

03-320 Mounting of crankshaft

Engine removed and disassembled.

Data

| Crankshaft standard dimension and repair stages | Crankshaft bearing journal diameter | Width of crankshaft thrust bearing journal | Crank pin diameter | | Width of crank pins |
|---|-------------------------------------|--|------------------------------|------------------------------|---------------------|
| Standard size | <u>63.965</u> | <u>27.000</u> | <u>51.965¹⁾</u>) | <u>47.965²⁾</u>) | <u>50.000</u> |
| | 63.950 | 27.021 | 51.945 | 47.945 | 50.100 |
| 1st repair stage | <u>63.715</u> | up to 27.50 | <u>51.715¹⁾</u>) | <u>47.715²⁾</u>) | up to 50.30 |
| | 63.700 | | 51.695 | 47.695 | |
| 2nd repair stage | <u>63.465</u> | | <u>51.465¹⁾</u>) | <u>47.465²⁾</u>) | |
| | 63.450 | | 51.445 | 47.445 | |
| 3rd repair stage | <u>63.215</u> | <u>51.215¹⁾</u>) | <u>47.215²⁾</u>) | | |
| | 63.200 | 51.195 | 47.195 | | |
| 4th repair stage | <u>62.965</u> | <u>50.965¹⁾</u>) | <u>46.965²⁾</u>) | | |
| | 62.950 | 50.945 | 46.945 | | |

| Basic bore and bearing play | Crankcase ³⁾ | Connecting rod | |
|---|------------------------------|------------------------------|------------------------------|
| Basic bore diameter | <u>68.480⁴⁾</u>) | <u>55.600¹⁾</u>) | <u>51.600²⁾</u>) |
| | 68.500 | 55.619 | 51.619 |
| Permissible out-of-round and conicity of basic bore | 0.01 | 0.01 | |
| Seat width of thrust bearing shell ³⁾ | <u>22.379</u> | | |
| | 22.400 | | |
| Radial bearing play | when new | 0.025–0.045 ⁵⁾) | 0.030–0.055 ⁵⁾) |
| | wear limit | 0.09 | 0.08 |
| Axial bearing play | when new | 0.10–0.22 | 0.22–0.38 |
| | wear limit | 0.30 | 0.50 |

¹⁾ Engines 116 and 117 except ²⁾.

²⁾ 116.960/961 (AUS) (J) (S) (USA) 116.962/963 and 117.962/963.

³⁾ Machined together with the crankshaft bearing caps.

⁴⁾ Tolerance range indicated on crankshaft bearing cap with paint, 68.480–68.490 blue, 68.490–68.500 red.

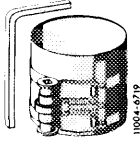
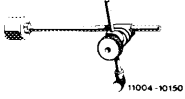

⁵⁾ The mean value is desirable for radial bearing play.

| Tightening torques | | Nm |
|-------------------------------------|--|---------|
| Crankshaft bearing threaded stud | Threaded stud in crankcase ¹⁾ | 30 |
| | Nut M 10 x 1 and lateral bolts | 50 |
| Connecting rod nuts | Initial torque | 40–50 |
| | Angle of rotation torque | 90–100° |
| Crankshaft end bolt | with 3 diaphragm springs ²⁾ | 270–330 |
| | with 4 diaphragm springs ²⁾ | 370–400 |
| Necked-down bolts for driven plates | Initial torque | 30–40 |
| | Angle of rotation torque | 90–100° |

¹⁾ After unscrewing, the threaded studs lose their locking effect. They may only be used once.

²⁾ See Note 03–324.

Special tools

| | | |
|---|---|------------------|
| Clamping strap for piston rings |  | 000 589 04 14 00 |
| Dial gauge holder for measuring crankshaft end play |  | 363 589 02 21 00 |
| Cover sleeves (2) for connecting rods and connecting rod bolts during piston installation |  | 117 589 00 98 00 |

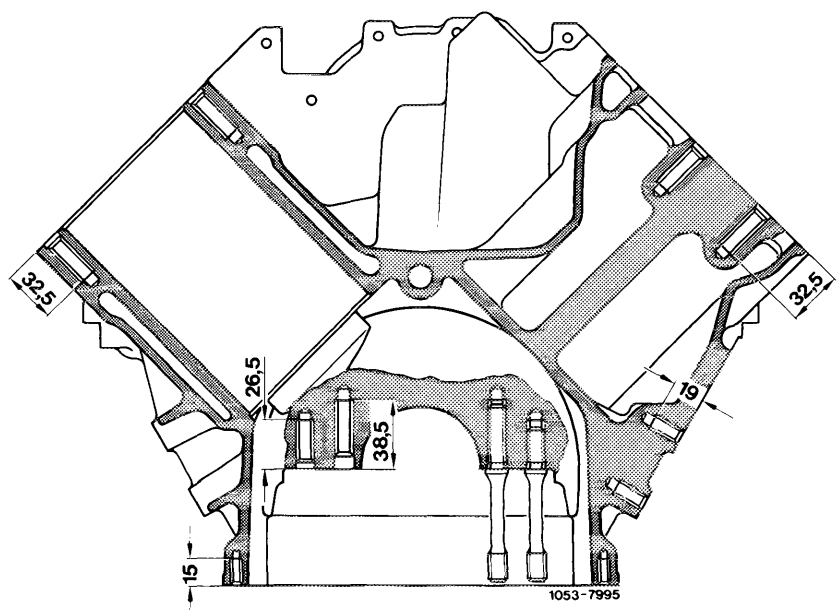
Note

Self-locking threaded studs are screwed into the crankcase for mounting of the crankshaft bearing caps.

These threaded studs may only be screwed in once, as the locking compound, which is applied to approx. 8 mm of thread length, will become ineffective after unscrewing the stud.

When renewing the threaded studs, pay attention to the different screw-in lengths and collar diameters.

No Heli-Coil inserts may be used in repair cases for the self-locking crankshaft bearing cap studs.



The five crankshaft bearing caps made of malleable cast iron are fitted into the crankcase with a lateral overlap of 0.01 mm.

The three center bearing caps are always bolted to the crankcase outer walls.

The crankshaft bearing caps have been machined together with the crankcase and are not available as a spare part.

Mounting of crankshaft with engine removed and disassembled.

Following a bearing failure, the connecting rods must be removed and any chips removed from the connecting rod bores.

Carefully clean oil galleries in the crankcase, crankshaft, timing case cover, oil filter housing, end cover, oil pump etc.

Check crankshaft for cracks, dimensions and hardness (03–318).

Associating crankshaft bearings, installing crankshaft

1 Install crankshaft bearing cap, observe marks, 1 is at the front.

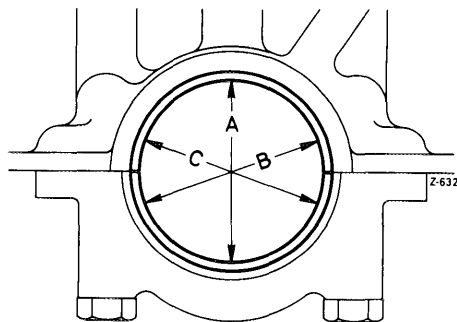
The bearing caps are fitted asymmetrically, in this way the caps can only be installed in one position.

2 Lubricate nut contact area and threads, tighten nuts with 50 Nm.

3 Lubricate thread and bolt head contact area of lateral bolts (M 10 x 40), install with washers and tighten with 50 Nm.

4 Measure basic bore in direction A, B and C at two levels (conicity). Note down values.

With the basic bore which exceeds the specified value or is conical, touch up bearing cap contact surface on a surface plate to a maximum of 0.02 mm.



5 Insert bearing shells, mount crankshaft bearing caps.

Tighten nuts to 50 Nm and lateral bolts with 50 Nm.

6 Measure bearing diameter, note down measured values.

7 Measure crankshaft journal, then determine crankshaft radial bearing play.

Note: The bearing play can be corrected by using different bearing shells, while the aim should be for the mean value of the specified bearing play. Crankshaft bearing shells without color coding are thicker than the ones with blue color coding. It must be observed however that the wall thicknesses of shells without and with color coding may overlap.

8 Measure width of fitted bearing journal and the fitted bearing. Determine crankshaft axial bearing play.

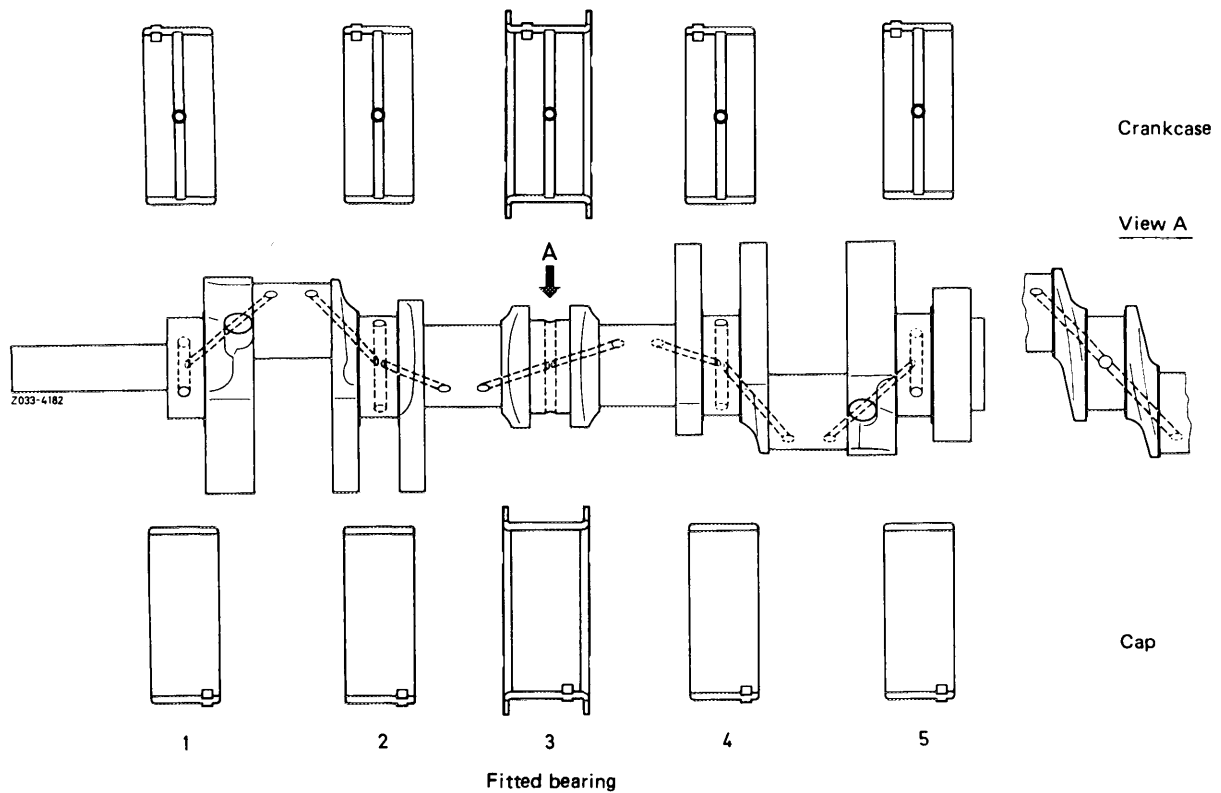
The fitted bearing shells of the repair stages are available in oversize.

Both fitted bearing shells must be machined together on both sides to the width of the fitted bearing journal minus the axial play.

9 Coat bearing shells and crankshaft with engine oil SAE 30 and fit crankshaft.

Caution!

Do not use bearing shells without oil hole in the crankcase but only in the bearing cap.

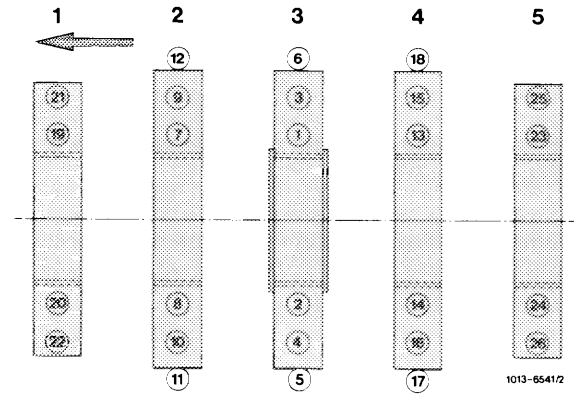


10 Tighten crankshaft bearing caps with a specified torque in the sequence of the tightening diagram. To do so, the thread and the bolt and nut contact areas should be lubricated beforehand.

Nuts 50 Nm.

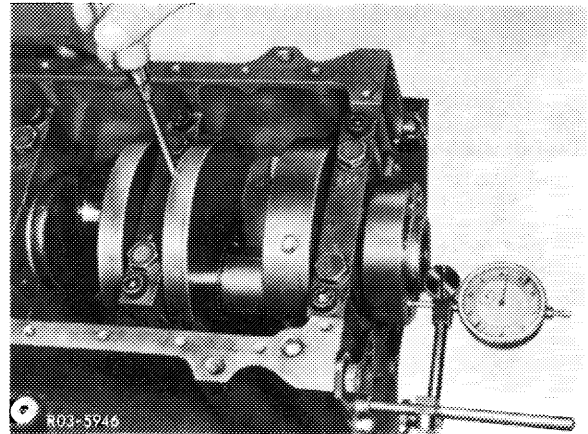
Lateral bolts 50 Nm.

Note: Quality 10.9 must be used for the lateral bearing cap bolts.



11 Measure crankshaft axial play (end float).

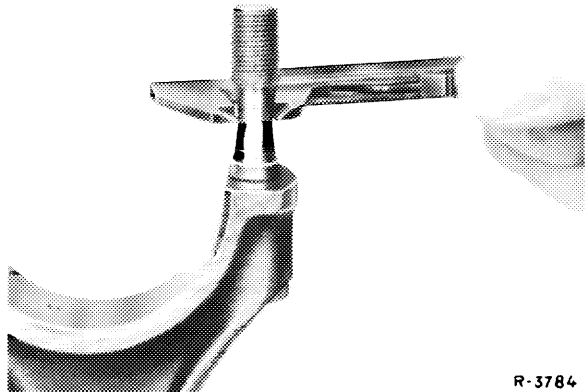
12 Rotate crankshaft by hand to check whether it runs freely.



Associating connecting rod bearings and installing connecting rods

13 Check connecting rod bolts (03-310).

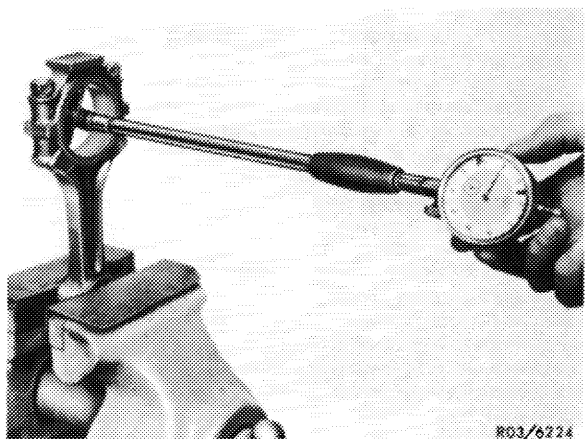
14 Recondition and square connecting rods (03-313).



15 Matching the stamped numbers, mount connecting rod bearing caps. Tighten connecting rod nuts with 40-50 Nm.

16 Measure basic bore in two directions. If the basic bore exceeds the specified value or is conical, touch up bearing cap contact surface on a surface plate up to a maximum of 0.02 mm.

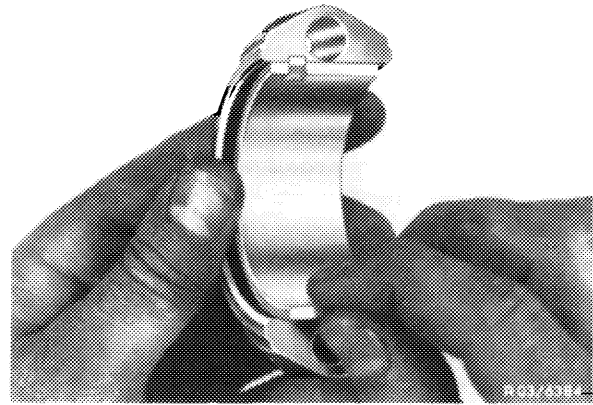
17 Insert connecting rod bearing shells, install connecting rod bearing caps with bearing shells and tighten connecting rod nuts with 40-50 Nm.



18 Measure and note bearing diameter.

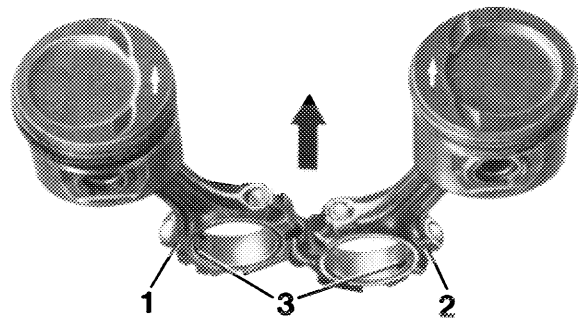
19 Measure crank pin. Determine radial connecting rod bearing play.

Note: The bearing play can be corrected by using different bearing shells, while the aim should be for the mean value of the specified bearing play. Crankshaft bearing shells without color coding are thicker than the ones with blue color coding. It must be observed however that the wall thicknesses of shells without and with color coding may overlap.



20 Mount piston and connecting rods (03-316).

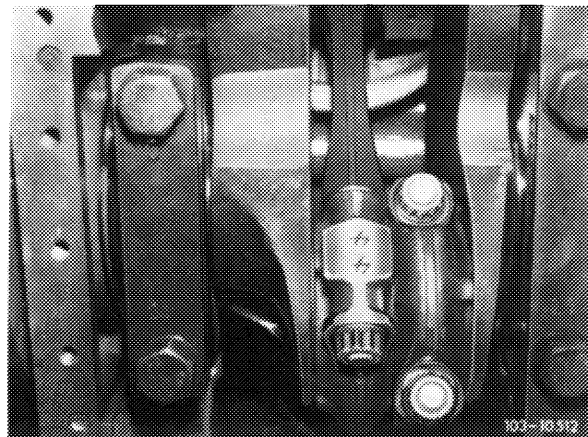
To do so, use cover sleeves on connecting rods to prevent damage to the cylinder wall.



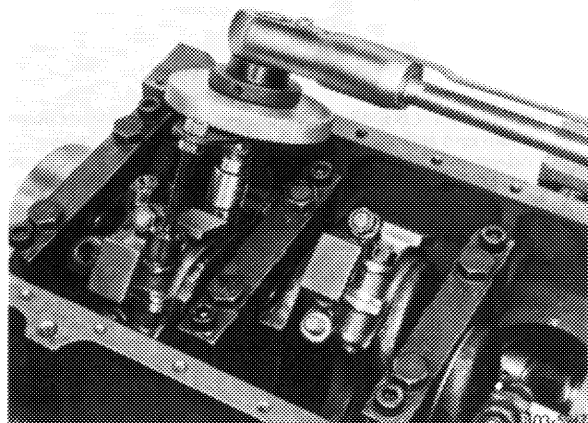
- 1 Connecting rod contact side
- 3 Locating grooves for bearing shells

21 Lubricate bearing shells, crankshaft, pistons and cylinders with engine oil SAE 30. Install connecting rods with pistons (03-316).

Observe marking!



22 Tighten connecting rod nuts with 40–50 Nm initial torque and 90–100° angle of rotation torque.



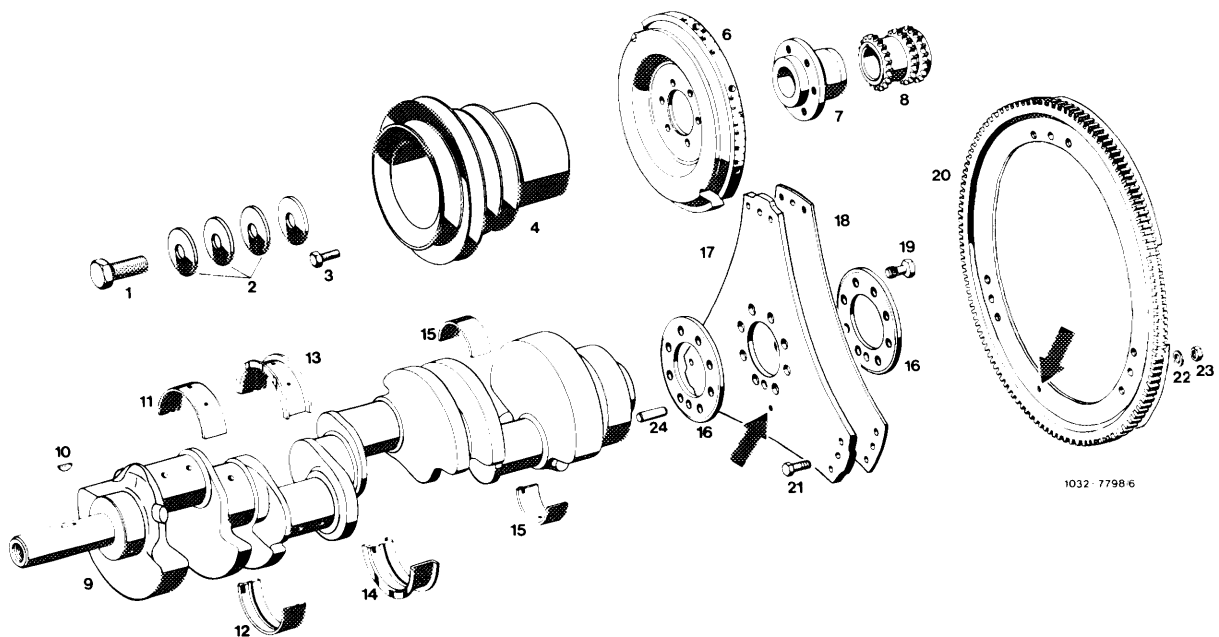
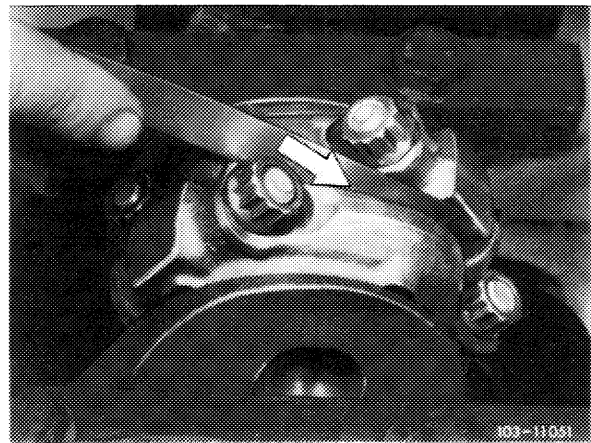
23 Measure axial connecting rod bearing play. Ensure freedom of movement of connecting rods in the pistons.

Caution!

Disassemble oil pump, clean and renew if required. Renew oil pressure limiting valve. Disassemble oil filter upper part and clean, carefully clean air-oil cooler or renew. Unscrew and clean oil pressure relief valve for oil filter insert and oil cooler bypass valve. Disassemble and clean oil damper.

Fit initial operation oil filter insert. After 1000 to 1500 km, change engine oil and oil filter element.

Note: For repair purposes it is possible on model 107.026 with engine 117.960 to exchange the crankshaft 1st version with the shorter crankshaft 117 031 14 01 together with an additional compensation plate (10.5 mm thick) and longer (29 mm instead of 23 mm) necked-down bolts.



- | | | |
|---|--|--|
| 1 Bolt M 18 x 1.5 x 45 | 11 Crankshaft bearing shell in crankcase | 17 Driven plate 1.5 mm thick, 296 mm dia. |
| 2 Diaphragm springs (4 required), 2nd version | 12 Crankshaft bearing shell in bearing cap | 18 Driven plate 1 mm thick, 287 mm dia. |
| 3 Bolt M 8 x 22 (6 required) | 13 Fitted bearing shell in crankcase | 19 Necked-down bolt for driven plates M 12 x 1.5 x 23 (8 required) |
| 4 V-belt pulley | 14 Fitted bearing shell in bearing cap | 20 Ring gear with segments |
| 6 Vibration damper | 15 Connecting rod bearing shells | 21 Fitted bolts |
| 7 Hub | 16 Plates 4.5 mm thick | 22 Spring washer B 6 |
| 8 Crankshaft sprocket | | 23 Nut M 6 |
| 9 Crankshaft | | 24 Dowel pin (only for EZL transmitter) |
| 10 Woodruff key | | |