



Workshop Manual

4 Cylinder Diesel Engine

LT

THE LT WORKSHOP MANUAL CONSISTS OF THE FOLLOWING BOOKLETS:

Repair Group	Title/Contents	Repair Group	Title/Contents
	MAINTENANCE		5 SPEED MANUAL GEARBOX 008 AND FINAL DRIVE
	Engines and information sources	34	Controls, housing
	Technical data/Settings	35	Gears, shafts
	Tightening torques/Settings	39	Final drive, differential
	Delivery Service		
	Standard Service		
	Identification plate, chassis and engine numbers		
	Lifting vehicle		
	Towing		
	2 LITRE PETROL ENGINE		RUNNING GEAR LT 28/31/35
10	Removing and installing engine	40	Front suspension
13	Crankshaft group	42	Rear suspension
15	Cylinder head, valve gear	44	Wheels, tyres, wheel alignment
17	Lubrication	46	Brakes — Mechanism
19	Cooling	47	Brakes — Hydraulics, regulator, servo
20	Fuel system	48	Steering
22	Carburetor, Controls		
26	Emission control system		
28	Ignition system		
30	Clutch		
	4 CYL. DIESEL ENGINE		RUNNING GEAR LT 40/45
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19	Cooling	47	Brakes — Hydraulics, regulator, servo
20	Fuel supply system	48	Steering
23	Fuel system, injection		
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	6 CYL. DIESEL ENGINE		BODY REPAIR WORK
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23	Fuel system, injection		
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28	Glow plug system		
30	Clutch		
	4 SPEED MANUAL GEARBOX 015 AND FINAL DRIVE		HEATING, VENTILATION
34	Controls, housing	80	Heating
35	Gears, shafts	83	Heater booster
39	Final drive, differential	85	Ventilation
			ELECTRICAL SYSTEM
		27	Starter, current supply
		90	Instruments, radio
		92	Windscreen wiper and washer
		94	Lights, switches
		97	Wiring
			CURRENT FLOW DIAGRAMS
			Main and additional current flow diagrams



Workshop Manual

LT

4 Cylinder Diesel engine

August 1978 edition

**Supersedes the present LT Workshop
Manual, June 1975 edition**

This manual is valid for the LT vehicles from the start of production (August 1975).

It describes all repair operations which require special instructions to ensure satisfactory work. All modifications introduced up to date of issue are incorporated.

The manual is divided into separate booklets according to subject.

A list of the individual booklets is given inside the front cover and each booklet has the contents listed according to repair groups and items to make it easy to find the information required.

VW-Audi Special Tools and Workshop Equipment

Special tools and/or workshop equipment are required for many of the operations described in the manual. This equipment is listed in each booklet together with the Repair Operations.

Workshop Bulletins

Workshop bulletins will be allocated to the individual booklets and should be filed at the back of the booklet concerned. To remind you that bulletins have been published, please mark the manual pages given on the bulletin with the bulletin number.

Fault finding

General fault finding instructions are given in the workshop manual.

Further instructions on the elimination of current defects are given in the "Fault finding handbook".

Technical information should always be made available to all foremen and mechanics because compliance with the instructions given is essential to ensure vehicle roadworthiness and safety. In addition, the normal safety precautions to be observed when working on motor vehicles are also applicable.

REPAIR OPERATIONS AND SPECIAL TOOLS

Rep. Op.	Operation	Page	VW Audi Special tools	Workshop Equipment
10 01 19 . .	Engine, R + I	2	2024 A 2035	
10 01 37 . .	Engine, D + A	6	2020 2026 2027 2028 2029 2063 10-221 VW 203 b VW 207 c or 10-508* VW 210 VW 382/7 VW 385/17 VW 387	Universal piston ring tensioner Piston ring pliers Micrometer 75-100 mm diam. Internal measuring appliance 75-100 mm diam.
10 19 02 . .	Compressions, checking	21	VW 1323 VW 1323/1	
13 10 02 . .	Pistons, checking	17		Piston ring pliers Micrometer 50-75 mm diam. Internal measuring appliance 50-75 mm diam.
13 10 20 . .	Pistons, R + I	17	VW 207 c or 10-508 VW 382/7 VW 385/17	Universal piston ring tensioner
13 19 19 . .	Piston rings, R + I	17		Piston ring pliers
13 40 02 . .	Conrod, checking bearing clearance	17		
13 48 01 . .	Crankshaft, checking bearing clearance	13		
13 48 19 . .	Crankshaft, R + I	13	2026 2027 2028 2029 2063 10-221 VW 203 b	
13 59 19 . .	Crankshaft oil seal (Flywheel end) R + I	13	2026 2027 2028 10-221	
13 67 19 . .	Crankshaft needle roller, R + I	13	2026 10-202	
13 74 19 . .	Crankshaft oil seal (pulley end) R + I	6	2029 10-221	

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Rep. Op.	Operation	Page	VW Audi Special tools	Workshop Equipment
13 76 19 . .	Crankshaft pulley, R + I	6	VW 210	
13 78 19 . .	V belt, R + I	6	VW 210	
15 01 06 . .	Valve clearances, checking and adjusting	21		
15 33 19 . .	Timing case cover, R + I	6	2029 10-221	
15 70 19 . .	Cylinder head, R + I	21		
15 70 37 . .	Cylinder head, D + A	21	2037 VW 382/7 VW 385/7 VW 387	
15 70 41 . .	Cylinder head, repairing	21		
15 70 55 . .	Cylinder head, renewing	21	VW 382/7 VW 385/17	
15 82 19 . .	Cylinder head cover, R + I	21		
15 84 20 . .	Combustion chamber inserts R + I	21	VW 382/7 VW 385/17	
17 03 01 . .	Oil pressure, checking	26		VW 1342
17 05 19 . .	Oil pressure switch, R + I	26		
17 20 19 . .	Oil pump R + I	26		
17 40 19 . .	Oil cooler, R + I	26		
17 50 19 . .	Sump, R + I	26	10-222	
19 01 01 . .	Cooling system, complete check	31		VW 1274
19 50 19 . .	Coolant pump, R + I	29	VW 210	
19 58 19 . .	Thermostat, R + I	29		
19 62 19 . .	Coolant hoses R + I	30		
19 70 19 . .	Radiator, R + I	31		
19 78 19 . .	Temperature sender R + I	29		
20 10 19 . .	Fuel tank, R + I	32		

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Rep. Op.	Operation	Page	VW Audi Special tools	Workshop Equipment
20 15 19 . .	Fuel gauge sender R + I	32		
20 18 29 . .	Water separator, clean	32		
20 31 19 . .	Fuel filter, R + I	32		
23 01 67 . .	Injection system, bleeding	34		
23 16 19 . .	Accelerator cable, R + I	33		
23 17 19 . .	Hand throttle cable, R + I	33		
23 22 19 . .	Stop cable, R - I	33		
23 29 19 . .	Injection pump, R + I	33		VW 1267 VW 1367 VW 1324
23 40 02 . .	Injectors, checking	36		VW 1322
23 40 20 . .	Injectors, R + I	35		
23 40 41 . .	Injectors, repairing	36	2031	VW 1322
23 60 05 . .	Idling speed, checking and adjusting	35		VW 1267 VW 1367 VW 1324
23 62 05 . .	Maximum speed, checking and adjusting	35		VW 1267 VW 1367 VW 1324
28 84 02 . .	Glow plugs, checking	37		
28 84 20 . .	Glow plugs, R - I	37		
30 12 15 . .	Clutch cable, adjusting	40		
30 12 19 . .	Clutch cable, R + I	39		
30 50 19 . .	Clutch, R + I	38	2026 2027	

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Camshaft, removing and installing/checking	13	• removing and installing	17
Capacities		• checking	17
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• Engine oil	26	checking	17
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Coolant, draining and filling	30		
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Oil pump, removing and installing/			
checking	26		

The following table contains engine code letters and general information on all engines which have been installed in LT vehicles to date.

Code letters		CG	CH	CL
Engine data				
Manufactured	from to	1.76	8.75	5.76
Capacity	litres	2.7	2.0	2.0
Output	kW at rpm	48/3600	55/4300	52/4300
Torque	Nm at rpm	152/2300	152/2400	132/2400
Bore	mm diam.	92	86.5	86.5
Stroke	mm	101.6	84.4	84.4
Compression ratio		21	8.3	7.0
Valve timing at 1 mm valve stroke	inlet opens before TDC inlet closes after BDC exhaust opens before BDC exhaust closes after TDC	34° 68° 72° 30°	20° 35° 22° 11°	20° 35° 22° 11°
RON	min.	45 CZ	85	80
Carburetor/Injection		Diesel	35 PDSIT	35 PDSIT
Distributor		—	060 905 205 A	060 905 205 A
Pistons, recess depth	mm	—	8.8	9.8
After burning		—	ab 8.77	ab 8.77
Engine is tuned specially for:				Countries with low octane fuel M 240
Information				
Order No. ³⁾				
Workshop Manuals:				
Maintenance	000 537 301 20	x	x	x
2 ltr. Petrol engine	000 537 311 20	—	x	x
4 Cyl. Diesel engine	000 537 321 20	x	—	—
Fault Finding Programme:				
Carburetor engines	348 530 407 20	—	x	x
Current defects:				
Service Handbook ¹⁾		x	x	—
Fault Finding Handbook ²⁾	000 530 451 20	x	x	x

1) Distributed in Germany only

2) Distributed to export countries only

3) Foreign language index, see Service department Information catalogue.

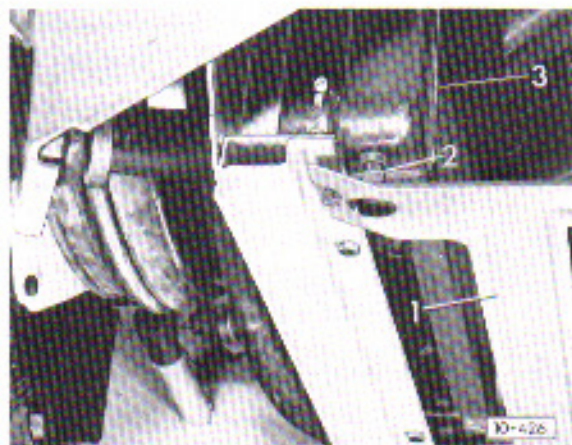
4) At 0.25 mm stroke

REMOVING AND INSTALLING ENGINE

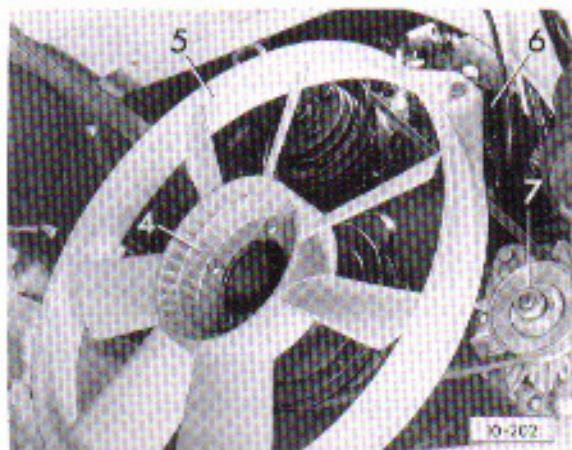
The engine is taken out upwards through the right hand side of the cab. The gearbox must be removed.

Removing

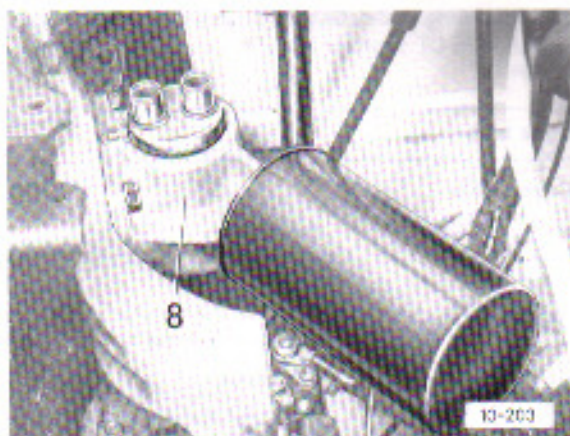
- Remove passenger's seat and bonnet.
- Disconnect battery earth strap.



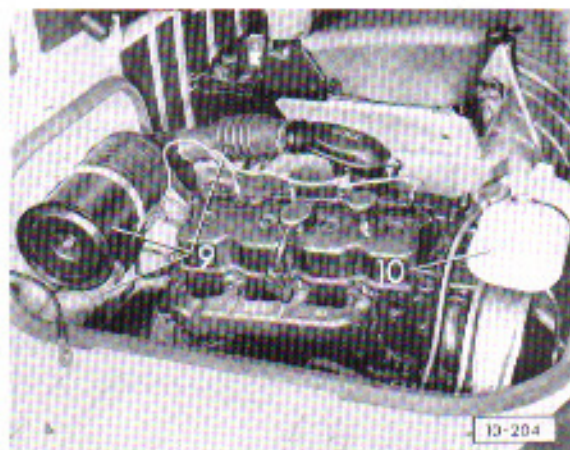
- Remove protective grille – 1 –.
- Drain coolant at radiator drain plug – 2 – and catch it in a clean container (heater regulating valve open).
- Remove radiator – 3 –.



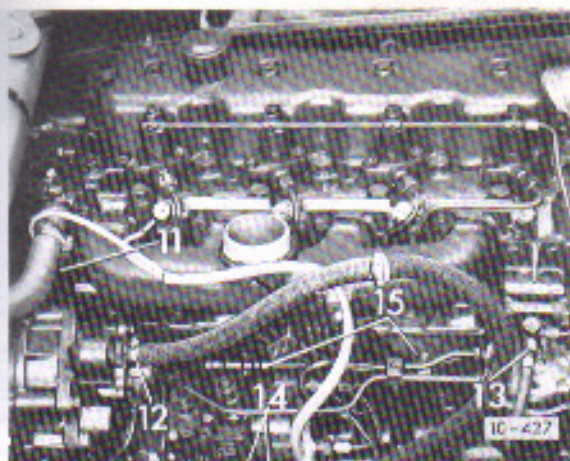
- Remove fan – 4 –.
- Remove fan cowl – 5 –.
- Remove fan cowl mounting – 6 –.
- Remove generator – 7 –.



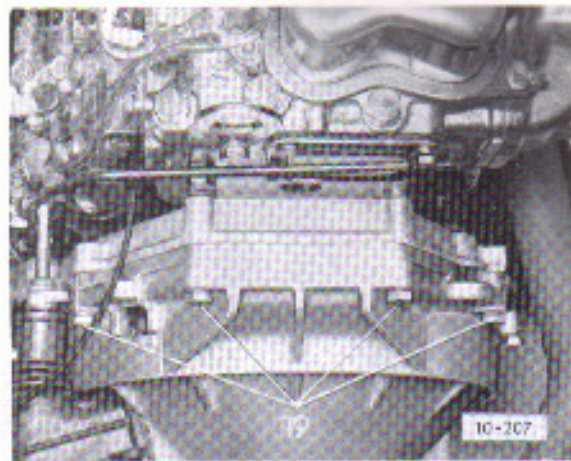
- Remove oil filter together with oil cooler – 8 –.



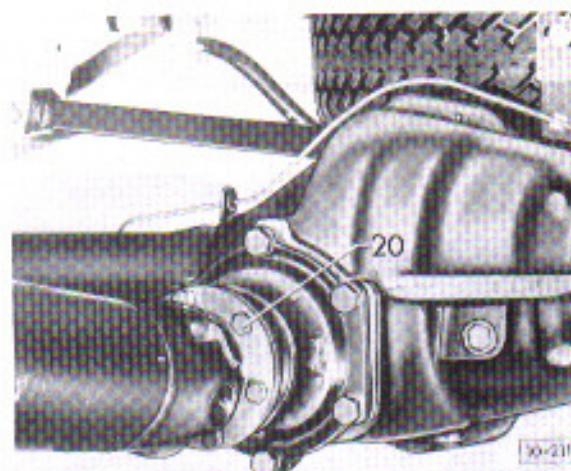
- Remove air cleaner – 9 – complete with intake pipe and elbow
- Remove expansion tank – 10 – complete with mounting and hoses.



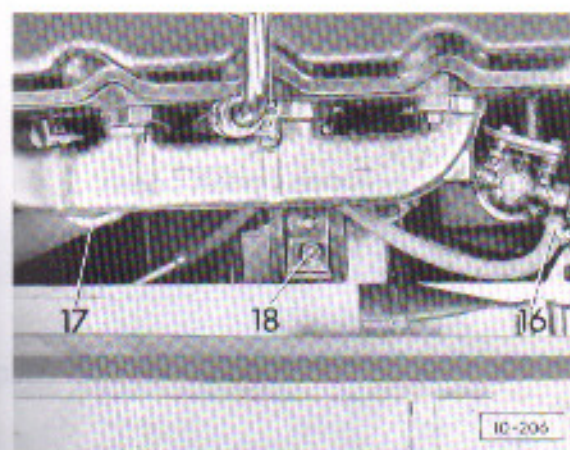
- Disconnect wires –11– from glow plugs, temperature sender and oil pressure switch.
- Pull off brake servo vacuum hose –12–.
- Pull fuel hose –13– off filter.
- Disconnect hand throttle and accelerator cable –14– at the injection pump.
- Disconnect stop cable –15– at injection pump and on housing.



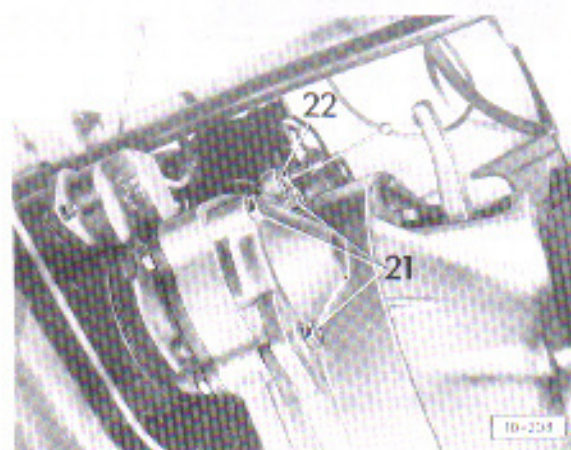
- Remove engine-gearbox bolts –19–.



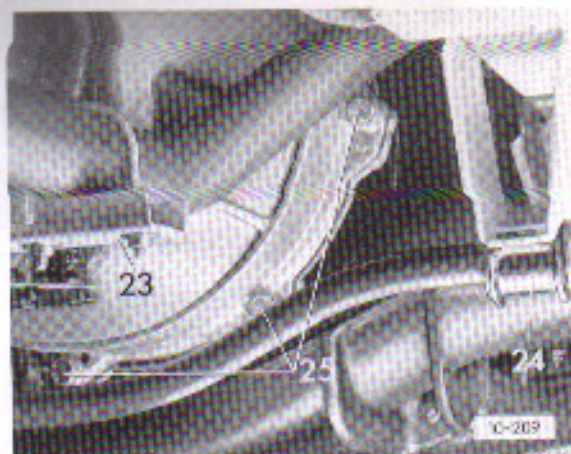
- Detach prop shaft –20– from rear axle, pull it out of gearbox and close gearbox with sleeve 2035.



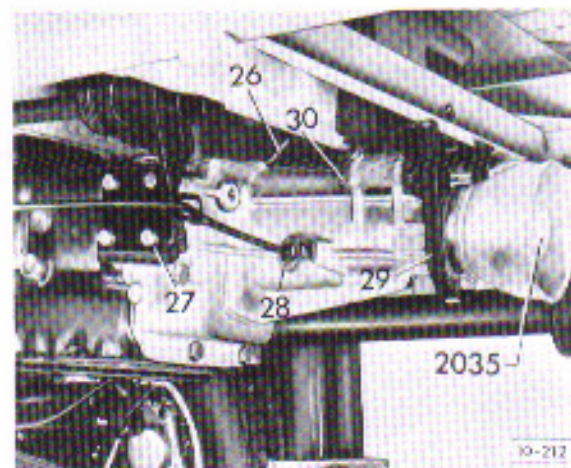
- Pull fuel hose –16– off the water separator.
- Detach exhaust pipe –17– from manifold.
- Remove engine securing nuts –18– on both sides.



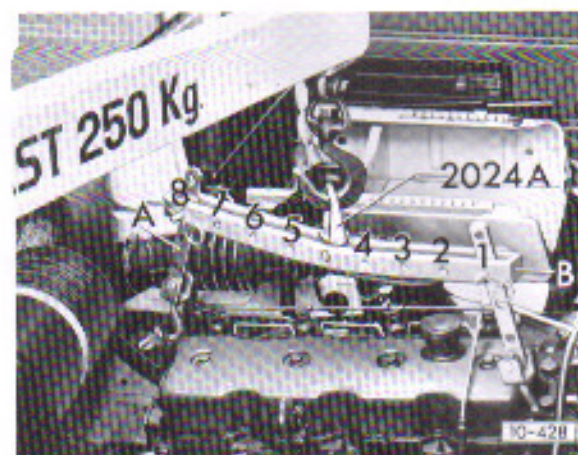
- Remove starter –21– and place it on front axle with wiring.
- Disconnect clutch cable –22– and take cable guide off gearbox.



- Detach exhaust pipe bracket –23–.
- Detach stabilizer –24– from body and press it down.
- Remove engine-gearbox bolts –25–.



- Detach earth strap –26– from body.
- Remove gear lever bracket –27–.
- Disconnect speedo cable –28– and seal opening with a rubber cap so that no oil can leak when gearbox is being removed.
- Remove retaining strap –29–.
- Detach gearbox from rear bonded rubber mounting –30–.
- Press gearbox off dowel bushes, pull it to the rear and place it on the vehicle lift.



- Attach engine lifting sling as follows:

Pulley end:

- 2 hook bar –A– hole in position
- 1 of the cross bar

Flywheel end:

- 2 hook bar –A– hole in position
- 8 of the cross bar

- Remove engine by carefully lifting and turning at the same time.

Installing

Install in the reverse sequence:

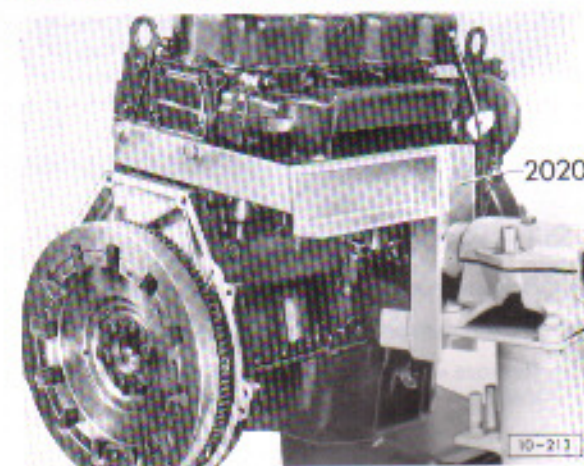
Note:

- Fill with coolant – page 30
- Adjust accelerator, hand throttle and stop cables – page 33
- Bleed fuel system – page 34
- Adjust max. and idling speeds – page 35

Tightening torques:

- Engine to gearbox: 75 Nm (7,5 mkg)
- Engine mountings: 45 Nm (4,5 mkg)
- Prop shaft to rear axle: 25 Nm (2,5 mkg)

SECURING ENGINE TO REPAIR STAND



If work is to be carried out on the engine once it has been removed, the engine should be mounted in the repair stand with adaptor 2020.

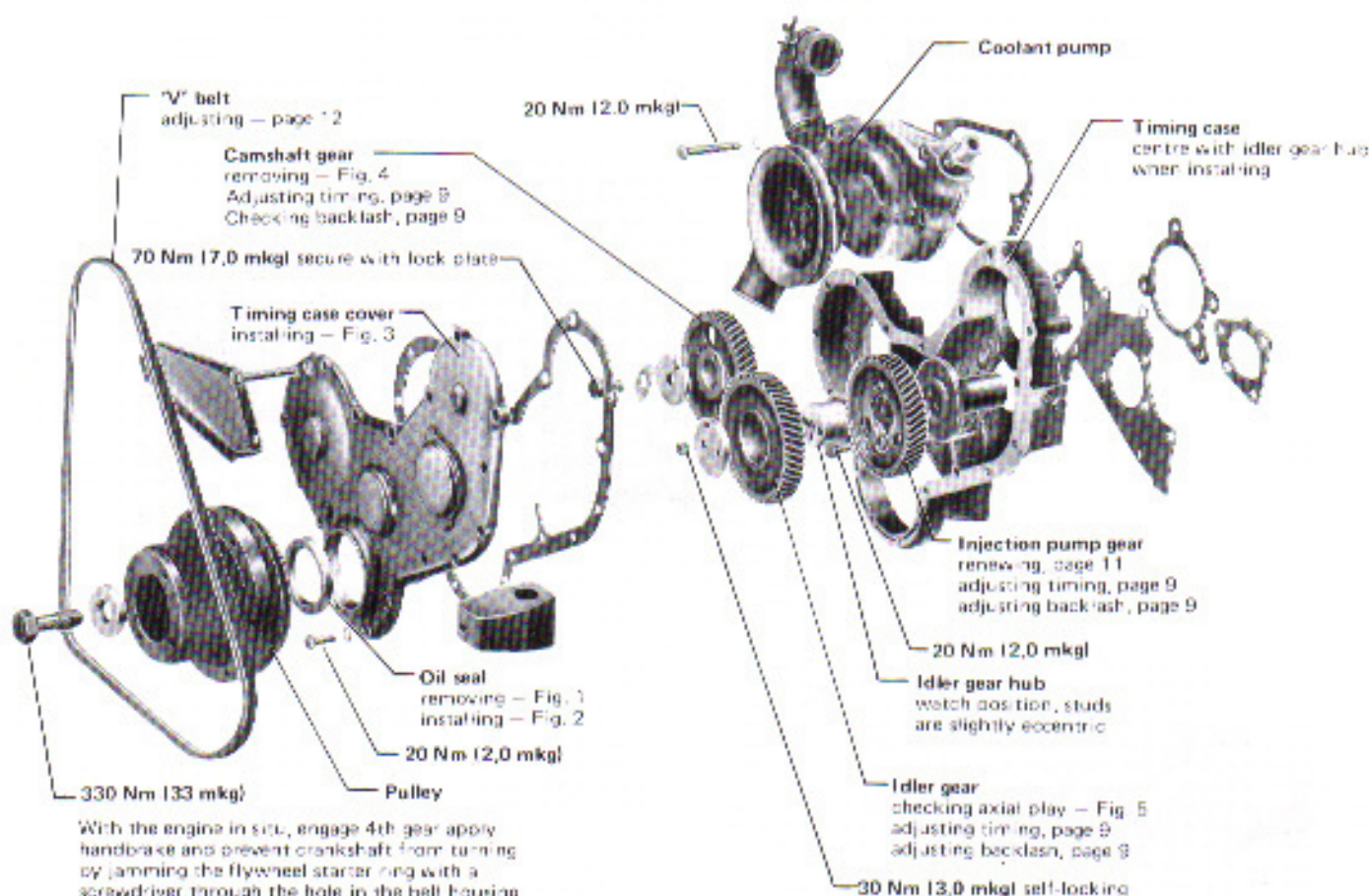
DISMANTLING AND ASSEMBLING ENGINE

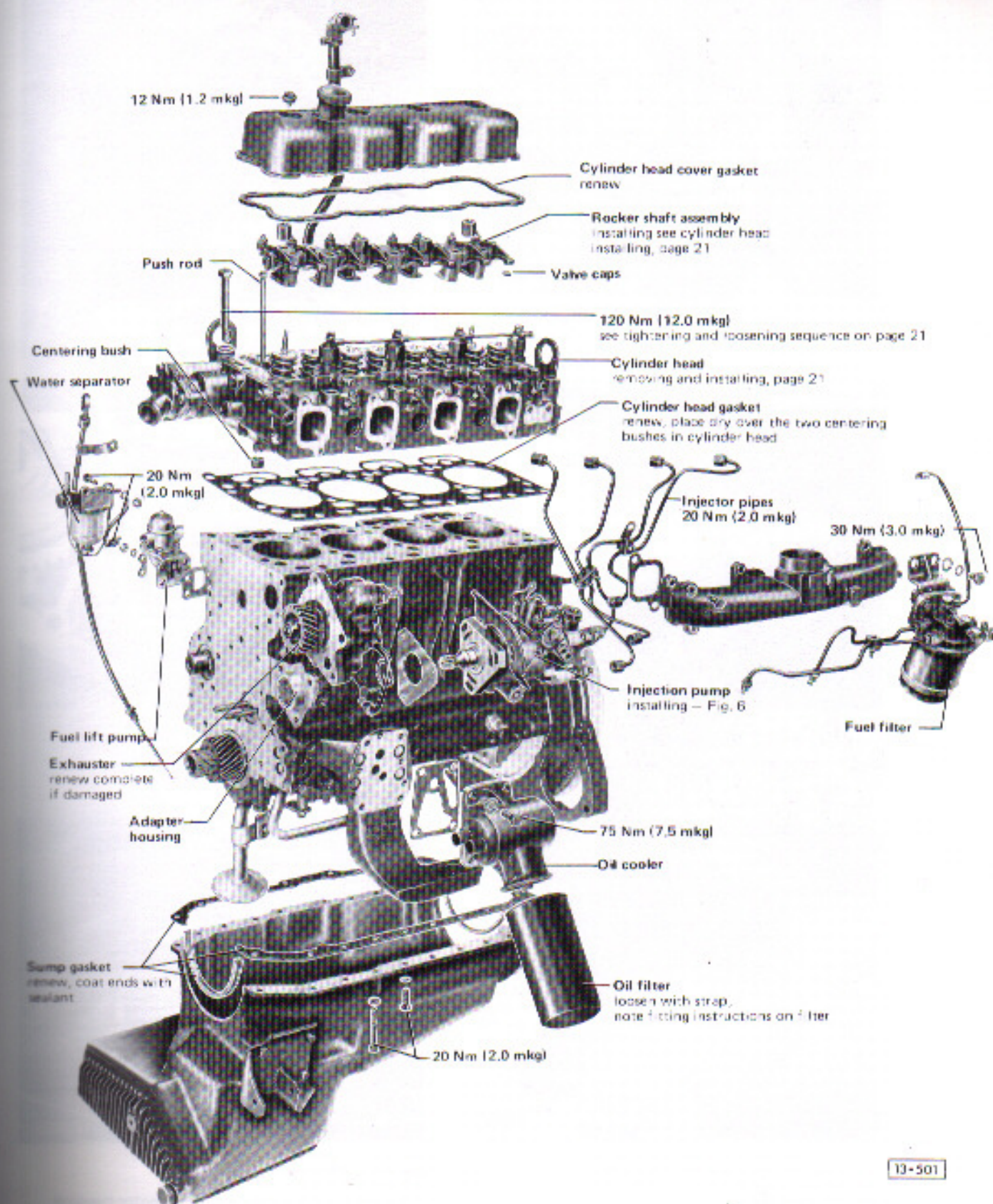
Note:

Due to the different numbers of teeth on the timing gears, the marks are only aligned once every 52 engine revolutions. To check the timing, it is advisable therefore to set the engine to TDC, remove the idler gear and install it as described on page 9.

Always fit new gaskets when repairing.

With the exception of the timing case, all the parts shown here can be removed and installed with engine in situ.





13-501

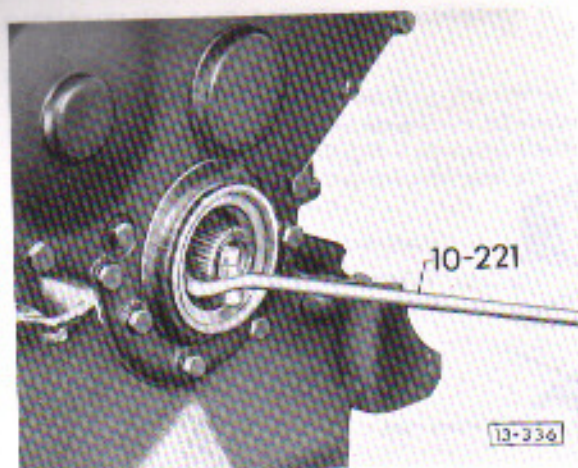


Fig. 1 Crankshaft oil seal, pulley end — Removing

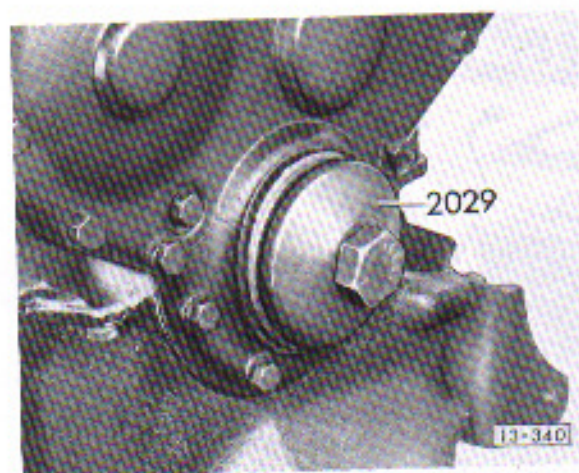


Fig. 2 Crankshaft oil seal, pulley end — Installing
Press fully home with pulley securing bolt.

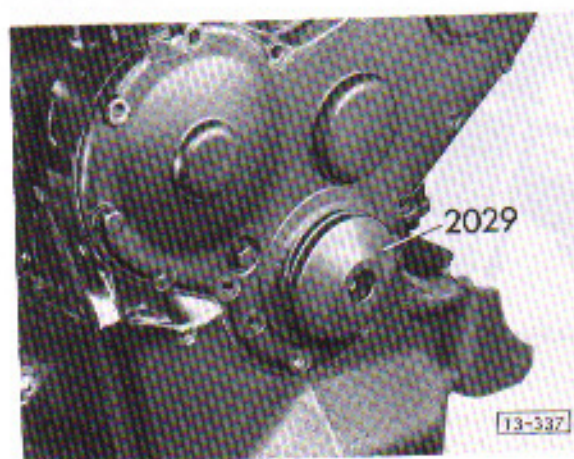


Fig. 3 Timing case cover — Installing
Centre with 2029.

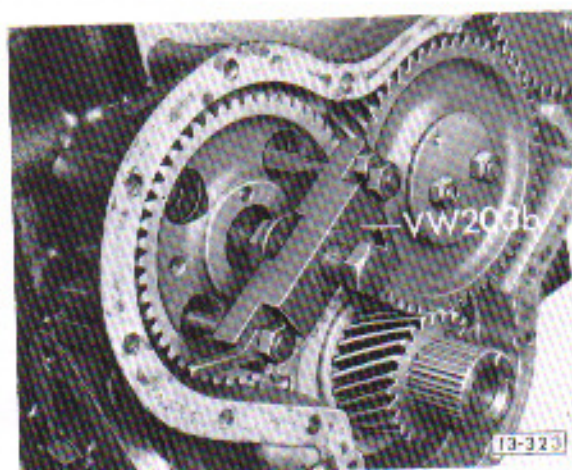


Fig. 4 Camshaft gear — Removing
— To support it, screw bolt in about 3 turns.

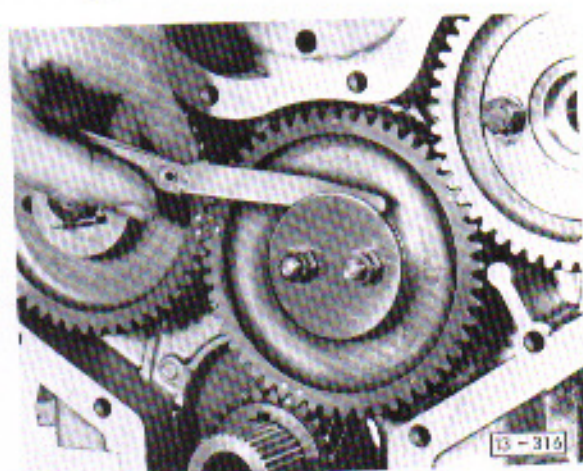


Fig. 5 Idler gear — Checking axial play
New: 0.15 — 0.30 mm
Wear limit: 0.38 mm

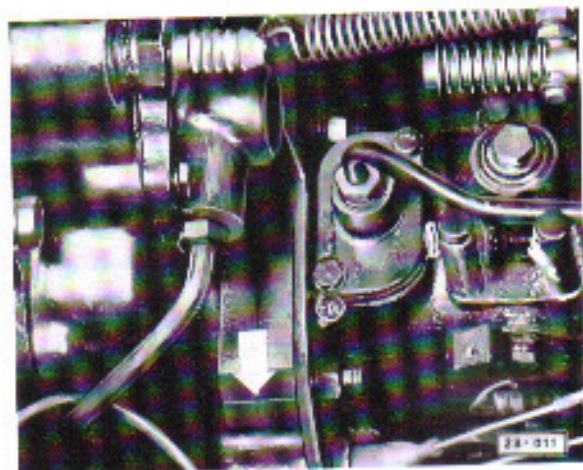
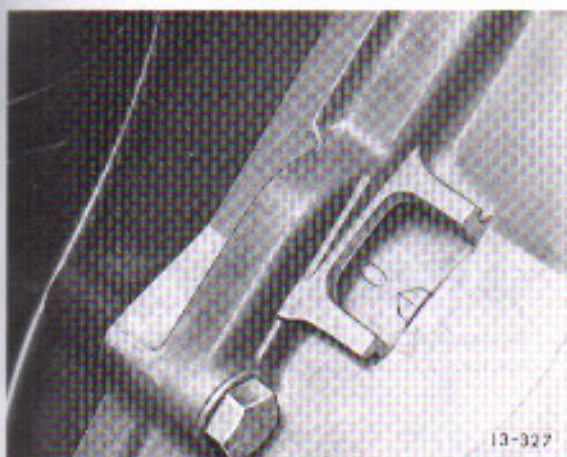


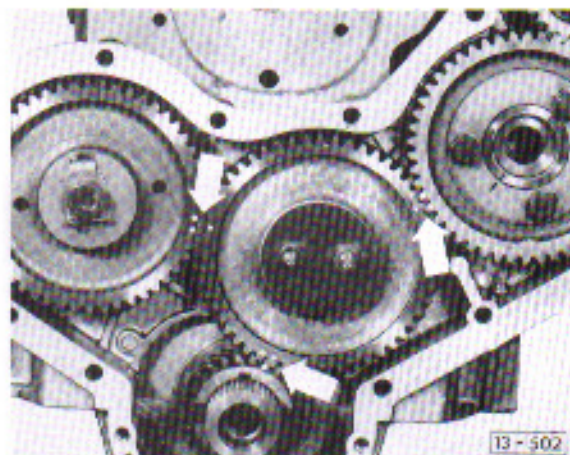
Fig. 6 Injection pump — Installing
The marks on the pump and the adaptor housing must be aligned. Pump shaft and drive hub fit in one position only.

INSTALLING TIMING GEARS

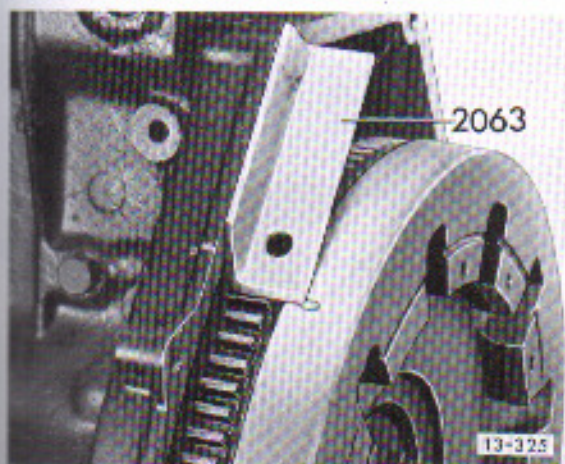
- Cylinder head in situ:
Back off the valve clearance adjuster screws and remove valve caps.



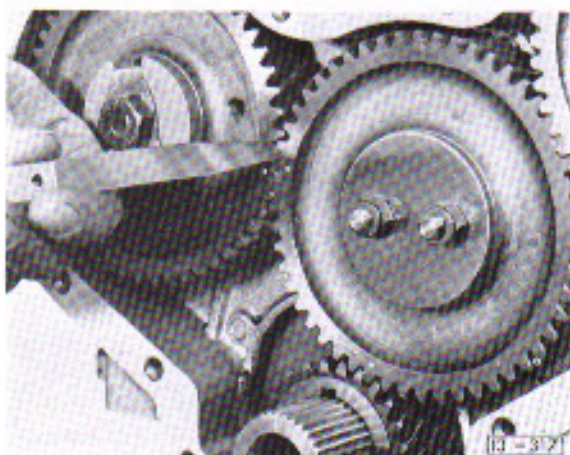
- Engine in situ:
Turn the engine over until the TDC mark on the flywheel lines up with the boss on the clutch bell housing.



- Install the idler gear so that the double mark on the idler lines up with the mark on the crankshaft and the other two marks on the idler line up with the double marks on the camshaft and FIP drive gear.



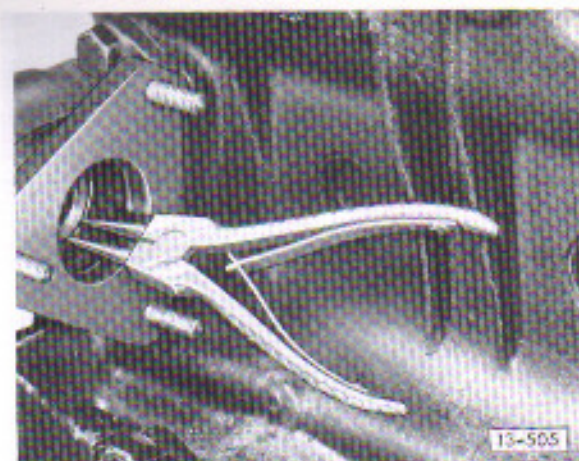
- Engine out:
Turn the engine over until the TDC mark on the flywheel lines up with the edge of the setting tool.

CHECKING AND ADJUSTING TIMING GEAR BACKLASH

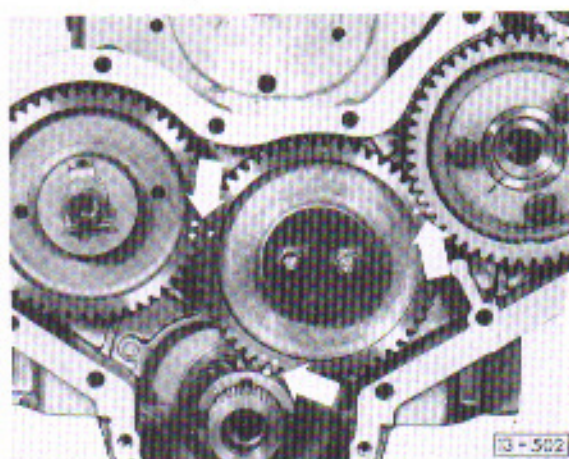
Crankshaft-camshaft-idler: 0.10 mm
FIP drive gear-idler: 0.10 – 0.25 mm.

The backlash between FIP drive gear and idler can be adjusted as follows:

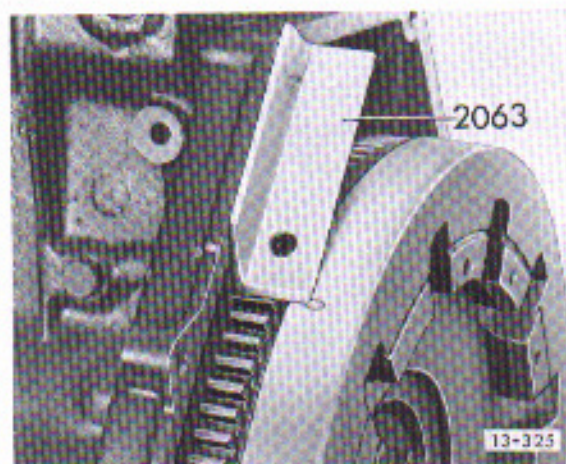
Back off the valve clearance adjuster screws and take out the valve caps.



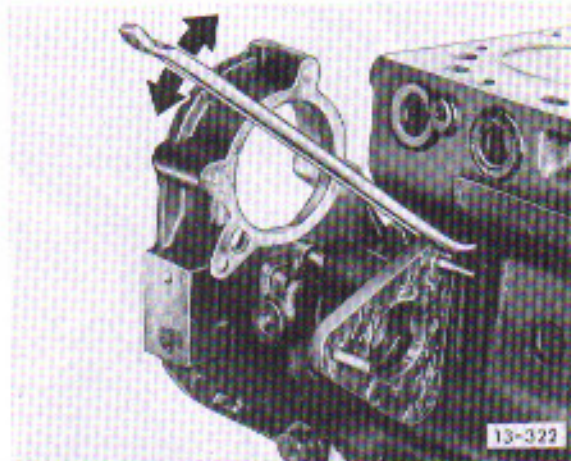
- Remove the drive hub circlip and pull off FIP drive gear with hub.
- Remove exhauster.
- Remove the bolts securing the adapter housing to cylinder block (2 bolts) and timing case (3 bolts).



- Reinstall FIP drive gear and hub and align the marks on idler, crankshaft and camshaft gears.



- Rotate crankshaft until TDC mark on flywheel lines up with the edge of the setting tool.
- Remove idler gear.

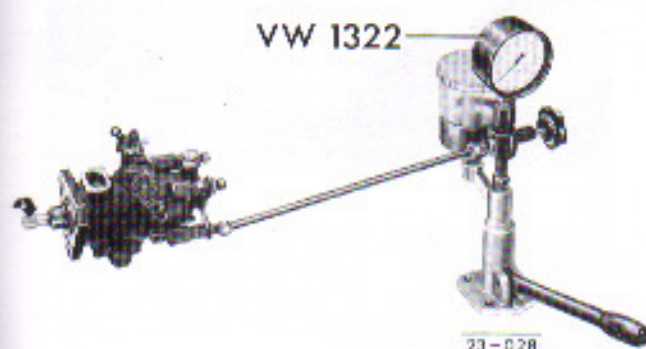


- Move adapter housing until the backlash is 0.10 – 0.25 mm.
- Tighten the bolts securing housing to cylinder block.
- Remove FIP drive gear with hub and tighten the 3 bolts in timing case.
- Reinstall FIP drive gear with hub and recheck the backlash and adjustment markings.

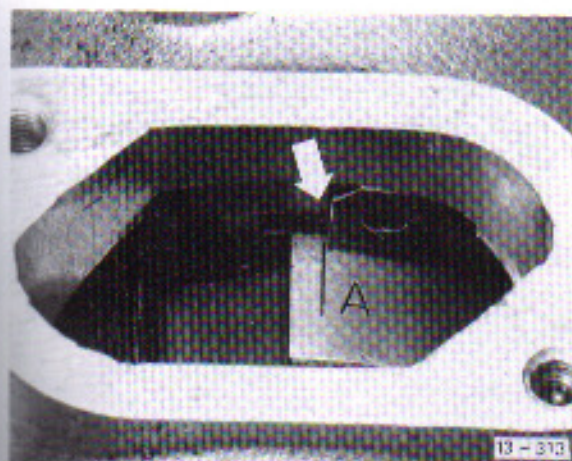
RENEWING F I P DRIVE GEAR

FIP drive gears supplied as service parts have no adjustment marks and must therefore be installed as follows:

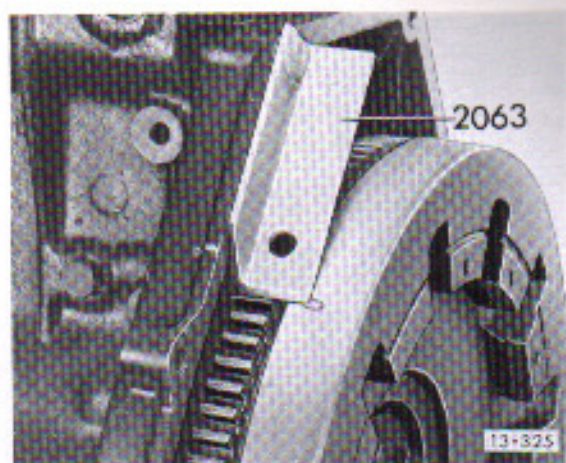
- Remove FIP.



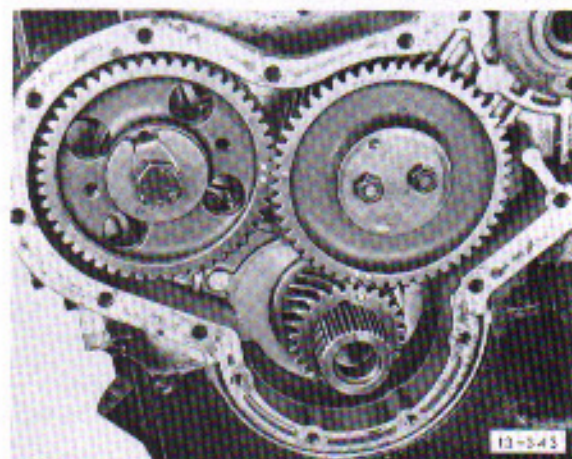
- Connect the injector test appliance to the FIP at the No. 1 cylinder connection (marked with a "W") and apply a pressure to the FIP of approx. 30 bar.
- Rotate the FIP drive shaft by hand in the normal direction of rotation (arrow) until the drive shaft becomes blocked.



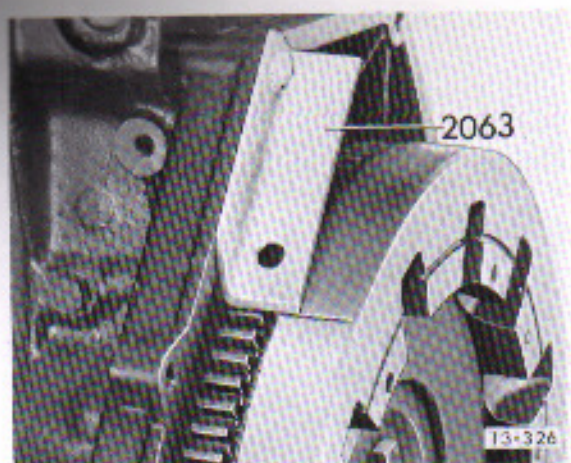
- In this position, the straight edge of the circlip must be in line with the "A" line on the rotor. If not, move circlip.
- Install FIP, and ensure that the markings for commencement of injection are in line.



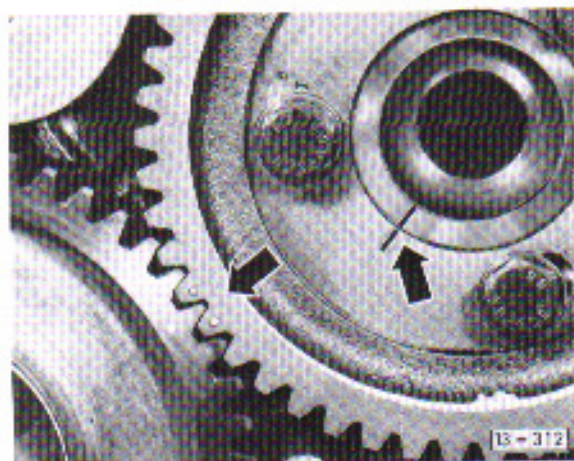
- Rotate the crankshaft until the valves on No. 4 cylinder are on "overlap" and the TDC mark on the flywheel is in line with edge of the setting tool.
- Back off the valve clearance adjusting screws and take out the valve caps.
- Remove FIP drive gear and idler gear.



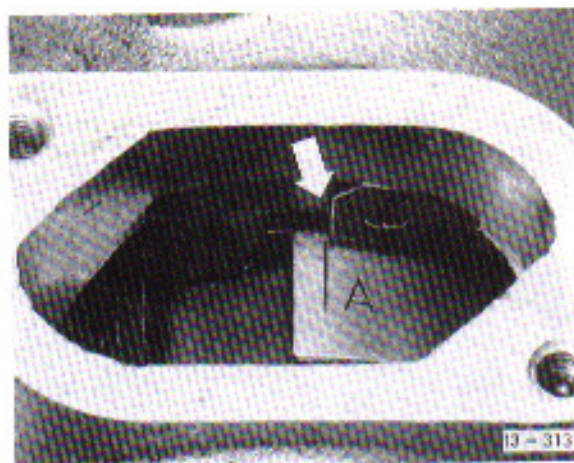
- Install idler gear so that the adjustment markings on the crankshaft, idler and camshaft gears are in line.



- Rotate the crankshaft to the left approx. 1/4 of a turn and then rotate in the normal running direction until the point of injection mark is in line with the edge of the setting appliance.



- Rotate crankshaft to TDC again. Make a mark on the pump gear in line with the mark on the drive hub and then make two center punch marks on the gear to correspond with the single punch mark on the idler gear.



- Rotate the FIP rotor until line "A" on the rotor is in line with the straight edge of the circlip.
- Install new FIP drive gear.
- Turn the crankshaft back a little and then forwards to the start of injection and recheck to ensure that line "A" is in line with the edge of the circlip.

ADJUSTING THE BELT TENSION

- Slacken off the Vee belt by loosening the generator securing bolts.
- Set the test appliance VW 210 to the appropriate value on the scale and then set test appliance up on the Vee belt.

Nominal values:

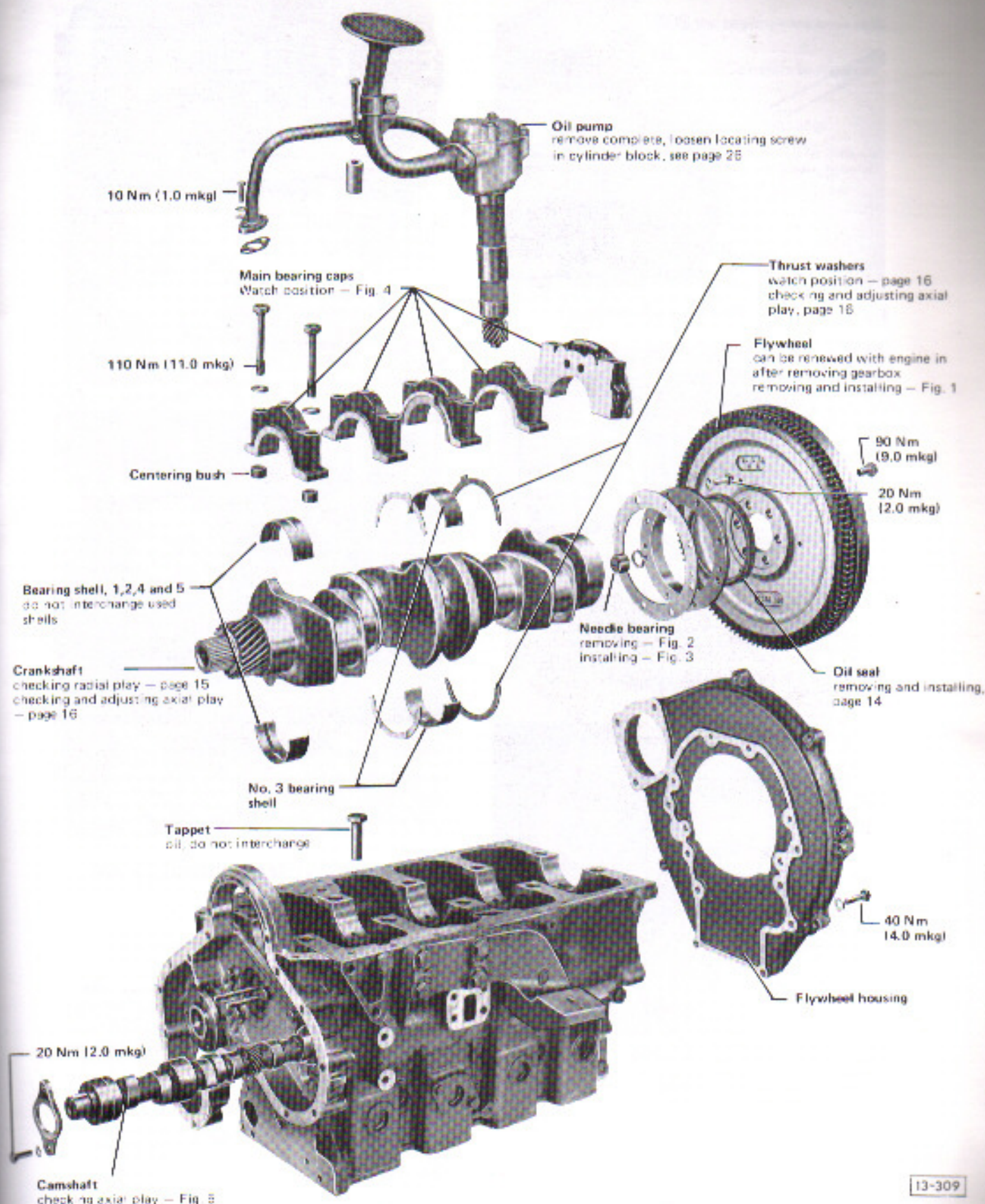
New belt: 16.5 – 16.8 scale divisions

Used belt: 15.7 – 16.0 scale divisions.



- Using a lever tension the Vee belt until the markings on the test appliance align.
- Tighten generator bolts and recheck belt tension.
- With new belts only:
Run engine for 5 – 10 minutes and then readjust Vee belt to the new belt value.

Dismantling and assembling cylinder block, crankshaft, flywheel



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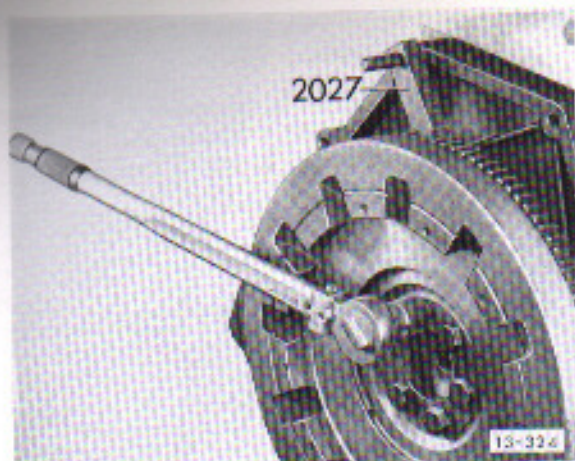


Fig. 1 Flywheel - Removing and installing

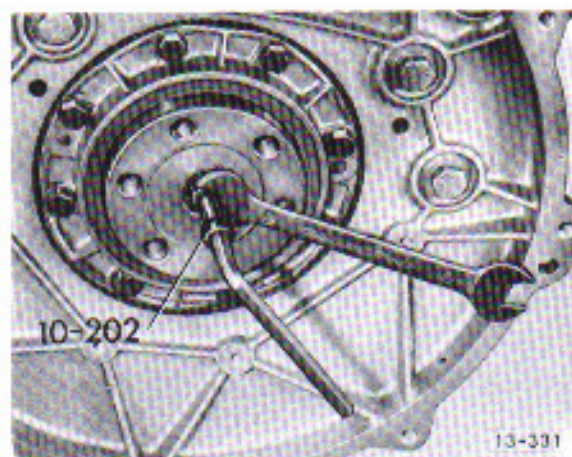


Fig. 2 Needle bearing - Removing

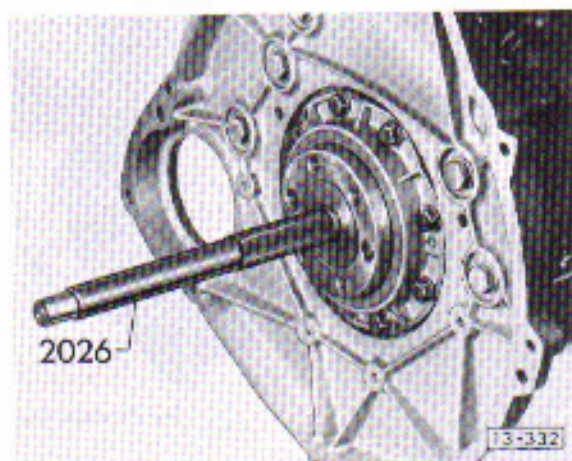


Fig. 3 Needle bearing - Installing

Lettered side must be outwards.

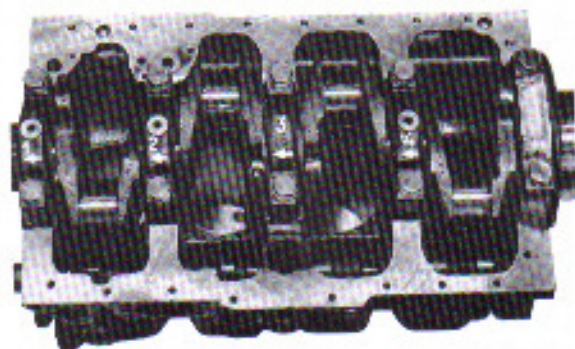


Fig. 4 Bearing caps - Positions

Bearing 1 - Timing case end
Bearing 5 - Flywheel end
Arrows point towards timing case.

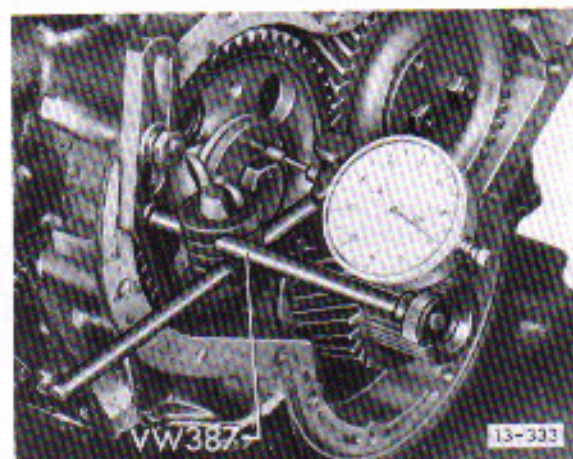


Fig. 5 Camshaft - Checking axial play

New: 0.08 - 0.23 mm
Wear limit: 0.38 mm

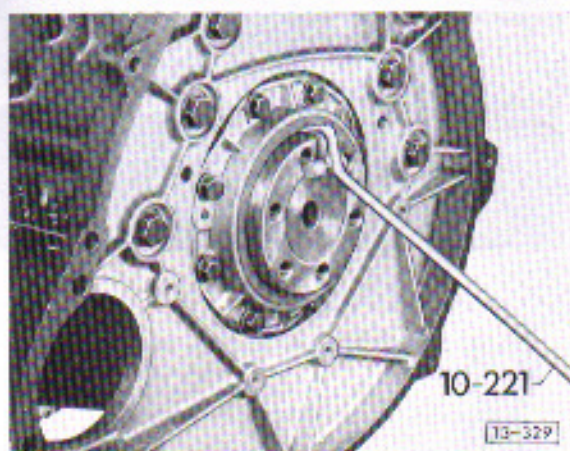
CRANKSHAFT OIL SEAL - REMOVING AND INSTALLING (Flywheel end)

The oil seal can be renewed with engine in situ, after removing gearbox.

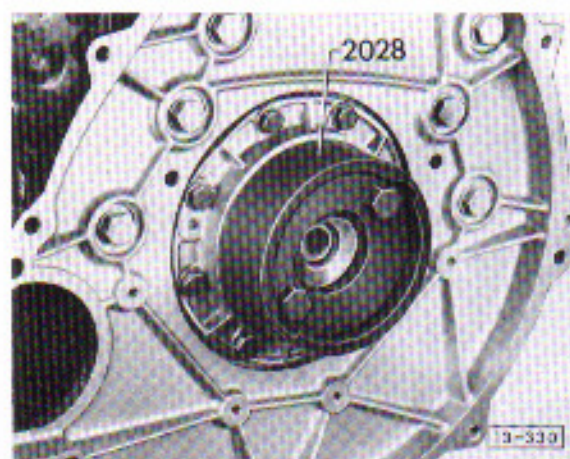
In production the oil seal is fitted flush with the rear face of its housing. In order to ensure that the seal contacts an unworn part of the crankshaft when repairing the engine, a fitting washer 2028 with two repair stages is available for use when pressing the seal in. The dimension from the rear face of the crankshaft to the outer edge of the seal is

Production	approx. 10.5 mm
1st repair stage	13.5 mm
2nd repair stage	16.5 mm

Before removing the oil seal measure the installation depth, then press new oil seal in to the next depth using the appropriate side of fitting washer 2028. If a new crankshaft is being installed, the oil seal should be pressed in until flush with housing.



— Removing crankshaft oil seal.



Installing crankshaft oil seal.

CHECKING CRANKSHAFT RADIAL CLEARANCE

A simple way of checking the bearing clearance is to use "Plastigage".

Plastigage is available in three diameters to measure from 0.025 to 0.23 mm.

Type	Colour	Measuring range
PG-1	green	0.025 to 0.075 mm
PR-1	red	0.05 to 0.15 mm
PB-1	blue	0.10 to 0.23 mm

- Remove bearing caps.
- Clean bearing shells and crankshaft journals.
- Place Plastigage strip on journal in axial direction. Install bearing caps and tighten bolts 110 Nm (11.0 mkg).

Caution!

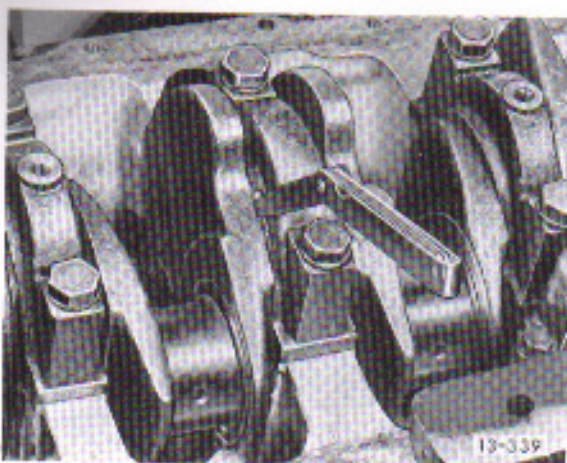
Do not rotate crankshaft.



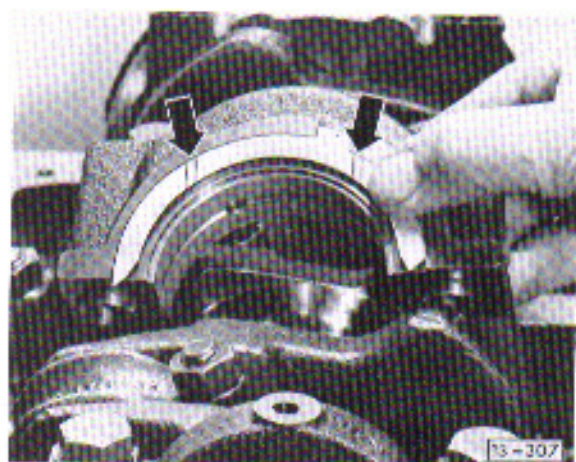
- Compare width of Plastigage strip with measuring scale. The figure on the scale gives the bearing clearance.

Clearance when new:	0.04 – 0.09 mm
Wear limit:	0.12 mm

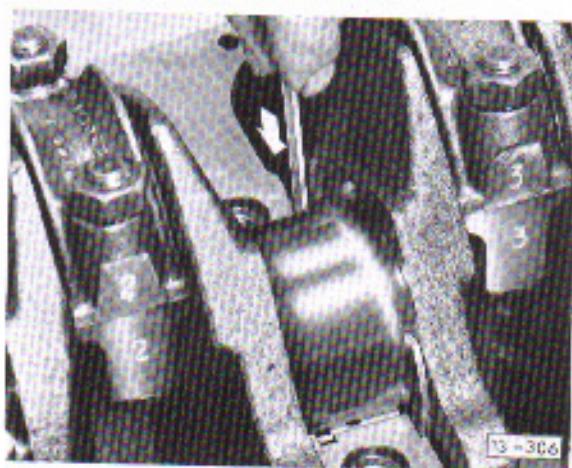
CHECKING AND ADJUSTING CRANKSHAFT END FLOAT



- The end float is measured with feelers at No. 3 bearing.
- | | |
|---------------------|----------------|
| End float when new: | 0.04 – 0.39 mm |
| Wear limit: | 0.51 mm |
- When the end float reaches the maximum permissible 0.51 mm it can be reset to the production dimension by installing new or oversize thrust washers.
- Thrust washer thickness:
- | | |
|-----------|----------------|
| New: | 2.27 – 2.32 mm |
| Oversize: | 2.46 – 2.50 mm |



- Installing thrust washers.
- The oil pockets (arrows) must be towards crankshaft webs.



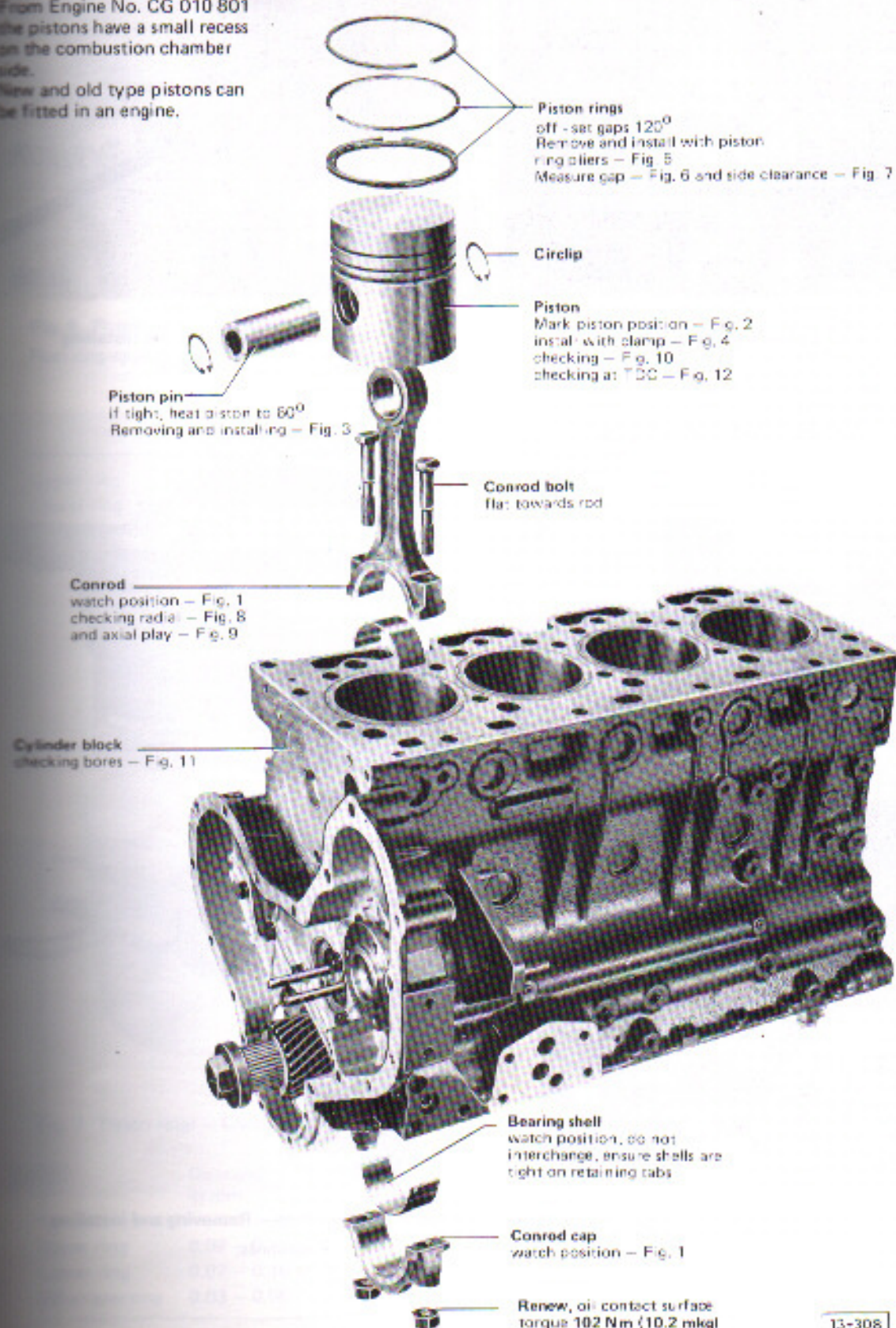
- Remove No. 3 main bearing cap and the two lower halves of the thrust washers.
- Push the upper washer halves round until they can be removed.

DISMANTLING AND ASSEMBLING PISTONS AND CONRODS

Note:

From Engine No. CG 010 801 the pistons have a small recess on the combustion chamber side.

New and old type pistons can be fitted in an engine.



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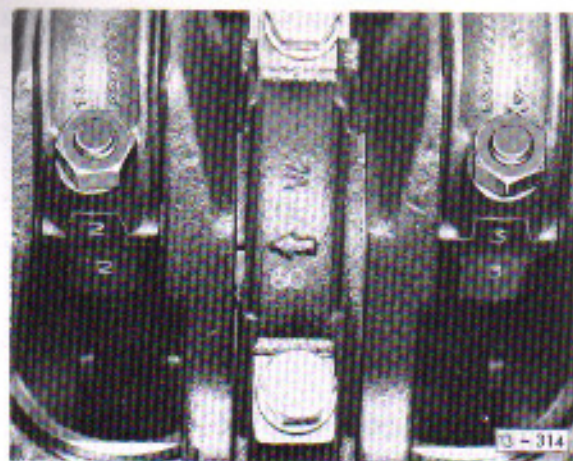


Fig. 1 Conrod marks and fitting position

Cap and rod are marked 1 – 4 to correspond with the cylinders. The numbers must be towards the camshaft when rods are installed. If rods are renewed they must be marked in the same way.

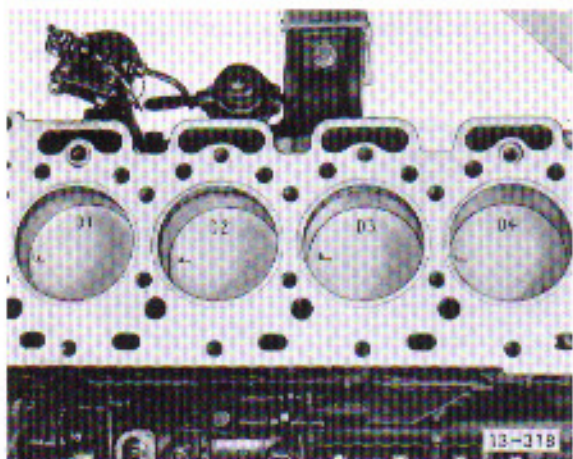


Fig. 2 Pistons – Fitting position

The pistons are also numbered to correspond with the cylinders. The letter "F" should be towards the timing case.

Note:

The letter "F" can also be inside on the piston crown.



Fig. 3 Piston pins – Removing and installing
AUDI: Piston pin mandrel 10-508.

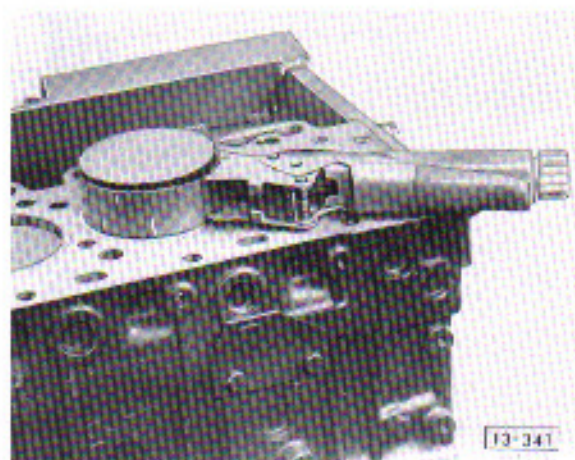


Fig. 4 Pistons – Installing



Fig. 5 Pistons rings – Removing and installing
"Top" must be upwards.

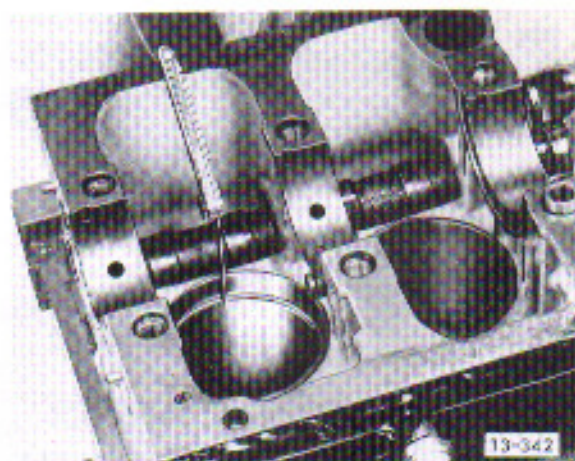


Fig. 6 Piston rings – Checking gap

Push ring squarely into bottom of bore about 15 mm.

	Gap in mm	Wear limit in mm
Upper ring	0.40 – 0.65	0.8
Lower ring	0.40 – 0.65	0.8
Oil scraper ring	0.25 – 0.40	0.8



Fig. 7 Piston rings – Checking side clearance

	Clearance in mm	Wear limit in mm
Upper ring	0.09 – 0.12	
Lower ring	0.07 – 0.10	0.2
Oil scraper ring	0.03 – 0.06	

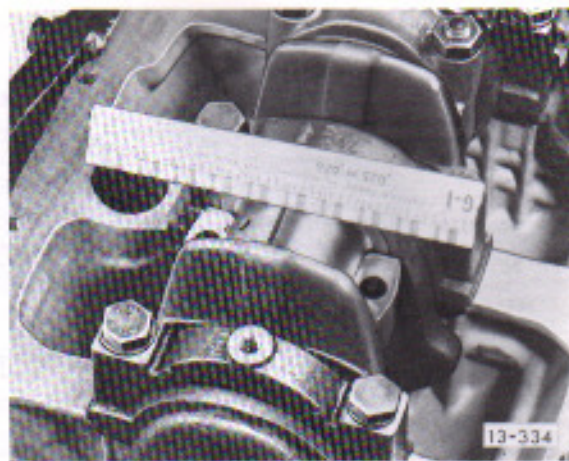


Fig. 8 Conrods – Checking radial clearance

Take cap off, clean shells and crankpins. Place Plastigage strip on crankpin axially. Install cap and tighten to 102 Nm (10.2 mkg).

Caution!

Do not rotate crankshaft.

Compare width of Plastigage strip with measuring scale. The figure on the scale gives the bearing clearance.

Clearance when new: 0.04 – 0.09 mm
Wear limit: 0.11 mm

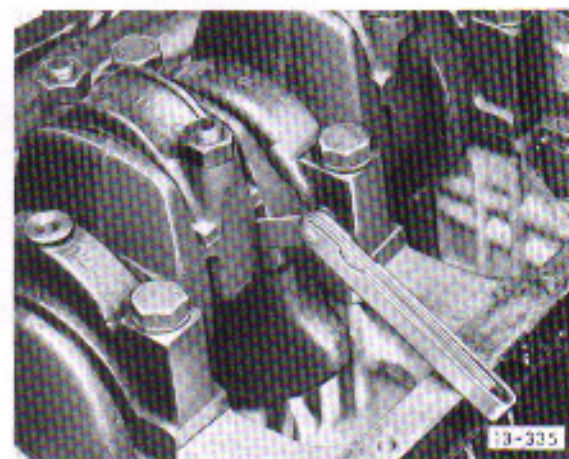


Fig. 9 Conrods – Checking axial clearance

Clearance when new: 0.24 – 0.33 mm



Fig. 10 Pistons – Checking

Measure 45 mm from bottom of skirt at 90° to piston pin axis.

Dimension when new: 91.926 – 91.944 mm
Deviation from nominal dimension: 0.04 mm max.

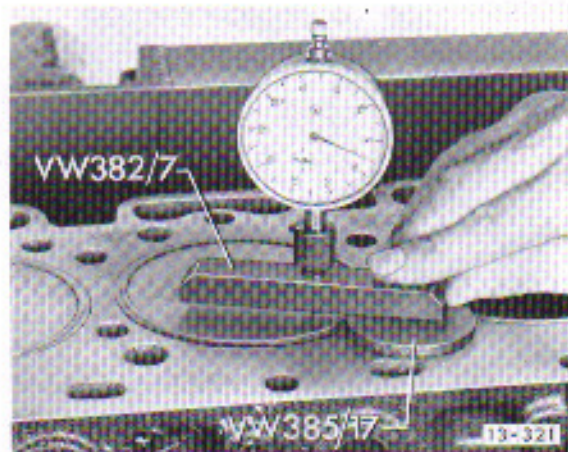


Fig. 12 Checking piston position at TDC

When new pistons are installed, the height of piston in relation to top of block must be checked at TDC.

In this position the piston should be not more than 0.05 mm above or 0.08 mm below the block top face.

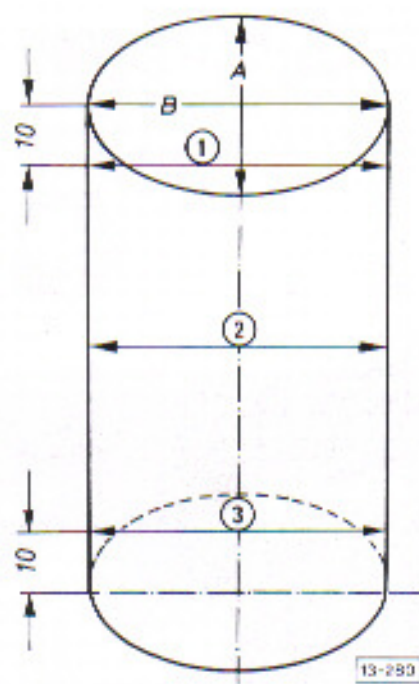
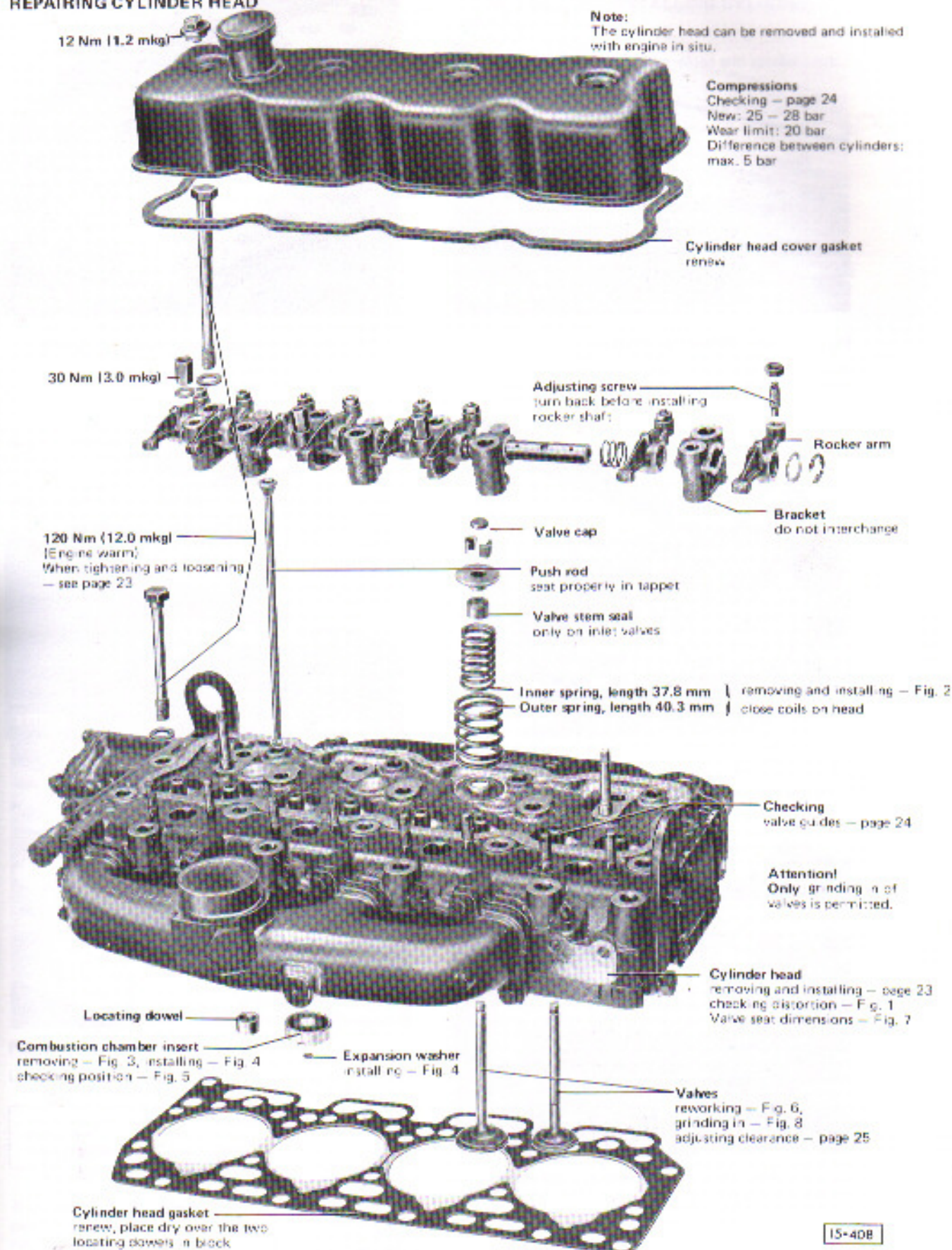


Fig. 11 Cylinder bores – Checking

Measure at 3 points in lateral direction "A" and longitudinal direction "B".

Dimension when new: 92.02 – 92.05 mm
Wear limit: 92.2 mm

REPAIRING CYLINDER HEAD



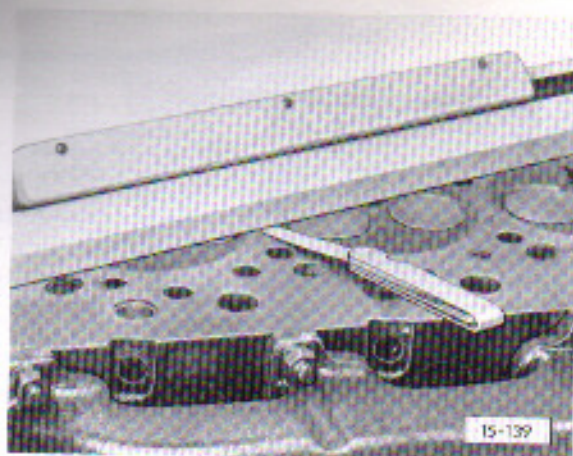


Fig. 1 Head — Checking distortion
Max. permissible 0.15 mm

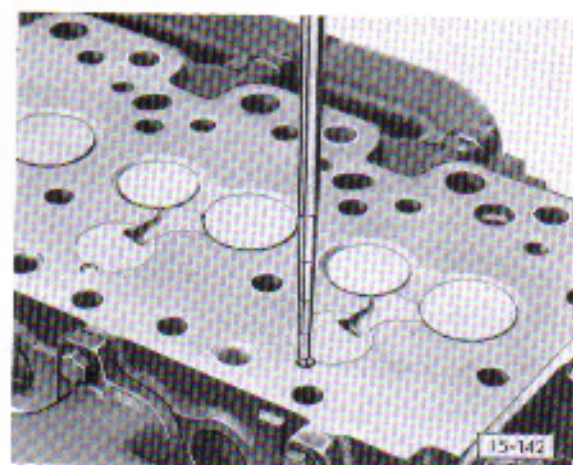


Fig. 4 Combustion chamber inserts — Installing
Secure with expansion washer.

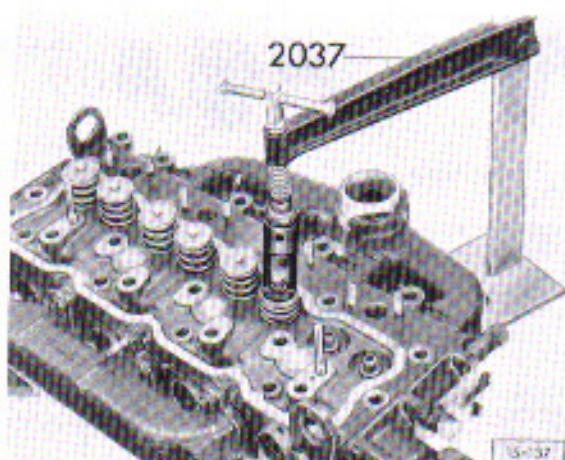


Fig. 2 Valve springs — Removing and installing
Close coils on head.

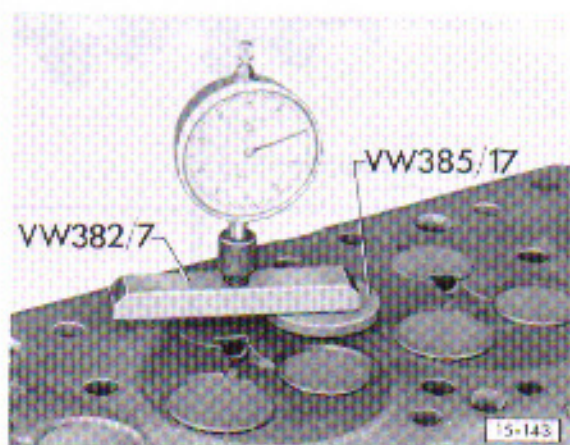


Fig. 5 Inserts — Checking position
Position in relation to face of head
above, max: 0.03 mm
below, max: 0.07 mm

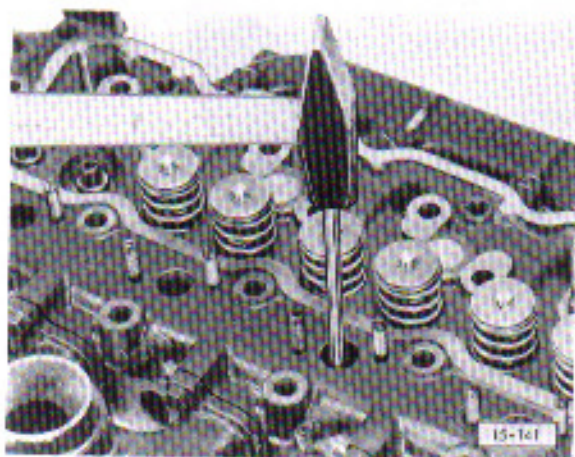


Fig. 3 Combustion chamber inserts — Removing
Knock out through injector bore.

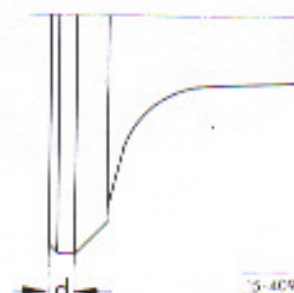


Fig. 6 Reworking valves

	Inlet	Exhaust
Valve stem: (diam)	7.92-7.95 mm	7.91-7.94 mm
Seat angle:	45°	30°
Dimension d:	min 1.15 mm	min 1.15 mm

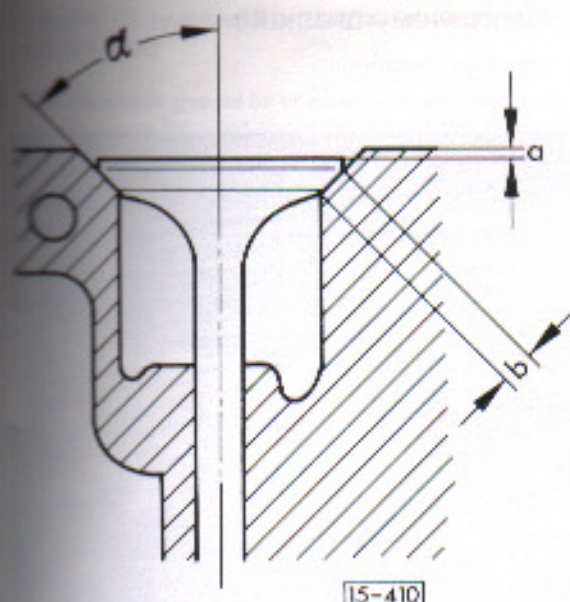


Fig. 7 Valve dimensions

	Inlet	Exhaust
Seat Width "b":	3,8 mm	3,3 mm
Angle :	45°	30°
Dimension 'a' :	0,79-1,3 max. 1,5 mm	0,79-1,3 max. 1,5 mm

Attention

Only grinding in of valves is permitted

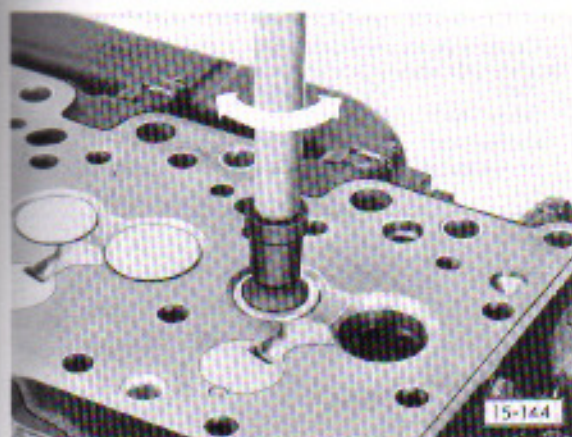


Fig. 8 Valves – Grinding

Lift and turn regularly to get uniform cut.

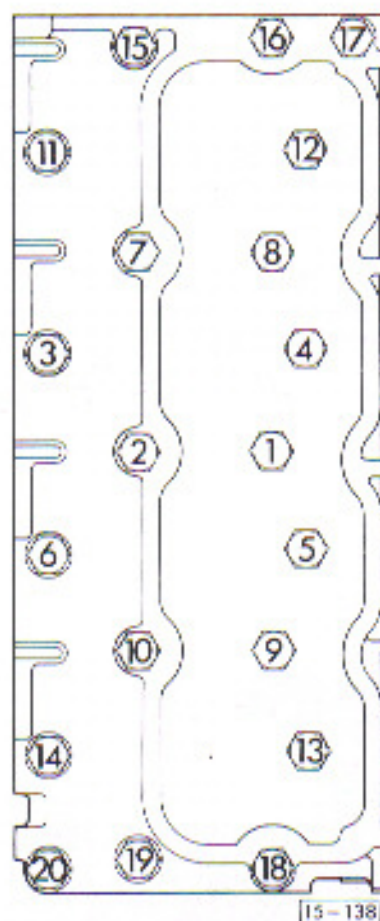
Caution

Carefully remove all traces of grinding paste.

If the seats (on the valves) have been reworked properly it may not be necessary to grind in when fitting new valves.

REMOVING AND INSTALLING CYLINDER HEAD

- Disconnect battery, glow plugs and sender unit for temperature gauge.
- Drain coolant, remove expansion tank complete with brackets and detach hoses at thermostat
- Remove breather pipe, dipstick and dipstick guide tube.
- Remove fuel filter complete with bracket and pipes.
- Remove inlet manifold, detach injector pipes at injector and pump and take off complete. If head is to be worked on, remove injectors and glow plugs.
- Detach exhaust pipe from manifold.



Tightening sequence: see illustration.

Loosening sequence: reverse order

Tightening torque: 120 Nm (12.0 mkg)

- When reassembling screw back the valve adjusting screws and install valve stem caps. Install the rocker assembly and tighten the two securing nuts.
- Then tighten head bolts in sequence shown and tighten rocker assembly securing nuts again.
- Run engine until warm (Coolant temperature: 80°C minimum)
- **Cylinder head bolts.** Loosen off each bolt separately approx. 30° (in the correct sequence) and tighten again to 120 Nm (12,0 mkg)
- Adjust valve clearances.

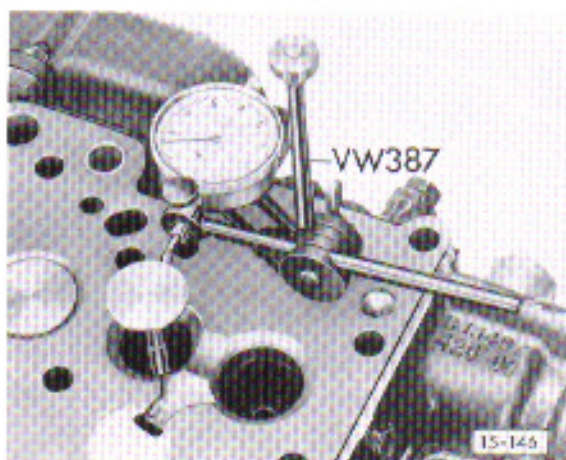
Note:

Retightening the cylinder head bolts after a further 1000 km running is not necessary.

VALVE GUIDES — CHECKING

When repairing engines with leaking valves it is not sufficient to rework or renew the valve seats and valves. It is also necessary to check the valve guides for wear. This is particularly important on engines which have done a considerable mileage. In cases where the valve guide wear is excessive the cylinder head must be renewed until a repair method is published.

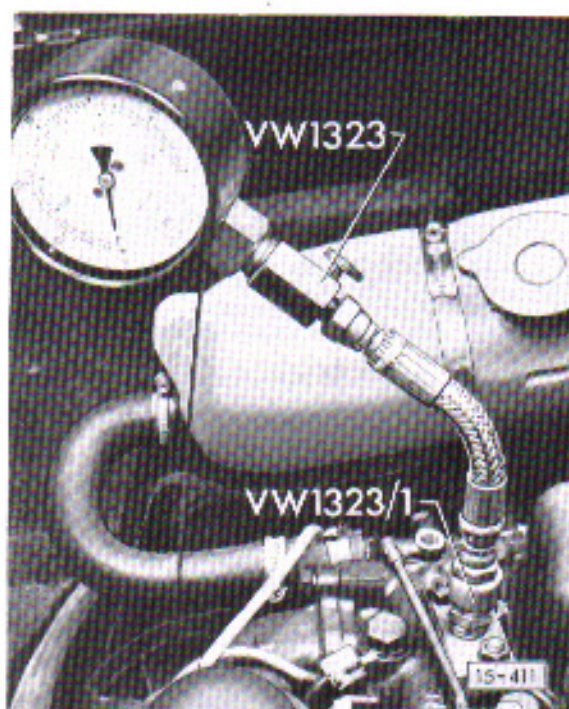
- Remove carbon deposits with a suitable tool.
- Insert new valve into guide so that end of stem is flush with end of guide.



- Measure rock
Wear limit: 0,6 mm

COMPRESSION — CHECKING

- Remove injectors



- Install adaptor in injector hole and connect tester
- Unhook return spring on injection pump stop linkage and hold pump lever in stop position.
- Operate starter and read off compression pressure on tester.

Compression pressure:

New: 25 — 28 bar

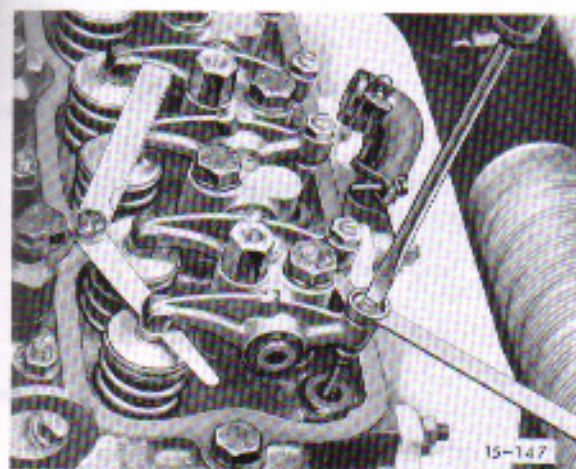
Wear limit: 20 bar

Difference

between cylinders: max 5 bar

VALVE CLEARANCE – CHECKING AND ADJUSTING

The clearance should be checked and adjusted with engine warm (coolant above 35°C – hand warm).



Settings: Inlet valves 0.25 mm
(warm) exhaust valves 0.35 mm

Note:

When repairs have been carried out on the cylinder head, the valves can be set with the engine cold. They must however be checked and if necessary adjusted with the engine warm after the cylinder head bolts have been pulled down again.

Settings: Inlet valves 0.30 mm
(cold) Exhaust valves 0.40 mm

Rotate engine with screwdriver through the hole in the bell housing or on the fan.

Adjustment sequence	Valves on overlap (rocking)
1	4
3	2
4	1
2	3

Note:

Readjusting valves after a further 1000 km running is not necessary

REMOVING AND INSTALLING PARTS OF LUBRICATION SYSTEM

Note:

Gasket should always be renewed when carrying out repairs.
Checking oil pressure — page 28

Capacities:

With filter = 11 litres

Without filter = 10 litres

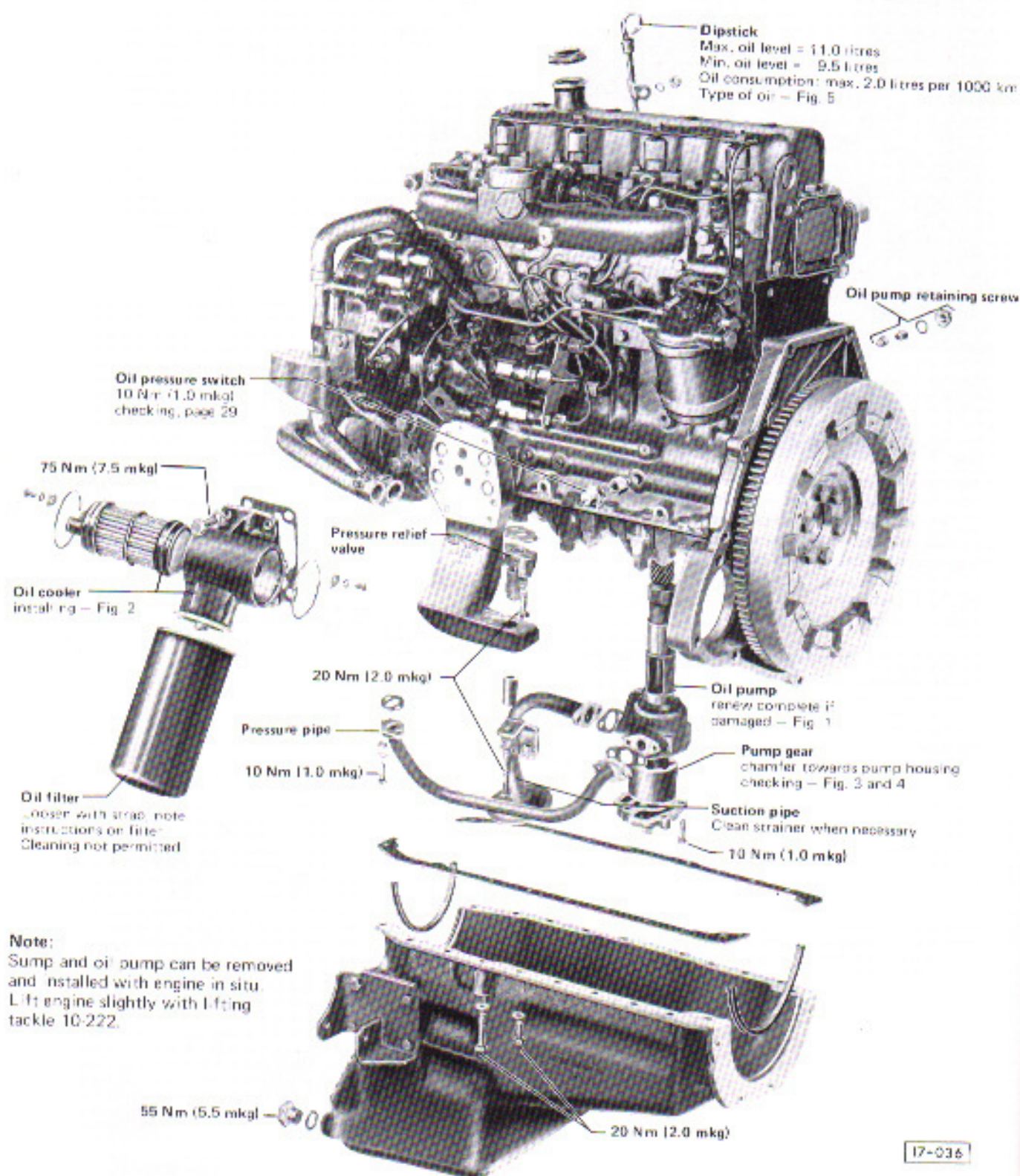
Dipstick

Max. oil level = 11.0 litres

Min. oil level = 9.5 litres

Oil consumption: max. 2.0 litres per 1000 km

Type of oil — Fig. 5



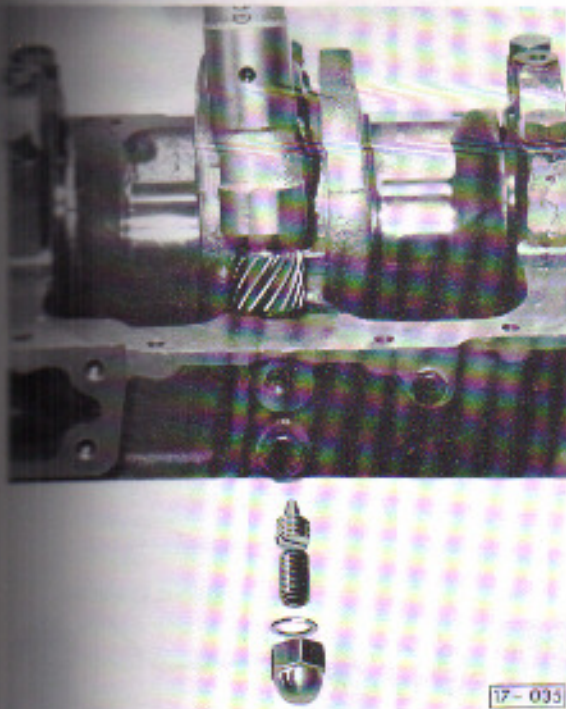


Fig. 1 Oil pump – Removing and installing

The pump is located from outside the block by a screw below the righthand engine bearer. The bearer must be removed to get at the locating screw.

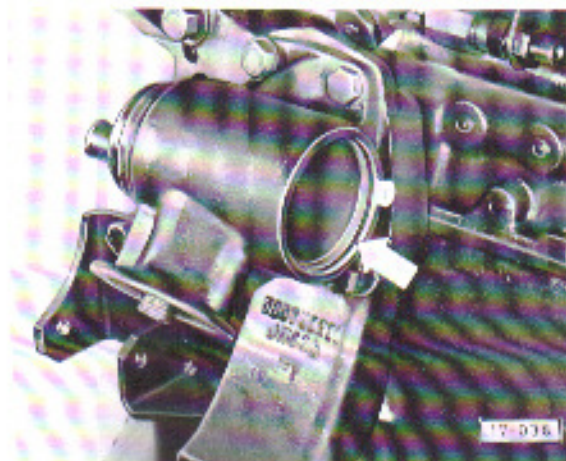


Fig. 2 Oil cooler – Installing

Insert one sealing ring first and then slide cooler in from the opposite until the second sealing ring can be inserted. Then press cooler back and secure with end plates.

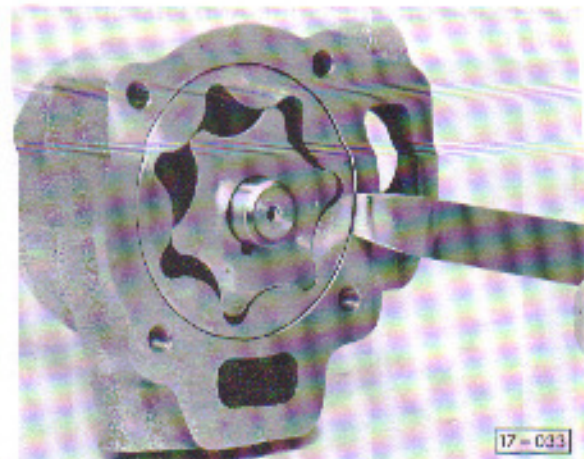


Fig. 3 Pump rotor/housing clearance – Checking

When new: 0.15 – 0.33 mm

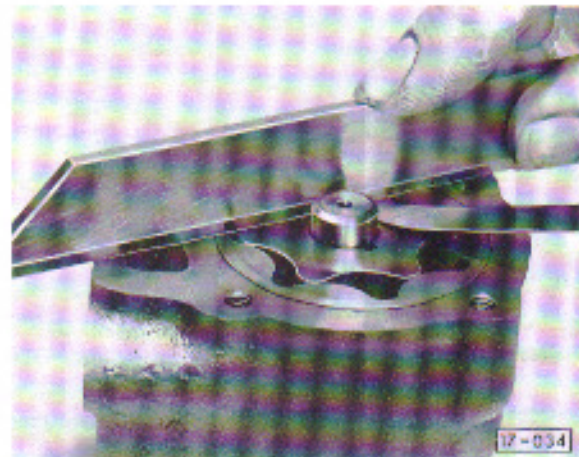


Fig. 4 Pump rotor end float – Checking

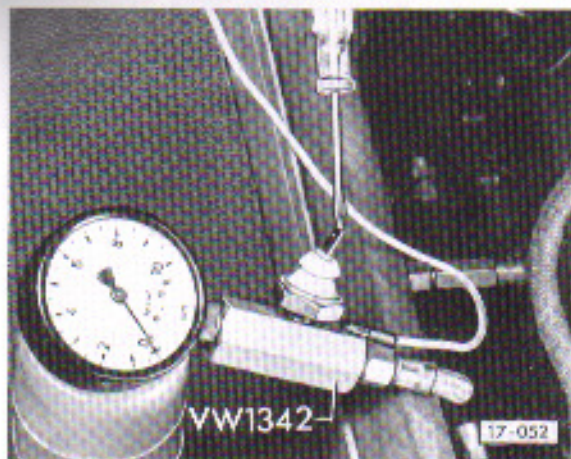
When new: 0.03 – 0.09 mm

Climate	Single grade oils	Multi-grade oils
Tropical	SAE 40	
	SAE 30	
	SAE 20W/20	SAE 20W-50 SAE 20W-40
Temperate	SAE 10W	SAE 15W-50 SAE 15W-40
		SAE 10W-40 SAE 10W-30
Arctic		

Fig. 5 Engine oil viscosity grades

Engine oil quality: CC or CD according to API specifications

CHECKING OIL PRESSURE AND PRESSURE SWITCH

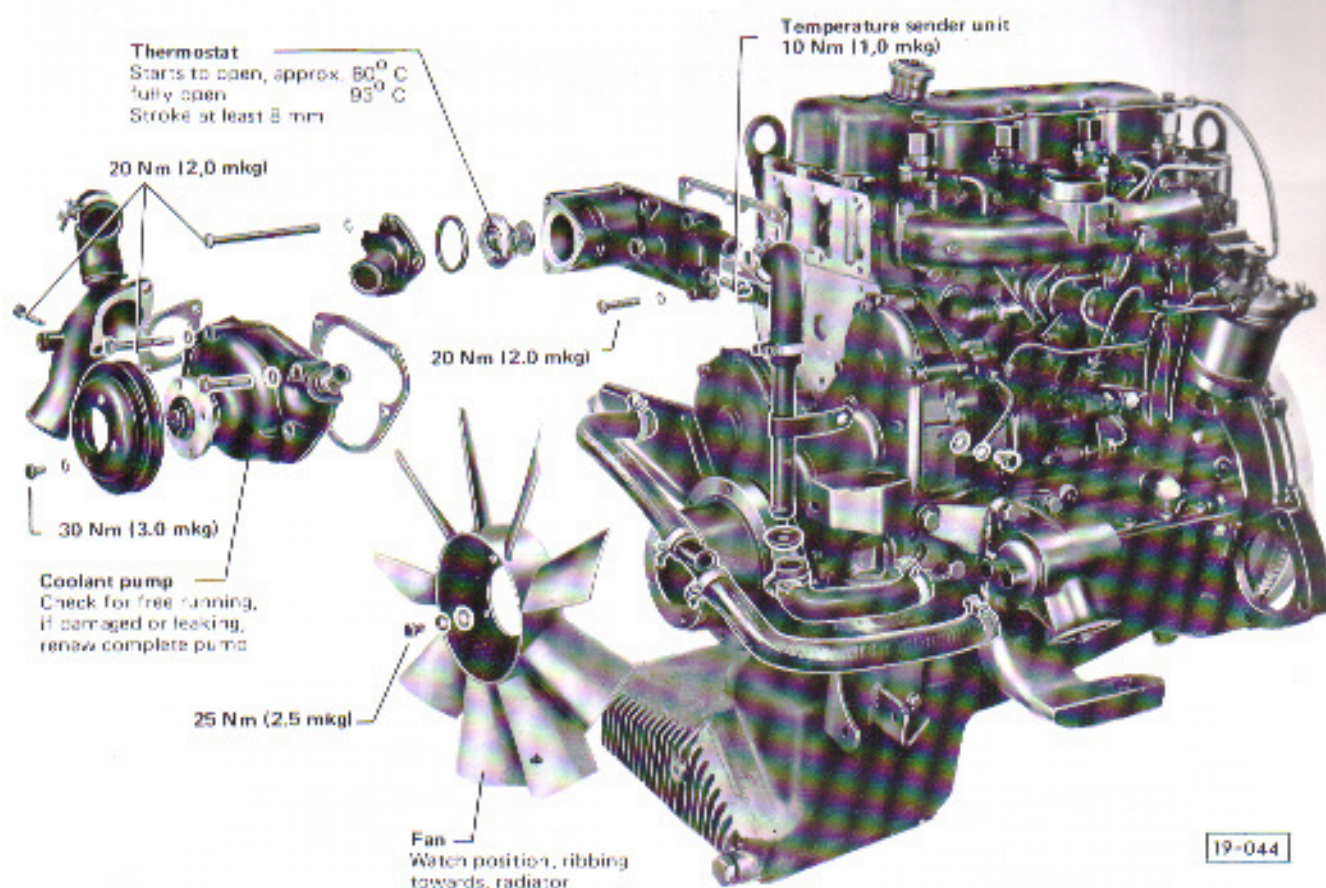


- Remove switch and screw it into tester
- Screw tester into cylinder block in place of switch, connect test lamp to switch and battery puls. Test lamp must come on, otherwise switch must be renewed.
- Start engine, and increase speed slowly. At a pressure of 0.3 – 0.6 bar the lamp should go out.
- Increase speed further.
At 2000 rpm and an oil temperature of 80° C the pressure should be at least 3.0 – 4.0 bar
Wear limit: min. 2.0 bar

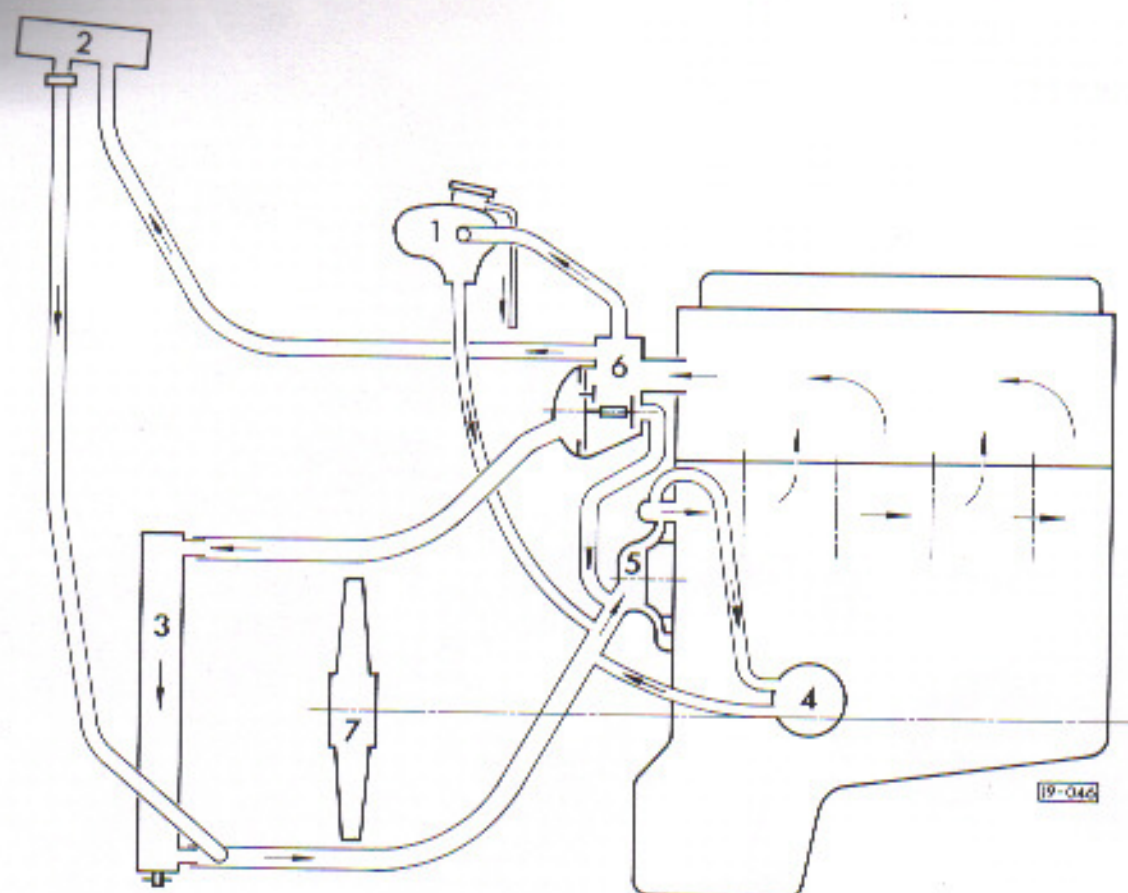
REMOVING AND INSTALLING PARTS OF COOLING SYSTEM

Note:

Always fit new gasket when carrying out repairs. All parts of the cooling system can be removed and installed with engine in situ.



COOLANT HOSE LAYOUT



- 1 – Expansion tank
- 2 – Heating
- 3 – Radiator
- 4 – Oil cooler

- 5 – Coolant pump
- 6 – Thermostat housing
- 7 – Fan

COOLING SYSTEM – DRAINING AND FILLING

Note:

The cooling system is filled at the factory with a mixture of water and VW frost and corrosion protective solution G 10 all the year. G 10 prevents freezing and corrosion, the formation of chalk and also raises the boiling point of the water.

For these reasons the cooling system must be filled with this coolant mixture all the year round. Due to the higher boiling point the coolant is an aid to operational efficiency when the engine is operating on full load, particularly in tropical countries.

Recommended mixtures

Frost protection	G 10	Water
-25° C	4.8 litres	7.2 litres
-35° C*)	6.0 litres	6.0 litres

*) Available as optional extra M 642 for cold climate countries

Draining

- Open heater control valve fully
- Take cap off expansion tank
- Drain coolant from plug in radiator

Note:

As the water contains G 10 it should be caught in a clean container for further use.

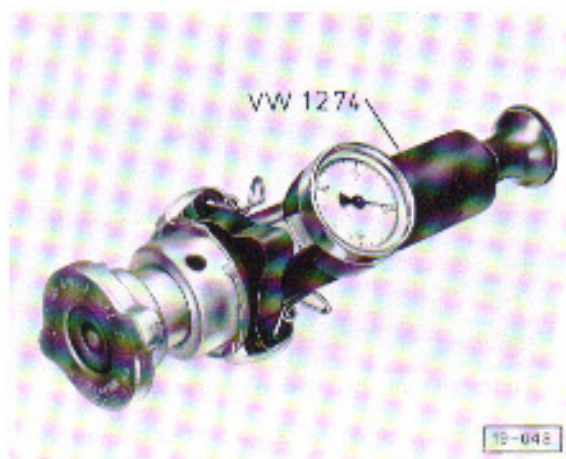
Filling

- Fully open heater control valve
- Fill system up to the mark in the expansion tank
- Close expansion tank and run engine at a fast idle for about 1 minute so that coolant circulates.
- Check coolant level and top up to mark if necessary.

CHECKING COOLING SYSTEM AND CAP



- Install tester on expansion tank.
- Using the hand pump, build up a pressure of approx. 1.0 bar. If the pressure drops, the leak must be found and rectified.



- Place cap on tester.
- Build up pressure with pump.
The valve should open between 0.9 and 1.15 bar.

REMOVING AND INSTALLING RADIATOR



- Remove grille —1—.
- Drain coolant from plug —2—.
- Detach lower hose —3—.
- Detach upper hose.
- Remove securing bolts —4— in bracket and take bracket off.
- Pull bellows off cowl —5— and take radiator —6— out downwards complete with cowl.

When installing:

- Ensure that radiator is located properly in the upper mounting.

REMOVING AND INSTALLING FILTER



- Remove bolt in centre of filter cover.
- Lower filter bowl and take element out.
- When installing bowl, ensure that element contacts sealing rings in cover and bowl.
- Bleed the fuel system (page 36)

CLEANING WATER SEPARATOR

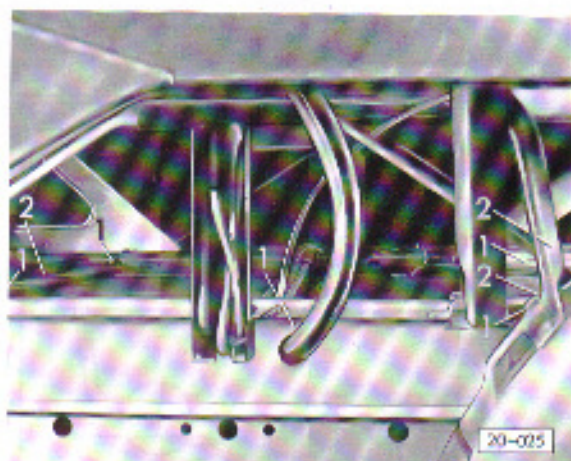


- Loosen nut under glass bowl
- Take bowl off, empty it and clean thoroughly.
- Take strainer out of top part, clean and install it.
- When installing bowl, fill it with clean diesel and do not overtighten nut.

REMOVING AND INSTALLING FUEL TANK

Removing

- Detach battery earthing strap
- *Pick-up trucks only:*
Remove spare wheel. Remove the rear bolt and loosen off the front bolt on the spare wheel side bracket.



- Remove the 3 bolts (2).
- Drain fuel. To do this loosen off the filler neck and swing downwards, and/or lift fuel tank slightly at left hand side.
- Pull filler neck off.
- Up to Chassis No. 287 2513 106
Pull the 5 breather hoses off.
- From Chassis No. 287 2513 107
Pull the single breather hose off.
- Detach fuel hose
- Detach the electric wires off the tank sender unit (if necessary lower tank slightly).
- Remove tank.

Installing

To install tank, proceed in reverse sequence.

REPAIRING FUEL INJECTION SYSTEM

Attention!

When working on the injection system, ensure that everything is kept scrupulously clean. Wipe pipe unions clean before loosening them.

Note:

If the injection pump is found to be faulty, it can only be replaced as repairs are not possible without proper test equipment.

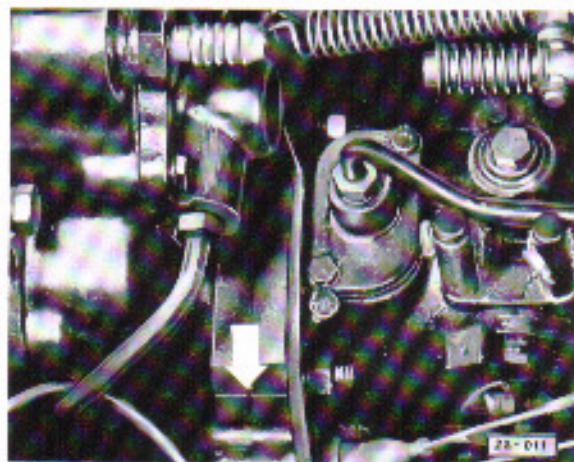
REMOVING AND INSTALLING INJECTION PUMP

Removing:

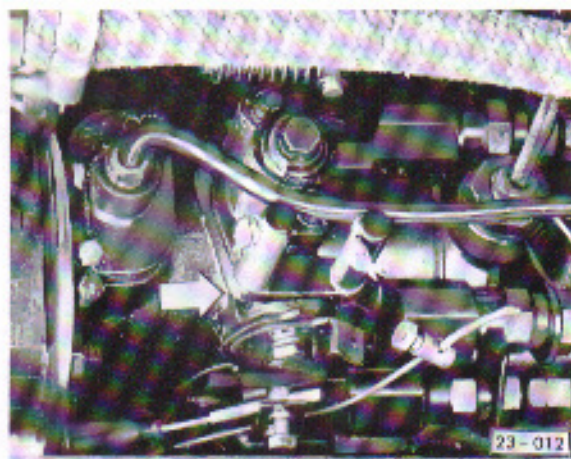
- Disconnect stop and throttle (hand and foot) control cables.
- Detach all fuel pipes from pump and cover unions up with clean cloths.
- Remove pump securing nuts and withdraw pump.

Installing:

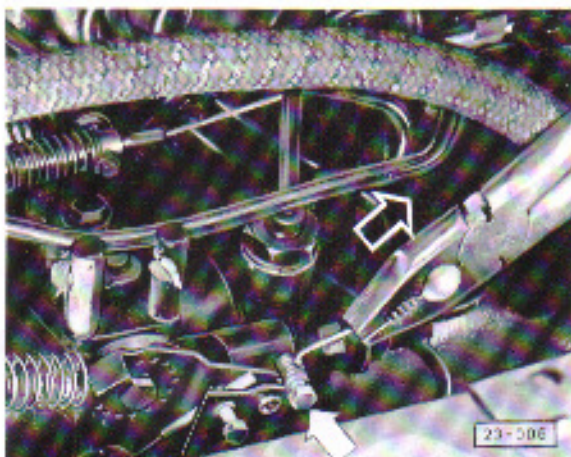
- Ensure that the bracket and spring are fitted to the lower bolt.



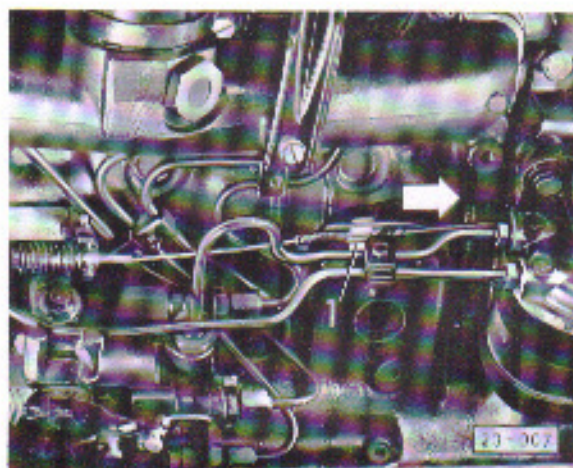
- Install pump so that marks on pump and adaptor housing are aligned. The pump drive shaft and driving hub only fit in one position.



- Connect cable in full throttle position so that the pump lever is contacting stop free of strain.
- Rotate hand throttle control knob anti-clockwise to the stop (normal idling position).



- Pull cable tight and secure it so that there is 1 – 2 mm play between pump lever and clamping screw.
- Attach stop cable to pump lever and disconnect return spring.
- Ensure that the stop device is in the stop position (ignition off).



- Pull cable tight in direction of arrow and tighten clamping screw — 1 —.
- Attach return spring.
- Bleed system.
- Adjust idling speed — page 35.
- Adjust max. speed — page 35.



- Operate hand priming lever on lift pump until fuel issues from vent valve — 1 — free of air bubbles.

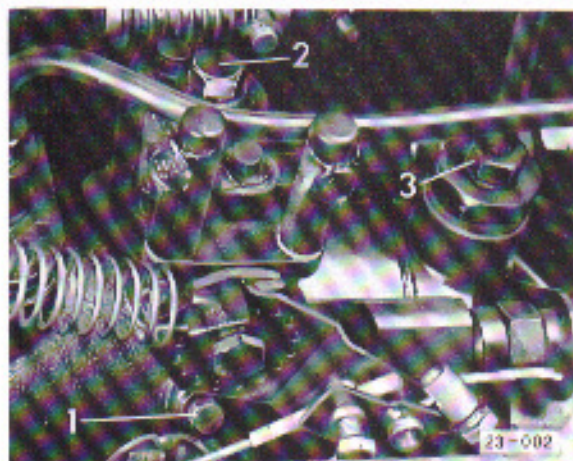
Note:

If the lift pump cam is at the top of its stroke, the engine must be turned on slightly so that the pump can be operated with the hand lever.

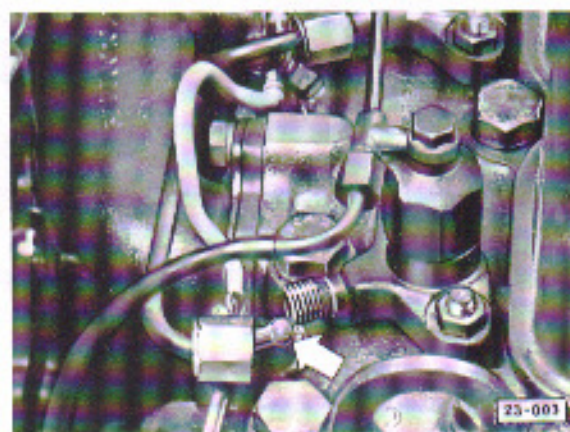
- Tighten valve — 1 —.
- Operate priming lever on lift pump until fuel issues from vent valve — 2 — free of air bubbles.
- Tighten valve — 2 —.
- Slacken union nut — 3 — (fuel inlet on pump).
- Operate lift pump lever until fuel issues free of air bubbles from union nut — 3 —.
- Tighten union nut — 3 —.

BLEEDING FUEL SYSTEM

If the tank has been allowed to run dry or when air has entered the system during repairs the system must be bled.



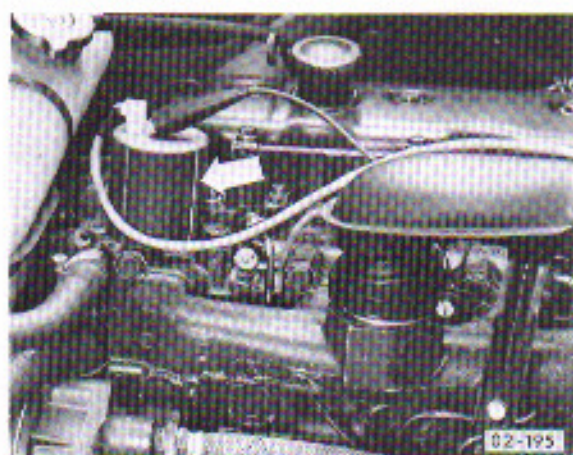
- Slacken vent valves — 1 — and — 2 — on the injection pump.



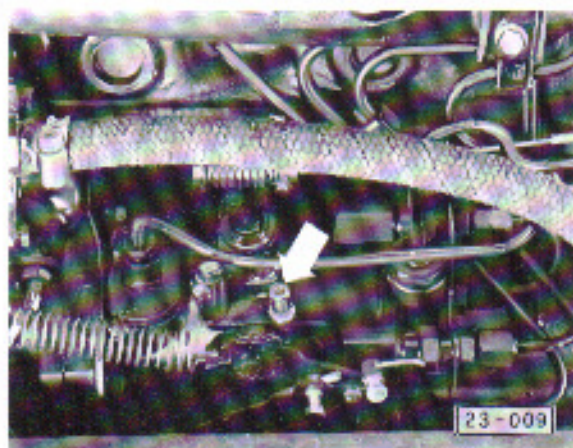
- Slacken union nuts on two injectors.
- Set accelerator to full throttle and switch ignition on. Ensure that the stop control is in the "run" position.
- Turn engine with starter until fuel issues free of air bubbles.
- Tighten union nuts. Engine is ready for starting.

CHECKING AND ADJUSTING IDLING AND MAXIMUM SPEEDS (NO LOAD)

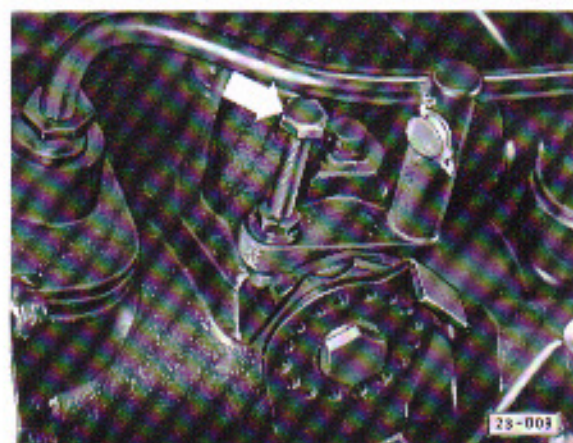
- Run engine until warm (oil temperature approx. 80°C)
- Connect rev. counter (VW 1267) and adapter (VW 1324).



- Attach adapter to the engine as illustrated.



- Set speed to 625 ± 25 rpm with adjusting screw (arrow). Ensure that the hand throttle knob is turned fully back.



- Run engine at top speed and set speed to 3900 – 4150 rpm with adjusting screw (arrow).
- Lock and seal the adjusting screw.

REMOVING AND INSTALLING INJECTORS

Note:

Faulty injectors cause the following troubles:

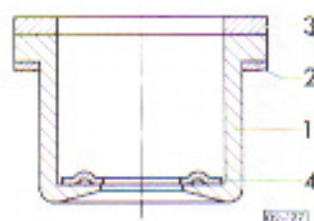
- Misfiring
- Knocking in one or more cylinders
- Engine overheating
- Loss of power
- Smoky black exhaust
- Increased fuel consumption

Faulty injectors can be located by loosening the pipe union nut on each injector in turn with the engine running at a fast idle. If the engine speed remains constant after loosening a pipe union nut, this denotes a faulty injector.

Injectors – Removing

- Detach return pipe.
- Detach high pressure pipe.
- Remove nuts and take injector out.
- Remove sealing washers from heat shield.

Note:



Heat shields – 1 – are fitted between the injector nozzles and the cylinder head. If a heat shield becomes loose, a new washer must be installed between heat shield and cylinder head.

Seals 3 and 4 must **always** be renewed watch position of seal – 4 –, ridge must be towards injector.

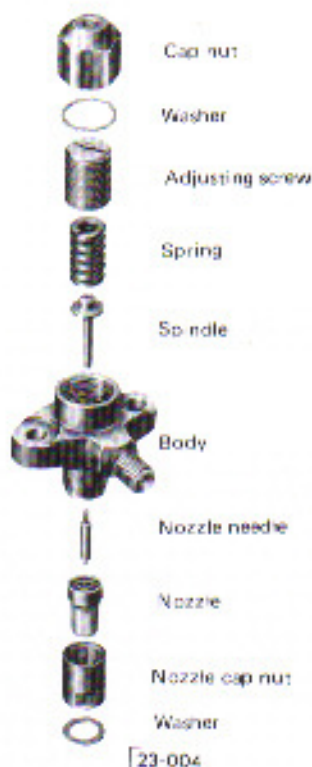
Installing – Injectors

- Install new sealing washers.
- Carefully tighten securing nuts alternately to 15 Nm (11.5 mkg)
- Tighten pipe union nut to 20 Nm (2.0 mkg)
- Bleed system.

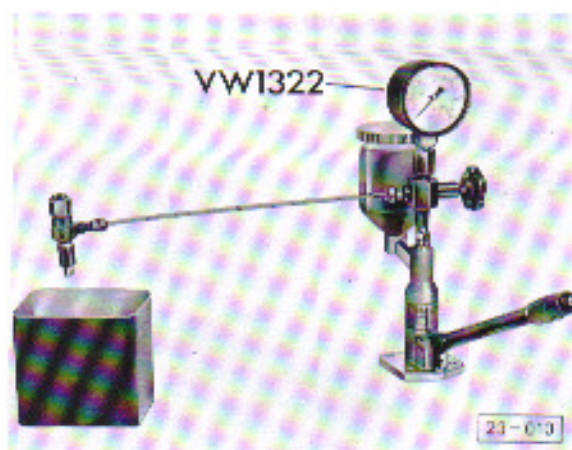
REPAIRING INJECTORS



- Secure injector in holding plate.



- When dismantling an injector ensure that all the parts are kept together and not interchanged with parts from other injectors.



- Check injectors for spray formation, noise, breaking pressure and leakage.

Caution!

When testing injectors take care not to expose the hands to the injector spray as the working pressure will cause the fuel oil penetrate the skin causing serious injury.

Spray test

Gauge isolated:
With rapid short strokes of the testing pump lever (4-6/sec) the sprays should be even and cut off cleanly. The injectors must not drip.

Noise test:

Gauge isolated:
Long slow strokes with the pump lever (1-2 strokes per sec). When injector is working properly it makes a "pinging" sound as the fuel emerges.

Breaking pressure test

Gauge working:
Move pump lever down slowly. Watch pressure at which injector works and adjust it if necessary by turning the adjusting screw.

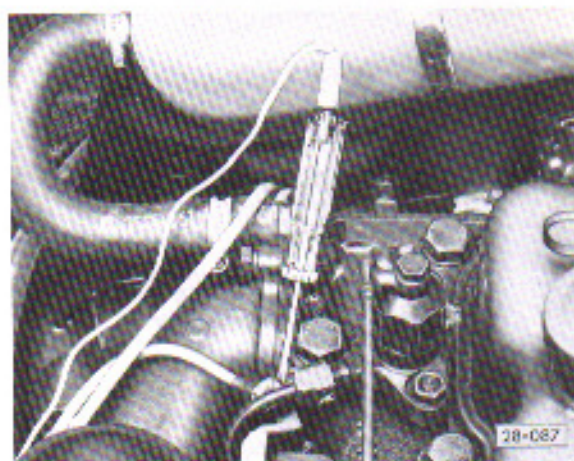
Breaking pressure for used injectors:
137 – 139 bar

Breaking pressure for new injectors:
152 – 155 atmospheres

- Tighten cap nut and check pressure again.

Leakage test:

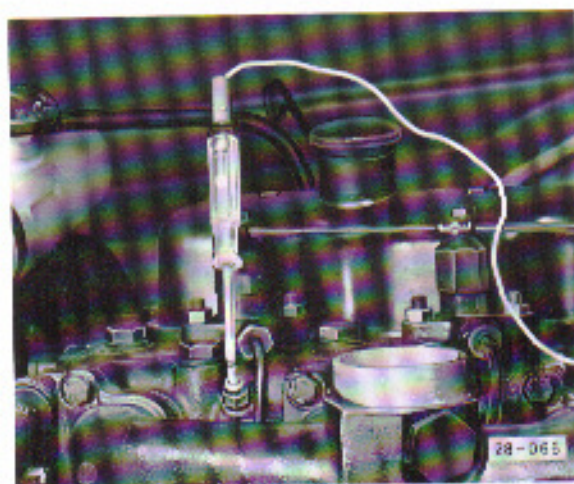
Gauge working:
Pump pressure up to about 130 bar and hold it for 10 seconds. No fuel should leak from the nozzle tip.

CHECKING THE GLOW PLUG SYSTEM**Check current supply**

- Attach a test lamp between No. 4 cylinder glow plug and earth
- Turn ignition key to "Glow" position, test lamp must light up.
- If the lamp does not light up, check the glow plug relay, ignition/starter switch or relay plate with fuse box.

Checking glow plugs

- Detach busbar and current rail from all glow plugs.



- Attach test lamp to battery (+) positive and then to each glow plug in turn.
- Test lamp lights up: Glow plug o.k.
- Test lamp does not light up: Glow plug defective, renew.

Note:

Glow plug tightening torque: 20 Nm (2.0 mkgf).

REPAIRING CLUTCH

Remove gearbox

See Manual gearbox 015, Rep. Gp. 34 booklet for repairs to clutch release lever and bearing.

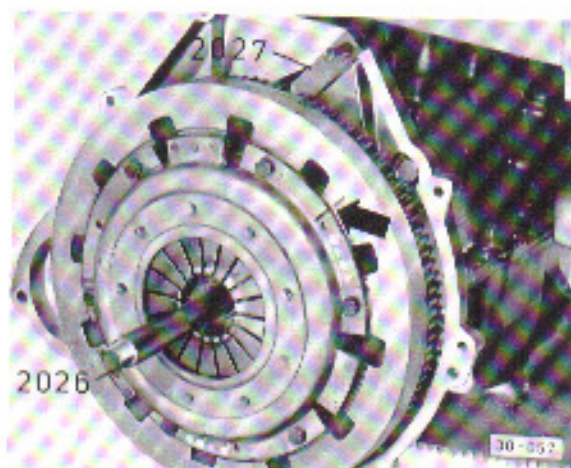
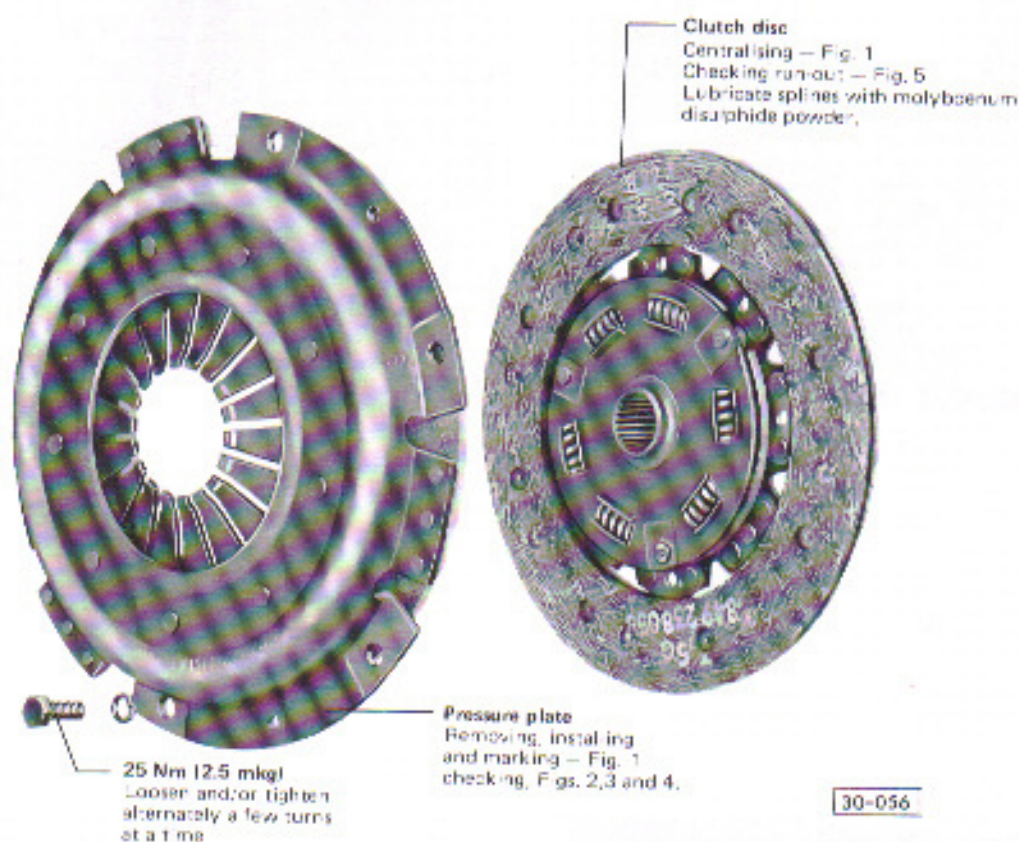


Fig. 1 Clutch — Removing and installing
Mark installation position before removing.

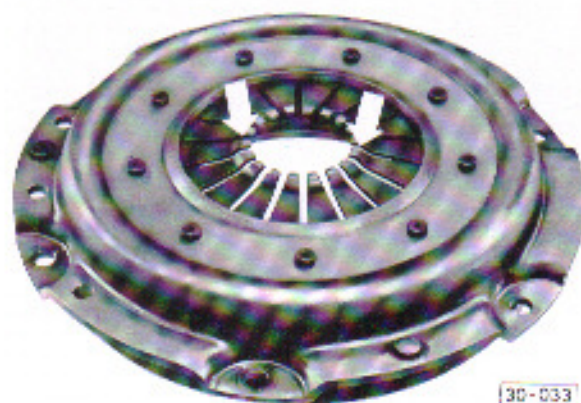


Fig. 2 Checking the ends of the diaphragm spring
Scoring to a depth of 0.3 mm is permissible.

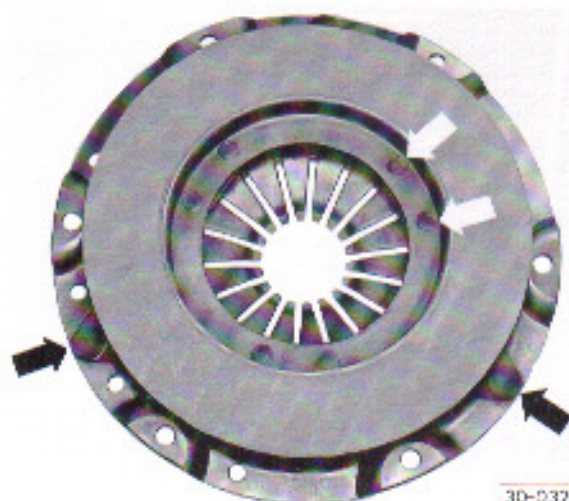


Fig. 3 Check the spring connections between pressure plate and cover for cracks, and tightness of rivets

Clutches with damaged or loose rivets must be renewed.

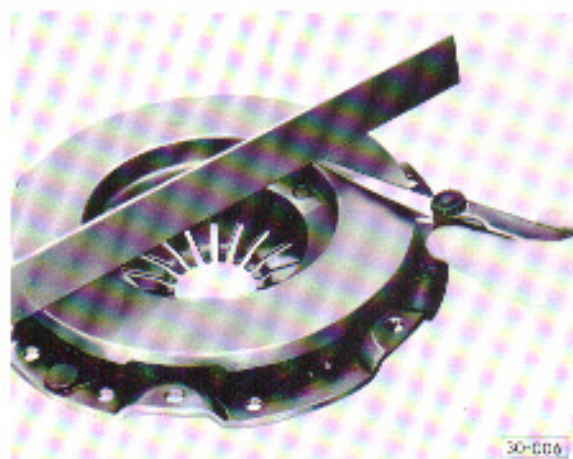


Fig. 4 Checking the pressure plate surface for cracks, signs of burning and wear

Pressure plates which are bowed inwards to a maximum of 0.3 mm are still serviceable.

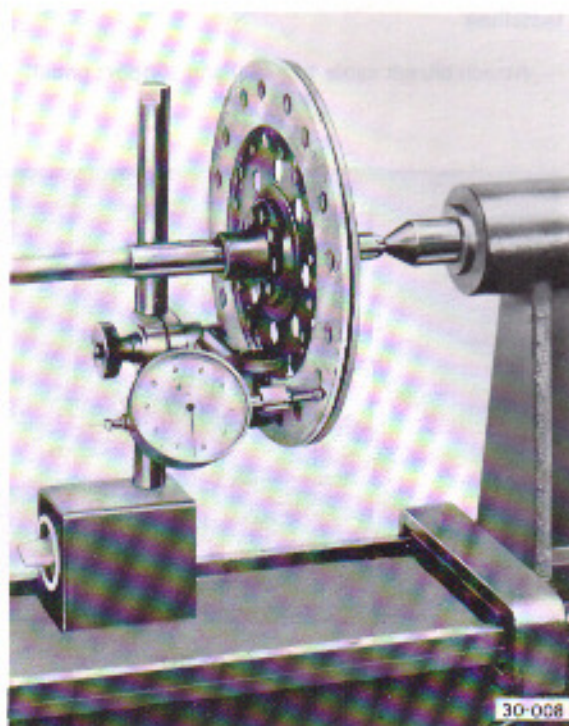


Fig. 5 Clutch disc – Checking run-out

Max. = 0.5 mm at 220 mm diameter

REMOVING AND INSTALLING CLUTCH CABLE

Removing



- Release the tension on the cable by turning the adjusting nut (1) at the gearbox mounting.
- Detach the clutch cable from the clutch release lever (2). Remove the cap together with return spring and unscrew the cable from the gearbox support.
- Detach the cable from the clutch pedal and take out from below.

Installing

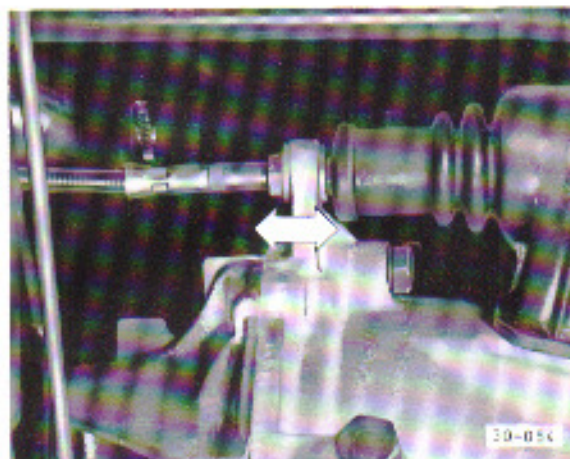
- Attach clutch cable to pedal and support pedal.



- Guide the clutch cable through the cleat on the body.
- Secure the cable to the gearbox support.



- Attach the clutch cable to the clutch release lever using pliers.
- Ensure that the cap on the gearbox and the rubber grommet in the body are correctly located



- The clearance is adjusted by turning the adjusting nut on the gearbox support.

The clearance at the clutch pedal = 20 mm.

Volkswagen Technical Site: <http://volkswagen.msk.ru> <http://vwts.info> <http://vwts.ru>
огромный архив документации по автомобилям Volkswagen, Skoda, Seat, Audi