



REPAIR MANUAL

for the MZ Motor-cycle

ETZ 250

IFA mobile-DDR

REPAIR MANUAL

for the MZ Motor-cycle

ETZ 250

**with 201 illustrations
and
29 drawings of special tools**

3rd Edition

VEB MOTORRADWERK ZSCHOPAU
Betrieb des IFA-Kombinates Zweiradfahrzeuge

The ETZ 250 MZ Motor-cycle is a product from VEB Motorradwerk Zschopau,
Betrieb des IFA-Kombinats Zweiradfahrzeuge

This Repair Manual was written by a group of engineers in the employ of
the manufacturer.

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Preface
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In the high latitudes of Finland, in the parching heat of Africa, and under the most different operating conditions, MZ Motor-cycles run to the satisfaction of their owners.

To ensure that the vehicles remain in perfect working order and reliable in service after a long period of operation, involving a certain amount of wear, we issue this Repair Manual to give the necessary instructions to our MZ-Workshops at home and abroad.

Repair work is a matter of confidence in several respects:

The safety of the driver depends on the reliability of the mechanic and his excellent workmanship.

Finding the actual cause of the trouble ensures that no material is wasted and labour costs are restricted to a minimum.

From these items, three advantages result:

1. no retouching work,
2. short times of inoperation and
3. low repair costs!

Good workmanship in repairs largely depends on the use of the special tools and means recommended by MZ. We should like to underline that especially self-service workshops and amateur constructors should bear this in mind to avoid considerable additional expenditure of labour and material.

Our authorised MZ-Workshops may purchase the special tools from the MZ Spare Sales Department - for amateur constructors and the like, however, there is only the possibility of constructing them with the help of the sketches given in Section 8.2.

We hope this Reference Book offers the required information to the staffs of the workshops contracted for servicing our products at home and abroad, and to the friends of MZ motor-cycles throughout the world; and we wish good success to each and all.

VEB MOTORRADWERK ZSCHOPAU
Betrieb des IFA-Kombinats Zweiradfahrzeuge
Service Department

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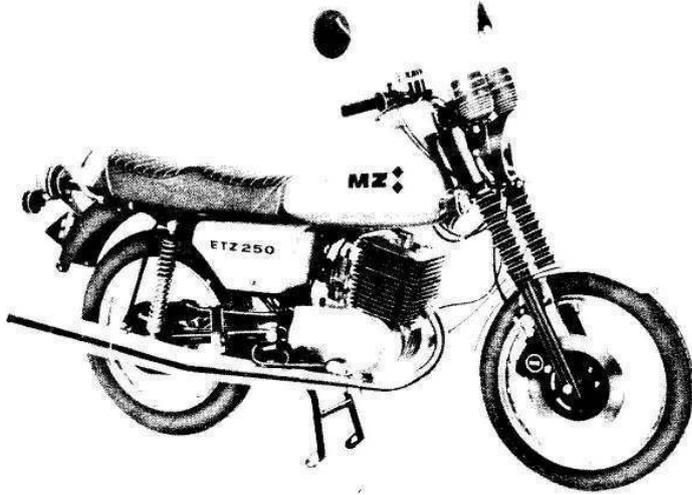


Fig. 1. ETZ 250 with disk brake

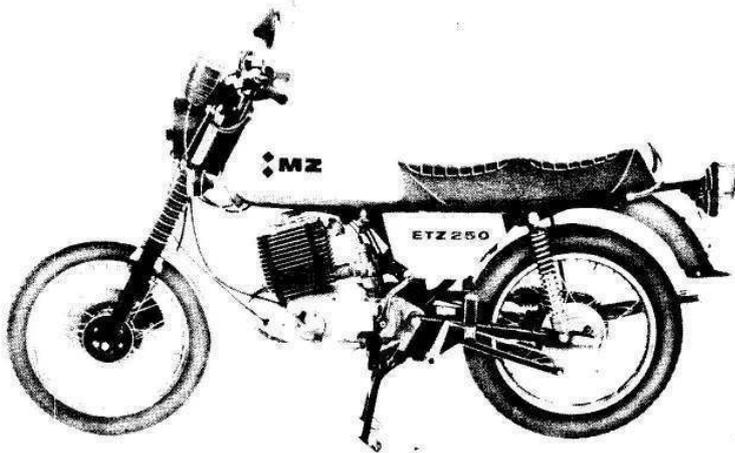


Fig. 2. ETZ 250, left-hand side

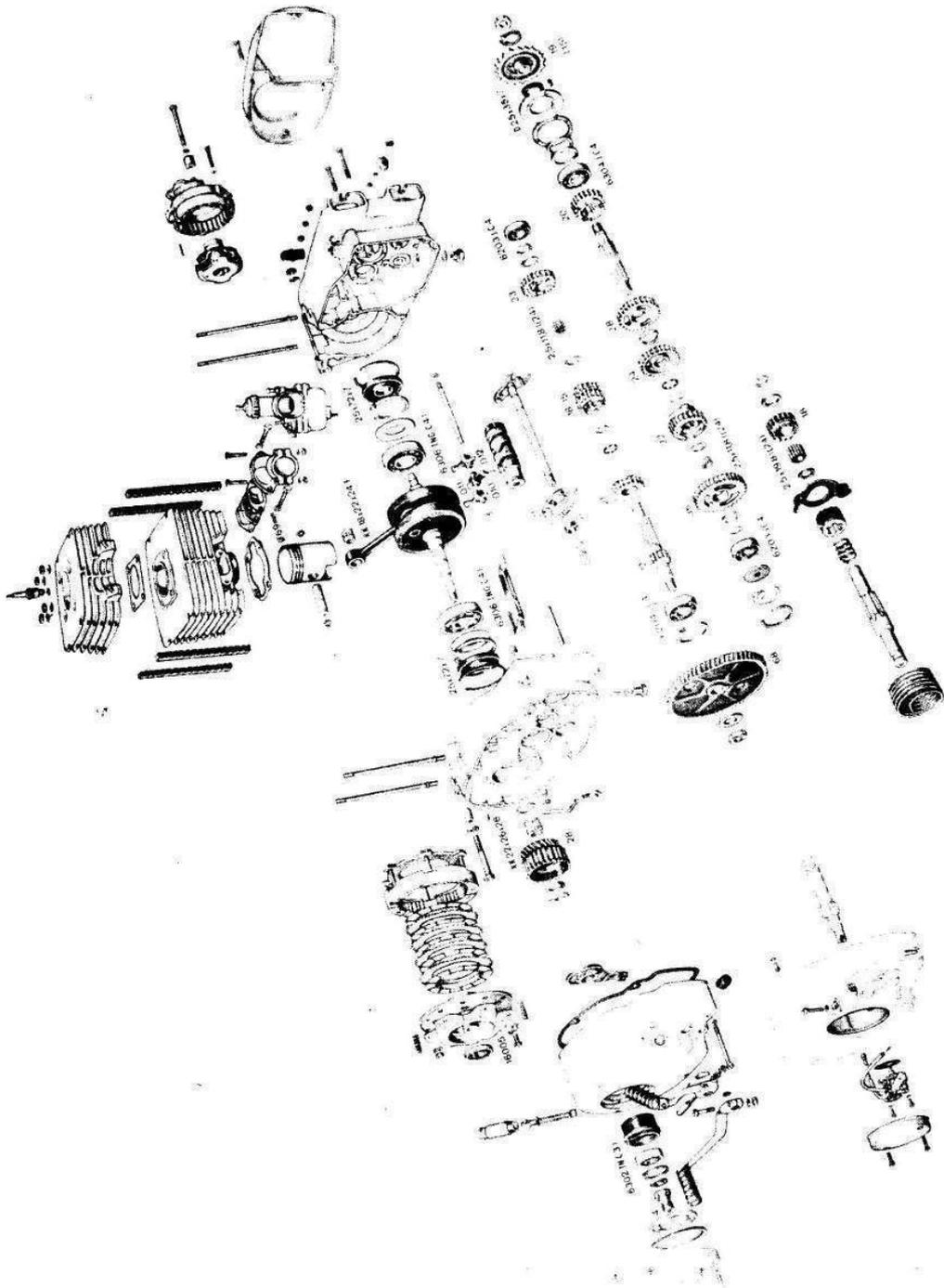


Fig. 3. Exploded view of the engine EM 250

1. Technical Data

1.1. Engine

Engine type	EM 250
Cycle	two-stroke reverse scavenging
Cooling system	air-cooled (relative wind)
Number of cylinders	1
Stroke / bore	65 mm / 69 mm
Swept volume	243 cm ³
Ratio of compression	10.5 : 1
Compression volume of cylinder head (when assembled)	about 26 cm ³
Maximum output at about 5,500 rpm	15.5 kW (21 hp)
at about 5,000 rpm	12.5 kW (17 hp)
Maximum torque at about 5,200 rpm	27.4 Nm (2.8 kpm)
at about 4,500 rpm	24.5 Nm (2.5 kpm)
Lubrication	petroil lubrication 50 : 1 or, for selected export countries, by means of oil proportioning pump)
Connecting-rod bearings	cage-type needle bearings for big end and gudgeon pin
Crankshaft main bearing	2 bearings 6306 C 4 f 1 bearing 6302 C 3 f
Lubrication of main bearings	petroil lubrication
Timing angles	
induction	155° crank angle
transfer	123° crank angle
exhaust	180° crank angle

1.2. Carburettor

Transfer port	BVF 30 N 2-5
Main jet	30 mm
Needle jet	135 (125 for 12.5 kW)
Partial-load needle	70 with cross bore
Needle position from top	2 A 531 (C 6) with 5 notches
Starting jet	3 to 4 (4th for running-in period)
Slow-running jet	110
Float valve	45
Slow-running air screw	20
Throttle valve, valve opening	for about 1 revolution open 5 mm

1.3. Electrical System

Ignition	battery ignition
ignition timing	2.5 ^{+0.5} mm before T.D.C. $\hat{=}$ 22° 15' - 2° crank angle
Contact breaker points gap	0.3 ^{+0.1} mm
Sparking-plug	ZM 14-260
electrode gap	0.6 mm
Dynamo	14 V, 15 A, three-phase current
Rectifier	silicon semi-conductor in three-phase bridge circuit
Regulator	single-system regulator, temperature-compensated, positive-regulating
Battery	12 V 5 (9) Ah
Ignition coil	12 V, miniature ignition coil
Headlamp	light opening 170 mm in diameter, asymmetrical passing beam
Stop, tail and number-plate lighting fitting	light opening 120 mm in diameter

Horn	under the fuel tank
Direction indicator	4-lamp flashing-light system
Switches	
ignition-light switch	in instrument pod
switch combination at handle-bars	dimmer switch, direction indicator system, electric horn, by-pass light signal
Stop-light switch	in rear-wheel hub and front-wheel hub or brake master cylinder
Electric bulbs	
headlamp	12 V, 45/40 W (twin-filament) or H4 55/60 W TGL 11 413
parking light	12 V, 4 W cap BA 9 s TGL 10 833
stop light	12 V, 21 W cap BA 15 s TGL 10 833
direction indicator	12 V, 21 W cap BA 15 s TGL 10 833
tail light	12 V, 5 W cap BA 15 s TGL 10 833
charging control light	12 V, 2 W cap BA 7 s TGL 10 833
idling indicating light	12 V, 2 W cap BA 7 s TGL 10 833
high-beam headlight indicator	12 V, 2 W cap BA 7 s TGL 10 833
control of direction indicator	12 V, 2 W cap BA 7 s TGL 10 833
speedometer illumination	12 V, 2 W cap BA 7 s TGL 10 833
Fuses	
main protection	fuse link 16 A
direction indicator system	fuse link 4 A
dynamo (line DF)	miniature fuse 2 A

1.4. Gearbox

clutch	on the left-hand end of crankshaft - in oil bath (5 friction disks)
gear-shift system	foot-operated
number of speeds	5
gear ratios	
1st speed	3.0 $\hat{=}$ 12 : 36
2nd speed	1.865 $\hat{=}$ 15 : 28
3rd speed	1.333 $\hat{=}$ 18 : 24
4th speed	1.048 $\hat{=}$ 21 : 22
5th speed	0.87 $\hat{=}$ 23 : 20
speedometer drive	2 $\hat{=}$ 12 : 24
revolution counter drive	4 $\hat{=}$ 4 : 16

1.5. Power Transmission

Transmission	
engine - gearbox	2.43
by helical gears	28 : 68 teeth
Transmission	
gear- rear wheel	19 : 48 teeth $\hat{=}$ 2.52 (solo operation) 15 : 48 teeth $\hat{=}$ 3.2 (side-car operation)
by roller chain, for solo operation	0.8 P-1-130 TGL 11 796 (12.7 mm x 7.75 mm x 8.51 mm, 130 rollers)
for side-car operation	0.8 B-1-128 TGL 11 796 (12.7 mm x 7.75 mm x 8.51 mm, 128 rollers)
Total gear ratio	solo side-car operation
1st speed	18.406 23.33
2nd speed	11.453 14.54
3rd speed	8.181 10.34
4th speed	6.428 8.16
5th speed	5.335 6.77

1.6. Cycle Parts

Frame	central tubular frame (welded rectangular section)
Engine suspension (elastic)	at cylinder head and rear casing
steering angle	63 degrees
castor	95 mm

Type of springing	
front	telescopic fork with oil-hydraulic damping, spring deflection 185 mm
rear	suspension units with spring load and oil-hydraulic damping, spring pre-load adjustable, spring deflection 105 mm
Wheels	wire-spoke wheels with non-offset spokes
Rim size	
front	1.60 x 18
rear	2.15 B x 18
Tyres	
front	2.75 - 18
rear	3.50 - 18
Tyre inflation pressure	
solo: front	150 kPa (1.5 kp/cm ²)
rear	190 kPa (1.9 kp/cm ²)
with permissible total load:	
front	170 kPa (1.7 kp/cm ²)
rear	250 kPa (2.5 kp/cm ²)
Brakes	
front	drum brake, diameter 160 mm width of lining 30 mm actuation by cable control or hydraulic single-disk fixed saddle brake brake disk diameter 280 mm
rear	drum brake, diameter 160 mm width of lining 30 mm actuation by linkage

1.7. Weights

Weight unladen (with fuel and tools)	151 kg (design with drum brake, front) 153 kg (design with disk brake, front)
permissible total weight	330 kg

1.8. Capacities

Gearbox	900 cm ³ of gear oil SAE 80
Fuel tank	17 l of fuel-oil mixture, including 1.5 l of reserve
Oil reservoir for oil proportionating system	1.3 l
Telescopic fork	230 cm ³ of damping fluid per member

1.9. Dimensions, Measured Values, Diagrams

Maximum speed	125 to 130 km/h depending on load, weather conditions and sitting position
Acceleration from 0 to 80 km/h	6.6 s
Fuel consumption	3.5 to 5 l/100 km

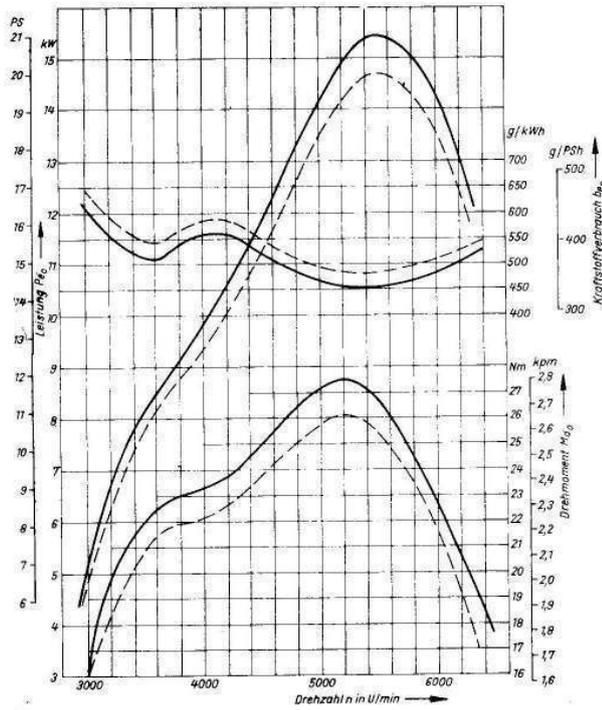


Fig. 4
Full load characteristics
of the engine EM 250

Drehzahl in U/min = speed in
rpm

Drehmoment = torque

Kraftstoffver-
brauch = fuel
consumption

Leistung = output

Fig. 5
Speed/gear diagram
ETZ 250 - Solo

Geschwindigkeit v in km/h =
speed v in km/h

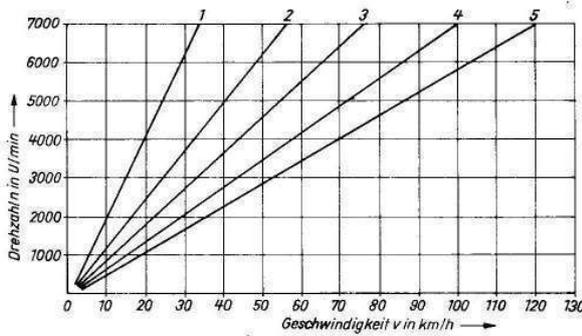
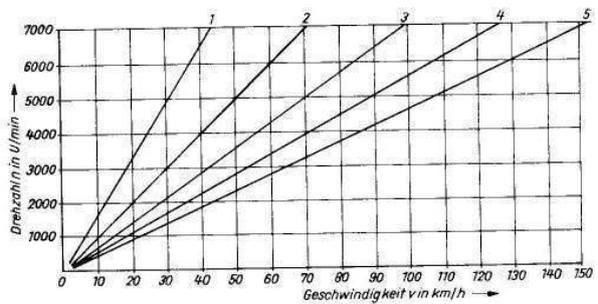


Fig. 5a
Speed/gear diagram
ETZ 250 - side-car design
Geschwindigkeit v in km/h =
speed v in km/h

2. Fuel, Lubricants and Fluids

2.1. Fuel

According to the design of the engine, a petrol of an octane rating of at least 88 (in the GDR abbreviated as "VK 88") should be used. In countries other than the GDR, the use of a fuel with a similar rating is recommended.

viscosity at 50 °C	53 to 68 cSt (corresponds to 8 °E roughly)
pour point maximum	- 25 °C
flash point	180 °C
water content	0.1 %

2.2. Two-stroke Engine Oil for Fuel-Oil Mixture

Engine oil is added to petrol in the RATIO of 1 : 50 (e.g. 0.2 litres of engine oil are added to 10 litres of fuel). The mixing ratio of 1 : 50 also applies to the running-in period. The two conrod bearings, the cylinder liner and the 6306 crankshaft main bearings as well as the piston are provided with oil by this simple and reliable system of petroil lubrication. Experiences gathered in the course of many years have shown that it is advisable to use

TWO-STROKE ENGINE OIL MZ 22 in the GDR. This additive-type oil meets the following requirements:

viscosity at 50 °C	20 to 25 cSt
pour point maximum	- 30 °C

It contains additives which effect a high temperature and pressure resistance. Limited tendency to coking; prevention of carbonaceous oil deposits or dissolving them. Wear reducing and corrosion preventing properties. Contains lead-separating agents preventing whisker formation in sparking-plugs.

FOR MZ MOTOR-CYCLES IN OPERATION IN COUNTRIES OTHER THAN THE GDR it is also advisable to use only two-stroke engine oils which possess these properties (e.g. Shell 2 T, Castrol 2 T, Arol 2 T, Mixol "S", LT-2T, etc.).

2.3. Oil Capacity of Gearbox

For gearbox and primary drive, an amount of 900 cm³ of "GL 60" gear oil is required. This is an additive-type gear oil which is suitable for the lubrication of change-speed gearbox and axle drives. It is an ageing-resistant refined lubricating oil with additives for an increase of the load-bearing capacity and a reduction of wear.

It has favourable low-temperature properties and meets the following technical requirements:

In countries other than the GDR, engine oil SAE 30 or 40 or gear oil SAE 80 with similar properties should be used.

2.4. Lubricants for Cycle Parts

The following lubrication points of the cycle parts must be lubricated with "Ceritol +k2" or "Ceritol +k3" antifriction bearing grease:

Steering bearing, wheel bearings, bearing for rear wheel drive, secondary chain, brake cams and brake shoe bearings, foot-operated brake shaft and speedometer drive (the two latter items only when being mounted or repaired).

This antifriction bearing grease has a drop point of about 130 to 150 °C, can be used for a temperature range from - 20 to + 100 °C, and is water-resistant at + 50 °C.

IN COUNTRIES OTHER THAN THE GDR, an anti-friction bearing grease of similar characteristics should be used.

2.5. Shock-absorber Oil - Telescopic Fork

As damping liquid, a mixture of

45 parts of shock-absorber oil and
1 part of molybdenum disulphide

should be used.

Shock-absorber oil viscosity:

8 to 11 cSt at 50 °

2.6. Shock-absorber Oil - Suspension Units

Shock-absorber oil WITHOUT ADDITIVES of the above viscosity is only used. The damping values of the telescopic fork and the spring-loaded suspension units are based on this viscosity. Springing and roadability will be impaired if shock-absorber oils of a different viscosity will be used.

2.7. Lubricant for Contact Breaker

"Unterbröl" special oil for contact breaker, viscosity 700 to 1,300 cSt at 50 °C.

2.8. Brake Fluid

For the disk brake, the brake fluid known as "Karipol grün" or - in countries other than the GDR - brake fluid SAE 70 R 3 or SAE J 1703 (for disk brakes) have to be used.

3. Disassembly of the Engine

The abbreviation "WoF" used below means width over flats of the tool (spanner) required.

3.1. Preliminaries

It is advisable, before starting the disassembling operations, to disconnect the battery and to remove it. During the repair period, it can be serviced. When the motor-cycle is kept in the workshop, the two fuses must be removed from the fuse strip under the right-hand panelling.

During the following work, the oil is allowed to drain from the gearbox (remove the oil drain plug (2) and unscrew the lower fastening screw (1) of the clutch cover).

NOTE: The gear-shift mechanism detent screw (3) does not serve for draining oil!

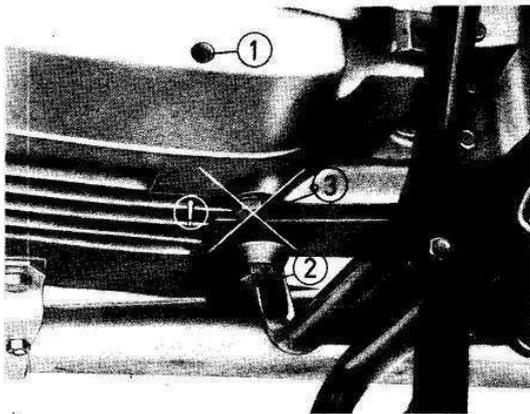


Fig. 6. Draining the lubricant from gearbox and clutch

3.1.1. Motor-cycle Right-hand Side

At the right-hand side of the motor-cycle, the operations for removing the exhaust system are started:

- (1) Remove the union nut from the cylinder by means of a hook spanner,
- (2) Remove the exhaust pipe clamp from the front of the engine (WoF 13),
- (3) Take off the holding brace from the silencer rear (WoF 13) and the dynamo cover (hexagonal socket-head bolt WoF 5).

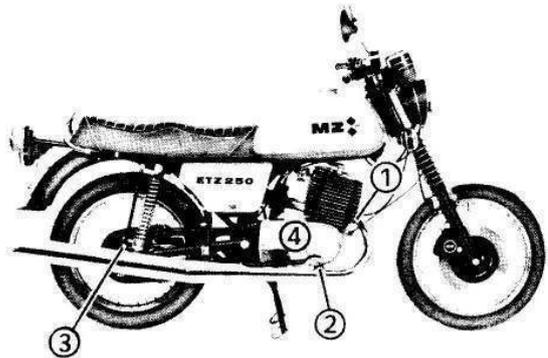


Fig. 7. Right-hand side of motor-cycle

After having pulled off the cables (1), unscrew the brush holder (2). After loosening the fastening screws (3), the stator can be removed. Using a box spanner (WoF 13), loosen the fastening screw of the cam of the dynamo. Sense of rotation of the spanner is opposite to the running direction of the engine. Then, the cam can be pulled off when slightly shaking the fastening screw (thread M 7).

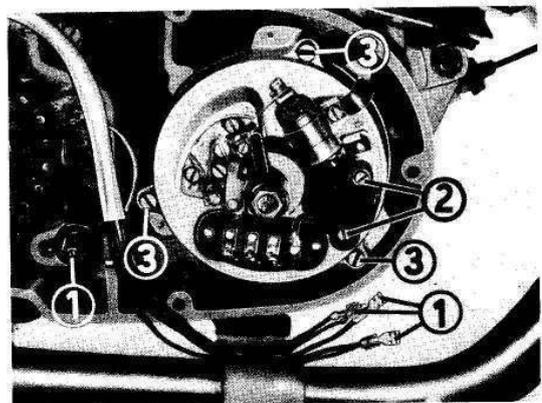


Fig. 8. Removing the stator from the dynamo

Extractor 02-MW 39-4(1) loosens rotor from cone of crankshaft (apply a blow with your hand on handle in the direction of rotation of engine). For the amateur constructor, a M 10 x 100 mm hexagon-head screw will do good service.

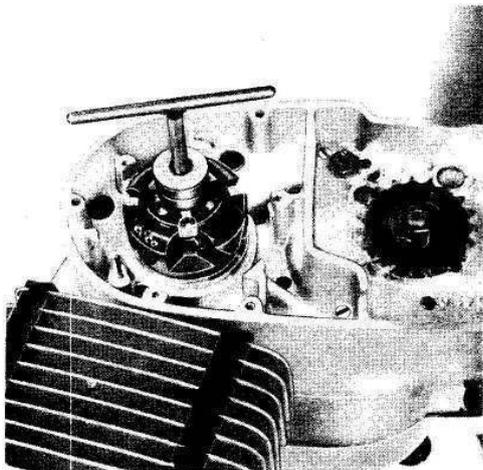


Fig. 9. Removing the rotor of dynamo

Open the secondary chain connecting link at front end of sprocket on drive shaft, using flat-nosed or combination pliers. Pull chain protecting hoses with chain from the engine towards the rear.

3.1.2. Removing the Carburetter

After closing the fuel shut-off cock and withdrawing the fuel feed hose, the carburetter can be dismantled. Sequence of operations:

- (1) Pull the protective rubber cap and unscrew starting carburetter actuation (WoF 14) under it
- (2) Unscrew carburetter casing cap and draw it out with piston valve
- (3) Loosen the clamping connection carburetter/induction pipe (screwdriver)
- (4) Loosen two screws (WoF 10) of the induction pipe connection

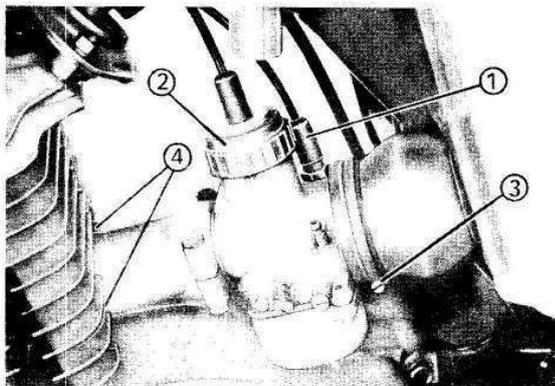


Fig. 10. Dismantling the carburetter

Slew out the carburetter with induction socket towards the left and pull it out of the induction tube (rubber).

3.1.3. Unhooking the Clutch Cable Control and Replacement

Remove protective cap (rubber) from casing of cable control holder (2), push along Bowden cable and take out the plug-type nipple.

Unscrew casing for cable control holder (2) from clutch cover (WoF 19) and push along cable for 5 cm, now the nipple (4) of the Bowden cable can be unhooked from the tie rod.

In the "deluxe model", the drive shaft for speedometer must be unscrewed before removing the engine

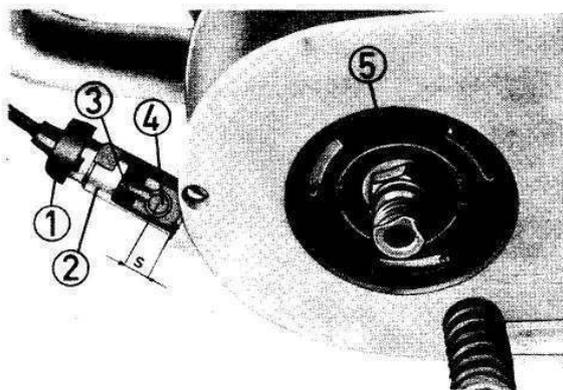


Fig. 11. Clutch cable control

3.1.4. Demounting the Engine

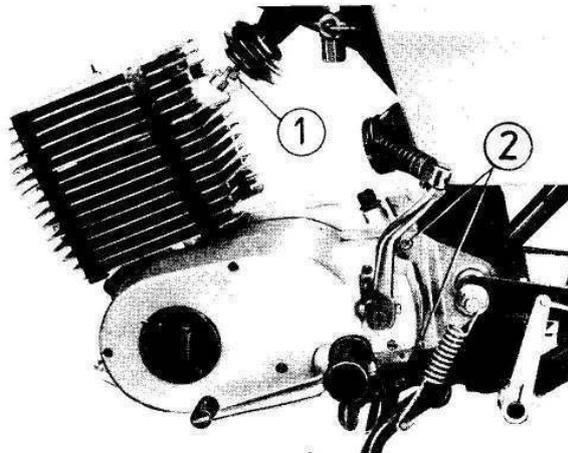


Fig. 12. Dismantling the engine or replacing the cylinder

Demounting the engine:

- Remove two nuts (WoF 13) (1) with washers from the studs of the cylinder head. Prop the engine from below;
- Unscrew the two fastening screws (2) from the rear engine shoes (WoF 13);
- After lowering the engine, draw it out in forward direction.

Replacement of cylinder:

The cylinder head, the cylinder and the elastic engine suspension can be changed in the position shown in Fig. 12. For the replacement of the cylinder, the electric horn (1) and the fuel tank must be removed. For changing the fuel tank, see Section 5.4.

3.2. Dismantling the Engine

3.2.1. Preliminaries

It goes without saying that the demounted engine must be cleaned externally before it is dismantled. Naturally, all parts must be kept in such a way that no part will be lost or damaged.

Before mounting the engine in the engine assembly device, remove the front clamping screw (WoF 13) and the fitting sleeve under it by means of mandrel 11 MW 3-4.

3.2.2. Removing the Clutch Cover

After loosening the clamping screw with nut (WoF 10), remove the gear-shift pedal. The kick-starter crank remains at the engine and is pulled off together with the clutch cover.

Remove the casing for the speedometer drive (?). Then demount the adjusting plate underneath and the drive gear for the speedometer (WoF 22).

After removing the 5 fastening screws of the clutch cover, alternately apply blows at points (3) by means of a plastic or rubber mallet and remove the clutch cover together with the kick-starter assembly.

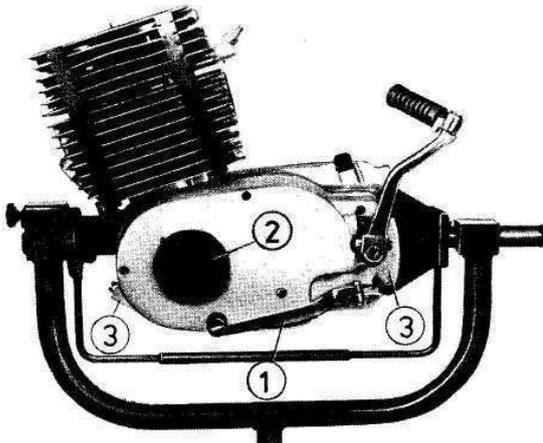


Fig. 13. Removing the clutch cover

3.2.3. Dismantling the Clutch and Primary Drive

Screw the clutch puller (1) fully on the thread of the clutch (2). The spindle (3) with compression member presses the clutch from the cone of the crankshaft. Pull the clutch from the internal driver. Remove corrugated washer (5) and thrust washer (4), remove drive gear with internal driver (3) and needle bearing (?) and spacer (1) from the crankshaft (see Fig. 21).

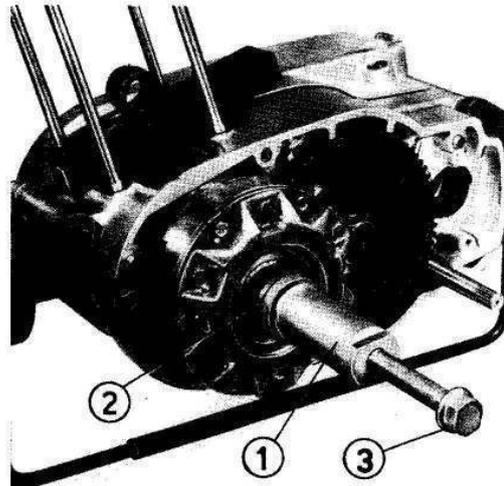


Fig. 14. Pulling off the clutch

After bending up the locking plate, by means of the assembling device (1) 22-50.430, block the drive gear and, using the socket wrench (2) (WoF 24), loosen the nut, unscrew it and remove the locking plate. The arrow-heads in the illustration show the fastening screws of the assembling device.

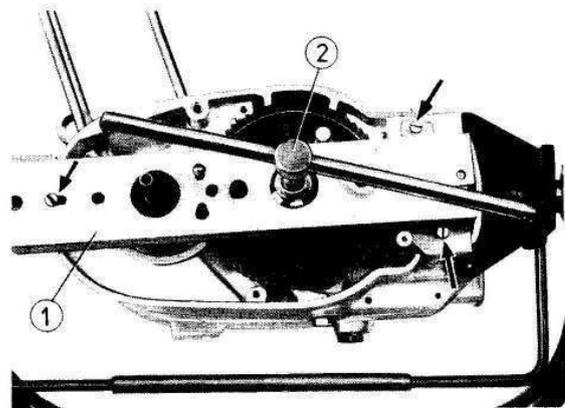


Fig. 15. Loosening the nut for the drive gear

Pull off the drive gear with 68 teeth by means of puller (1) 05 MW 45-3.

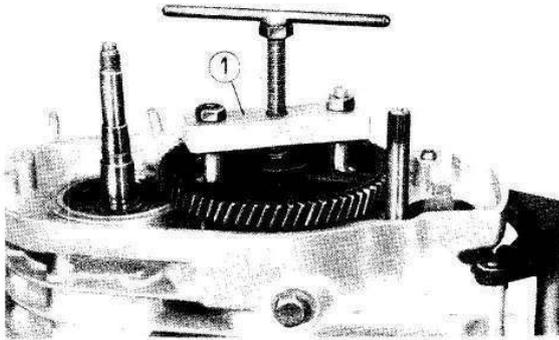


Fig. 16. Pulling the drive gear

Move the lock-lever (1) out of the drum cam (2), unhook tension spring (3) and remove it from guide bolt(4). Remove wire retaining ring (5) and snap ring (6), cap for drive shaft (7) and oil guide plate.

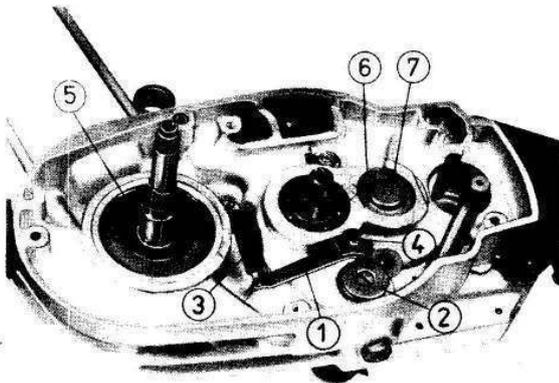


Fig. 17. Removing gear-shift detent and circlips

3.2.4. Dismantling the Kick-starter

Clamp the bearing collar of the kick-starter shaft between copper jaws or wood inserts in a vice (Fig. 84). Do not damage the thread of the splined bolt when driving out. To this end, loosen the nut M6 (WoF 10) only so far that it can be used as "thread protection". After removing the splined bolt, the kick-starter spring relaxes, the clutch voer turns to the right. Now, the complete kick-starter shaft can be drawn out of the clutch cover.

3.2.5. Dismantling the Clutch Actuating Mechanism

By turning clockwise, remove the pressure lever in the clutch cover from the worm of the bearing bush. Press the bearing bush out of the clutch cover (from the inside to the outside). For the replacement of the supporting bearing 6302 of the crankshaft, remove the circlip from the bearing bush and press out the bearing.

3.2.6. Demounting and Mounting the Clutch

The assembly device 05-MW 150-2 (Fig. 18) enables the dismantling and assembling of the clutch. To facilitate work, it is clamped in a vice. Fig. 20 shows the mounting position.

For dismantling or checking the clutch, it must be so positioned that the pressure plate (1) is not put on the propping screws (2) (Fig. 18).

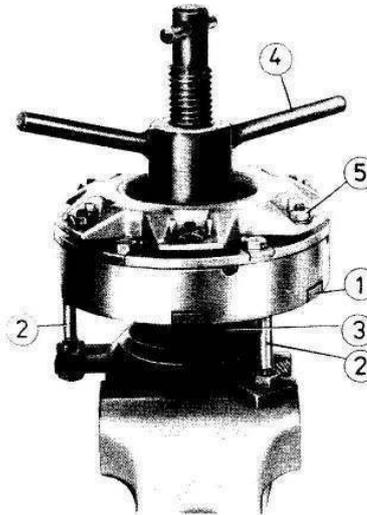


Fig. 18. Dismantling the clutch

For dismantling and assembling the clutch, the internal driver with drive gear (3) must be plugged on the assembly device. By turning the lock nut (4) clockwise, the clutch flange is relaxed and the nuts (WoF 10) (5) can be loosened and removed with lock plates. After removing the lock nut (4), the clutch can be dismantled into its individual parts (Fig. 21). Checking for wear is dealt with in Section 3.4.1.

Sequence of clutch assembling (Figs. 19, 19a, 20, 21)

- Put internal driver with drive gear (3) on the assembling device (Fig. 19);
- Place the pressure plate with spacer bolt (6) on the supporting screws of the assembling device (Fig. 19);
- Put the gear ring (7) in place (Fig. 19);
- Alternately fit internal segments (8) and external segments (8a) (the parcel of segments is centred by the internal driver);
- Mount the clutch body (9), screw in the hexagon-head screws (11) with lock plates (10) and lock them (Fig. 19a);
- Place the spacer washers 00-18.196 (14a) on the spacer bolts (Fig. 19a);
- Put the compression springs (12) on the clutch body (9);
- Mount the pressure flange (13) and tension it with the upper part of the clutch assembling device. Adding the lock plates (10), fasten the pressure flange by means of the nuts (14) and lock them (Fig. 20).

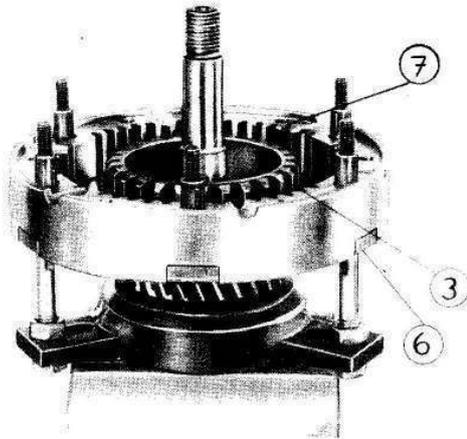


Fig. 19. Assembling the clutch - 1st phase

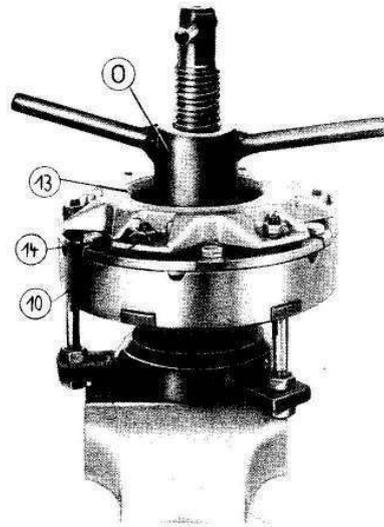


Fig. 20. Clutch - screwing the pressure flange in place

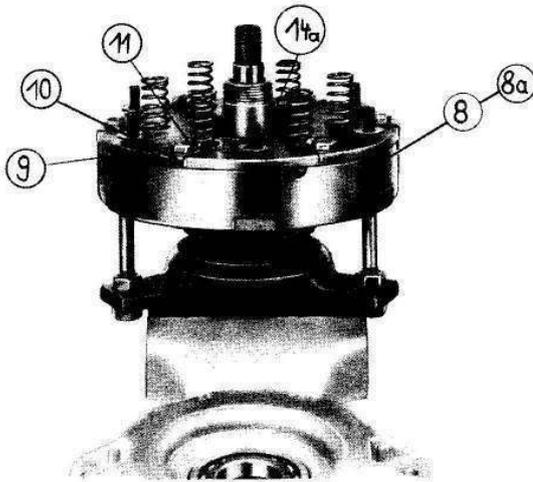


Fig. 19a. Assembling the clutch - 2nd phase

Functional test of the complete clutch in the assembling device:

The lock nut (4) of the assembling device (Fig. 18) is tightened by turning clockwise, it must be possible to turn the internal driver (3) with drive gear. The same test can be performed with the upper part of the O5-MV 150-2 assembling device with the clutch mounted in the engine.

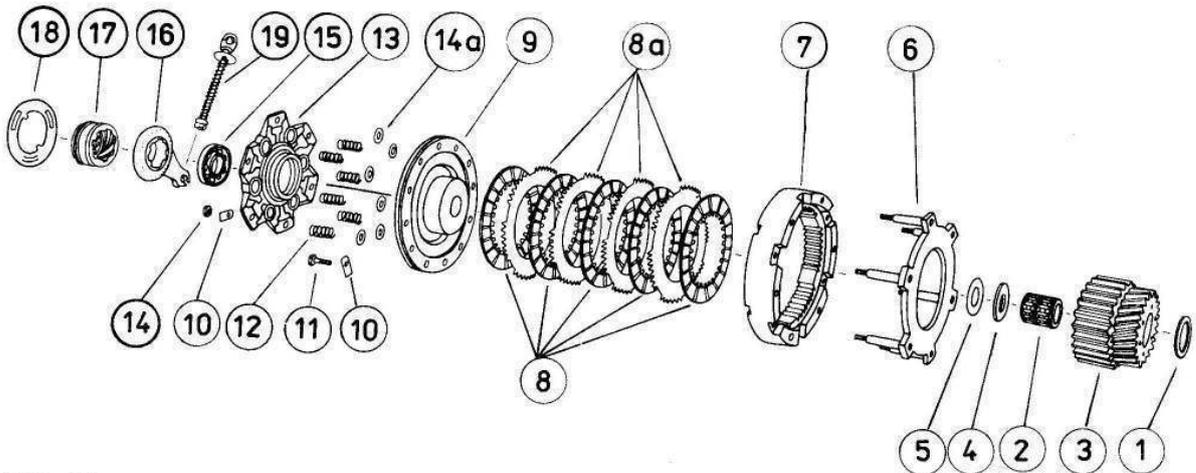


Fig. 21
Exploded view
of clutch

3.2.7. Demounting the Cylinder Assembly

Loosen the nuts (WoF 13) crosswise from the cylinder studs with a socket wrench, pull off the cylinder head and then the cylinder.

NOTE: When the engine is not dismantled, the opening of the crank compartment must be closed with a clean cleaning rag!

Press the gudgeon pin out by means of the pressing device (1) 22-50.010 and draw the piston from the connecting rod.

NOTE: Beating out the gudgeon pin is detrimental to the crankshaft and destroys the needle bearing on the pin!

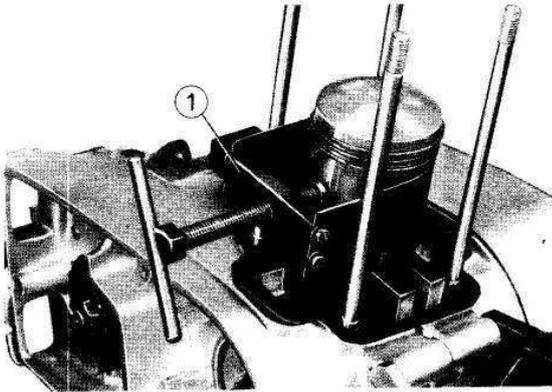


Fig. 22. Pressing out the gudgeon pin

3.2.8. Dismantling the Engine Dynamo Side

- Before loosening the nut of the sprocket wheel at the gearbox (WoF 24), bend up (1) the lock plate and apply the holding-up device (2) 05 MW 45-3 (right-handed thread).
(3) = idling contact switch

- Pull the sprocket wheel from the gearbox. If this cannot be done manually, use the puller 05 MW 45-3.

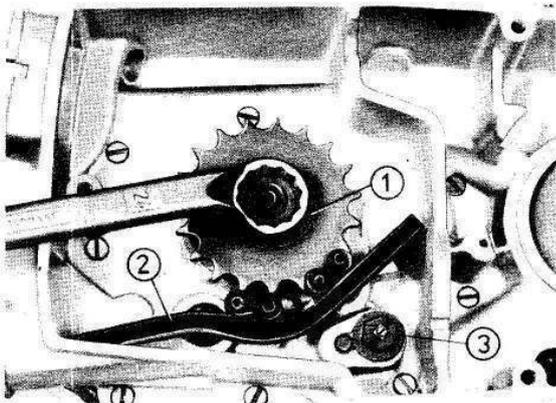


Fig. 23. Removing the sprocket wheel from the gearbox

- Unscrew the sealing cap (1), remove it with packing and take out the shims;
- Remove cylindrical roll (2) for armature detent and the wire circlip (3);
- Press out the rubber stopper (4);
- Loosen the housing fastening screws (14 screws) by means of a screwdriver and take out of housing;
- Open the locking handle of the engine assembling device.

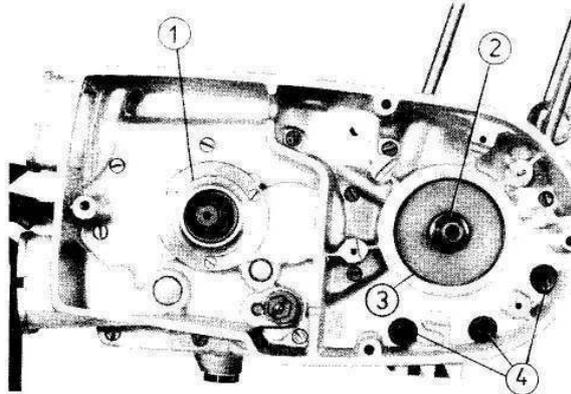


Fig. 24. Engine right-hand side

3.2.9. Separating the Two Housing Halves

The assembly bridge 22-50.430 is screwed on the right-hand housing half by means of two M 6 screws (1) (see Fig. 25). By means of the spindles (2) of the bearing extractor 6203 and the clutch puller, the housing halves are separated by uniformly turning the pressure spindles.

NOTE: The use of other means such as screwdrivers, chisels etc. leads to the destruction of the housing!

Take off the right-hand housing half, clamp the left-hand housing half in the engine assembling device.

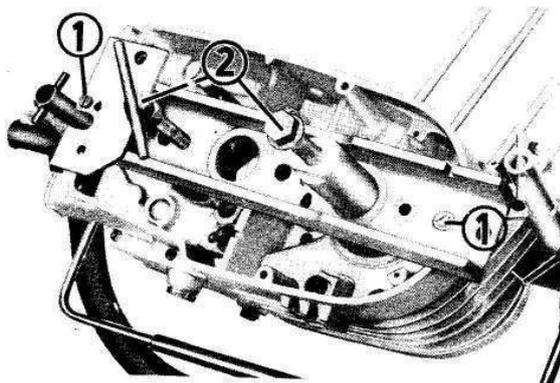


Fig. 25. Separating the housing

3.2.10. Dismantling the Gear-shift Mechanism and the Gearbox

(A) = driving shaft
(B) = driven shaft

Sequence of operations:

- Press the control arm (1) of the control member (2) out of the drum cam (3) in the direction of the arrow-head and pull the control shaft with control member (4) out of the housing;

NOTE: Do not damage the insulating disk (5) of the drum cam!

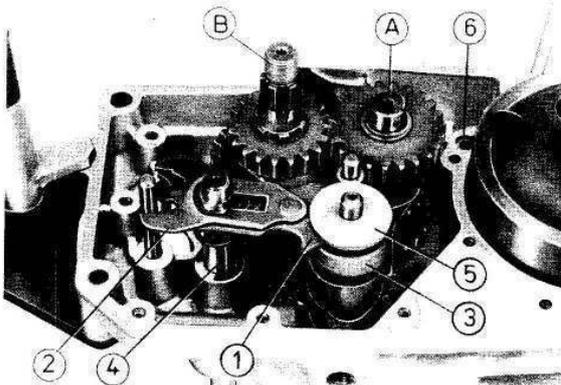


Fig. 26. Gear-shift mechanism and gearbox

- Remove the separating disk (6) (rubber) from the oil catch-pocket of the housing;
- Drive the driving and driven shafts out of their bearing seat from the clutch side by means of an aluminium, brass or copper mandrel. The gear-shift detent screw has been removed during a preceding operation.
- Pull the complete gearbox (driving and driven shafts, drum cam, guide bolt with selector forks) out of the left-hand housing half.

3.2.11. Pressing-out the Crankshaft

- Fasten the assembly bridge (1) 22-50.430 with the clutch puller (2) inserted on the clutch side of the left-hand housing half by means of the fastening screws (3) and (4).

NOTE: Before mounting the clutch puller, in any case place the pressure member (5) on the centring collar of the crankshaft (Fig. 28)!

- Press out the crankshaft by turning the pressure spindle (6) of the clutch puller clockwise; support the crankshaft with your right hand from below and retain it so that it cannot fall down when it leaves the bearing seat.

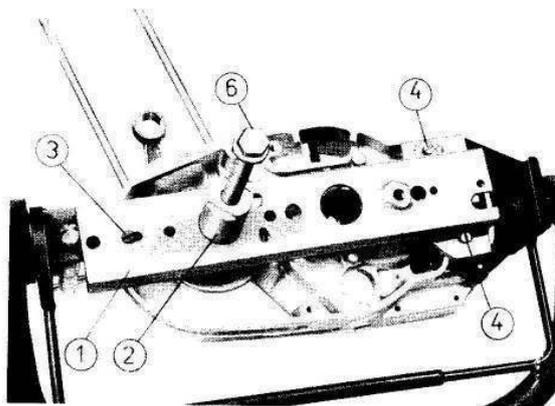
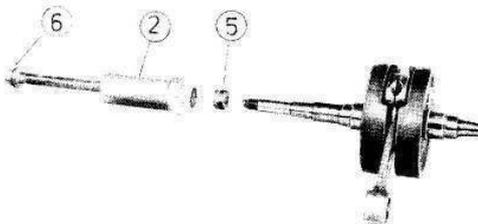


Fig. 27. Pressing out the crankshaft



3.2.12. Dismantling the Gearbox Bearing

Before removing the ball bearings, the two housing halves should be heated to prevent damage to the bearing seats in the housing. The ball bearings are driven out by means of the drift 11 MW 7-4.

Left-hand housing half:

Remove the circlip of the 6204 bearing from the clutch side and drive out the bearing from the gearbox compartment. Drive out the 6203 bearing from the outside towards the gearbox compartment (the circlip has been removed after the dismantling of the primary drive).

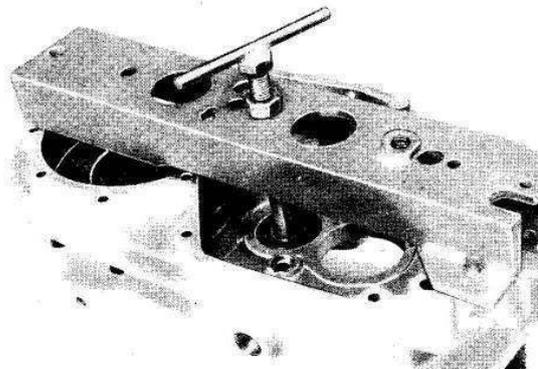


Fig. 29. Removing the 6203 bearing

Right-hand housing half:

Drive out the 6204 bearing from the gearbox compartment to the outside. Remove the 6203 bearing with pulling screw (1) and cartridge (2).

3.2.13. Pulling the 6306 Bearings from the Crankshaft

The crankshaft main bearings 6306 C 4 f are pressed off from the crankshaft by the ball bearing puller 22-50.431 (1). The two halves of the tool are applied between bearing and crank disk of the crankshaft, compressed in a vice and pre-tensioned with 2 screws M 8 x 100 (2). By screwing in two other screws with hardened pin at the start of the thread (3), the bearings are pressed against the crank disks of the crankshaft (Fig. 30).

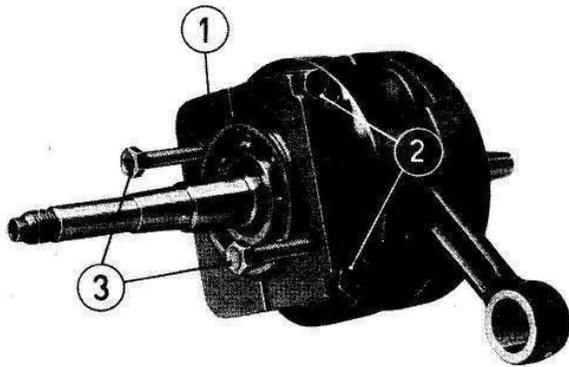


Fig. 30. Pulling the 6306 ball bearings from the crankshaft

3.3. Cleaning all Engine Parts

Before checking for wear, all engine parts are subjected to a careful cleaning process. The use of facilities and methods depends on the given possibilities. In any case, perfectly clean, non-corroded parts must be available. Pay particular attention to the free passage of the oil ducts for the crankshaft main bearings in the two housing halves. Push wire through the oil ducts (1).

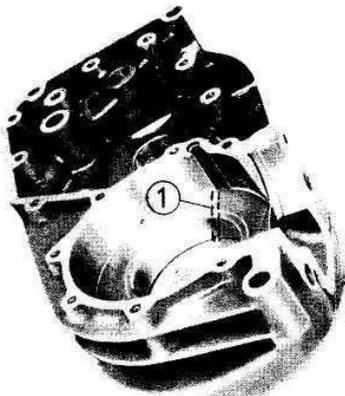


Fig. 31. Checking the oil ducts in the housing

Coked spots in the exhaust duct and transfer ports are cleaned in the cylinder. The combustion compartment in the cylinder head and the piston head must be cleaned with scraper and wire brush to remove carbonaceous oil deposits. After cleaning, these two surfaces must be bright and without scoring. In Section 3.4.3.4., information is given about the cleaning of the piston ring grooves.

3.4. Checking for Wear

3.4.1. Clutch and Clutch Operating Mechanism

POINTS OF WEAR:

- INTERNAL SEGMENT WITH FRICTION LINING

Wear is increased with incorrect clutch adjustment (no clutch lever clearance or clutch is allowed to slip excessively). In extreme cases, the friction lining will burn away. When the clutch can no longer be readjusted and when it slips when the engine is accelerated, new segments must be mounted.

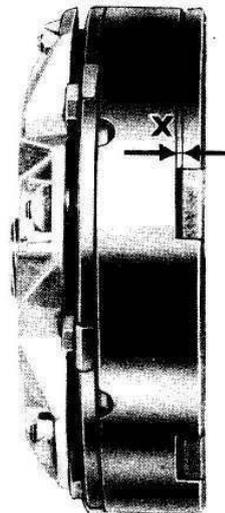


Fig. 32. Clutch wear value

This holds when the dimension "x" in Fig.32 falls below 0.5 mm. New segments have a thickness of 3.0 mm \pm 0.1 mm. Wear value: -0.3 mm

- EXTERNAL SEGMENT

They must be replaced, when they have become blue - tarnished due to clutch slipping - (softened!) or are distorted. Thickness in new state: 1.5_{-0.1} mm.

Deviation from plane condition of the surface is maximum 0.2 mm

- COMPRESSION SPRINGS

Their spring action may diminish, i.e. they relax. In severe cases, the clutch will slip even if all other components and the adjustment are in order.

Values in new condition:

Length, relaxed 28.3 mm ± 0.6 mm

Mounting length 17.0 mm

Spring force in mounted state 135 N (13.5 kp) ± 11 %

- DRIVE GEAR WITH INTERNAL DRIVER (Fig. 33)

Check that the notched-pin connection between drive gear and internal driver is in order. When the notched pin connection is loose, the internal driver with drive gear must be replaced (re-riveting is useless!).

- TOOTHING - DRIVER and GEAR RING

If noise is emitted when pulling the clutch, individual segments (external or internal, or the thrust plate show increased backlash in the gear ring or internal driver and they will clash when the clutch pressure is relieved. The noise can be removed when fitting the segments to the gear ring and internal driver individually and replacing segments with excessive play.

- NEEDLE BEARING AND CLUTCH THRUST BEARING

In the needle bearing for the internal driver, traces of wear will hardly be found, even after a longer period of operation.

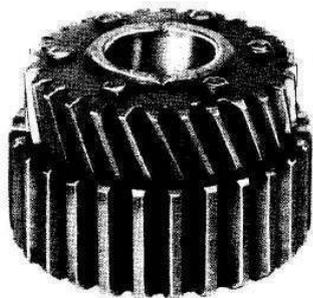


Fig. 33. Internal driver with drive gear

The clutch thrust bearing is caulked three times at uniform spacings at the outer ring, seated in the pressure flange (1). See to it that the outer ring of the thrust bearing does not turn in the pressure flange.

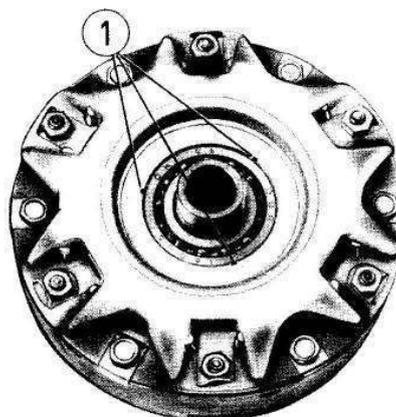


Fig. 34. Clutch thrust bearing

- CONE IN THE CLUTCH BODY

The cone may be damaged due to the slipping of the clutch on the cone of the crankshaft because of incorrect mounting. In slight cases, the clutch body can be repaired by grinding with grinding paste on the cone of the crankshaft.

- PRESSURE LEVER AND BEARING BUSH (Fig. 35)

Burr formation, points of pressure and sharp edges (1) at the teeth of the two components cause jerky engagement and disengagement of the clutch. These defects are removed by means of a suitable corundum stone or a special smooth cut file. Before assembling, put the two parts together and check that they are free to move easily.

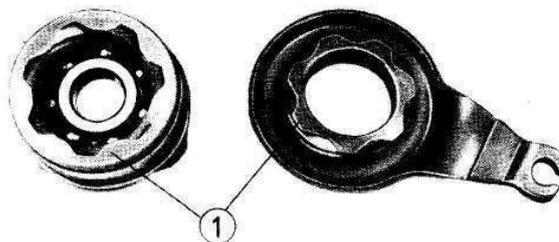


Fig. 35. Clutch actuating mechanism

3.4.1.1. Primary Drive

If there is excessive backlash between the drive gear (28 teeth) riveted to the clutch driver and the drive gear (68 teeth) to the gearbox, noise will be emitted when the engine is idling and in load change.

In new condition, the backlash is 0.036 mm to maximum 0.131 mm.

If the backlash is more than 0.25 mm, a new pair of spur gears must be mounted.

The radial play of the bearings 6306 and 6303 must be taken into account when measuring the backlash. The spur gears must be checked for damaged teeth.

3.4.1.2. Inevitable Wear on Kick-starter

Wear will mainly occur on the cam plate (1) if, during starting, the kick-starter is not fully kicked down. Due to this or to wrong ignition timing the engine will kick back and the cam plate will be destroyed due to abnormal stress (distortion or breakage).

The distorted or broken cam plate causes a reduction of the distance (x) between kick-starter gear and driver in the mounted condition of the kick-starter shaft, and this leads to heavy wear on the teeth (2) of the two gears.

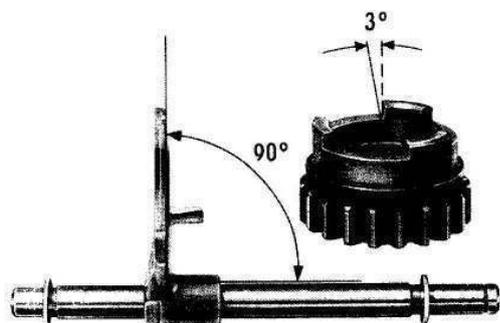


Fig. 36. Kick-starter shaft

3.4.2. Gears, Shafts and Selector Forks

The relief cuts in the claws at the control gears (on both sides) and the counter gears are arranged at an angle of 3° .

In the engaged condition (gear engaged), due to the wedge effect of the relief cuts, a force is produced which is designed to retain control gear and toothed gear (loose gear) in mesh.

Not only the gear-shift detent lever (1) (Fig. 17) keeps the various gears in the engaged state but also the wedge effect of the relief cuts contributes to this end.

When the claws of the control gears are heavily worn, the bearing surface becomes smaller and the gears jump out of engagement.

The selector forks must be checked for their angular condition; they must be perfectly at right angle to the guide bolt of the selector forks (90°). Slightly distorted selector forks can be straightened in a cold state, but great care must be taken.

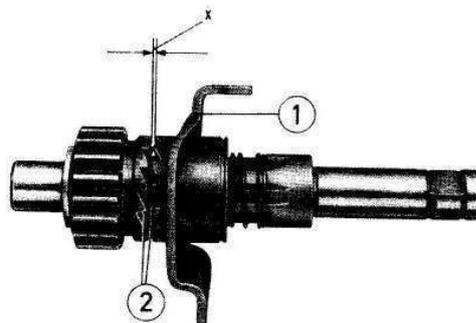
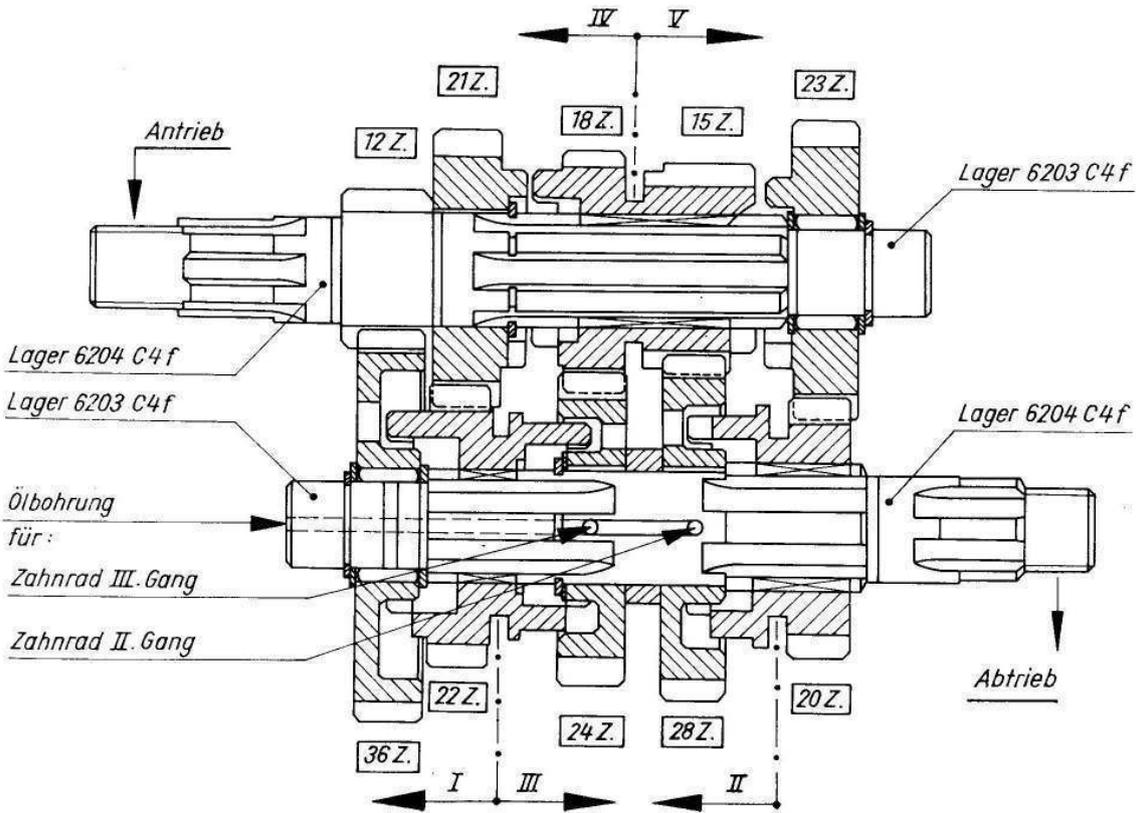


Fig. 37. Selector forks and claws

A selector fork not at right angle as described above will continually strike against the control edge and will be tarnished and become blue like the control gear. As a consequence, the hardened case will be lost and the two components become useless already after a short period of operation, hence, they must be replaced. For a proper check of the gearbox, it is necessary to clean all parts carefully in order to perceive blue tarnished parts clearly.

The drive shaft must be checked for clean oil bores for the lubrication of the toothed gears for the 2nd and 3rd speeds (Fig. 38).

In general, tarnished, i.e. blue, gears, shafts and selector forks must be replaced by new parts in any case.



Antrieb = drive
 Abtrieb = output
 Lager = bearing

Fig. 38. Gear-shift mechanism

Ölbohrung für: Zahnrad III. Gang, Zahnrad II. Gang =
 Oil hole for: gear 3rd speed, gear 2nd speed

3.4.2.1. Gear-shift Shaft with Control Member and Control Stop

The control member must be checked that the control arm is free (1), (2) to move easily. The compression spring (3) must fit well in the countersunk bore in the gear-shift shaft. The same applies to the lock plates (4), (5), (6), (7). Dimension "a" is 16.6 mm. This section limits the angle of rotation of the gear-shift shaft (8). The return spring (9) has a long service life; it should be checked for cracks.

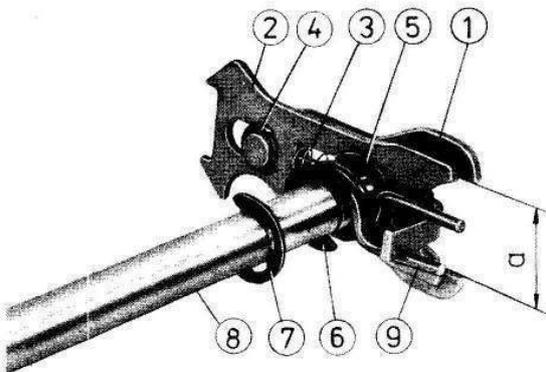


Fig. 39. Foot-operated gear-shift shaft with control member

The cylindrical pin 8 x 80 (control stop) pressed into the housing, see Fig. 57, must not be loose or distorted. The serration of the foot-operated gear-shift shaft will be destroyed when the foot-operated gear-shift lever is loose and will not be re-tightened. When the serration is severely damaged, the foot-operated gear-shift shaft with control member must be replaced.

3.4.3. Crank Assembly

3.4.3.1. Cylinder and Piston

When an engine output reduction occurs which is not due to wrong ignition timing, carburettor tuning, leaky shaft seal rings or clogged exhaust system (back pressure too high) while the dismantled piston is "black" round the entire piston skirt below the piston ring portion, then piston and cylinder must be replaced (compression and combustion pressure escapes between piston rings and cylinder wall).

In this case the cylinder liner (zone of port) shows a flare and immediately below the upper edge of the liner a collar can be felt.

Changing only the worn piston rings is useless in this case.

Replacement of the cylinder can be effected by mounting a new cylinder with piston or by regenerating the dismantled cylinder (this is more economical); for this purpose, the cylinder is reground after a new piston (taking the specified mounting clearance of 0.04 mm into consideration). Pistons of the following oversizes are available:
69.50 mm; 70.00 mm; 70.50 mm; and 71.00 mm.

3.4.3.2. Control Measurement of Piston and Cylinder

In the new condition of piston and cylinder, the mounting clearance between cylinder liner and piston is 0.05 mm. The wear limit is about 0.09 mm. Then a new or a replacement cylinder must be mounted because the noise increases with increasing mounting clearance (especially with load changes and when the engine is unloaded). The nominal size of the piston is measured 15 mm above the piston lower edge. Only a new piston can reach the specified nominal size in a control measurement taking the measuring instructions into consideration. A piston that has already run is deformed. The cylinder must be measured in the lower and upper third of the liner by means of an internal measuring instrument. Without measuring instrument, wear can be identified by the edge (collar) about 8 mm below the upper edge of the cylinder liner.

3.4.3.3. Removal of Slight Piston Seizing

If the piston has been seized, in a slight case, the piston can be restored to proper working condition by finishing the points of seizure by means of a corundum stone soaked in a fuel-oil mixture. Slight seizure marks of aluminium remains (caused by the piston) in the cylinder are removed by means of fine emery paper (grain 400) with every care. The retouching operation in cylinder and on piston must be carried out in longitudinal direction only.

NOTE: It is of no use to remove only the points of seizure and to leave the cause of jamming unchanged.

Below are a few examples of such causes:

- Lack of oil (no fuel-oil mixture but only fuel was filled up);
- Insufficient fuel supply and, hence, shortage of oil due to insufficient fuel feed from fuel tank to carburetter. Vent holes in tank cover clogged;
- Fuel filter cock clogged or fastening screws at handle excessively tightened (the handle must move easily);
- Basic carburetter tuning changed;
- Ignition timing wrong; consequently, overheating of the engine;
- Exhaust system changed, back pressure wrong;
- Air filter system defective;
- Engine takes in wrong air (mixture too lean in the upper engine speed range).

3.4.3.4. Piston Rings

Before used pistons are employed again, the piston rings and ring grooves must be subject to special care.

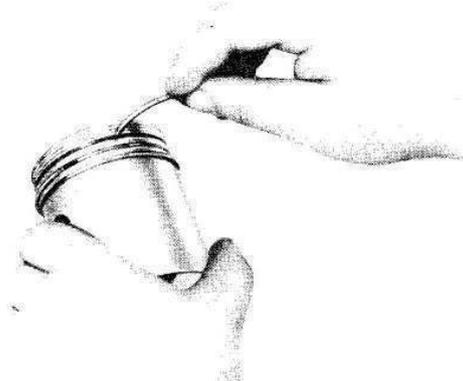


Fig. 40. Cleaning the ring grooves

Piston rings sticking in the grooves due to excessive or unsuitable oil in the fuel (petrol mixture) are carefully removed; they must not be expanded too much. The carbonaceous oil deposit on the interior circumference must be removed and the ring grooves must be carefully cleaned by means of an old broken ring of the same type.

After this operation, the piston rings must be freely movable in the ring grooves. The piston rings must not be exchanged; they must be fitted in the same groove from which they were taken.

WIDTH OF THE RING GROOVES

upper ring groove	2.08 +0.02 mm
central and lower ring groove	2.04 +0.02 mm
wear value	2.10 mm

THICKNESS OF THE PISTON RINGS

all piston rings	2.00 -0.010 mm
wear value	-0.022 mm
	1.90 mm (maximum)

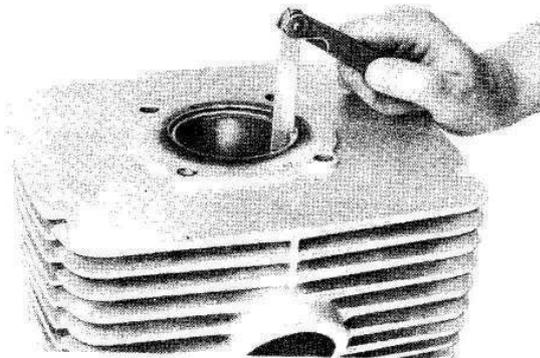


Fig. 41. Measuring the piston ring gap

Before fitting the piston rings, the state of wear must be checked. For this purpose, the piston ring is inserted in the cylinder liner, about 10 mm below the upper edge of the cylinder, and then the ring gap is measured. In new condition of the piston rings, the gap should be 0.2 mm. When the ring gap is more than 1.6 mm, piston and cylinder are unserviceable.

When the arresting pins in the piston are loose (face of the pins is bright), or if they are missing, a new piston with cylinder (which may be ground) have to be mounted.

NOTICE: The edges of the ports must be chamfered otherwise awkward noise will be produced with the engine unloaded! Therefore, slightly chamfer the ports of newly ground cylinders!

3.4.3.5. Cylinder Head

When the cylinder head has become leaky - indicated by the oiled up upper ribs of the cylinder -, the cylinder head can be refinished on a surface plate by means of fine emery cloth (grain 400) to a limited extent, performing motions in a circle, unless there is a new cylinder head available.

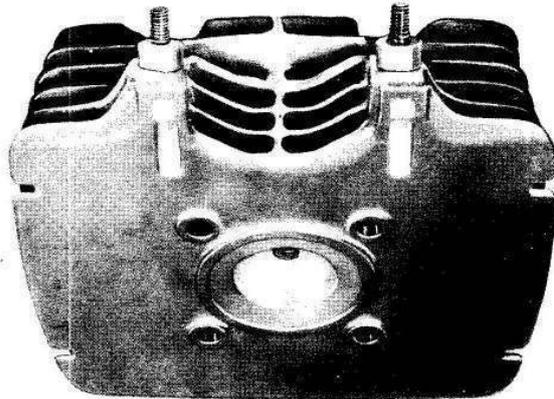


Fig. 42. Cylinder head - sealing surface and combustion chamber

When a cylinder head is leaky, an additional insertion of an aluminium shim is wrong. This will not be a remedy, the compression ratio will be changed and a further power reduction will be caused.

NOTICE: When demounting and mounting the cylinder head, take care that the fastening nuts are loosened and tightened uniformly and crosswise.

If this is neglected, the cylinder head will be subjected to particular stresses and become leaky.

3.4.3.6. Crankshaft

An inspection will show whether the collars of the sealing rings (1) are worn too much, whether the thread for fastening the clutch (2), the centring collar (3) and the thread for the anchor bolts (4), the cones for the clutch (5) and the anchor (6) are still in proper condition.

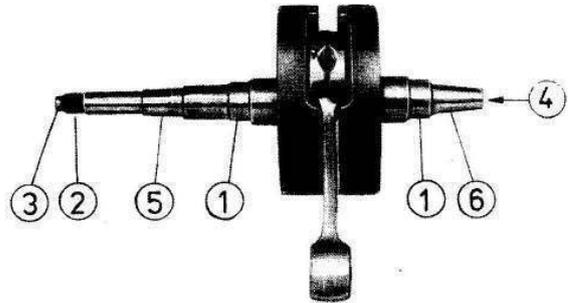


Fig. 43. Crankshaft

When defects found cannot be removed by refinishing, a new or a regenerated crankshaft must be mounted.

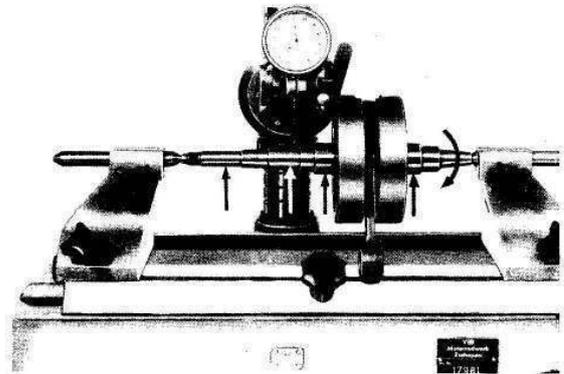


Fig. 44. Measuring the amount the crankshaft is out of true radially

Then the amount the crankshaft is out of true radially is measured at the points indicated in Fig. 44. For this purpose, the crankshaft is clamped between two fixed centres of a testing equipment or of a lathe.

The permissible amount is 0.03 mm. Greater values lead to ignition troubles at high rotational speeds, vibrating of the engine and leaky shaft seal rings.

The result is a poor engine output. A new crankshaft should also be tested because it may have been subject to transport damage.

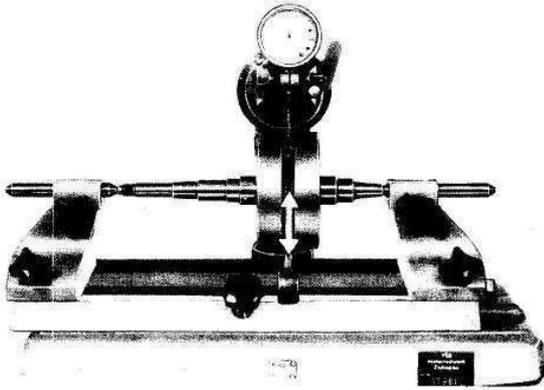


Fig. 45. Measuring the radial play of the connecting rod

Worn needle bearings in the big end and small end of the connecting rod are indicated by noise under load. Measurement of the big-end boss is taken in the manner shown in Fig. 45. With the crankshaft in new condition, the radial play is 0.020 to 0.035 mm. If the value is more than 0.05 mm, the crankshaft is worn.

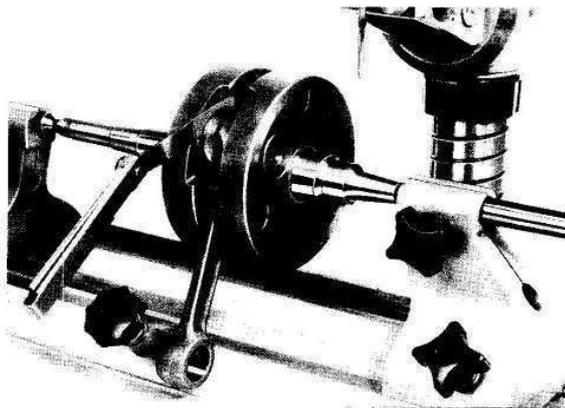


Fig. 46. Checking the axial play of the big-end boss

The condition of the bearing in the small-end boss can only be judged subjectively by means of the conventional workshop equipment. The gudgeon pin must be free to be turned in the conrod while the resistance offered by the pin is just felt. Gudgeon pins showing signs of wear or a blue colour due to tarnishing are useless and must be replaced.

Axial play of the big-end boss between the crank disks is 0.170 to 0.563 mm.
Wear value: 1.0 mm.

3.4.4. Case and Packings

First and foremost, the sealing surfaces of the case must be checked. If they are damaged, they can be refinished in cases not too severe in the manner shown in Fig. 42 for the cylinder head, using a surface plate and fine emery cloth.

Further checks in the case concern the bearing seats and the grooves of the snap rings; they must be in proper condition.

Bearing seats are useless when the bearings can be pushed by hand into the COLD case or on the bearing seat of shafts (with the bearing inner ring in a COLD state).

All paper packings are replaced by new ones in any case.

The shaft seal rings must be checked for fissures in the sealing lip, the wear and tension of the lip, further for the presence of the spring in the groove provided for this purpose and the quality of the connection of the two spring ends. It is better to replace a shaft seal ring prematurely than to dismantle the engine once more a month later because of this relatively cheap part.

3.4.5. Radial Grooved Ball Bearing for Crankshaft and Gearbox

Defective crankshaft main bearings are identified by the characteristic engine noise and by the impossibility to set the contact breaker gap correctly.

The condition of the bearing tracks and the balls can be found by inspection after pressing the bearings with plastic cage apart. Worn bearings are damaged by pitting.

For bearings the rule also holds that after a prolonged period of operation of the engine all bearings should be replaced by new ones (on the occasion of a general overhaul).

The following bearings have to be used:

For the crankshaft, two 6306 C 4 f (plastic cage) as main bearings and one 6302 C 3 f as supporting bearing for the crankshaft in the bearing bush (plastic cage) have to be used.

In the gearbox, two 6203 J C 4 bearings, one 6204 J C 4 bearing and one 6304 J C 4 bearing

are mounted.

4. Assembling the Engine

4.1. Preliminaries

It is taken for granted that all engine parts are properly cleaned. Defective parts were identified and rejected. The parts that are further usable were prepared for re-fitting. Before describing the assembly of the engine, we below give some instructions regarding the selection and mating of various units of construction.

4.1.1. Selection of Piston and Cylinder

The cylinder of the ETZ 250 differs from the cylinders used so far. In the cylinder, four transfer ports are arranged. The induction duct has a guide nose for the piston rings. The piston can only be used in the 69.6 design with a curve adapted to the new cylinder.

Marking (Tolerance group)	Piston 69.6	
	Nominal size in mm	Nominal size in mm
- 1	68.99	68.94
0	69.00	68.95
+ 1	69.01	68.96
+ 2	69.02	69.97

This Table gives piston and cylinder dimensions in new condition which were procured by our Department Spare Parts Sale or which were mounted in our works.

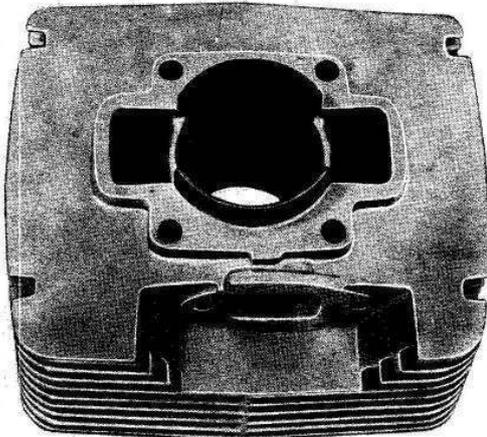


Fig. 47. Cylinder - lower sealing area

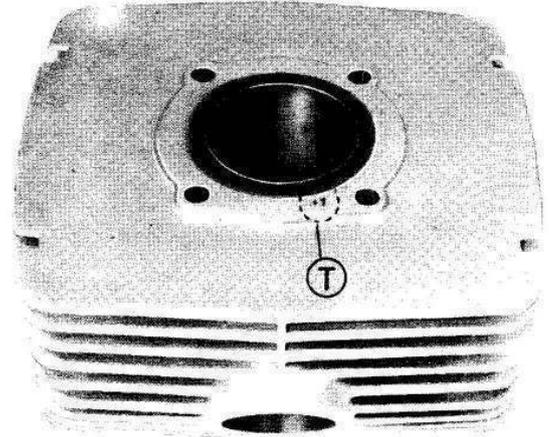


Fig. 49. Cylinder marking
(T) Tolerance group

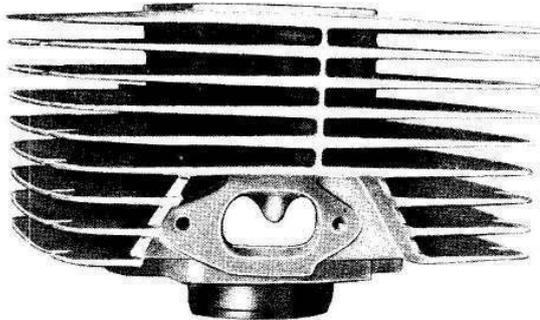


Fig. 48. Cylinder - induction part

A mounting clearance of 0.05 mm between piston and cylinder is specified. The following Table facilitates the selection of the parts to be mated.

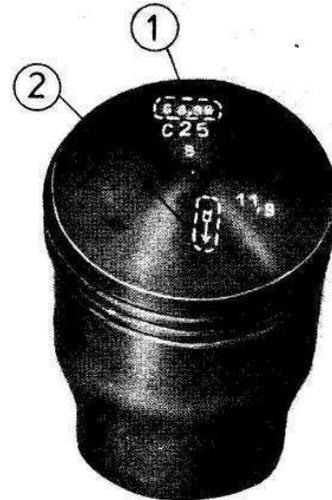


Fig. 50. Piston marking

- (1) Nominal size in mm
- (2) Mounting direction

4.1.2. Regeneration of the Cylinder

Each cylinder can be ground out for maximum 2.00 mm related to the basic size (69.00 mm).

Pistons in the oversizes of 69.50; 70.00; 70.50; 71.00 are available.

The cylinder is ground in the cylinder grinding shop according to the available piston and taking the specified mounting clearance of 0.04 mm into account; it is delivered in the mated state.

4.1.3. Selection of the Needle Bearing for the Gudgeon Pin (New Parts)

Needle bearings can easily be selected with the help of the Table shown in Fig. 51. This is only possible for new

parts (crankshaft, piston and gudgeon pin and needle bearing).

Pay attention to the fact that commercial packings of needle bearings are marked only with the mean dimensions (determined from upper and lower needle dimensional deviations). The bearings are not marked! Therefore, keep open packings separate.

When used gudgeon pin, piston and crankshaft are used further, then fit the needle bearing according to feel. (Colour marking cannot be identified readily.) The gudgeon pin must be fitted in such a way that it is possible to turn it without jamming while the resistance offered to motion is just felt.

Connecting rod marking	Gudgeon pin marking	Needle bearing mean dimensional deviation (mm)
black	white	- 2; - 3
	black	- 1; - 2
green	white	- 4; - 5
	black	- 3; - 4
white	white	- 6; - 7
	black	- 5; - 6
blue	white	- 8; - 9
	black	- 7; - 8

Fig. 51. Table for bearing selection (dimensions in mm)

4.1.4. Bearings and Sealing Rings

For the gearbox, bearings with plastic case are used.

- 2 x 6204 J C 4,
- 1 x 6203 J C 4 and
- 1 x 6304 J C 4

The crankshaft main bearings 6306 must be used in the sorted group C 4 f and the supporting bearing of the crankshaft in the bearing bush (clutch cover) in the sorted group C 3 f. As clutch thrust bearing, a grooved ball bearing 16 005 is fitted.

The shaft seal rings D 25 x 72 x 7 must be resistant to fuel and oil (only use original shaft seal rings).

The needle bearing for the clutch driver should be selected according to the following Table when a new driver is mounted.

Clutch driver (marking)	Needle bearing (mean deviation in mm)
yellow	-1; -2; -3; -4
black	-2; -4; -5; -6
green	-5; -6; -7; -8; -9

4.1.5. Pre-assembly of the Gearbox

All drive gears and needles of bearings must be provided with engine oil when fitting.

4.1.5.1. Completing the Drive Shaft (A)

- Slip on the drive gear for the 4th speed (1) up to the fixed wheel (2), mount thrust washer (3) and circlip (4);

NOTE: Pay particular attention to the proper fit of the circlips in the groove. Checking by striking the shaft on hardwood, keeping the drive gear (1) in one hand.

- Slip the control gear for the 4th and 5th speeds (5) on the drive shaft; take care that the side with the 18 teeth points to the drive gear for the 4th speed (1);
- Place a hardened and ground spacer (6) against the collar (start of the grooves). Two of these spacers are required on the drive shaft and two on the output shaft. They are exchangeable.
- Slip on the drive gear for the 5th speed (7) and fit the 24 needles (8) (2.5 x 11.8), then mount the spacer (6) and the circlip (9) (take care that the circlip is well seated in the groove).