Repairing and Re-bushing of Connecting Rods

Job No.
03–13

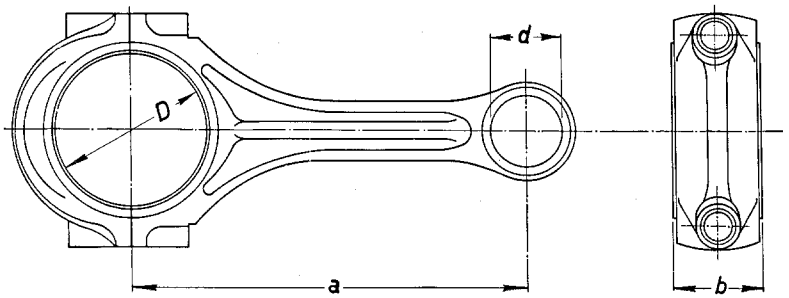


Figure 03–13/1

Dimensions of Connecting Rod
in mm

Model	Distance a	Base bore D	Base bore d	Width b
OM 636	193.95 / 194.05	54.000 / 54.019	25.000 / 25.021	33.800 / 33.784
OM 621	148.95 / 149.05	55.600 / 55.619	29.000 / 29.021	31.880 / 31.841

The connecting rods of OM 636 were changed several times. Even though the repairing is similar for all versions, some important instructions have to be taken into consideration when subsequently installing reinforced connecting rods in older engines of the OM 636 (see Job No. 03–11, Page 03–11/3 and 03–11/4).

1. General

a) Select the connecting rods, so that the difference in weight is within the range of 10 g for the OM 636 and 5 g for the OM 621 for the complete set of connecting rods installed in any one engine. For this reason the connecting rods are classified in different weight groups with corresponding color coding (see Figure 03–13/3).

b) The etched numbers (1 to 4) on the connecting rods must correspond to the numbers etched on the big-end caps (see Figure 03–13/2). The number 1 indicates the 1st cylinder, number 2 the 2nd cylinder and so on.

c) Connecting rod with bushing, piston and piston pin must all have the same color code to ensure proper force-fit and clearance.

The pistons must be selected in such a way that the difference in weight is within the range of 4 g in any one engine.

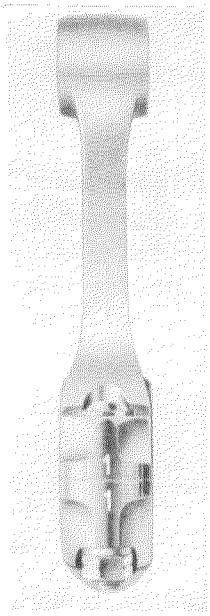


Figure 03–13/2

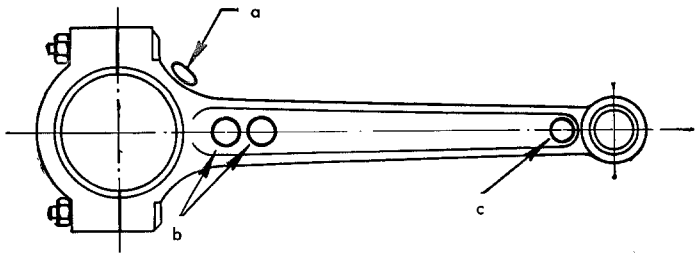


Figure 03–13/3

a = Color code of overhaul stages for connecting rods with bearing shells installed

None = Standard size
Red = 1st overhaul stage
White = 2nd overhaul stage
Yellow = 3rd overhaul stage
Blue = 4th overhaul stage

b = Color code of the weight groups for connecting rods

c = Color code for corresponding small-end bushings, piston pins and pistons! Recently, also connecting rods without the colour mark (c) are supplied. These connecting rods can be installed together with amber or green marked piston pins, for the OM 636 or black or white marked piston pins for the OM 621.

2. Fitting of Bearing Shell Halves

Clearances between Crankshaft Journals and Connecting Rod, with fitted Bearing Shells

Model	Radial *	Axial	Crush of bearing shell halves
OM 636	0.05 to 0.07	new 0.10 to 0.21 after repair up to 0.5	+ 0.01
OM 621	0.045–0.065	new 0.120–0.259 after repair up to 0.5	+ 0.01

* The radial clearance specified in the above table is an average clearance which must be adhered to in actual operation.

The bearing shell halves of the big-end bearings are supplied ready for assembly similar to the bearing shell halves of the main bearings. The bearing shell halves are identical and can be interchanged as long as only new bearings are involved. The fitting of the big-end bearing shells is similar to the fitting of the main bearing shells (see Job No. 03–9 as well as Figure 03–5/2 and 03–5/3).

The dia. of the big end basic bore is 54.000–54.019 mm for the OM 636 and 55.600–55.619 mm for the OM 621; with fitted bearing shells, standard: 49.99–50.02 mm for the OM 636 and 51.99–52.02 mm for the OM 621; reduce this value by 0.25 mm each for the repair sizes I, II, III and IV.

By regrinding the sides of the crankshaft bearings and finishing of the connecting rods, the axial clearance is increased. An increase of this axial play of up to 0.5 mm is permissible.

3. Replacing of small end bushing

Measures of the small end bushing

	Basic bore in the conn. rod		Outer dia. of the small end bushing		Inner dia. rough turned		Inner dia. finished [1] (bushing pressed in)	
	OM 636	OM 621	OM 636	OM 621	OM 636	OM 621	OM 636	OM 621
Standard	25.000 / 25.021	29.000 / 29.021	25.048 / 25.035	29.048 [2] / 29.035	21.500 / 21.552	25.500 / 25.552	22.007 / 22.013	26.012 x / 26.018
with larger outer dia. (for repairs only)	25.500 / 25.521	29.500 / 29.521	25.548 / 25.535	29.548 [2] / 29.535	21.500 / 21.552	25.500 / 25.552	22.007 / 22.013	26.012 x / 26.018

[1]) Regarding tolerance groups of the finished small end bushing, refer to the table overleaf.

x [2]) On piston rods with splash lubrication (rolled bushing) ⌀ 29.096 / 29.058 or 29.596 / 29.558

Worn out small end bushings should be replaced. The overlap of the small end bushing in the bore should at least amount to 0.03 mm. The small end bushing of the **OM 636** (without lubricating groove) should be pressed in and caulked in the basic bore in the groove provided for this purpose (Figure 03–13/4).

On the **OM 621** press small end bushing with lubricating groove and oil bore into connecting rod with oil bore so that the oil hole coincides with the bore in the connecting rod.

On the OM 621 engine the gudgeon pin boss forced feed lubrication has been abandoned including the hole through the piston rod. The gudgeon pin boss of these engines now has three holes for splash lubrication. The ID of the small end bushing has crossed grooves at the upper hole, the two lower holes are provided with one oil pocket each. (Fig. 03–13/4 a.)

Upon insertion of the small end bushing for the OM 636, use a cutter 35 mm dia. and 3 mm wide to machine the lubricating groove for gudgeon pin lubrication (observe dimensions given in Fig. 03–13/4).

Then finish the bore and chamfer the edges on both sides. If no fine boring machine is available for this work, use an adjustable reamer to ream the bore cautiously. Ream the bore in parallel with the big end bore.

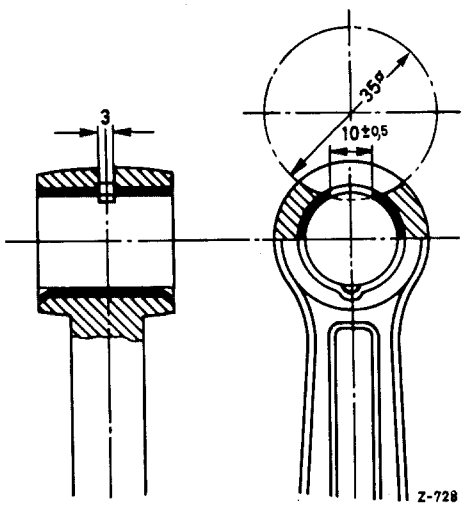
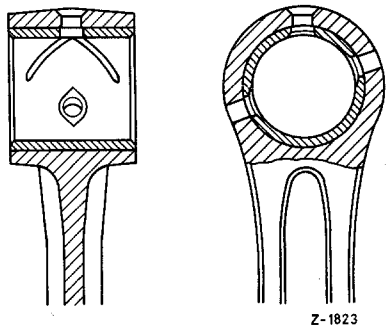


Figure 03–13/4

OM 636

Cutter dia. 35 mm
Cutter width 3 mm
Length of lubricating groove 10 mm
Small end bushing is caulked in the connecting rod



If the basic bore in the connecting rod is worn out ream it to 25.500–25.521 mm for the OM 636 and 29.500–29.521 mm for the OM 621 and press in a bushing which is thicker by 0.5 mm.

The piston pin clearance amounts to 0.010–016 mm. To ensure that this clearance is obtained, use connecting rod with bushing and piston pin of identical colour mark (see Figure 03–13/3 and table overleaf). Also choose a piston of the same colour code.

Color Codes of Matched Connecting Rods, Piston Pins and Pistons

Model	Color	Small-end base bore	Diameter of piston pin	Running clearance	ID of piston pin boss
OM 636	yellow	22.007 / 22.010	21.997 / 21.994	0.010 to 0.016	21.993 / 21.990
	green	22.010 / 22.013	22.000 / 22.997		21.996 / 21.993
OM 621	black	26.012 / 26.015	25.997 / 25.994	0.015 to 0.021	25.993 / 25.990
	white	26.015 / 26.018	26.000 / 25.997		25.996 / 25.993

x Now, pistons, gudgeon pins and piston rods for model OM 621 are available without color coding, and the running clearance between gudgeon pin and small end bushing may be 0.012–0.024 mm.

4. Tightening Connecting Rod Bolts

The connecting rod bolts are without lock washers and are tightened to an elongation of 0.1 mm (Figure 03–13/5).

The elongation must be measured with a dial gauge or a micrometer and corresponds to a tightening torque of 3.75 to 3.80 mkg. If the nut is loosened the bolt should return to its original length. Small deviations of up to 0.01 mm are permissible. A larger deviation is a sign that the bolt has been tightened too much and has been overstretched. In this case use a new connecting rod bolt and nut.

In exceptional cases the nut can be tightened with a torque wrench. Make sure, however, that the thread of the connecting rod bolt and the thrust surface is well oiled with graphited oil.

The head of the connecting rod bolt must not protrude beyond the side of the connecting rod and must be properly seated in the recess. The connecting rod bolt must be tightly seated in the bore of the connecting rod. For this reason the tolerance of the shank diameter of the connecting rod bolts is divided in two stages (plain 10.001 to 10.008, white 10.009 to 10.016 mm). The head of the thicker connecting rod bolt (10.009 to 10.016 mm) is marked with white paint. The diameter of the bore in the connecting rod is 10.000 to 10.015 mm.

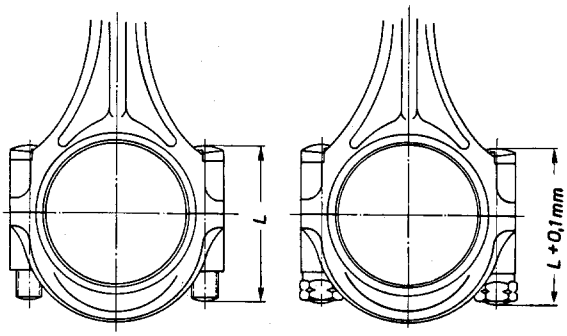


Figure 03–13/5

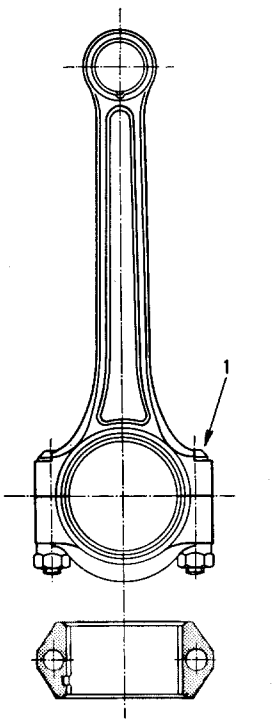


Figure 03–13/6

1st version

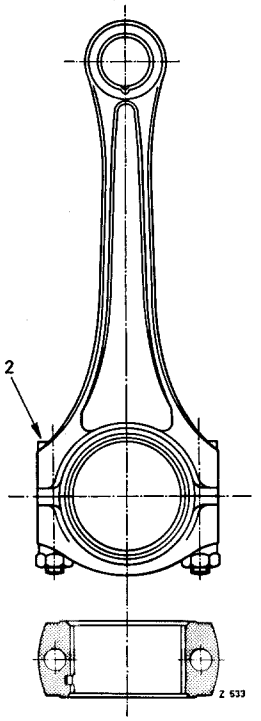


Figure 03–13/7

2nd version reinforced

1 Connecting rod bolt with securing nose
2 Connecting rod bolt with toothed head

In the 1st connecting rod design for OM 636 (see Figure 03–13/6) the connecting rod bolts were secured against turning by two noses. In the 2nd design (see Figure 03–13/7) the connecting rod bolt is provided with a toothed head which has a force-fit seat in the bore of the connecting rod and secures the bolt against turning.

Bolts with worn teeth must be replaced.

5. **Squaring Connecting Rod**

After every repair operation and before assembly in the engine the connecting rod must be checked on a suitable testing device to ensure that the two bores are correctly aligned (Figure 03–13/8).

The permissible deviation from parallelism of axis is 0.03 mm and the permissible twist is 0.1 mm. In both cases the permissible deviation is calculated in relation to a length of 100 mm.

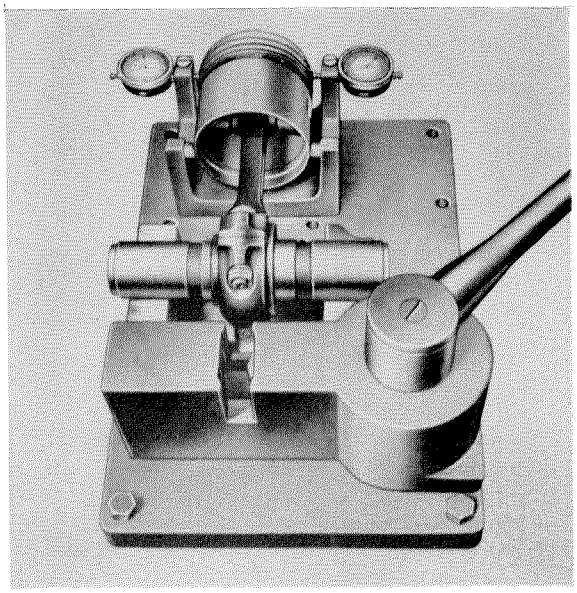


Figure 03–13/8