Index

4-cylinder

5-cylinder

★ NEW INFORMATION since last filming

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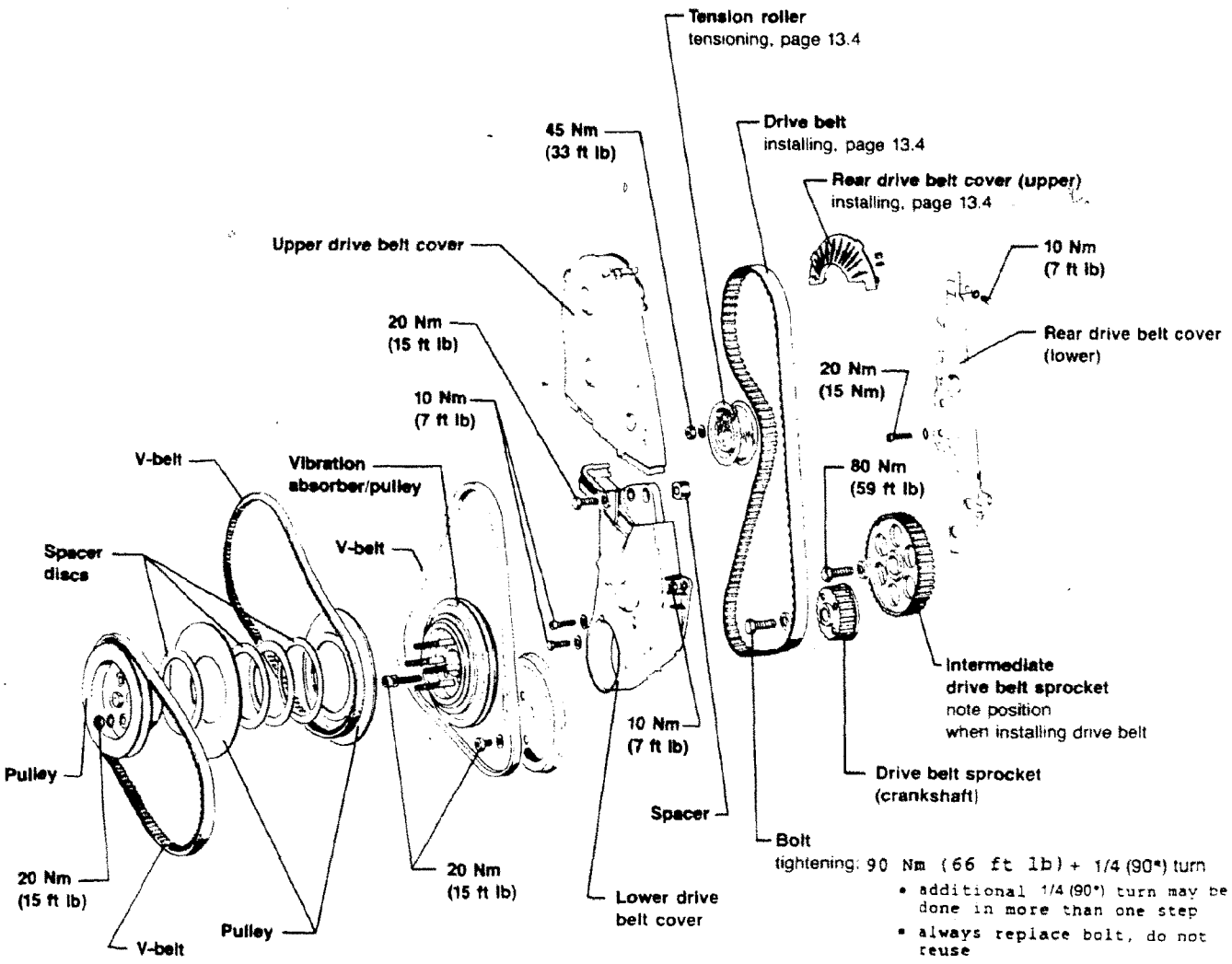


- additional 1/4 (90°) turn may be done in more than one step
- always replace bolt, do not reuse
- use tool 3099 to hold belt sprocket while loosening or tightening bolt
- lightly coat the bolt threads and shoulder with oil prior to installing

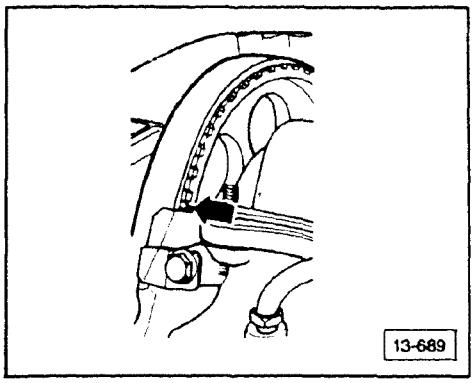
CAUTION

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

13-0905

Drive belt, installing

(Timing adjustment)



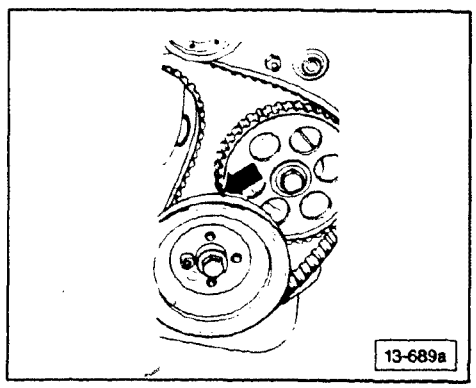
CAUTION

Do not turn crankshaft or camshaft with drive belt removed. Engine may be damaged by valves hitting pistons.

Note

The crankshaft must not be at TDC.

▶ ■ align mark on camshaft sprocket with cylinder head cover (**arrow**)

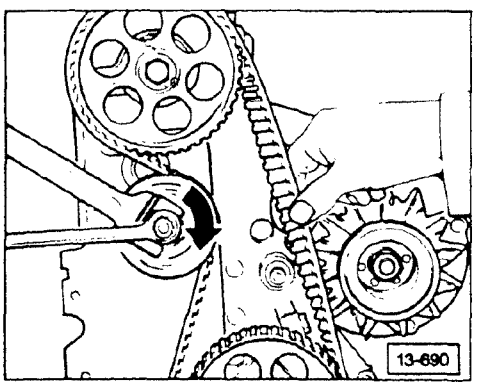


▶ ■ align mark on crankshaft pulley/vibration dampener with mark on intermediate shaft sprocket (**arrow**) (TDC Cylinder no. 1)

■ mount drive belt on crankshaft and intermediate shaft sprockets

■ mount pulley and vibration dampener on crankshaft with all four fasteners.
Note installation position

■ mount drive belt on camshaft sprocket wheel



▶ ■ tighten drive belt by turning tensioner in direction of (**arrow**)
- torque: 45 Nm (33 ft lb)
- it must be possible to twist drive belt 90° in center between camshaft and intermediate sprockets

■ tighten lock nut on tensioner

■ turn crankshaft twice and re-check drive belt tension

■ remove crankshaft pulley and vibration dampener

■ install lower drive belt cover

■ install upper drive belt cover, V-belt pulley, vibration dampener and V-belt

■ check ignition timing; if necessary, adjust (see Group 29)

(more)

Note

If you've removed the drive belt from the camshaft sprocket, adjust the belt as follows:

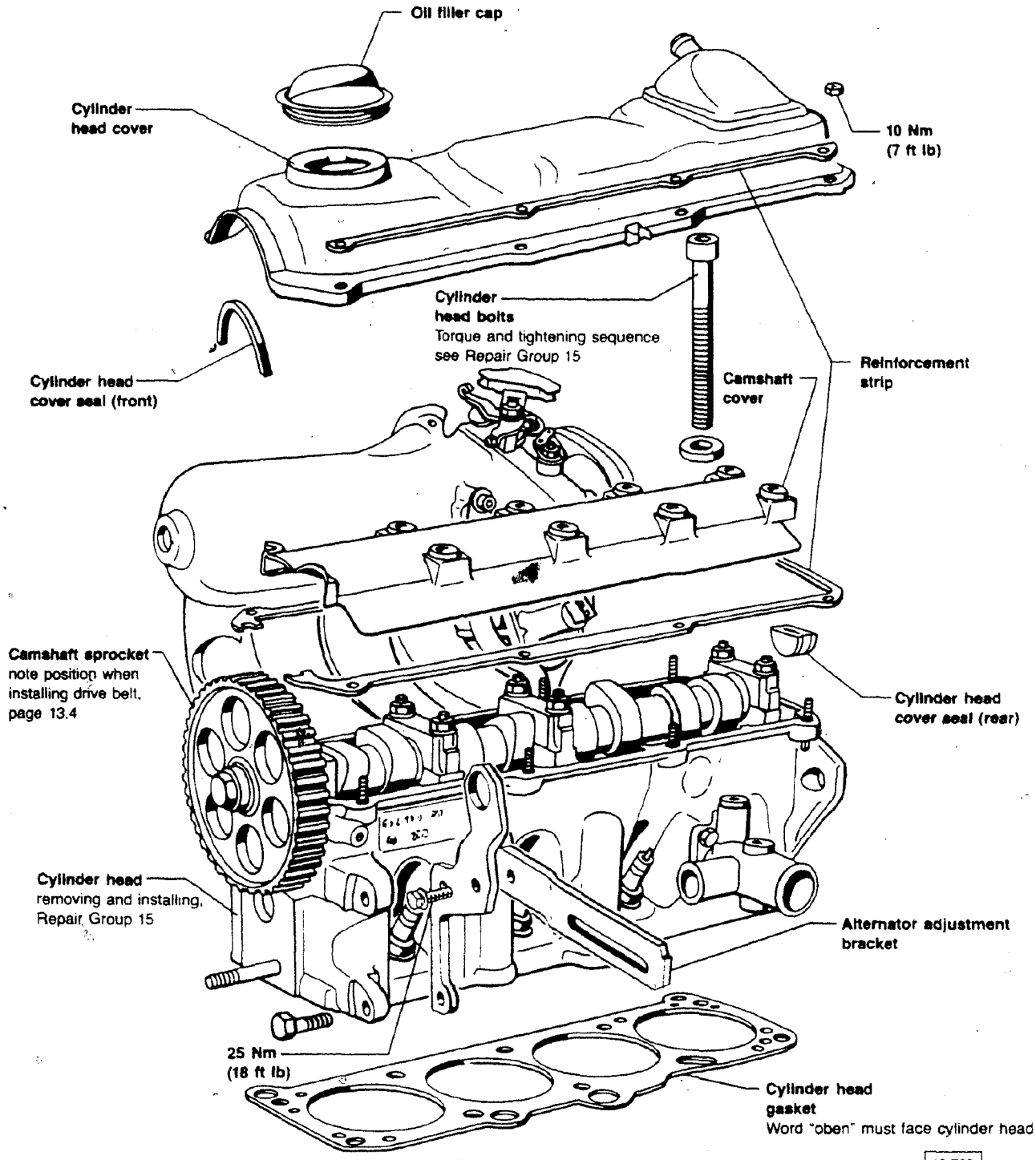
- set crankshaft to TDC on cylinder no. 1
- align mark on camshaft sprocket with cylinder head cover
- mount drive belt and tighten
- check if ignition distributor rotor is pointing to marking for cylinder no. 1 on distributor housing. If not, turn distributor until mark and rotor align. If necessary, remove and reinstall distributor
- turn crankshaft twice and check that crankshaft and camshaft marks are aligned with proper reference points
- check ignition timing and if necessary, adjust (see Group 29)

CAUTION

Coolant/anti-freeze **must not** be reused when replacing engine, cylinder head, cylinder head gasket, radiator and heater core.

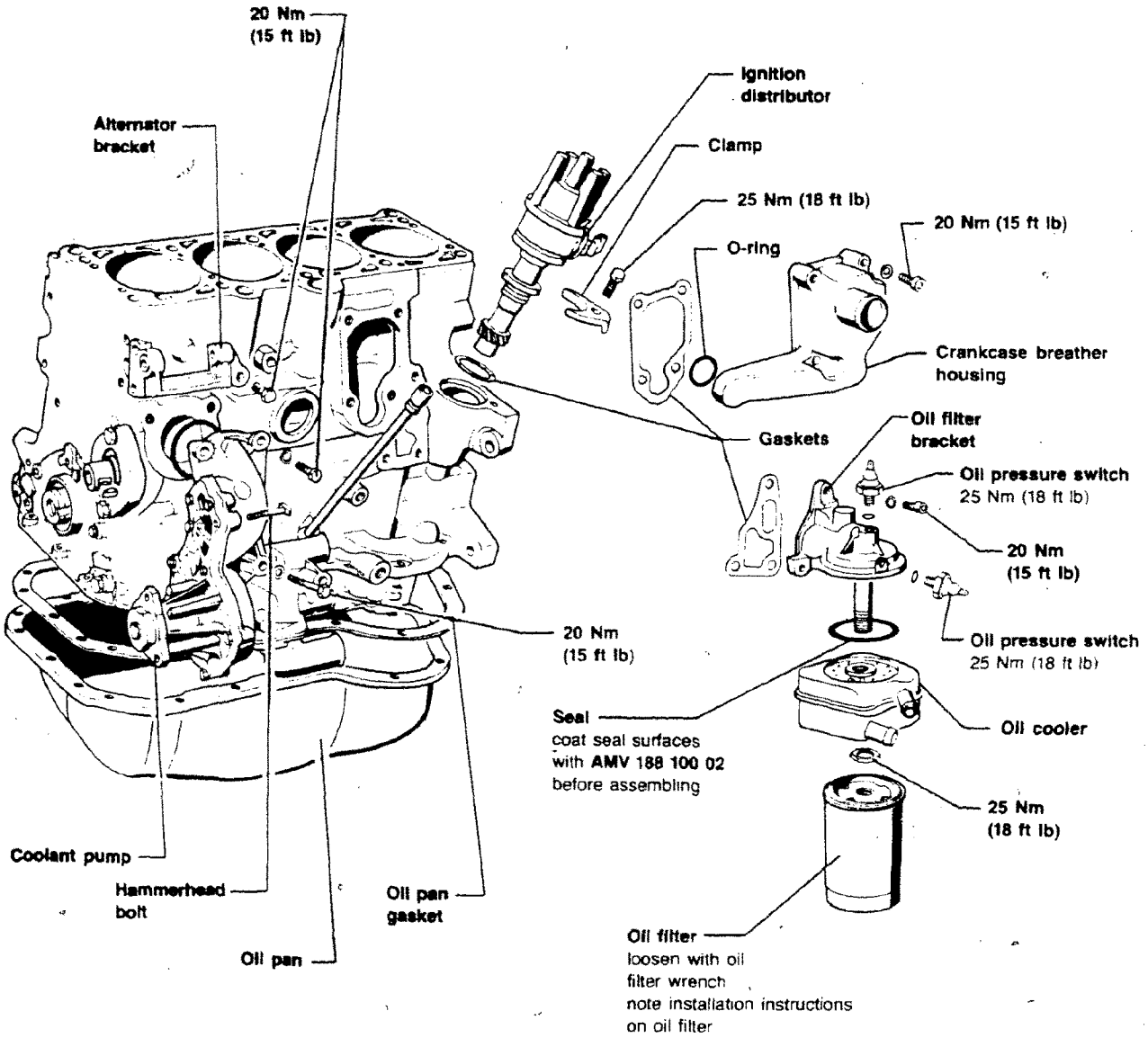
CAUTION

Always replace gaskets and seals.

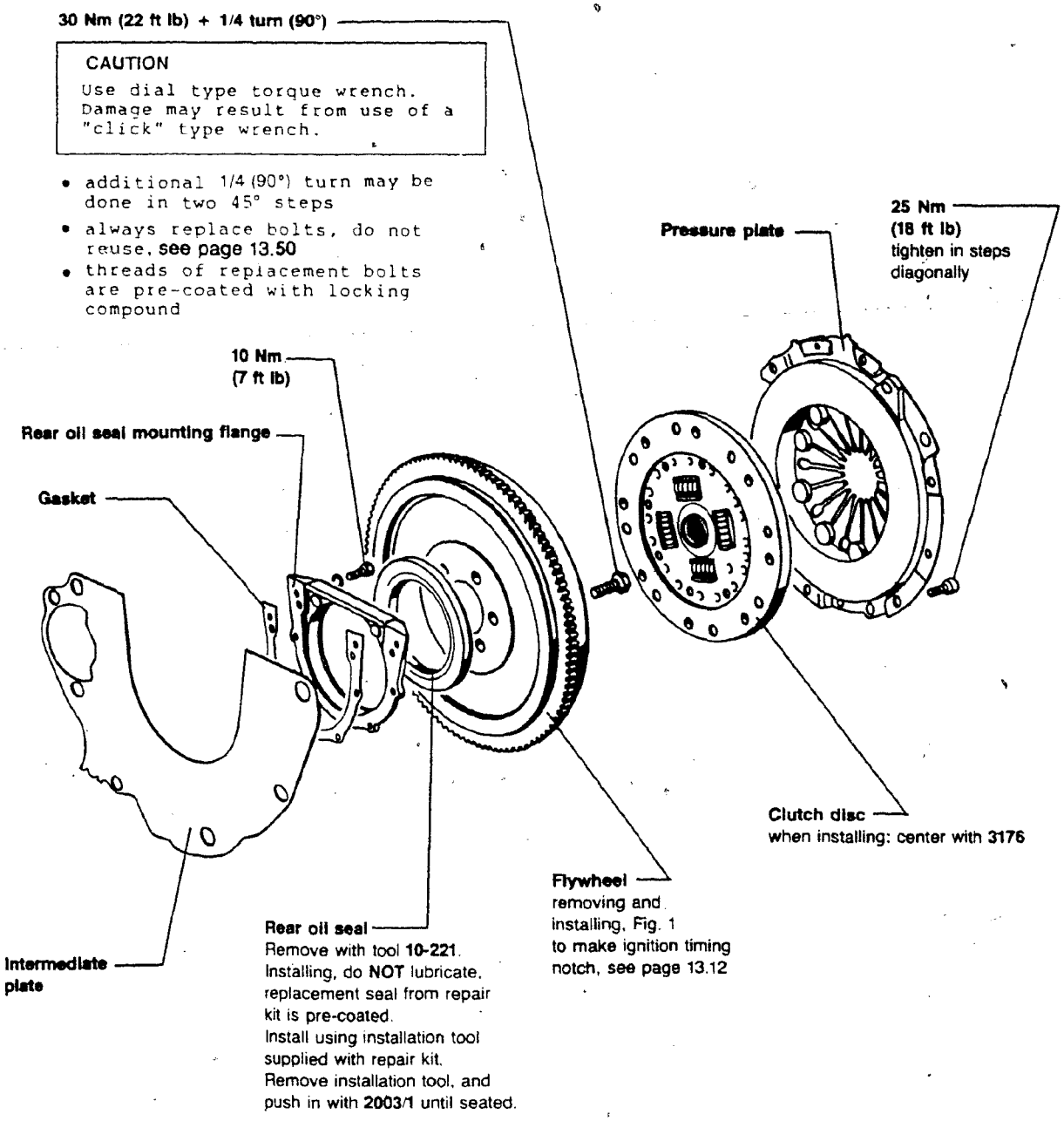


CAUTION

If you find metal shavings in the engine oil as a result of engine damage; clean oil passages thoroughly, then replace oil cooler and oil filter.



13-0908

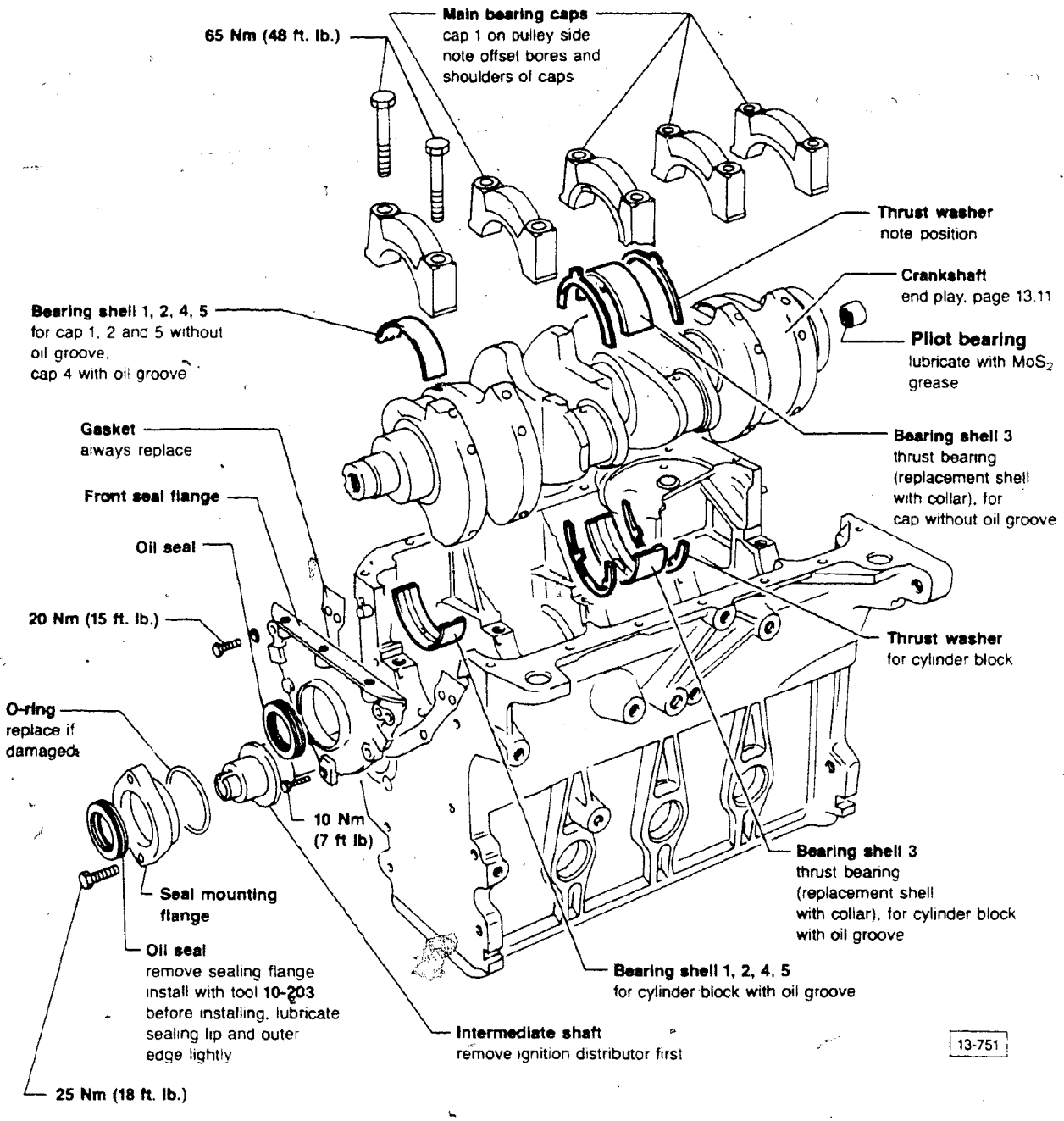

30 Nm (22 ft lb) + 1/4 turn (90°)
CAUTION
Use dial type torque wrench. Damage may result from use of a "click" type wrench.
• additional 1/4 (90°) turn may be done in two 45° steps
• always replace bolts, do not reuse, see page 13.50
• threads of replacement bolts are pre-coated with locking compound
25 Nm (18 ft lb) tighten in steps diagonally
Pressure plate
10 Nm (7 ft lb)
Rear oil seal mounting flange
Gasket
Clutch disc when installing: center with 3176
Flywheel removing and installing, Fig. 1 to make ignition timing notch, see page 13.12
Rear oil seal Remove with tool 10-221. Installing, do NOT lubricate, replacement seal from repair kit is pre-coated. Install using installation tool supplied with repair kit. Remove installation tool, and push in with 2003/1 until seated.
Intermediate plate
13-752

CAUTION

Coolant/antifreeze **must not** be reused when replacing engine, cylinder head, cylinder head gasket, radiator and heater core.

CAUTION

Short blocks are supplied with a pilot bearing in the crankshaft. Remove the pilot bearing before installing engine in vehicles with automatic transmissions.

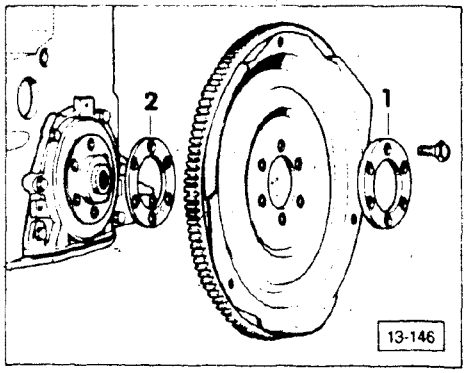


CAUTION

Do not interchange worn bearing shells.

Crankshaft dimensions (mm)

	Main bearing journal (mm)	Connecting rod journal (mm)
Basic dimension	54.022-54.042	47.822-47.842
1st undersize	53.772-53.792	47.572-47.592
2nd undersize	53.522-53.542	47.322-47.342
3rd undersize	53.272-53.292	47.072-47.092



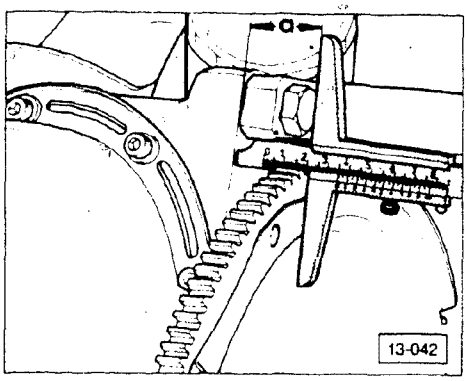
Drive plate, installing

- chamfer of washer **1** must point to drive plate
- install bolts
  - torque: 30 Nm (22 ft lb) + 1/4 (90°) turn

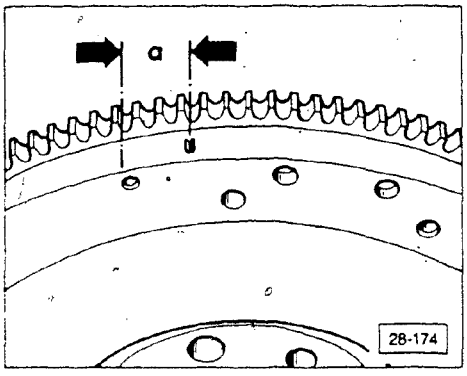
CAUTION

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



- use shim **2** (shown in above illustration) if necessary
  - **a** = 30.5-32.1 mm (1.20-1.26 in.)



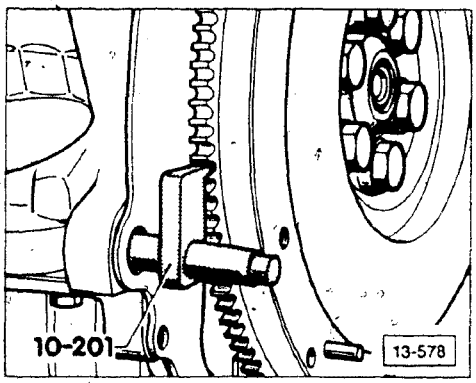
Making ignition timing mark

Note

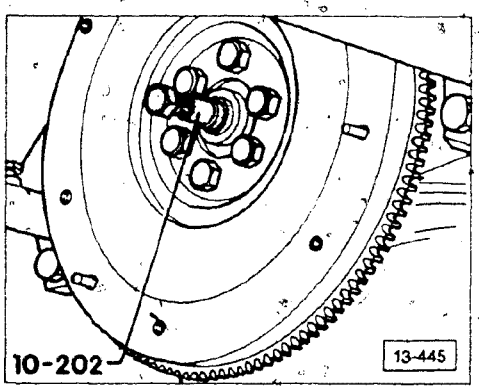
If you replace the flywheel/drive plate you will have to inscribe the ignition timing mark. Replacement flywheel/drive plates have the zero degree TDC mark only.

Make ignition timing mark at a point in an arc left from center of TDC marking.

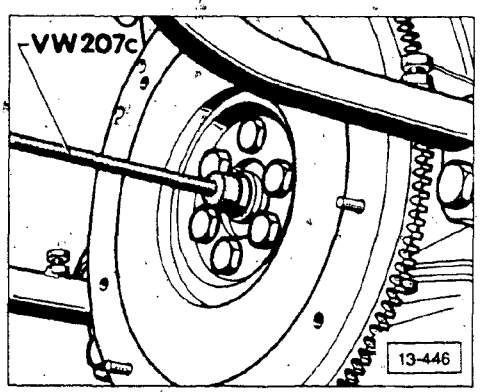
- **a** = 14 mm (9/16 in.) along arc



▶ **Fig. 1** **Flywheel/torque converter drive plate, removing/installing**



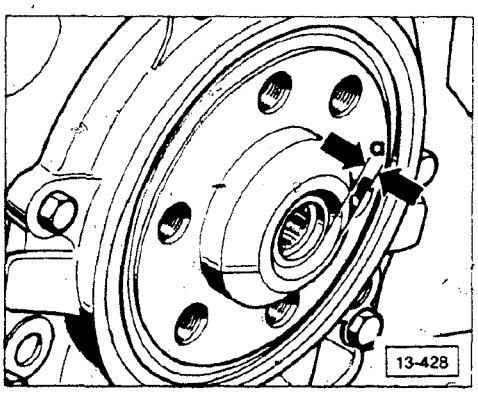
▶ **Fig. 2** **Pilot bearing, removing**



▶ **Fig. 3** **Pilot bearing, installing**

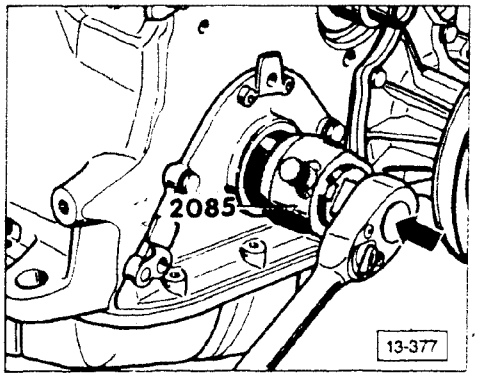
With **VW 207 C** or **3176**

Lettered side of bearing must face away from engine



▶ **Fig. 4** Installation depth

- **a** = 1.5 mm (0.060 in.)

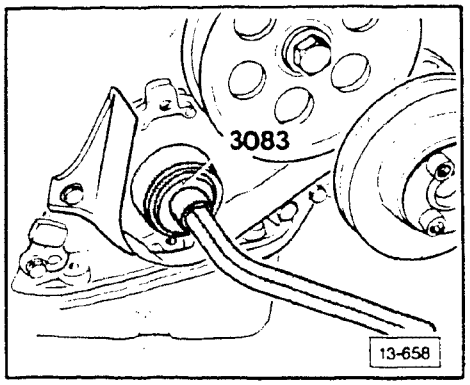


Crankshaft oil seal — drive belt side, removing/installing

Removing

- remove drive belt
- remove drive belt sprocket (use **3099** to loosen mounting bolts)
- unscrew inner part of oil seal extractor **2085** two turns (approximately 3 mm) out of outer part and lock with knurled screw
- to guide extractor, insert cylinder bolt from **3083** into crankshaft until it stops
- lubricate threaded head of oil seal extractor, set in position and push as far as possible into oil seal
- loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out
- clamp extractor in a vise and remove oil seal using pliers

Installing



- lightly lubricate sealing lip and outer edge of new oil seal
- place guide sleeve from **3083** onto crankshaft pin and push oil seal over guide sleeve
- press in oil seal up to stop

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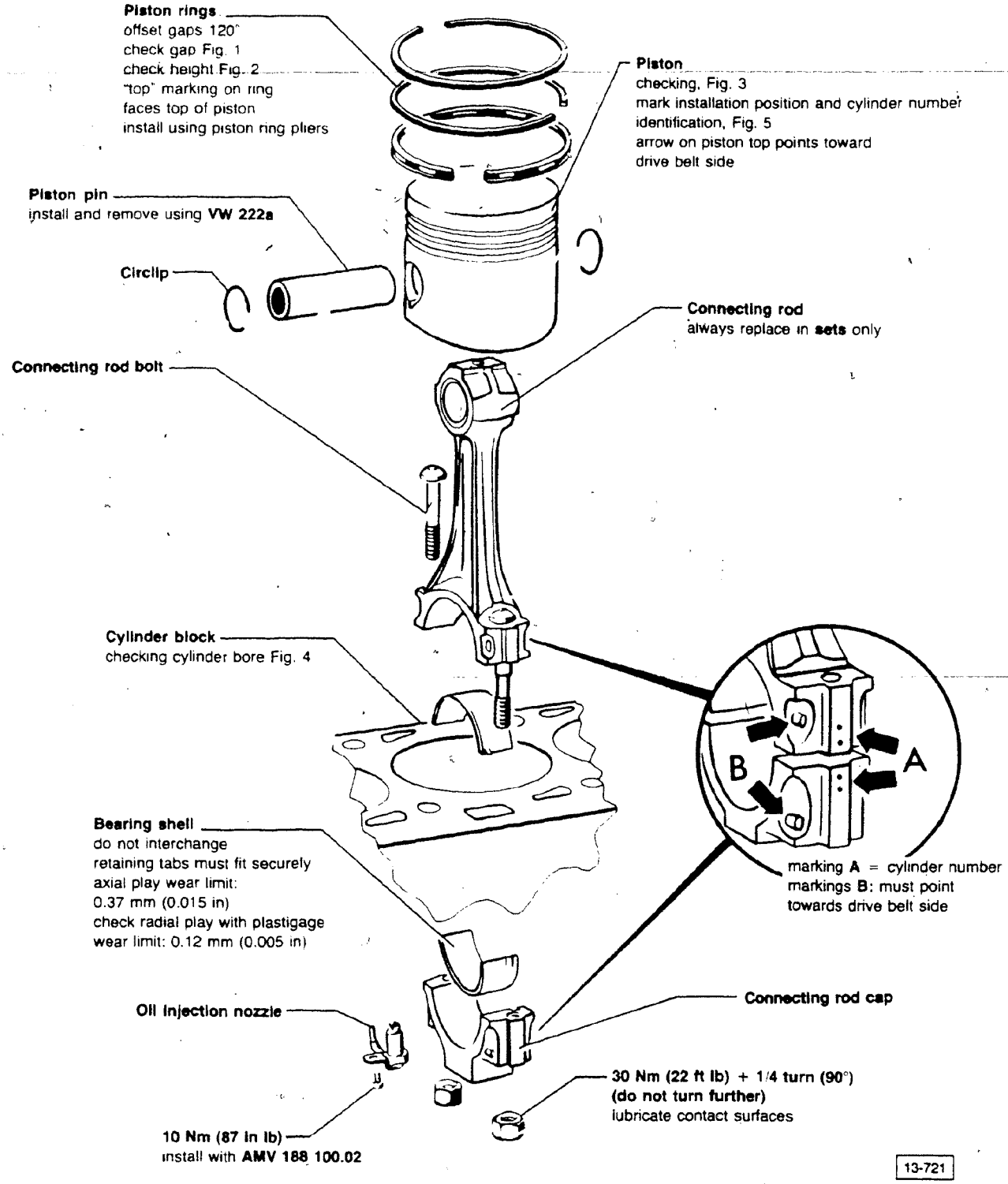
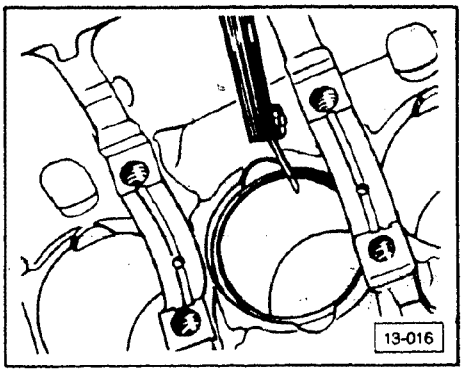
CAUTION

Do not turn crankshaft when measuring radial play.



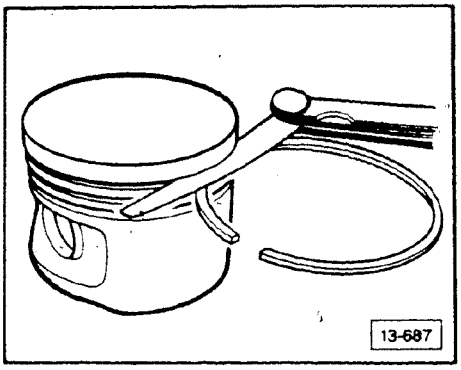


▶ Fig. 1 Piston rings, checking end gap

- Insert piston ring squarely into cylinder until it is approximately 15 mm (0.59 in) from bottom edge of cylinder

New:
- compression ring 0.30 to 0.45 mm (0.012 to 0.018 in)
- oil scraper ring 0.25 to 0.45 mm (0.010 to 0.018 in)

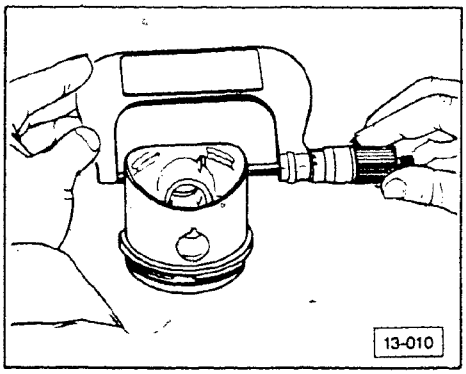
Wear limit:
- 1.0 mm (0.04 in)



▶ Fig. 2 Piston ring side clearance, checking

New:
- 0.02-0.05 mm (0.001 to 0.002 in)

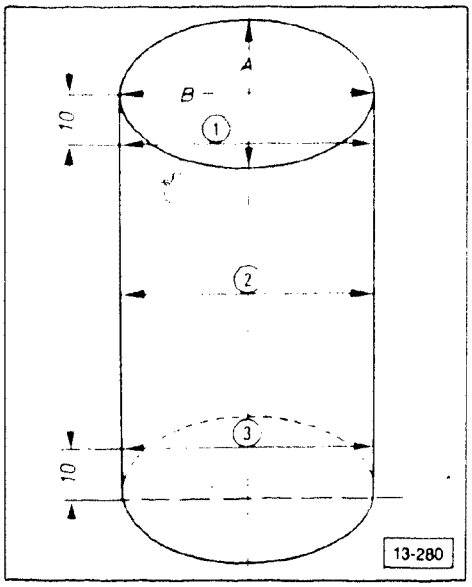
Wear limit:
- 0.15 mm (0.006 in)



▶ Fig. 3 Piston, checking

- Measure approximately 10 mm (0.39 in) from lower edge of skirt at 90° angle to piston pin axis

Nominal dimension tolerance:
- maximum 0.04 mm (0.0016 in)



▶ **Fig. 4 Cylinder bore, checking**

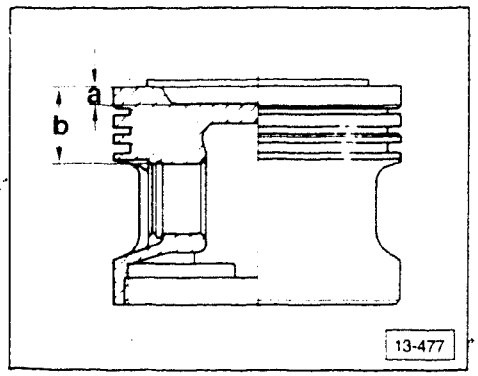
- Measure at three points in cross direction **A** and longitudinal direction **B**

  Use inside micrometer 50-100 mm (2 to 4 inches)

  Maximum deviation from nominal dimension:
  - 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**. Engine mounted in fixture can cause distortion affecting measurement.



▶ **Fig. 5 Piston identification**

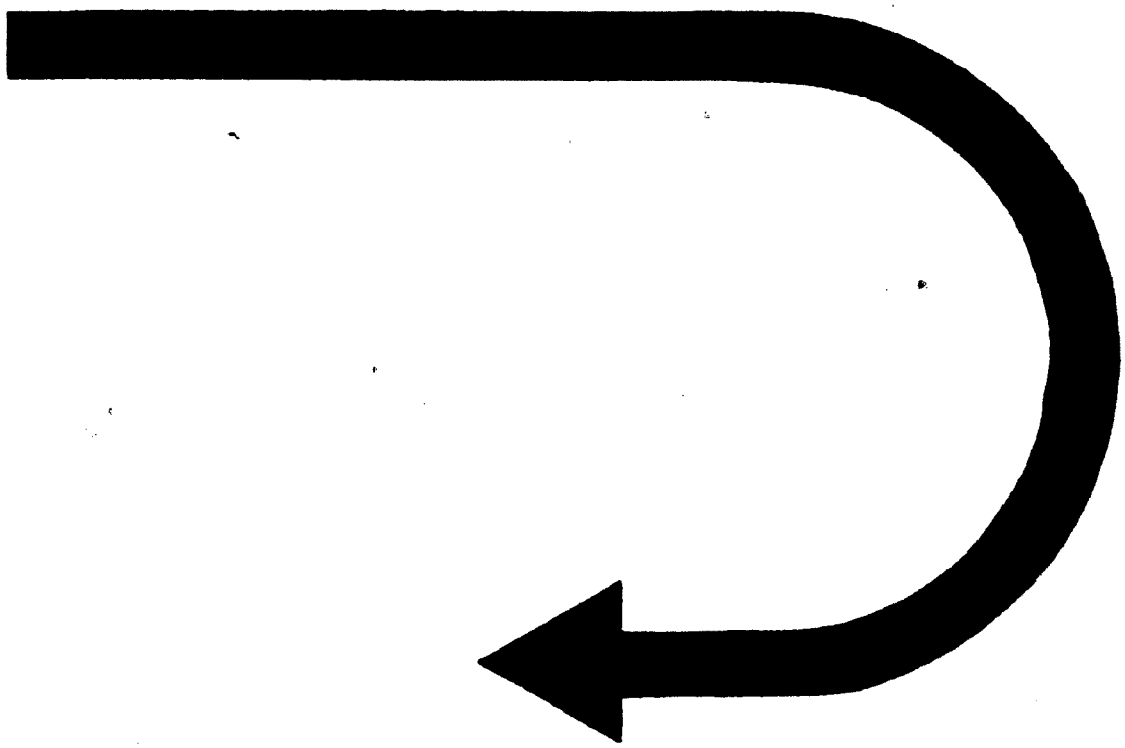
Recess depth a (mm, in)	Recess depth b (mm, in)
4.6 mm (0.181 in)	19.3 mm (0.759)

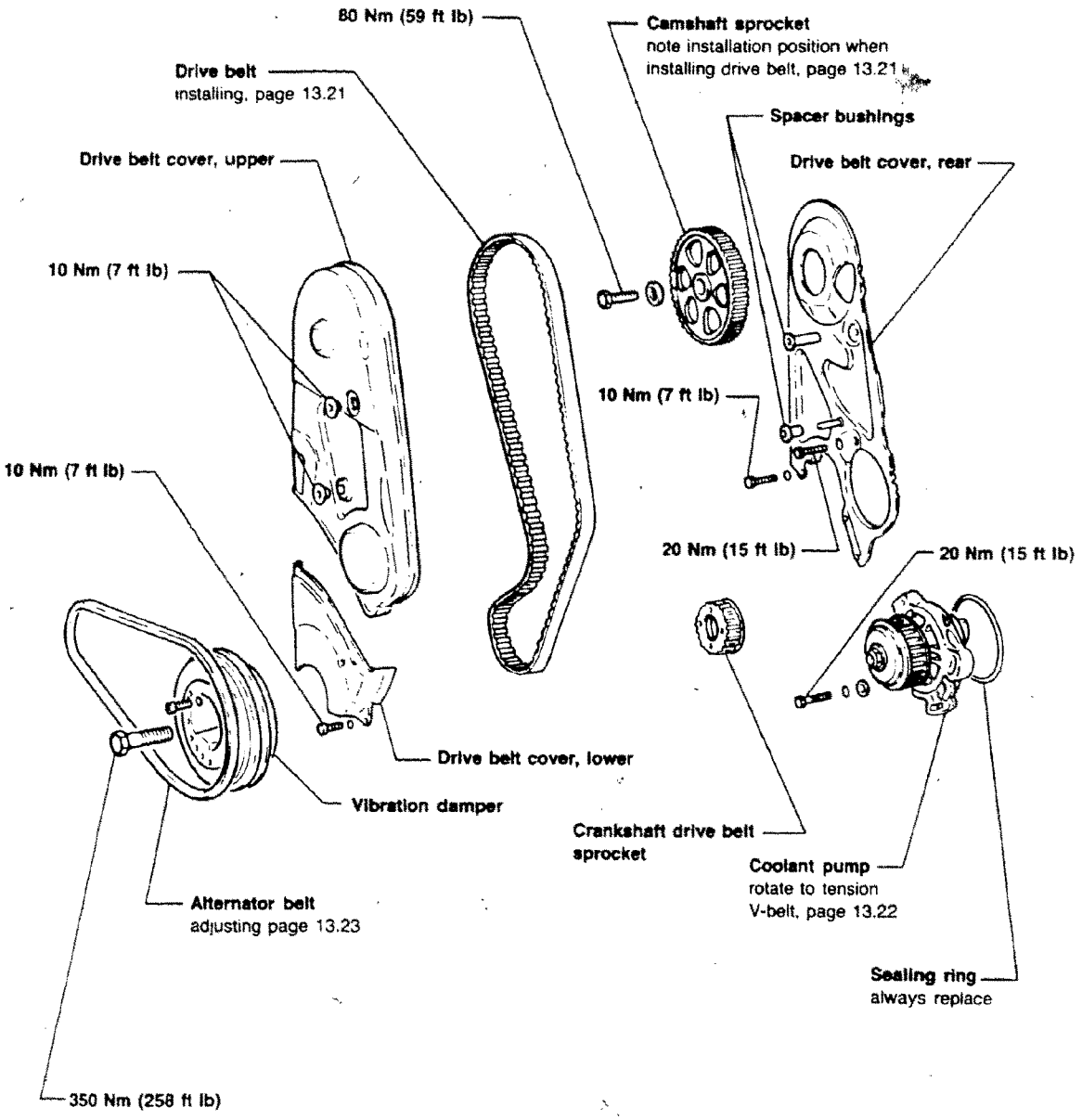
Piston and cylinder diameters (mm)

Size	Piston	Cylinder Bore
Standard	82.48 mm	82.51 mm
1st oversize	82.73 mm	82.76 mm
2nd oversize	82.98 mm	83.01 mm

CONTINUED IN THE

BEGINNING OF NEXT ROW




80 Nm (59 ft lb)
Camshaft sprocket
note installation position when installing drive belt, page 13.21
Drive belt
installing, page 13.21
Spacer bushings
Drive belt cover, upper
Drive belt cover, rear
10 Nm (7 ft lb)
10 Nm (7 ft lb)
10 Nm (7 ft lb)
20 Nm (15 ft lb)
20 Nm (15 ft lb)
Drive belt cover, lower
Vibration damper
Crankshaft drive belt sprocket
Coolant pump
rotate to tension V-belt, page 13.22
Alternator belt
adjusting page 13.23
Sealing ring
always replace
350 Nm (258 ft lb)

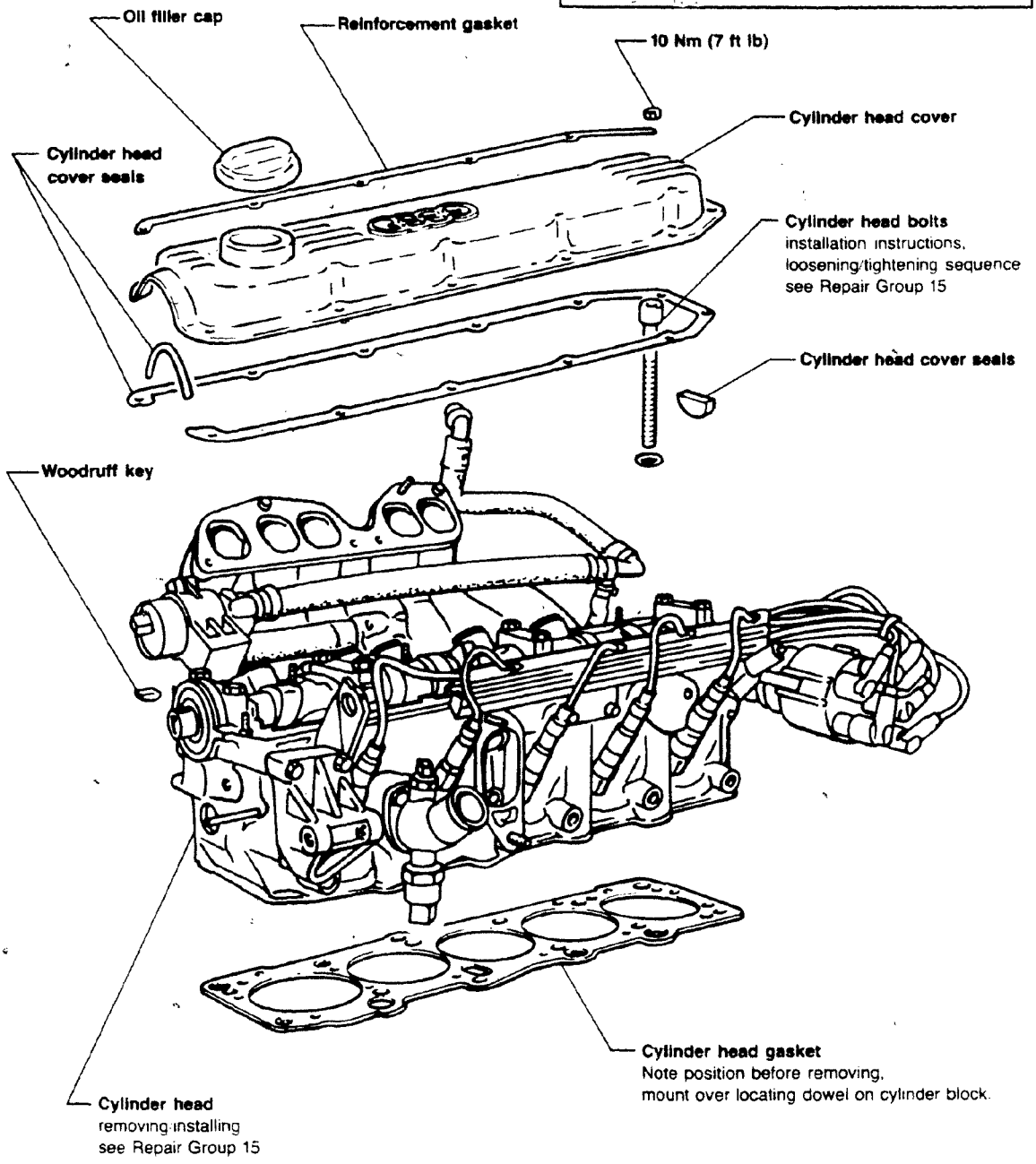
13-795

CAUTION

Always replace gaskets and seals.

CAUTION

Coolant/antifreeze **must not** be reused when replacing engine, cylinder head, cylinder head gasket, radiator and heater core.



CAUTION

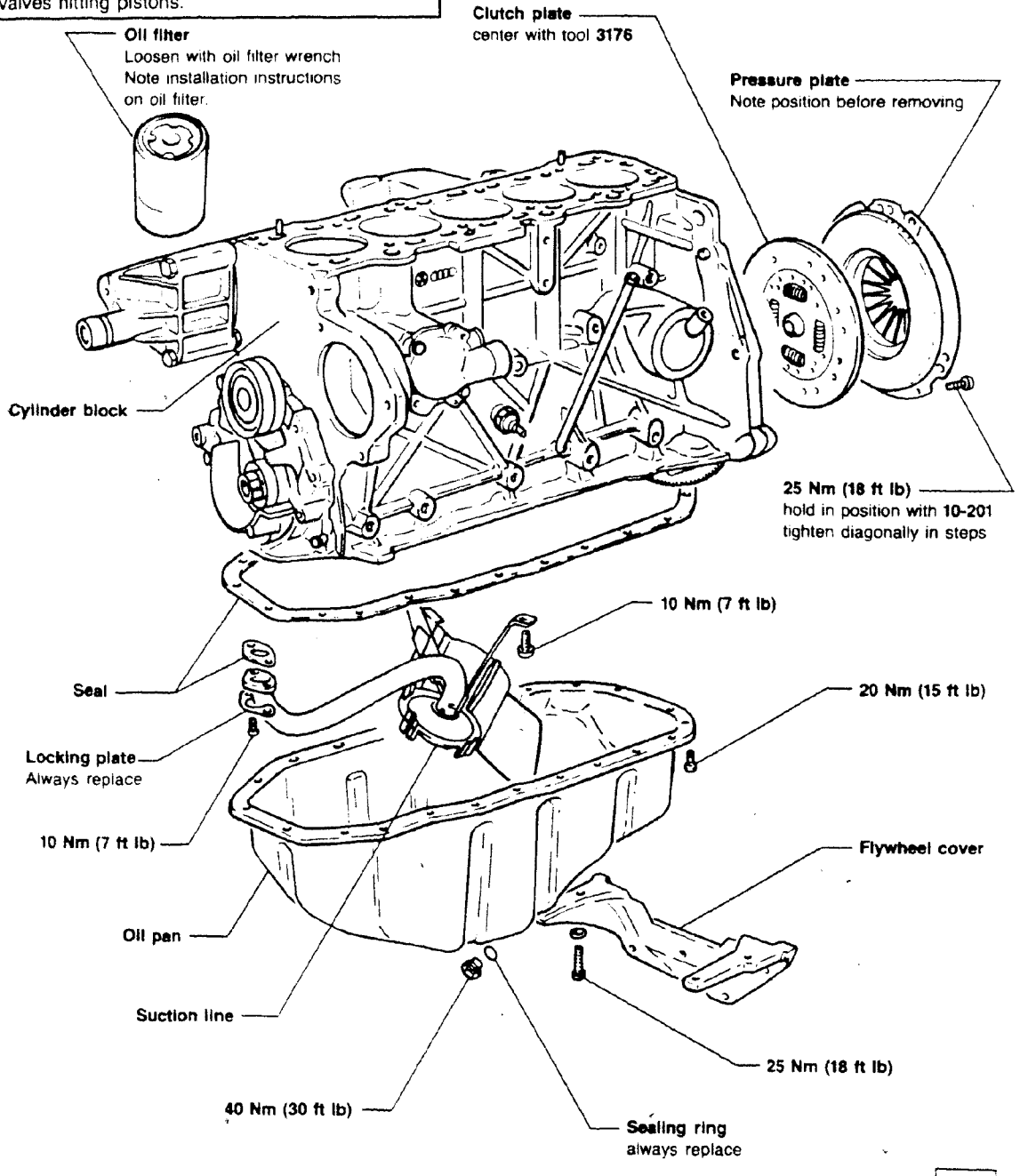
Always replace gaskets and seals.

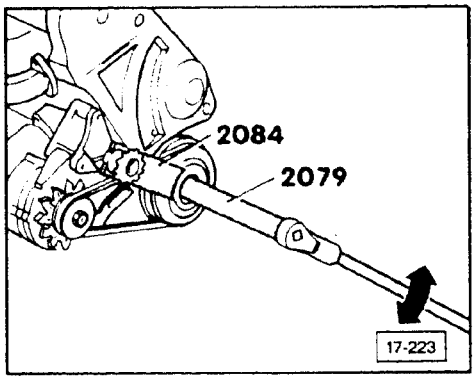
CAUTION

Do not turn crankshaft or camshaft with drive belt removed. Engine may be damaged by valves hitting pistons.

CAUTION

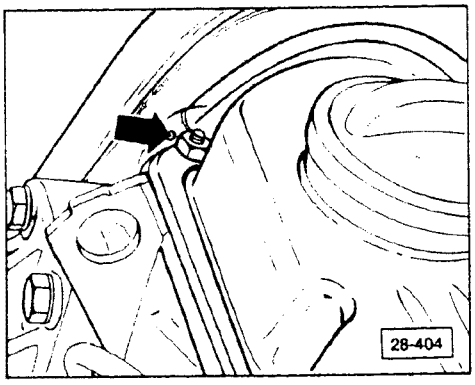
Coolant/antifreeze **must not** be reused when replacing engine, cylinder head, cylinder head gasket, radiator and heater core.





▶ **Fig. 1 Vibration damper, removing/installing**

- apply corrosion inhibitor **AMV 188 001 02** to top thread and bolt contact surface
- install belt and sprocket on crankshaft with vibration damper
- insert retainer **2084** in vibration damper, and torque bolt for vibration damper to 350 Nm (258 ft lb) using extension **2079**
- torque with extension tool **2079**, in alignment with the torque wrench



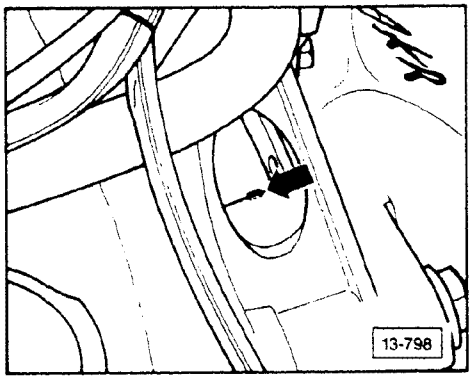
▶ Drive belt, installing

(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.

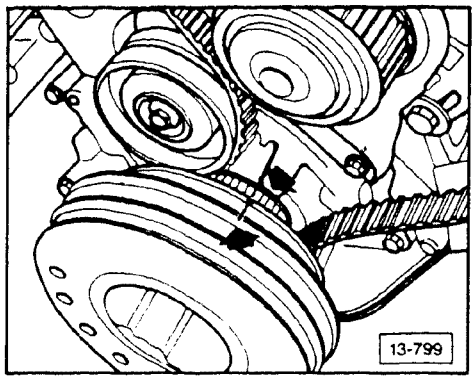


▶

- set crankshaft at TDC

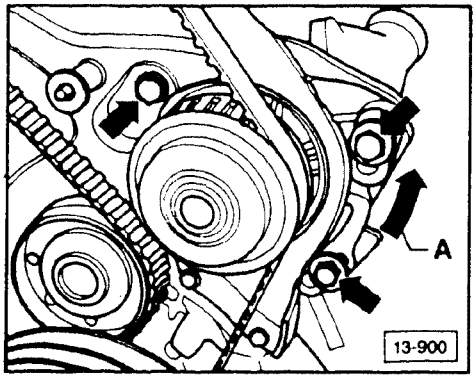
With engine installed:

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

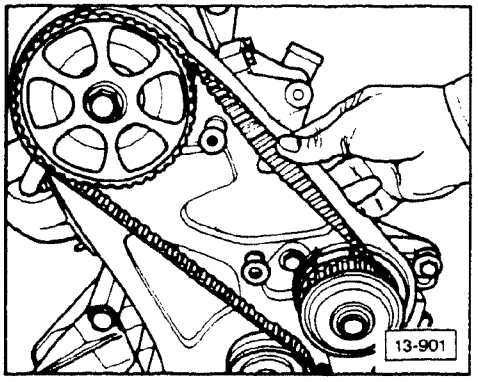


With engine removed:

- 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 counterclockwise (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 sprocket and coolant pump
- recheck adjustment
- install drive belt cover
- install power steering pump (see Repair Group 48)
- install alternator V-belt, page 13.23

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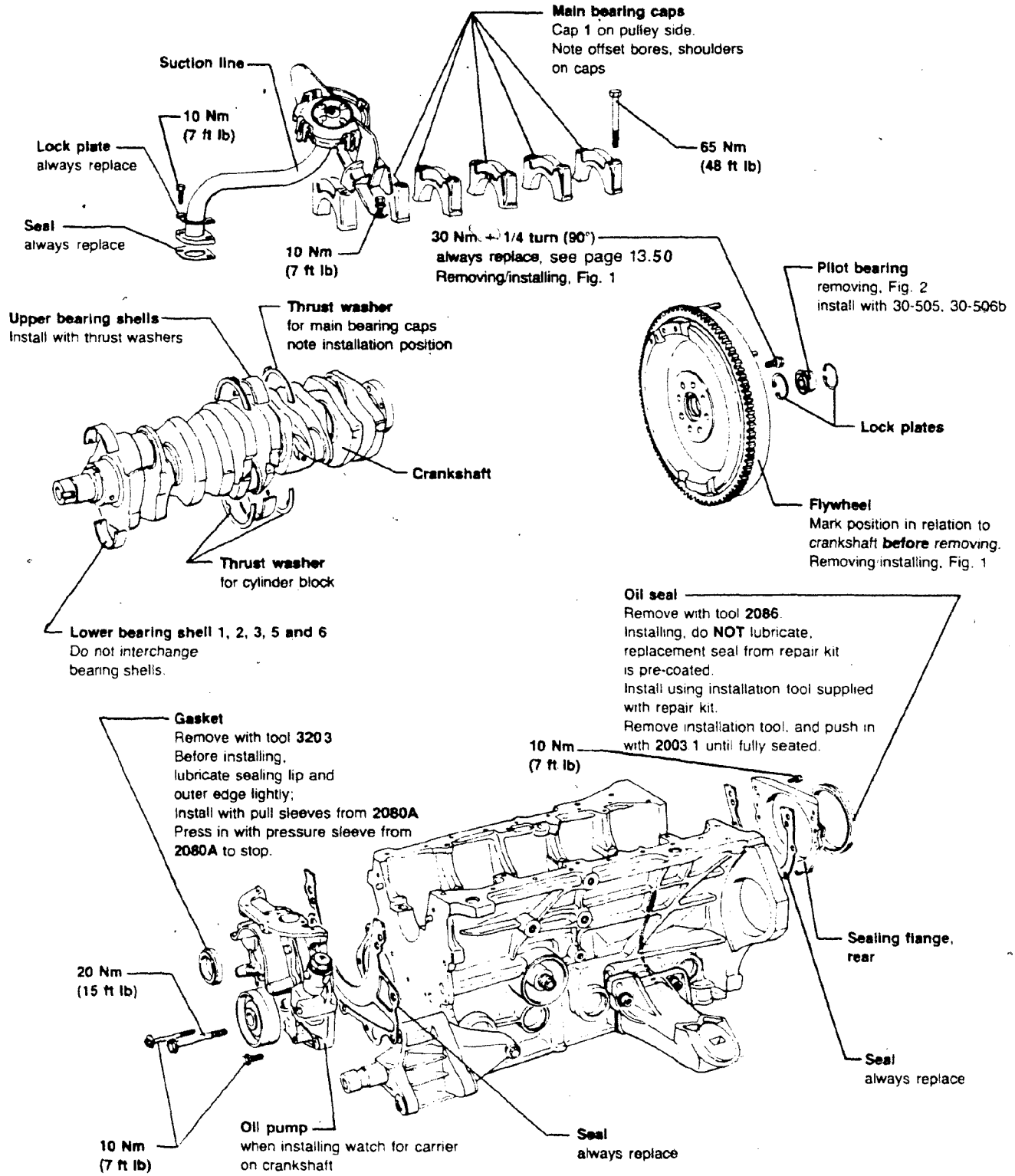
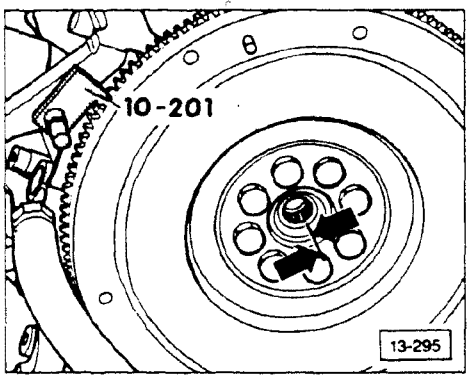


Note

Do not turn crankshaft when measuring end play.

13-794

D-8



▶ **Fig. 1 Flywheel, removing/installing**

Removing

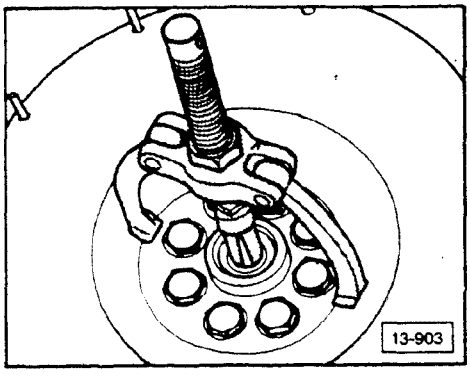
- mark relationship to crankshaft (as shown)

Installing

- install bolts
  - torque: 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, see page 13.50
  - threads of replacement bolts are pre-coated with locking compound



▶ **Fig. 2 Pilot bearing, removing**

- remove needle bearing with extractor (as shown)

▶ **Crankshaft dimensions (mm)**

Stage	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

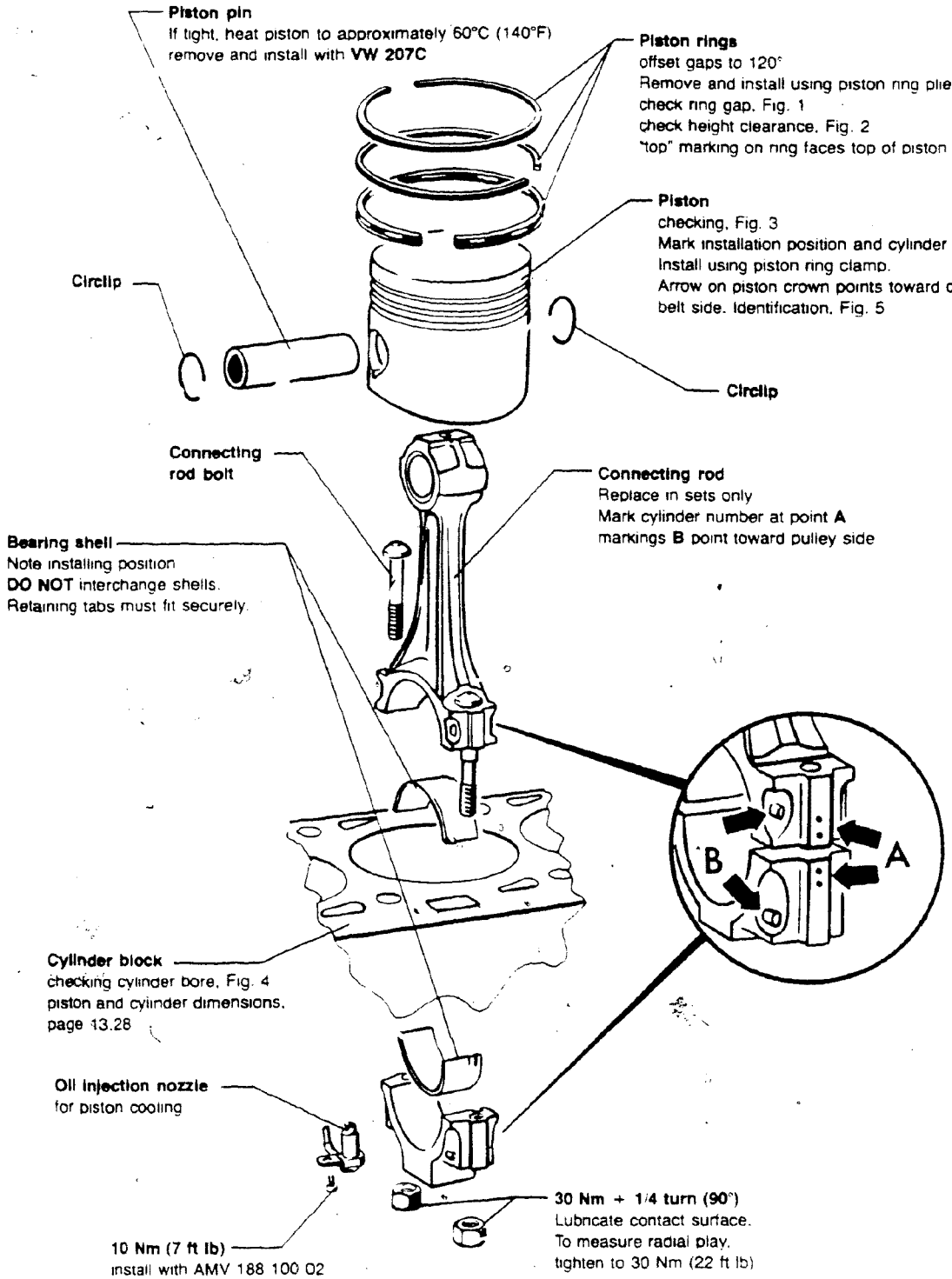
end play
new = 0.07-0.23mm (0.003-0.009 in.)
wear limit = 0.25mm (0.010 in.)
radial play – check with plastigage
new = 0.018-0.058mm (0.001-0.002 in.)
wear limit = 0.16mm (0.006 in.)

Connecting rod bearings, checking

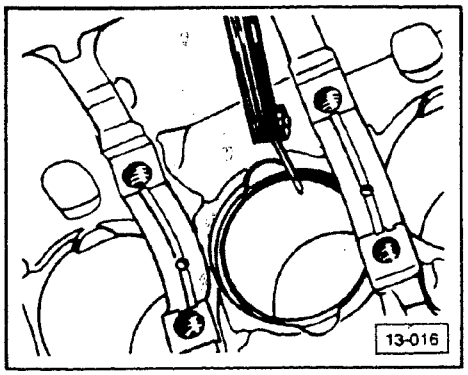
axial play
new: 0.05 to 0.31mm (0.002-0.012 in.)
wear limit: 0.4mm (0.016 in.)

radial play
new: 0.010 to 0.056mm (0.0004-0.002 in.)
wear limit: 0.12mm (0.005 in.)
(check radial play with plastigage)

D-9


Piston pin
If tight, heat piston to approximately 60°C (140°F)
remove and install with VW 207C
Piston rings
offset gaps to 120°
Remove and install using piston ring pliers
check ring gap, Fig. 1
check height clearance, Fig. 2
"top" marking on ring faces top of piston
Piston
checking, Fig. 3
Mark installation position and cylinder number.
Install using piston ring clamp.
Arrow on piston crown points toward drive
belt side. Identification, Fig. 5
Circlip
Circlip
Connecting
rod bolt
Connecting rod
Replace in sets only
Mark cylinder number at point A
markings B point toward pulley side
Bearing shell
Note installing position
DO NOT interchange shells.
Retaining tabs must fit securely.
B
A
Cylinder block
checking cylinder bore, Fig. 4
piston and cylinder dimensions,
page 13.28
Oil injection nozzle
for piston cooling
30 Nm + 1/4 turn (90°)
Lubricate contact surface.
To measure radial play,
tighten to 30 Nm (22 ft lb)
10 Nm (7 ft lb)
install with AMV 188 100 02

13-721

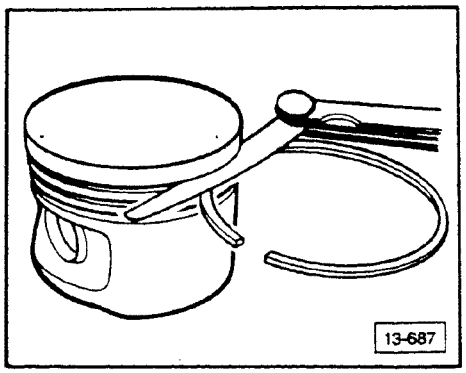


▶ Fig. 1 Piston rings, checking end gap

Insert ring squarely into cylinder until it is approximately 15mm from edge of cylinder.

New:

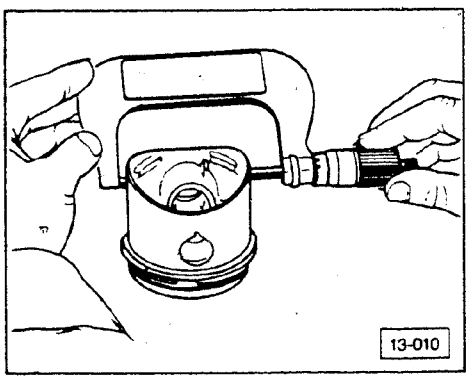
- compression rings: 0.20-0.40mm (0.008-0.016 in.)
- oil scraper ring: 0.25-0.50mm (0.010-0.020 in.)
- wear limit: 1.0mm (0.04 in.)



▶ Fig. 2 Piston rings, checking side clearance

New:

- compression rings: 0.02-0.07mm (0.001-0.003 in.)
- oil scraper ring: 0.02-0.06mm (0.001-0.002 in.)
- wear limit: 0.15mm (0.006 in.)

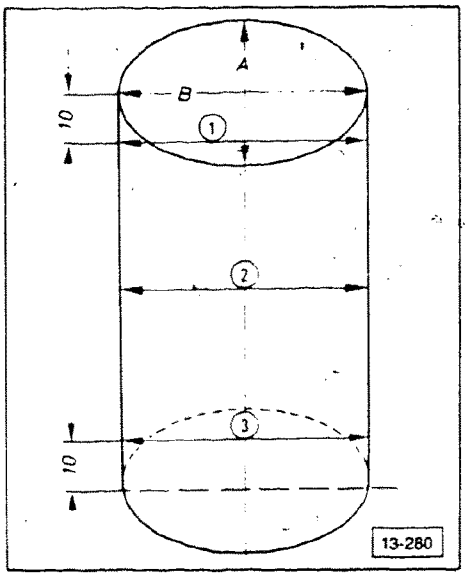


▶ Fig. 3 Piston, checking

Measure pistons approximately 10mm (3/8 in.) from the lower edge, at 90° to piston pin axis.

Nominal dimension tolerance:

- maximum 0.04mm (0.0016 in.)



▶ Fig. 4 Cylinder bore, checking

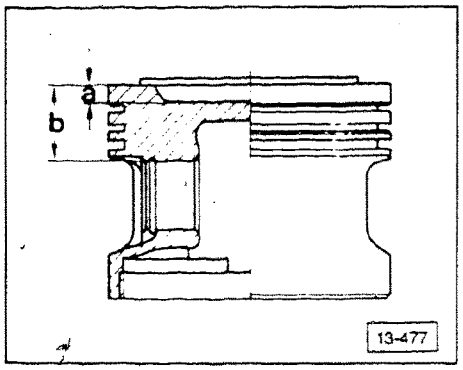
Measure at three points in cross direction **A** and longitudinal direction **B**

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

Nominal dimension deviation:
- maximum 0.08mm (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.



▶ Fig. 5 Piston identification (in mm)

a = 4.4mm
b = 22.2mm

Note

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

▶ Piston and cylinder dimensions

Size	Piston diameter	Cylinder bore
Standard	82.48mm	82.51mm
1st oversize	82.73mm	82.76mm
2nd oversize	82.98mm	83.01mm

THIS FRAME INTENTIONALLY LEFT

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