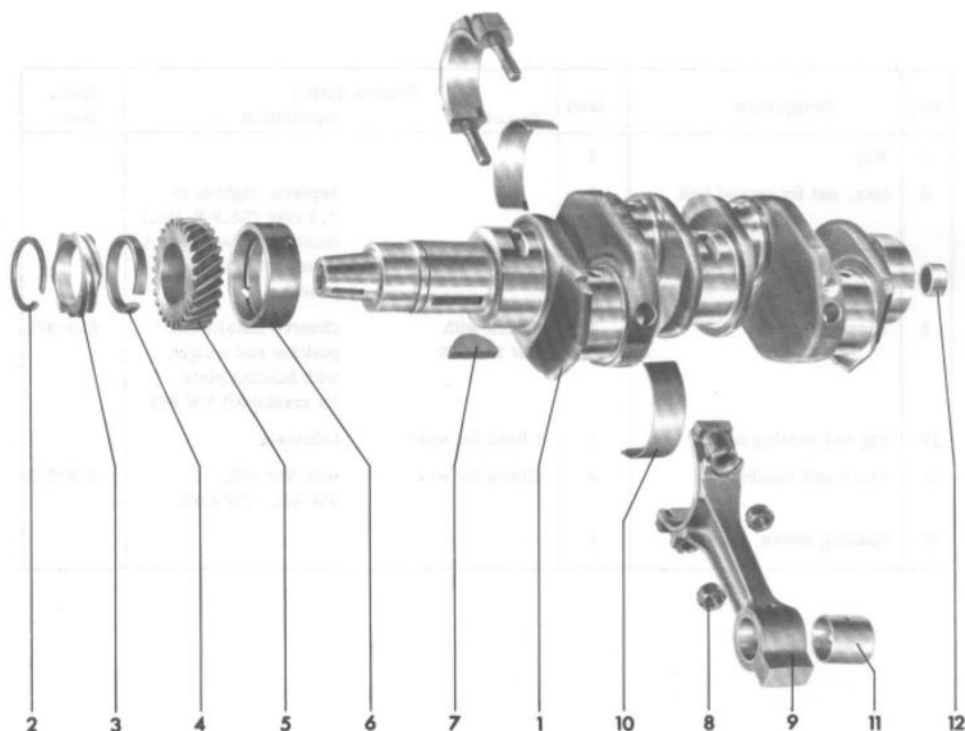


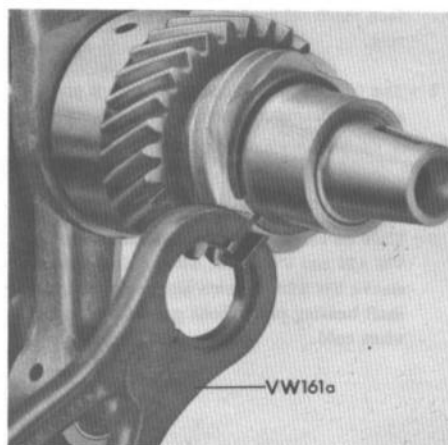
No.	Designation	Special Tool	Explanations
1	Holding rails for bearings of differential	VW 457	
2	Peening punch	VW 124b	
3	Pipe tool, 60 mm dia. (2.4")	VW 415a	
4	Guide sleeve, tapered	VW 428	
5	Guide sleeve	VW 427	
6	Holding plate for crankshaft	VW 801	
7	Inspection and reaming fixture for connecting rod	VW 214f/70	
8	Pressure plate	VW 402	
9	Pipe tool	VW 421	
10	Pipe tool	VW 416b	
11	Punch	VW 409	
12	Circlip pliers	VW 161a	
13	Feeler gauge		



No.	Designation	Each	Observe during:		Spec. Instr.
			Removal	Installation	
1	Crankshaft	1	Check for wear		6.3-2/1
2	Locking ring	1	with circlip pliers with VW 415a, VW 428, VW 161a		
3	Ignition distributor drive gear	1	Check for wear	Heat to approx. 80°C (176°F) with VW 415a, VW 427	6.3-2/1
4	Intermediate ring	1			
5	Crankshaft gear	1	Remove on press with VW 457	Heat to approx. 80°C (176°F), chamfer facing bearing 3 with VW 415a, VW 427	6.3-2/1
6	Crankshaft bearing 3	1	Check for wear	Lubricate, hole for set pin facing crank web	

No.	Designation	Each	Observe during:		Spec. Instr.
			Removal	Installation	
7	Key	1			
8	Hex. nut for conrod bolt	8		Replace, tighten to 3.3 mkg (23.9 ft.lbs.) (contact surface lubr.), secure with peening punch	
9	Connecting rod	4	Check with VW 214f/70	Observe installation position and weight, with holding plate for crankshaft VW 801	6.3-3/1
10	Big end bearing shell	8	Check for wear	Lubricate	
11	Small end bushing	4	Check for wear	with VW 402, VW 421, VW 416b	6.3-3/2
12	Spacing sleeve	1			

DISASSEMBLY AND PREASSEMBLY OF CRANKSHAFT

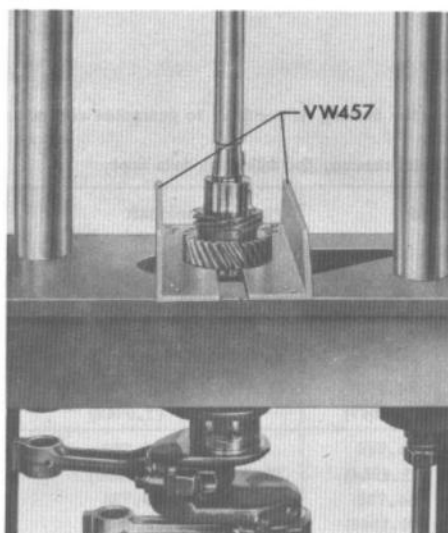


Disassembly

- 1 - Remove locking ring for ignition distributor drive gear with circlip pliers VW 161a.

Caution!

Do not store removed crankshaft without corrosion protection by oil or grease.



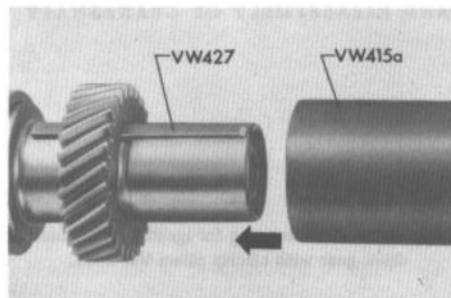
- 2 - Remove ignition distributor drive gear, intermediate ring and crankshaft gear on repair press in combination with holding rails from VW 457.

Slight seizing marks may be carefully removed, but without impairing press seat.

Checkup

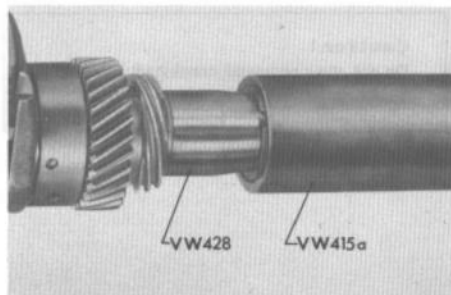
- 1 - Check crankshaft for out-of-true, cracks (resonance test) and wear. If required, regrind crankshaft or replace.
- 2 - Clean crankshaft and blow compressed air through oil ducts.
- 3 - Inspect bore of crankshaft gear and ignition distributor drive gear for seizing marks and check contact pattern of teeth.

Out-of-true on 2nd and 4th bearing (bearings 1 and 3 on V-blocks)	Bearing journals out-of-true	Unbalance
max. 0.02 mm (.0008")	max. 0.03 mm (.0012")	max. 12 cmg



Preassembly

- 1 - Heat crankshaft gear in oil bath to approx. 80°C (176°F) and fit in combination with VW 427 and VW 415a. The chamfer should face the crankshaft bearing. Fit intermediate ring.
- 2 - The ignition distributor drive gear is pressed on in the same manner.



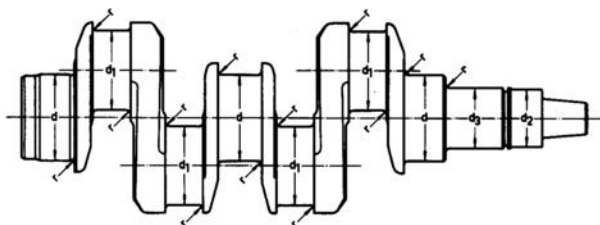
- 3 - Slide on locking ring in combination with VW 428 and VW 415a. The conical guide sleeve VW 428 prevents any damage to crankshaft bearing pin. Check gears for tight seat when cold.

RECONDITIONING OF CRANKSHAFT

Crankshafts which must be reconditioned should be sent to the factory, if possible, to guarantee accurate and expert regrinding.

In cases where the crankshaft cannot be submitted for special reasons, the following data apply:

	Pins for crankshaft bearings 1, 2 a. 3 (d_1)		Pins for conrod bearing (d_1)		Pins for crankshaft bearing 4 (d_2)	
	Rated dia. mm (in.)	Lapping dia. mm (in.)	Rated dia. mm (in.)	Lapping dia. mm (in.)	Rated dia. mm (in.)	Lapping dia. mm (in.)
Normal	60.00 (2.362)	59.990 (2.3618) 59.971 (2.3611)	55.00 (2.1654)	54.996 (2.1652) 54.983 (2.1647)	40.00 (1.575)	40.000 (1.5748) 39.984 (1.5742)
Undersize 1	59.75 (2.353)	59.740 (2.3520) 59.721 (2.3512)	54.75 (2.156)	54.746 (2.1554) 54.733 (2.1548)	39.75 (1.565)	39.750 (1.5650) 39.734 (1.5643)
Undersize 2	59.50 (2.342)	59.490 (2.3421) 59.471 (2.3414)	54.50 (2.146)	54.496 (2.1455) 54.483 (2.1450)	39.50 (1.555)	39.500 (1.5551) 39.484 (1.5545)
Undersize 3	59.25 (2.332)	59.240 (2.3323) 59.221 (2.3315)	54.25 (2.136)	54.246 (2.1357) 54.233 (2.1352)	39.25 (1.545)	39.250 (1.5453) 39.234 (1.5446)



$$\begin{aligned}
 d_3 &= \frac{42.006}{41.995} \text{ mm dia.} & r &= \frac{2.5}{2.0} \text{ mm dia.} \\
 &= \frac{1.6538}{1.6534} \text{ in. dia.} & &= \frac{.098}{.079} \text{ in. dia.}
 \end{aligned}$$

Careful grinding of radii on crankshaft and camshaft bearing pins is of decisive importance for the life of the crankshaft. Try for a value of 2,5 mm (.098 in.). The radii must be polished.

Regrinding

Never refinish bearing shells.

Following the grinding, be sure that the oil holes have no sharp edges. Chamfer edges lightly, if required.

The crankshaft gear and the ignition distributor drive gear should be pressfit to crankshaft
 42.006 mm dia. (1.6538 in.)
 41.995 mm dia. (1.6534 in.) If repeated removal and fitting of these gears will loose the pressfit, chromeplating or the spraying of metal at the pertinent spots may reestablish the required pressfit.

To be sure that the crankshaft is free of cracks, a resonance test is recommended prior to installation. Then check crankshaft for out-of-round.

INSPECTION AND INSTALLATION OF CONNECTING RODS

Checkup

- 1 - Check connecting rods for external damage. Replace entire connecting rod, even if only the bolts are damaged.

- 2 - Check connecting rod weight.

The difference in weight of the connecting rods in one engine should not exceed 6 grams.

Conrod weight = conrod complete, but without bearing shells.

2 Weight classes are available for installation,

white = 746-752 grams

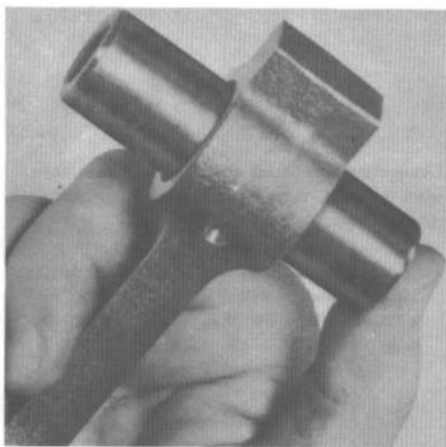
black = 769-775 grams

which are also available as spare parts.

Refinishing is therefore not required.

The colour coding is on connecting rod cap.

- 3 - Check conrod bushing. In a new bushing the normally tempered piston pin should slip in easily under light finger pressure.

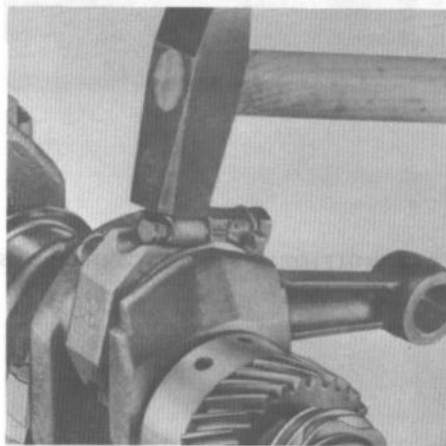


- 4 - Square connecting rod in conrod testing fixture VW 214f/70; straighten, if required.

Installation

- 1 - The code numbers on the parting joint of connecting rod top and bottom should be located on one side.

- 2 - Slight distortions which may occur when tightening the conrod bolts between the bearing halves may be removed by applying light hammer blows against both sides of connecting rod.

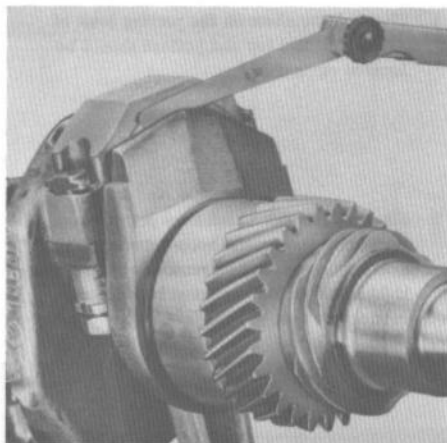


The connecting rod should slide under its own weight. Any refinishing or recessing of bearings is never permitted.

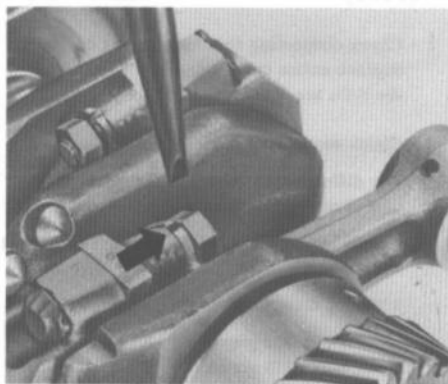
- 3 - Measuring axial play of connecting rod with feeler gauge.

During installation (new): 0.1-0.4 mm
(0.004-0.016")

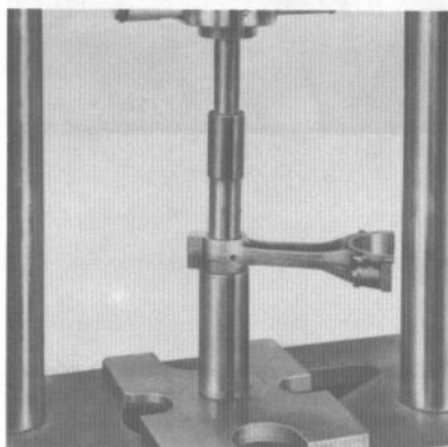
Wear limit: 0.7 mm
(0.026")



- 4 - Secure hex. nuts with peening punch VW 124a.



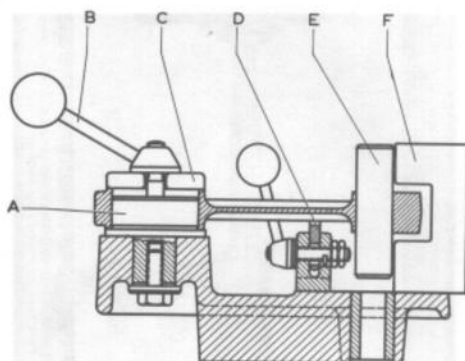
RECONDITIONING CONNECTING RODS



Connecting rods which are slightly bent or have worn bushings, must be squared and provided with new bushings.

- 1 - Remove small end bushings in VW repair press in combination with VW 402, VW 409, VW 416b, and VW 421.

2 - Insert connecting rod in fixture VW 214f/70.

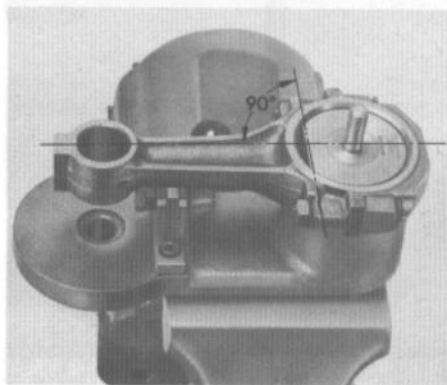


A - Receiving mandrel D - Support
B - Locking lever E - Bolt
C - Take-up washer F - Sight gauge

Turn mandrel A in such a manner that the milled surface is crosswise to center axis of connecting rod.

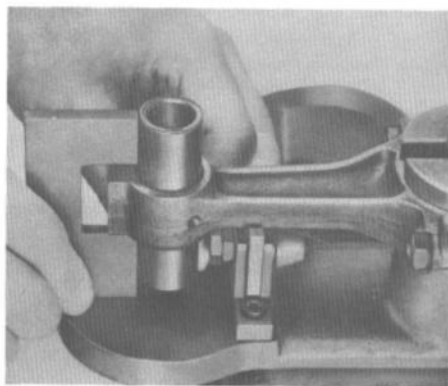
3 - After fitting washer C, tighten locking lever B only to the extent that the connecting rod is still movable in both directions. Support D is loose.

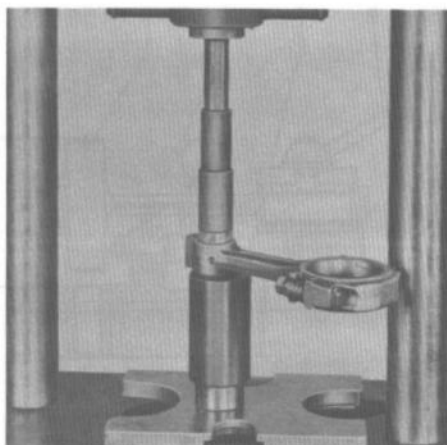
4 - Introduce bolt E into conrod eye and push with two fingers in the direction of mandrel A in such a manner that no canting will occur between the receiving mandrel and the conrod bearing or between the conrod eye and bolt.



5 - Check connecting rod for distortion and parallel alignment. (The illustration shows the inspection for parallel alignment).

If there are deviations, tighten locking lever well and straighten connecting rod with straightening mandrel.





6 - Install small end bushing on VW repair press in combination with VW 402, VW 409 and VW 421.

7 - Drill oil holes (3,5 mm dia. = 0.14").

8 - Place rod of reamer through conrod eye and pertinent bore of fixture, with the conical guide bushing serving for centering the small end bushing.

Tighten locking lever and support for holding connecting rod.

Small end bushing ID	24,015-24,024 mm dia. (0.9455-0.9458")
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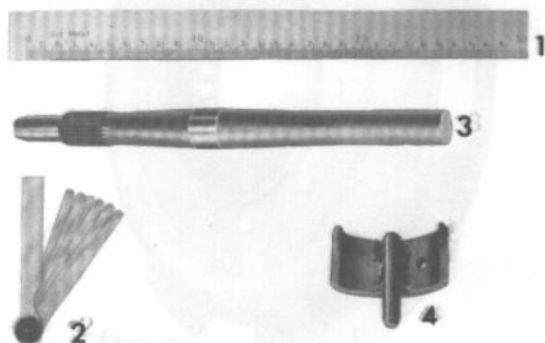


Following the reaming, the inside surface of the bushing should be free of score and chatter marks. The piston pin should slide in easily under finger pressure and without using oil. If bushings have been reamed too much by mistake, the non-permissible play between the piston pin and the bushing should not be compensated by installing an oversize piston pin. Always use a new bushing and ream.

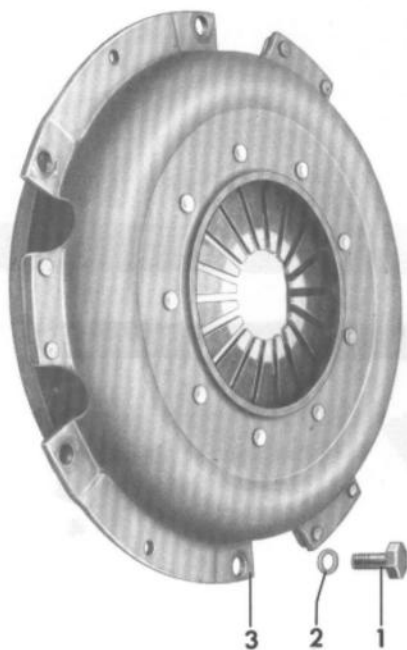
9 - Check parallel alignment and distortion once again, this time with the piston pin inserted as described above. Any slight differences can be straightened out by introducing a mandrel into piston pin.



TOOLS



No.	Designation	Special Tools	Explanations
1	Steel straightedge		at least 200 mm (7.9 in.) long
2	Feeler gauge		commercial
3	Input shaft		
4	Holding clip for flywheel	VW 215c	

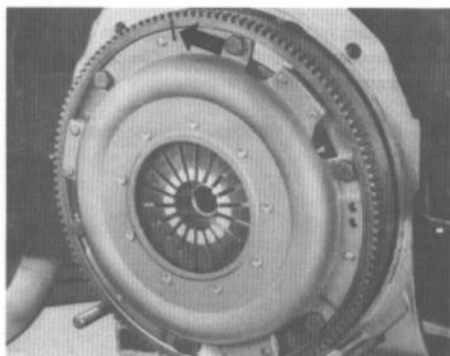


No.	Designation	Each	Observe during:		Spec. Instr.
			Removal	Installation	
1	Multi-tooth screw M 7 x 15	6		Tighten crosswise to 2,0 mkg (14,5 ft.lbs.)	
2	Spring plate	6			
3	Diaphragm spring clutch	1	Mark installation position, check for wear		7.1-2/1

REMOVAL AND INSTALLATION OF CLUTCH

Removal

- 1 - New engines are balanced following assembly, this is why the installation position of the clutch should be marked, to eliminate major unbalance during reinstallation.



- 2 - Loosen fastening bolts uniformly.

Loosen bolts alternately and crosswise by one or two turns, until the spring action stops, to eliminate any distortion of cover.

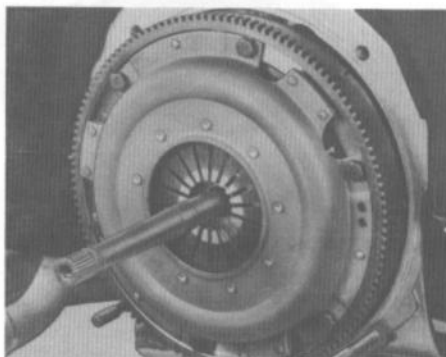
Installation

Observe the following instructions for installation:

- 1 - Clean contact surface of clutch disk in flywheel and check for wear. Surface cracks and score marks can be removed by grinding or machining. If required, replace flywheel.
- 2 - Coat needle bearing in flywheel with approx. 0.2 cm multi-purpose grease only if it has been cleaned. Moisten felt ring with engine oil. Wipe off excess lubricant.
- 3 - Check clutch and clutch disk. Instructions on how to conduct an inspection are contained in the sections "Inspection of Clutch" and "Clutch Disk".
- 4 - Check splining of input shaft and coat lightly with molybdenum disulfide powder. Apply powder with a brush or a piece of non-fraying cloth. The clutch disk should slide easily without unpermissible radial play.

- 5 - Check clutch throwout bearing. The throwout bearing requires no service. Do not wash or flush with cleaning gasoline or other cleaning agents, but with a clean cloth only. Replace bearings which are contaminated inside and out. Watch out for correct seat of holding springs. Grease guide bushing lightly with molybdenum disulfide paste.

- 6 - Insert clutch with clutch disk into flywheel. Accurate centering of clutch disk is performed with the assistance of an input shaft.



- 7 - Observe balancing marks. When a new clutch is installed, the balancing marks on clutch and flywheel should be offset by 180°.

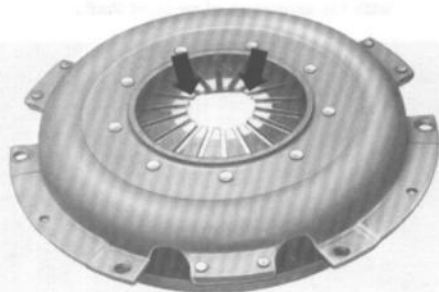
	Designation (heavy end)
Flywheel	White paint stripe on outside edge, if remaining unbalance is between 5 and 20 cmg.
Clutch	White paint stripe on outside edge, if the remaining unbalance is between 5 and 15 cmg.

- 8 - Tighten fastening bolts uniformly and crosswise to 2.0 mkg. (14.5 ft.lbs.)

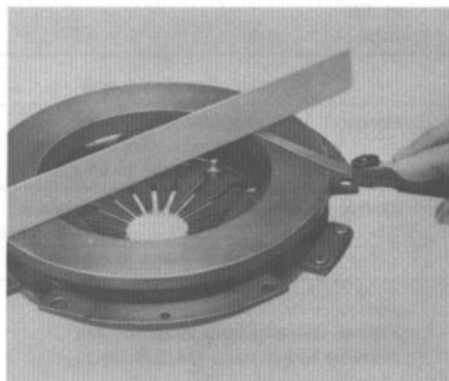
INSPECTING CLUTCH

The inspection of the diaphragm spring clutch is restricted to a thorough sight test. Any reconditioning or repairing of clutch in workshops is not intended.

- 1 - Check ends of diaphragm spring for wear marks (support of clutch throwout bearing). Wear marks of up to 0.3 mm (0.0012 in.) are of no significance.

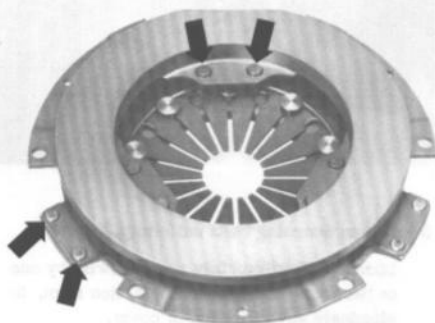


- 2 - Check supporting surface of pressure plate for cracks, burned spots and wear. Pressure plates which are bent inwards up to 0.3 mm (0.0012 in.) are still fit for installation.



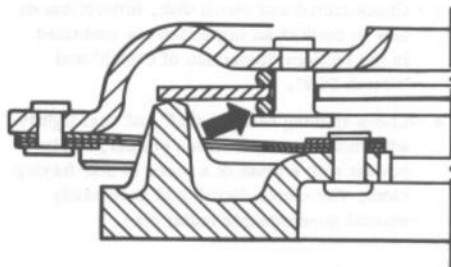
- 3 - Inspect spring connections between pressure plate and cover for cracks. Check rivet connections for tight seat.

Clutches with damaged or loose riveting

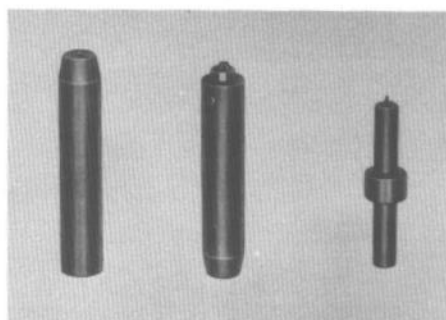


- 4 - The diaphragm spring is mounted on cover between two wire rings by means of a rivet connection.

Clutches with visible wear on rivet head or wire ring should be replaced.



TOOLS



No.	Designation	Special Tool	Explanations
1	Riveting tool for clutch disk	VW 783	

INSPECTION OF CLUTCH DISK

- Toothing:** The clutch disk should slide easily on input shaft without unpermissible radial play. Replace worn parts.
- Riveting:** Check riveting; replace clutch disk, if required.
- Spring elements:** If the spring elements or the driven plate are cracked, completely replace clutch disk.
- Clutch lining:** Replace worn, cracked, oily or burned linings.
- Out-of-true:** Check clutch disk for lateral wobble. Max. 0.5 mm (0.02 in.) at 210 mm dia. are permitted, (8.3"). Straighten slightly distorted disks with rubber hammer.

LINING CLUTCH DISK

- 1 - Unusable linings may not be removed by tearing them off but by drilling the rivets on rivet head end.

- 2 - Use only linings approved by Volkswagen.

Flywheel end: Jurid or Textar

Clutch end: Textar

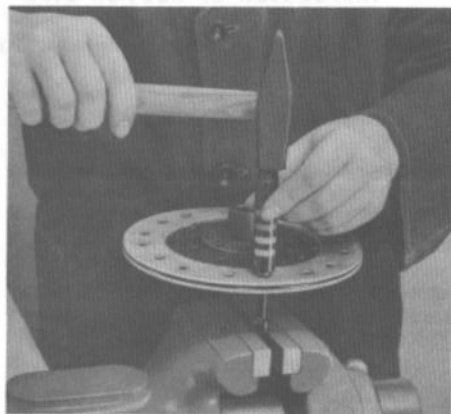
- 3 - For attaching clutch linings on clutch disk use only rivets (spare part No. 311 141 195 A), which have a 2 mm dia. (0.08 in.) bore.

- 4 - When riveting, be sure that the rivet shoulder is always inserted into the larger bore of the double lining spring. Riveting is done on clutch lining.

Caution!

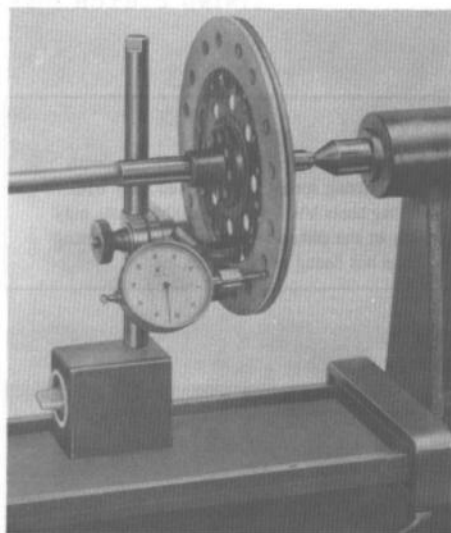
Riveting clutch linings on clutch disks with double lining spring is permitted only with riveting tools VW 783. Unsuitable tools may result in the distance between the two lining springs not being maintained.





5 - Using riveting tools VW 783:

- a - Clamp riveting support into vise.
- b - Split rivet with rivet header, but be sure not to turn header.
- c - Double-punch individual rivet segments with die.



6 - Upon application of lining, check clutch disk for out-of-true.

Permissible lateral out-of-true (measured at 210 mm dia. = 8.3"): max. 0.5 mm (0.02").

The engine used in Type 914/2.0 vehicles is an air cooled, four cylinder, four cycle unit with valves in head (OHV). The cylinders are arranged in two opposed banks of two cylinders each. The engine is attached to the transaxle by four bolts. The power train, consisting of engine, transmission, and differential, is supported by two mounts, that is, a transverse engine mount, bolted in the center to the crankcase and at both ends to the longitudinal body side members, supporting the forward part of the power train, and the rear transverse mount which rests in rubber cushions.

Ignition System

The ignition system is battery powered. It incorporates an ignition coil and a distributor with automatic spark advance with centrifugal and vacuum control. The ignition system transforms battery voltage from 12 volts to the required ignition voltage, delivering it to each of the four spark plugs in proper sequence and at an exact firing time with the aid of a distributor. The distributor is driven by the crankshaft through a worm gear and shaft.

Cooling

The cooling system utilizes a radial blower. The blower impeller is attached to the crankshaft hub by three bolts. It draws air through an opening in the blower housing and forces it through shrouds and baffles to the finned cylinders and cylinder heads. Part of the fresh cooling air is used for the interior compartment heating by passing through heat exchangers which encase part of the exhaust pipes.

A thermostat located below cylinders 1 and 2 actuates two flaps in the intake ducts of the forward half of the cooling blower housing by means of a control cable. The flaps control the flow of fresh air to permit quicker engine warmup and also maintain a fairly constant operating temperature under all load conditions; this provision does not affect the flow of heating air.

Oil Circulation

The engine is lubricated by a forced feed system with an oil cooler. The gear type oil pump is located on the driven end of the camshaft and is driven by it. The oil is picked up from the lowest point in the crankcase and forced into the oil galleries in the crankshaft to lubricate the connecting rods. Another part of the oil lubricates the camshaft bearings, while still another part flows through the hollow push rods to the rocker arms where it lubricates rocker arm bearings and the valve stems. The cylinder walls, pistons, and piston pins are splash lubricated.

Dirt particles are kept out of the lubrication system by a full flow oil filter as well as a screen located at the lowest point in the crankcase. Should the oil filter become clogged, a ball check valve located in the filter base opens a bypass channel allowing the oil to flow directly to the points of lubrication.

The oil cooler is mounted on the crankcase side and is cooled by air drawn by the cooling blower. It is located in the oil circuit in such way that oil pumped by the pump must pass through the oil cooler before reaching the individual lubrication points. This cooling system ensures that the oil retains all its lubricating qualities even at high outside air temperatures and maximum engine loads.

A bypass valve allows part of the oil to bypass the oil cooler and flow directly to the oil galleries when the oil is cold and thick. A pressure relief valve located at the oil circuit terminal end maintains an oil pressure of about 2.0 atm (25.5 psi) in the main bearing and camshaft bearing area.

An oil pressure switch (sensor) is located in the pressure line between the oil pump and oil cooler. It opens the warning lamp circuit when the oil pressure has reached 0.15 - 0.45 atm (2.2 - 6.5 psi).

The oil pressure warning lamp lights up when the ignition switch is turned on or when the oil pressure is too low.

Cylinder Heads

Each two cylinders have one common, removable, and extensively finned light alloy cylinder head with shrunk-in valve seats and guides. The valves are located overhead. The exhaust valves are armored in high grade chrome-nickel steel. In addition, to provide better heat dissipation, the stems are sodium filled.

Valve Timing

The camshaft is located in the crankcase and rides in three split-sleeve steel inserts which are coated with white metal. It is driven by the crankshaft through helical gears. Bearing number 3 takes up the axial thrust of the camshaft. Camshaft gear is made of light alloy and is riveted to the camshaft. Valve timing is effected by cams through cam followers, pushrods, and rocker arms. Each cam actuates one valve in each of two opposing cylinders.

Cylinders

The four special-cast cylinders are uniform in design and can be individually replaced together with their corresponding pistons. Cooling is by air with heat dissipation through integral cooling fins.

Pistons

The steel reinforced pistons have two compression rings and one oil scraper ring in each. An expander is located between the piston and oil scraper ring. The piston pins float in the small end bushing of the connecting rods and are secured in the pistons by circlips.

Crankcase

The two-piece crankcase is made of pressure cast light alloy. Both halves are machined together as a pair during manufacture and cannot be replaced individually.

Crankshaft

The crankshaft is symmetrically forged with all bearing journals induction hardened. Four main bearings are used. Bearings 1, 3, and 4 are aluminum-sleeve inserts with leaded surface. Bearing $\neq 2$, as seen from the clutch side, is a split-sleeve tri-metal insert. Bearing $\neq 1$ also takes up the axial thrust of the crankshaft. The flywheel, with integral starter gear, is attached with five bolts and secured against torsional slippage. Camshaft and distributor drive gears are secured with Woodruff keys. The hub of the cooling blower impeller is seated on the conical shaft end and secured with a Woodruff key and nut. Crankshaft sealing at the flywheel and cooling blower ends is by means of oil seals.

Connecting Rods

The four connecting rods are steel forgings with I-section shank. The big ends of the connecting rods ride on tri-metal bearing inserts; the small ends have lead-bronze coated steel bushings to accommodate the piston pins.

Clutch

The single plate, dry clutch disc has linings on both sides and is free to move axially on the input shaft splines. The clutch cover, which accommodates the clutch pressure plate and diaphragm spring, is bolted to the flywheel. In engaged condition, the clutch disc is pressed against the flywheel by the clutch pressure plate and diaphragm spring, thus providing for power transfer between engine and transmission.

Distributor - 1975 Models

AFC Fuel Injected Engine

The distributor centrifugal spark advance vacuum retard curves are identical to the 1974 specifications (vacuum spark advance is not used).



Distributor rotor without speed limiter



Distributor rotor with speed limiter

Engine speed is controlled by the distributor rotor with a built-in speed switch (except California). California vehicles have a separate speed switch that limits the fuel supply.

