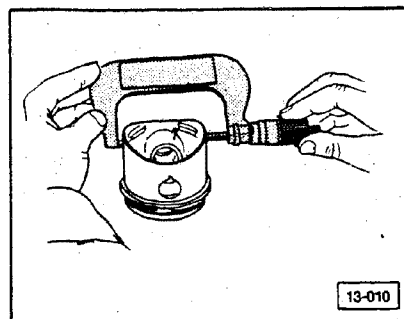
► Fig. 6 Piston and cylinder dimensions (mm)

Engine Code NF	Piston dia.	Cylinder bore
Standard	82.48	82.51
1 st oversize	82.74	82.76
2 nd oversize	82.98	83.01



► Fig. 7 Piston pin circlip, removing

- pry out with punch (as shown)



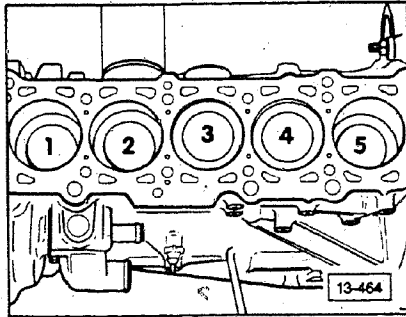
► Fig. 8 Piston clearance/wear, checking

Measure piston approximately 12 mm (15/32 in.) from the lower edge, at 90° to piston pin axis.

Nominal dimension tolerance:

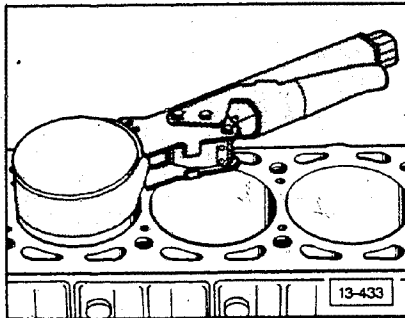
- maximum 0.04 mm (0.002 in.)

Engine – Crankshaft, Crankcase



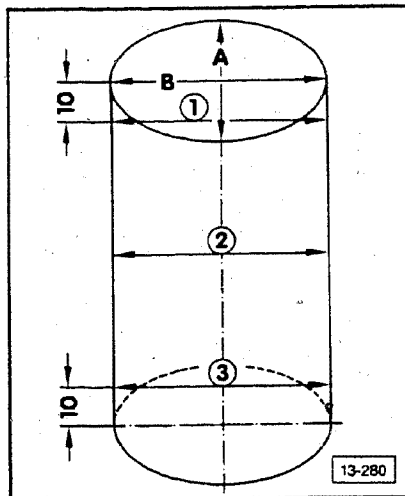
► Fig. 9 Pistons, installed position

Arrow on piston top points to pulley. Number and mark pistons before removing. Do not mix pistons/cylinders. Piston has to be installed in cylinder it came out of.



► Fig. 10 Piston, installing

- install with piston ring clamp



► Fig. 11 Cylinder bore, checking

Measure at three points 1, 2, 3 in cross direction **A** and longitudinal direction **B**

1 = 10 mm (3/8 in.) from top

2 = middle of cylinder wall

3 = 10 mm (3/8 in.) from bottom
use inside micrometer 50-100 mm
(1.97-3.93 in.)

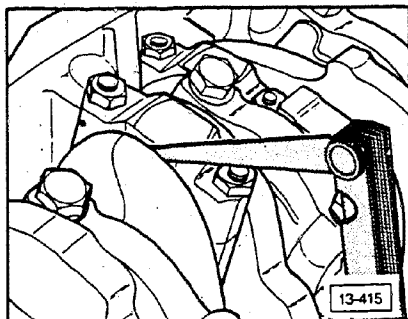
Nominal dimension deviation:

- maximum 0.08 mm (0.003 in.)

CAUTION

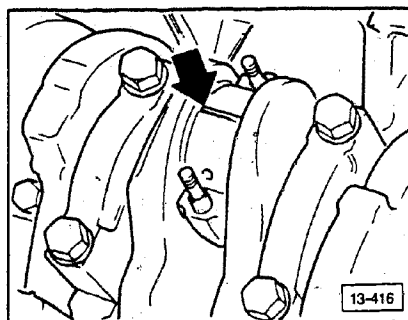
Do not measure cylinder bore when cylinder block is mounted to work bench with engine mount **VW 540**. Measuring may be affected because of cylinder block distortion.

Engine – Crankshaft, Crankcase



► Fig. 12 Connecting rod side clearance, checking

- wear limit: 0.4 mm (0.016 in.)



► Fig. 13 Connecting rod bearing clearance, checking

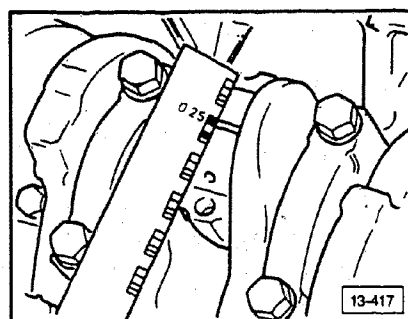
Note

May be checked with engine installed.

- remove bearing cap
- clean shells and journal
- lay Plastigage® across journal (arrow)
- oil contact surface of nut
- install bearing cap and tighten to 30 Nm (22 ft lb) **plus 1/4 turn (90°)**
- using old nuts and bolts

CAUTION

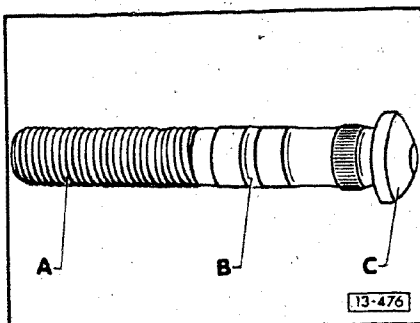
Do not turn crankshaft.



- remove bearing cap again
- compare flattened width of Plastigage® with measuring scale
 - new part: 0.010-0.058 mm (0.0004-0.002 in.)
 - wear limit: 0.12 mm (0.005 in.)

CAUTION

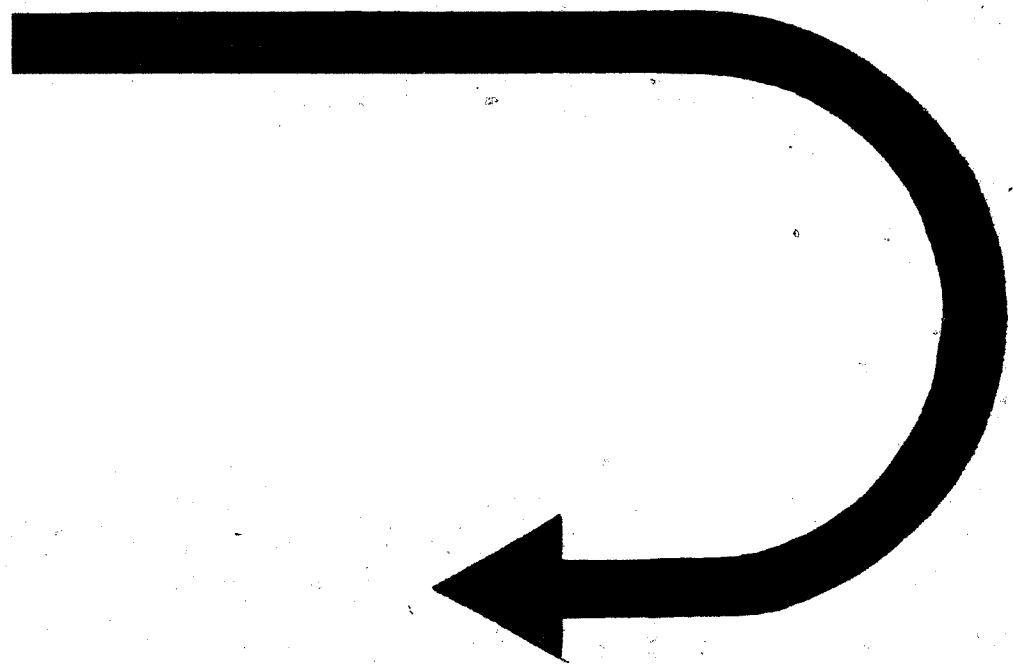
During repairs, always replace nuts and bolts at final assembly.



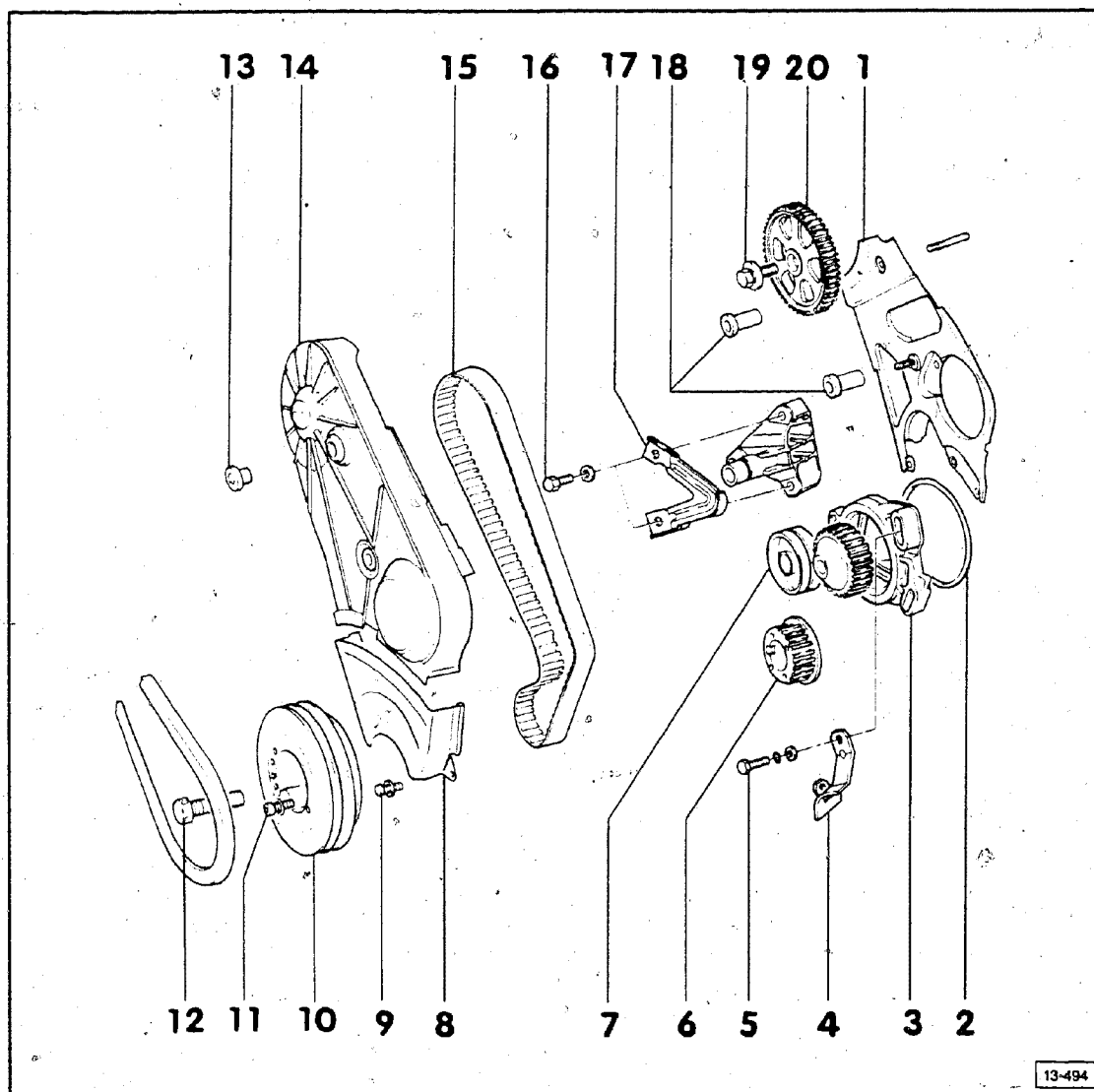
► Fig. 14 Connecting rod bolt, identification

- stretch type bolts used
 - A – thread diameter M8 x 1 thread length 25 mm (approximately 1.0 in.)
 - B – smooth center surface
 - C – conical bolt head shape

CONTINUED IN THE
BEGINNING OF NEXT ROW



Engine – Crankshaft, Crankcase



Note

Always replace seals, gaskets, O-rings.

1 — Drive belt cover, rear

2 — O-ring

3 — Coolant pump
turn counterclockwise to tension drive belt

4 — V-belt deflection limiter, left

5 — 22 Nm (16 ft lb)

6 — Drive belt sprocket
crankshaft mounted

7 — Idler pulley
removing, page 13.22

8 — Drive belt cover, lower

9 — 10 Nm (7 ft lb)

10 — Vibration damper
note installation position, holes offset

11 — 22 Nm (16 ft lb)

12 — 350 Nm (258 ft lb)

13 — 10 Nm (7 ft lb)

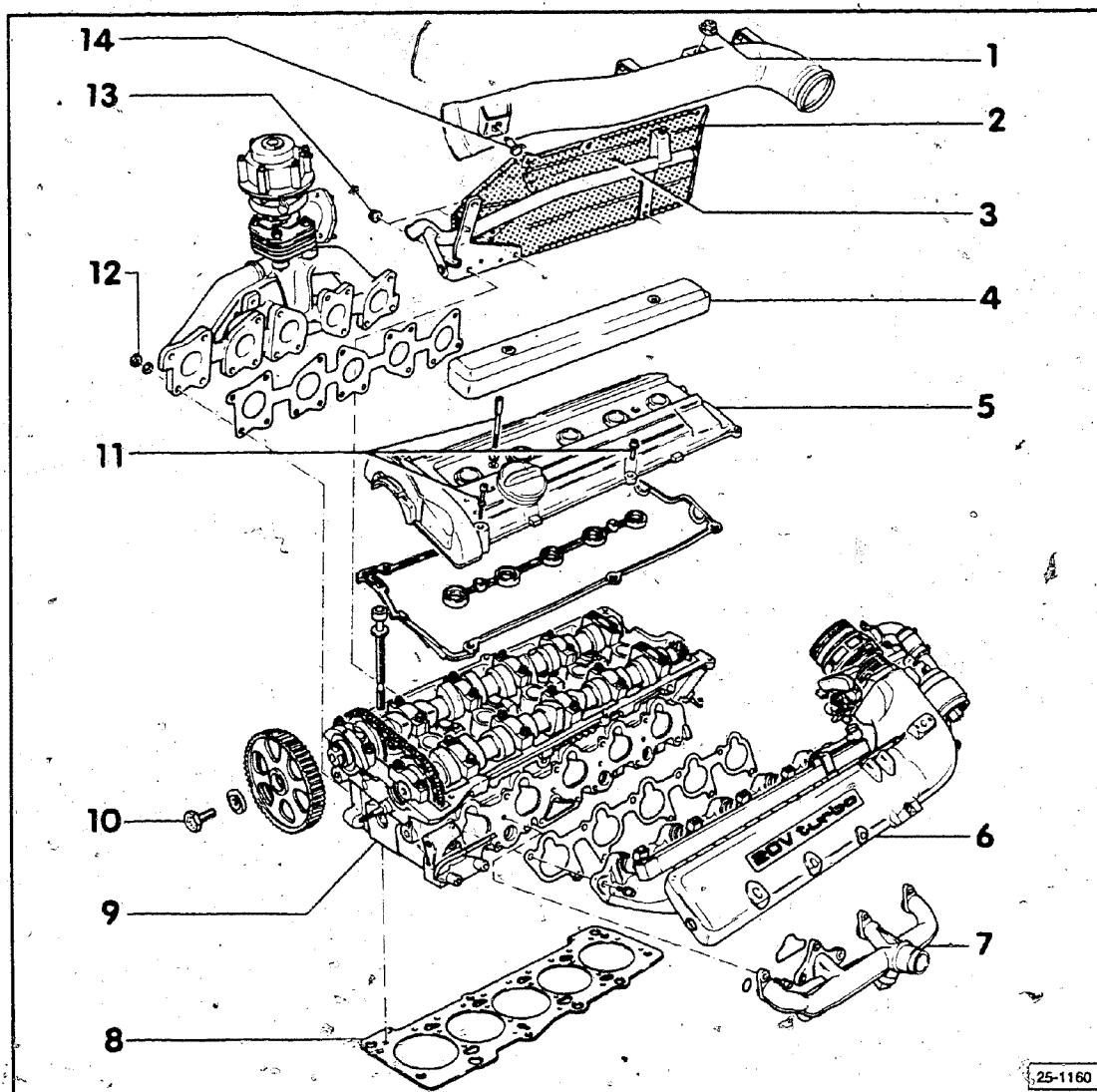
14 — Drive belt cover, top

Engine – Crankshaft, Crankcase

- 15 — Drive belt
 - installing, page 13.24
 - turn coolant pump to left to tension
- 16 — 43 Nm (32 ft lb)
- 17 — V-belt deflection limiter, (right)
- 18 — Spacer bushings
- 19 — 67 Nm (50 ft-lb)
- 20 — Camshaft sprocket

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Engine – Crankshaft, Crankcase



Note

Always replace seals and gaskets. Cylinder head can be removed with engine installed.

When installing replacement head, oil contact surface between hydraulic lifter and camshaft.

1 — 22 Nm (16 ft lb)

2 — Heat shield

3 — Crankcase breather pipe

4 — Ignition wire cover

5 — Cylinder head cover
remove throttle valve housing first

6 — Intake manifold — 22 Nm (16 ft lb)
remove/install with tool V.A.G. 1669 or equivalent

7 — Coolant manifold — 10 Nm (7 ft lb)

8 — Cylinder head gasket

- install over locating pin in cylinder block
- word "OBEN" or part number must face cylinder head

9 — Cylinder head

- installing, see Repair Group 15
- checking for distortion

10 — 67 Nm (50 ft lb)

11 — 10 Nm (7 ft lb)

12 — 25 Nm (18 ft lb)

13 — 22 Nm (16 ft lb)

14 — 22 Nm (16 ft lb)

Engine – Crankshaft, Crankcase

Vibration damper, removing/ installing

Removing

- insert holder **2084** in vibration damper
- loosen and remove vibration damper with extension **2079** in alignment with torque wrench

Installing

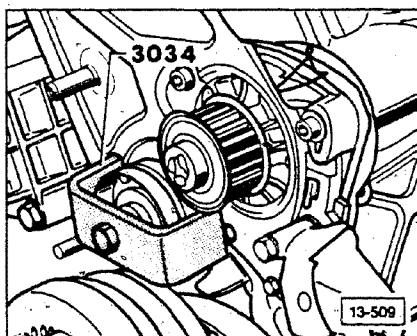
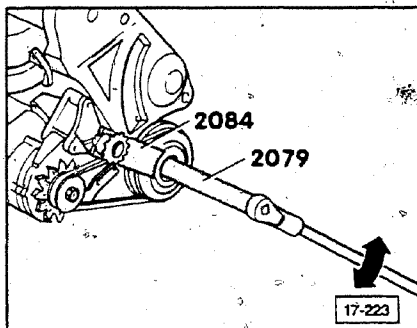
CAUTION

Part numbers are listed for reference only. Always consult with the Parts Department for latest information.

- coat threads and contact surfaces of bolt head with anti-corrosion compound
Part No. **AMV 188 000 02** or equivalent
 - torque 350 Nm (258 ft lb)

Idler pulley, removing

- use tool **3034**



Engine – Crankshaft, Crankcase

Oil pan, removing/installing

Removing

CAUTION

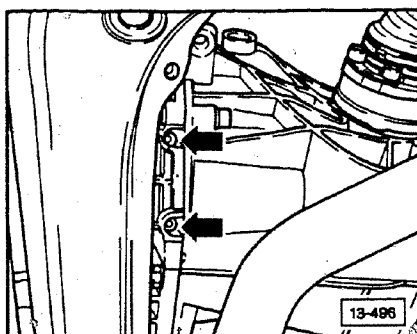
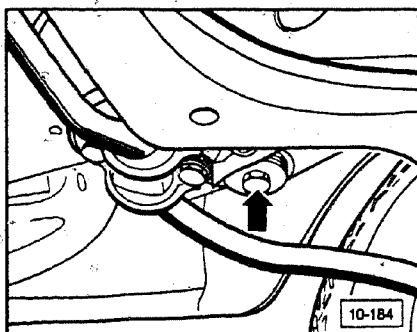
Subframe will drop approximately 100 mm (approximately 4.0 in.).

- remove oil dipstick
- drain engine oil

CAUTION

Do not reuse subframe bolts.

- remove both subframe bolts (arrow)



- turn flywheel so that recesses are pointing down vertically and remove both rear oil pan bolts (arrows)
- remove oil pan

Installing

Install in reverse order, noting the following:

- install rear oil pan bolts finger tight, then tighten to:
 - M 6 = 10 Nm (7 ft lb)
 - M 8 = 22 Nm (16 ft lb)
- tighten subframe bolts to 65 Nm (48 ft lb) plus 1/4 turn (90°)

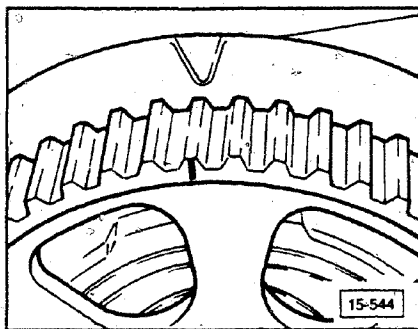
Engine – Crankshaft, Crankcase

Drive belt, installing

(Setting valve timing)

Cylinder head cover installed

- align mark on camshaft sprocket with arrow on cylinder head

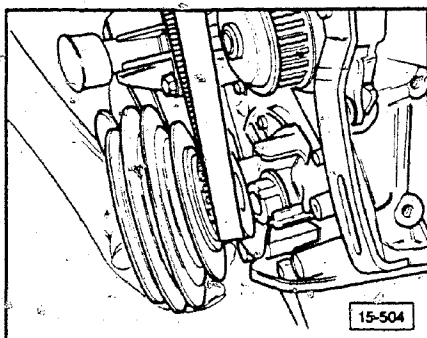
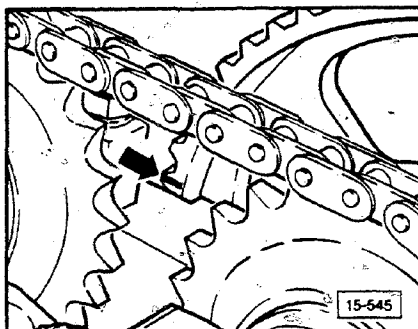


CAUTION

Toothed belt must not be jammed between oil pump and sprocket when installing vibration damper.

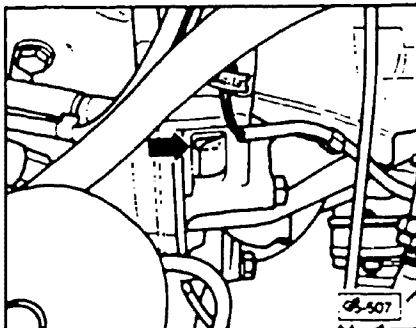
Cylinder head cover removed

- mark on camshaft sprocket must align with upper edge of cylinder head (arrow)



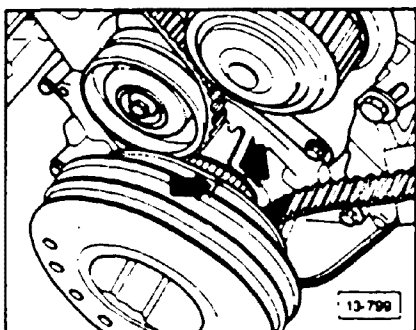
- install belt and sprocket on crankshaft with vibration damper

Engine – Crankshaft, Crankcase



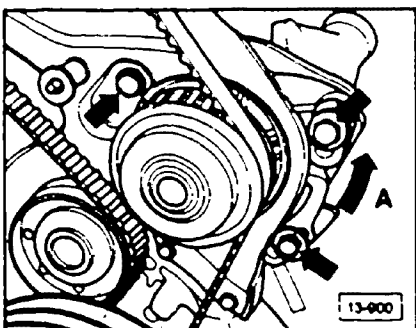
With engine installed

- set crankshaft at TDC
- align TDC mark 0 with cast mark (arrow) on clutch housing

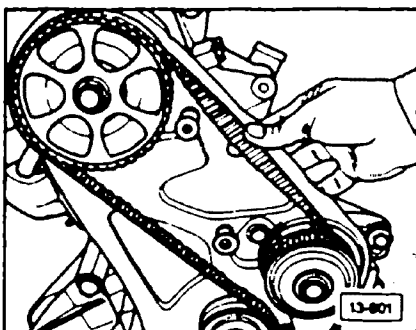


With engine removed

- align notch on pulley with reference mark on oil pump housing (arrows)
- install lower drive belt cover
 - additional adjustment mark provided
- install drive belt over idler pulley, coolant pump onto camshaft sprocket



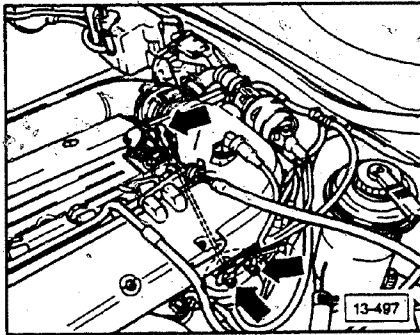
- adjust drive belt tension by turning coolant pump counter clockwise (arrow A)



- drive belt is tensioned correctly when belt can be twisted 90° with thumb and index finger mid-way between camshaft and coolant pump
- tighten coolant pump
 - torque 20 Nm (15 ft lb)
- turn crankshaft 2 full turns, and recheck adjustment
- check ignition timing, see Repair Group 28
- install power steering pump, adjust V-belt

Engine – Crankshaft, Crankcase

Cruise control vacuum unit, removing/installing



Removing

- remove ball pin securing clip (arrow)
- disconnect linkage from cam ball pin
- unscrew and remove vacuum from bracket

Installing

Reinstall all components in reverse order, noting the following:

- check cruise control system for proper function

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Engine – Crankshaft, Crankcase

Power steering V-belt, adjusting

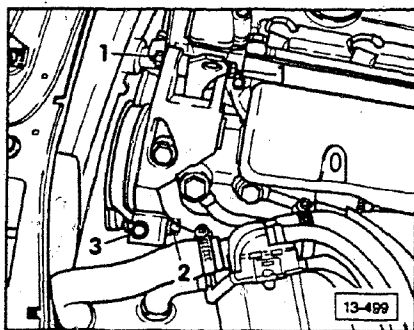
Note

Use torque wrench **V.A.G. 1410** with socket **V.A.G. 1410/2** (22 mm) or equivalent.

- loosen bolts 1, nut 2
- turn adjusting bolt 3 as required
- check belt deflection by thumb:

new and used belt approximately
10 mm (25/64 in.)

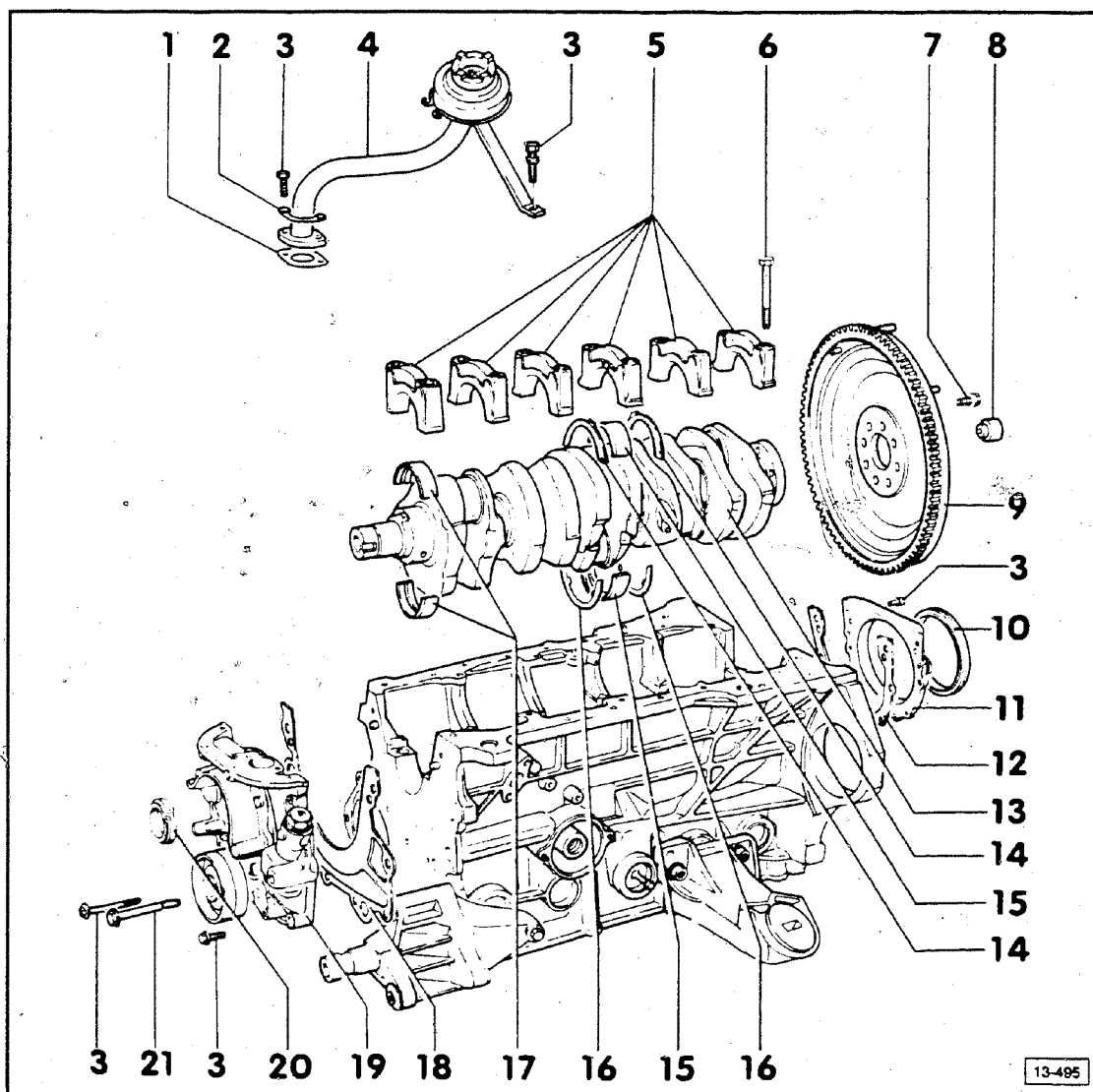
- tighten bolts 1, nut 2 to 22 Nm (16 ft lb)



THIS FRAME INTENTIONALLY LEFT

BLANK

Engine – Crankshaft, Crankcase



CAUTION

Use dial type torque wrench for installing flywheel bolts. Damage may result from use of a "click" type wrench.

CAUTION

Do not turn crankshaft.

Note

Always replace seals, gaskets, o-rings.

1 — Seal, suction line

2 — Locking plate
always replace

3 — 10 Nm (7 ft lb)

4 — Suction line

5 — Main bearing caps

- cap 1 on pulley side
- note bore offset
- retaining tabs on shells must align

6 — 65 Nm (48 ft lb)

7 — Bolt with shoulder — 30 Nm (22 ft lb) plus 1/4 turn (90°)

- always replace — do not reuse
- additional 1/4 turn may be done in two 45° steps
- threads of replacement bolts are pre-coated with locking compound
- see page 13.12a

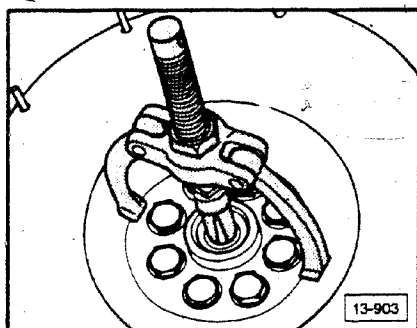
- 8 — Pilot needle bearing
 - removing/installing, page 13.30
 - lettered side must face outward
- 9 — Flywheel
 - remove/install with locking spanner tool 10-201
 - install ignition timing pin after installation
- 10 — Oil seal
 - removing/installing, page 13.31
- 11 — Sealing flange, rear
- 12 — Sealing flange gasket, rear
 - always replace
- 13 — Crankshaft
 - wear limits, dimensions, page 13.33
- 14 — Thrust washer
 - note installation position
 - for main bearing caps
- 15 — Bearing shell 4
 - install with thrust washers
 - for bearing caps without oil grooves
 - for engine block with oil grooves
- 16 — Thrust washer
 - without retaining tabs
 - for cylinder block
- 17 — Bearing shells 1, 2, 3, 5, 6
 - for main bearing caps without oil groove
 - for cylinder block with oil groove
 - do not interchange worn bearing shells
 - retaining tabs must engage in recesses in block, bearing caps
- 18 — Oil pump gasket
- 19 — Oil pump
 - crankshaft driven
 - note correct engagement of drive gear
- 20 — Oil seal
 - removing/installing, page 13.31
- 21 — 22 Nm (16 ft lb)

Engine – Crankshaft, Crankcase

Pilot needle bearing, removing/ installing

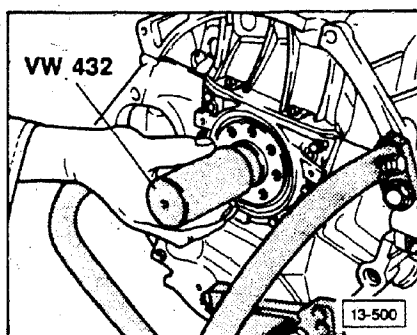
Removing

- remove pilot bearing with extractor
(as shown)



Installing

- install with tool **VW 432** until flush
 - letters on bearing must face outward



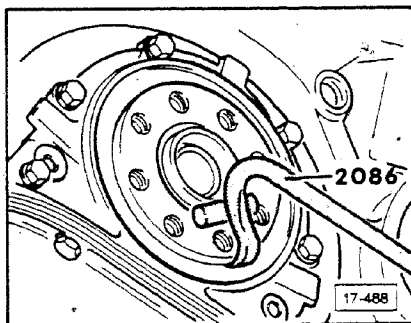
Engine – Crankshaft, Crankcase

Crankshaft oil seals, removing/ installing

Flywheel side

Removing

- remove with tool 2086

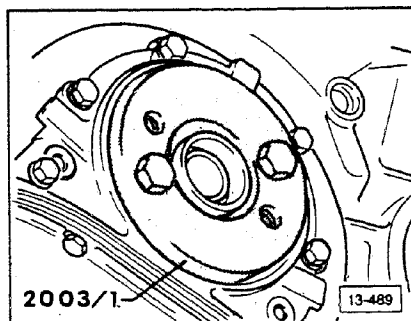


Installing

Note

Replacement seal in repair kit is pre-coated.
Do NOT lubricate.

- install with installation tool supplied with repair kit
- press in oil seal with tool 2003/1 until fully seated



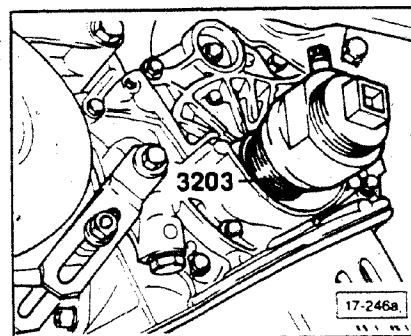
Pulley side

Removing

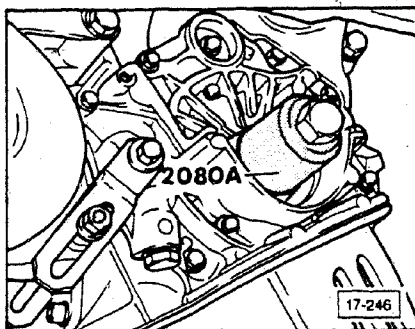
- remove V-belt pulley with drive
- remove with tool 3203

Installing

- use vibration damper mounting bolt
- coat oil seal lip and outer surface lightly with oil



Engine – Crankshaft, Crankcase



- install using locating sleeve from tool 2080A
- press in seal using thrust sleeve from tool 2080A

Note

If wear marks show on crankshaft, press gasket in to stop.

Crankshaft, checking

Radial clearance

Note

Crankcase bearing clearance can also be checked with engine installed.

- remove bearing caps
- clean shells and journals
- lay Plastigage® across journal (**arrow**)
- install bearing caps
 - tighten to 65 Nm (48 ft lb)

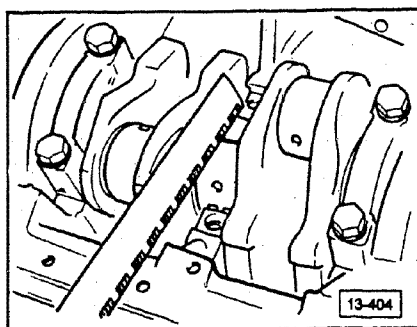
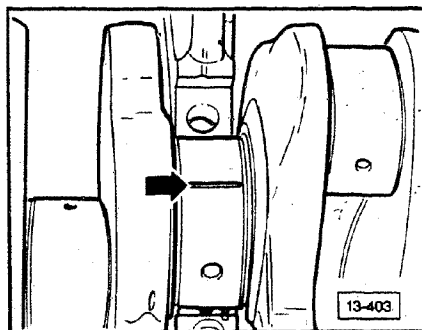
CAUTION

Do not turn crankshaft.

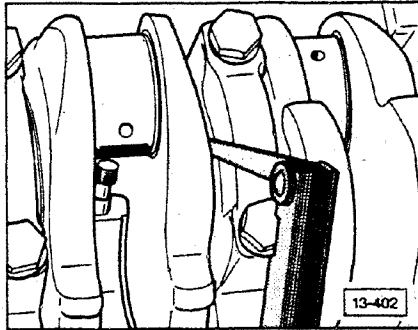
- remove bearing caps

- compare flattened width of Plastigage® with measuring scale

new:	0.018-0.058 mm (0.001-0.002 in.)
wear limit:	0.16 mm (0.006 in.)



Engine – Crankshaft, Crankcase



End play

- check with feeler gauge on main bearing No. 4

new: 0.07-0.23 mm
(0.003-0.009 in.)

wear limit: 0.30 mm
(0.012 in.)

Crankshaft, dimensions

(in mm)

Engine code: 3B

	Main bearing journal diameter	Connecting rod journal diameter
Standard	57.958 — 57.978	47.758 — 47.778
1st undersize	57.708 — 57.728	47.508 — 47.528
2nd undersize	57.458 — 57.478	47.258 — 47.278
3rd undersize	57.208 — 57.228	47.008 — 47.028

Engine – Crankshaft, Crankcase

Flywheel, replacing

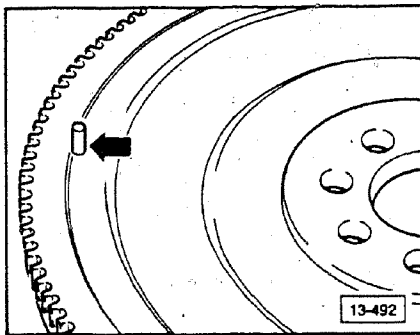
Engine code 3B

CAUTION

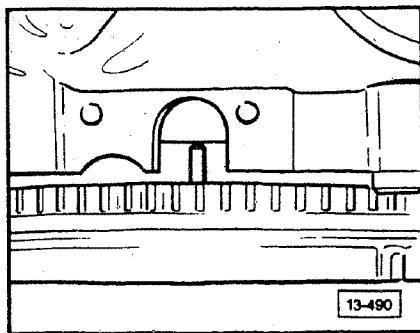
Do not bend pins when replacing flywheel.

CAUTION

If the pin for ignition timing reference sensor is not installed when replacing flywheel, the electronic ignition system will obtain no control impulse and engine will not start.



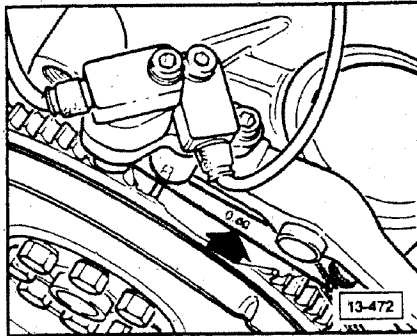
- insert pin for ignition timing point (arrow) until flush



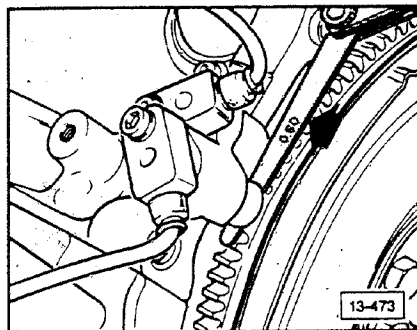
Ignition timing reference sensor, installing

- turn flywheel until pin for ignition timing point is below opening for ignition timing reference sensor

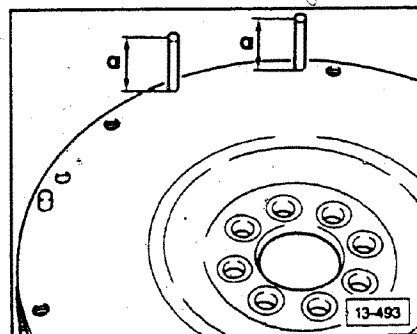
Engine – Crankshaft, Crankcase



- install sensor
- insert feeler gauge (arrow) between pin and ignition point sensor
 - specified value: 0.45-1.25 mm (0.017-0.049 in.)



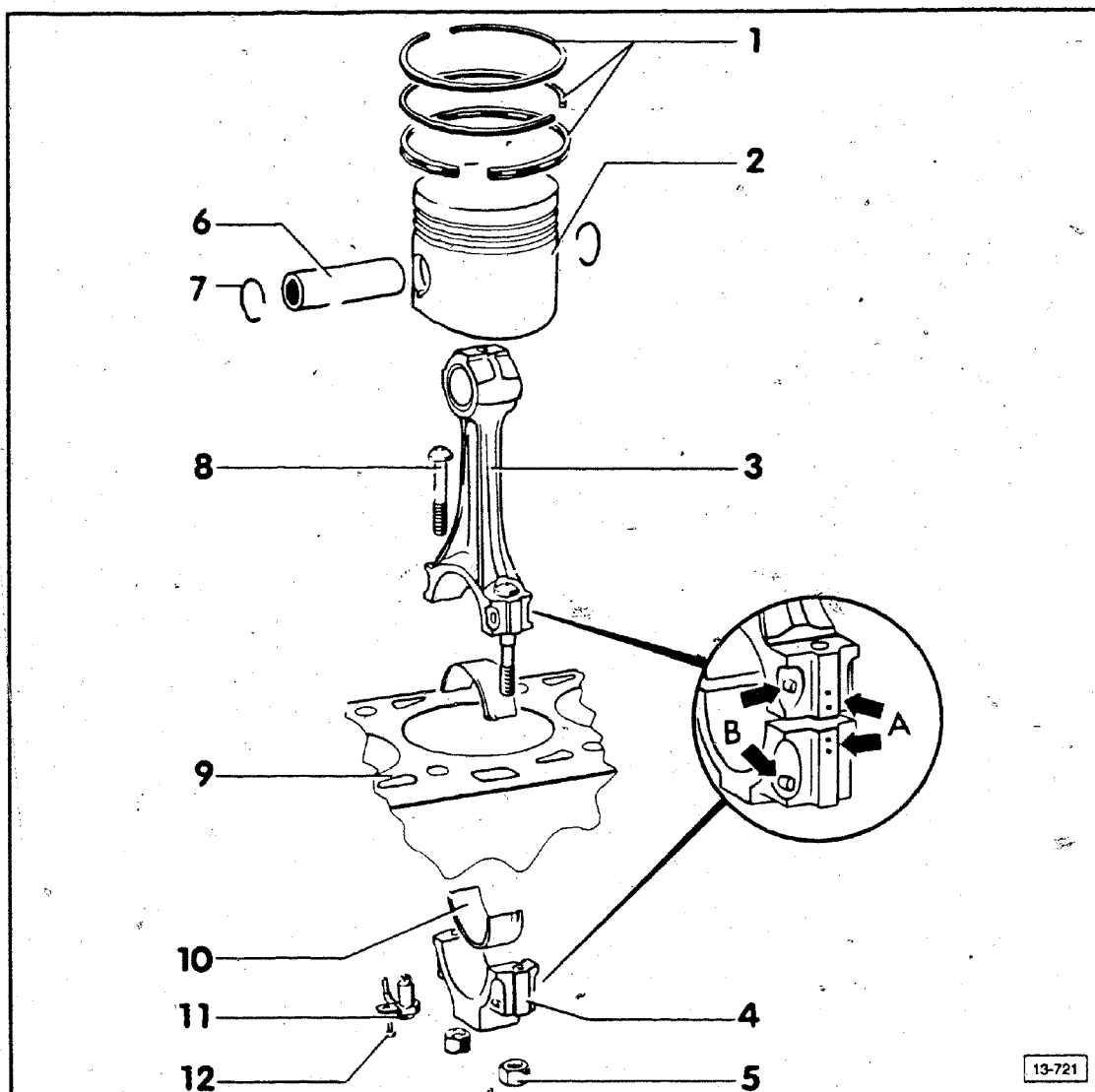
- insert feeler gauge (arrow) between splines of the flywheel and sensor for engine RPM
 - specified value: 0.50-1.25 mm (0.020-0.049 in.)



Engine tester magnetic pick-up pins, checking

- pin height a 36-0.5 mm (1.3-0.02 in.)

Engine – Crankshaft, Crankcase



Note

Do not turn crankcase when measuring radial play.

1 — Piston rings

- offset gaps to 120°
- "top" mark on ring faces piston
- removing/installing, page 13.38
- checking, page 13.38

2 — Piston

- mark installation position and cylinder
- removing/installing, page 13.40
- dimensions, page 13.40
- arrow on crown points toward drive belt side

3 — Connecting rod

- replace in sets only
- mark cylinder number A
- markings B point toward pulley side
- do not interchange pistons, bearing caps

4 — Connecting rod cap

- mark cylinder number A
- markings B point toward pulley side
- do not interchange

5 — 30 Nm (22 ft lb) plus 1/4 turn (90°) lubricate contact surface of nut first

6 — Piston pin

- if tight, heat piston to approximately 60°C (140°F)
- remove/install with tool 10-508 or equivalent

Engine – Crankshaft, Crankcase

- 7 — Circlip
pry out
- 8 — Connecting rod bolt
- 9 — Cylinder block
 - checking cylinder bore, page 13.40
 - piston/cylinder dimension, page 13.40
- 10 — Bearing shell
 - note installed position
 - do not interchange used bearing shells
 - retaining tabs must fit securely
 - measuring clearance, page 13.24
- 11 — Oil spray jet
for piston cooling
- 12 — 10 Nm (7 ft lb)

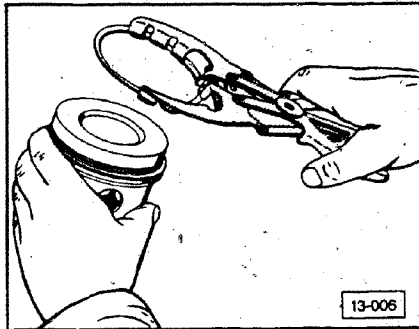
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Engine – Crankshaft, Crankcase

Piston rings, removing/installing

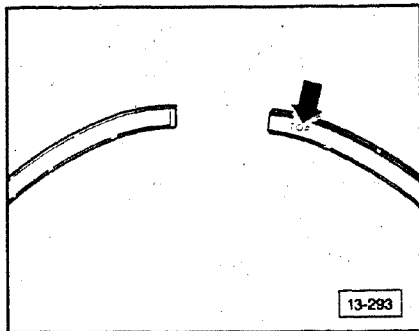
Removing

- remove with piston ring pliers (as shown)



Installing

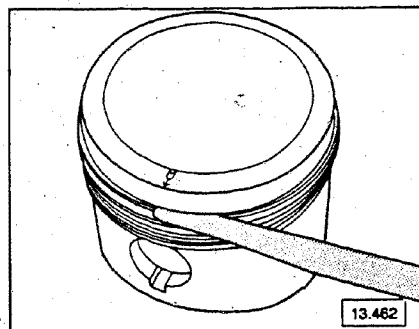
- reinstall in reverse order of removal, noting the following:
 - marking on ring, "TOP", faces toward top of piston
 - chamfer on plain compression ring must point to piston crown
 - indentation on stepped scraper ring must point to piston pin



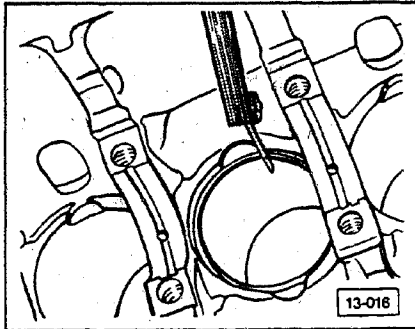
Piston rings, checking

Side clearance

- new: 0.04-0.072 mm (0.002-0.003 in.)
- wear limit: 0.1 mm (0.004 in.)



Engine – Crankshaft, Crankcase



End gap

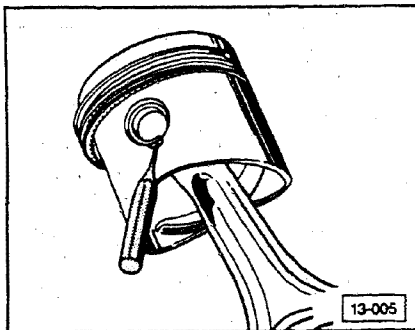
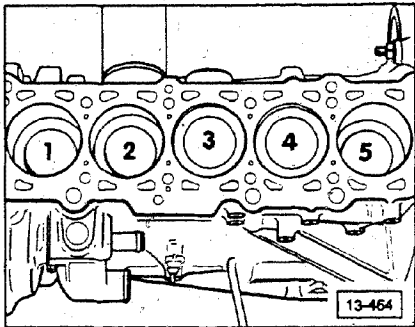
- insert ring squarely into cylinder until it is approximately 15 mm (19/32 in.) from edge of cylinder
 - new: 0.15-0.35 mm (0.006-0.014 in.)
 - wear limit: 1.0 mm (0.04 in.)

Pistons, checking/installing

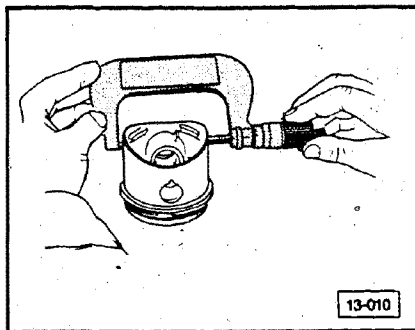
Note

Piston has to be reinstalled in cylinder it came out of.

- number and mark pistons
 - arrow on piston points to pulley
- remove piston



- pry out piston pin circlip



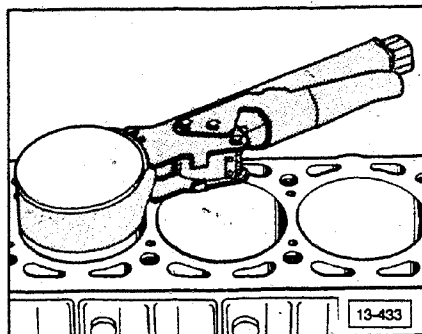
Checking

- measure piston approximately 12 mm (15/32 in.) from lower edge, at 90° to piston pin axis
- maximum deviation: 0.04 mm (0.002 in.)

Engine – Crankshaft, Crankcase

Installing

- use piston-ring clamp to install



Piston/cylinder dimensions

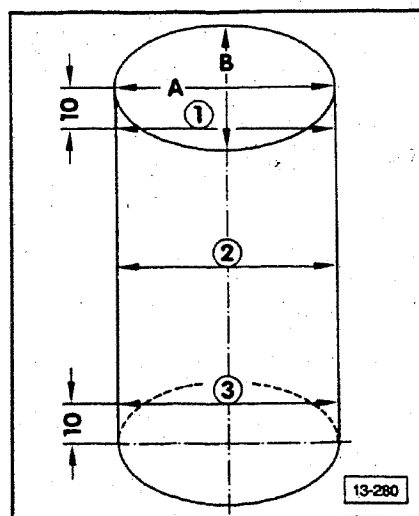
(in mm)

Engine code 3B	Piston diameter	Cylinder bore
Standard	80.98	81.01
1st oversize	81.23	81.26
2nd oversize	81.48	81.51

Cylinder bore, checking

CAUTION

Do not measure cylinder bore when cylinder block is mounted to work bench with engine mount VW 540. Measuring may be affected because of cylinder block distortion.



Measure at three points 1, 2, 3 in cross direction A and longitudinal direction B.

1 — 10 mm (3/8 in.) from top

2 — middle of cylinder wall

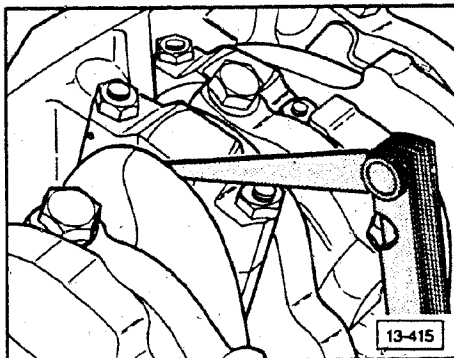
3 — 10 mm (3/8 in.) from bottom

Use inside micrometer 50-100 mm (1.97-3.93 in.)

Nominal dimension deviation:

- maximum 0.08 mm (0.003 in.)

Connecting rod, checking



Side clearance

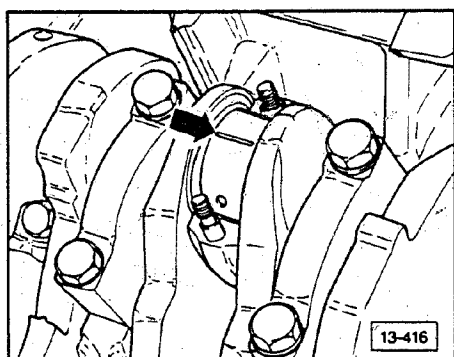
- wear limit: 0.4 mm (0.016 in.)

Bearing clearance

Note

May be checked with engine installed.

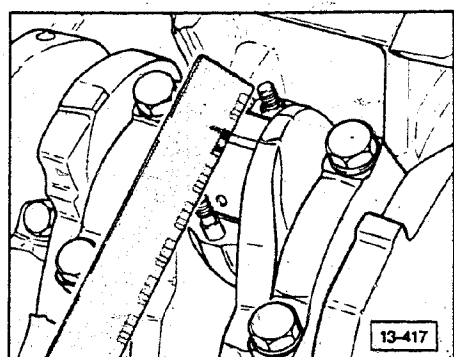
- remove bearing cap
- clean shells and journal



- lay Plastigage® across journal (arrow)
- oil contact surface of nut
- install bearing cap and tighten to 30 Nm (22 ft lb)
- using old nuts and bolts

CAUTION

Do not turn crankshaft.



- compare flattened width of Plastigage® with measuring scale

- new part: 0.010-0.052 mm (0.0004-0.002 in.)
- wear limit: 0.012 mm (0.005 in.)

CAUTION

During repairs, always replace nuts and bolts at final assembly.