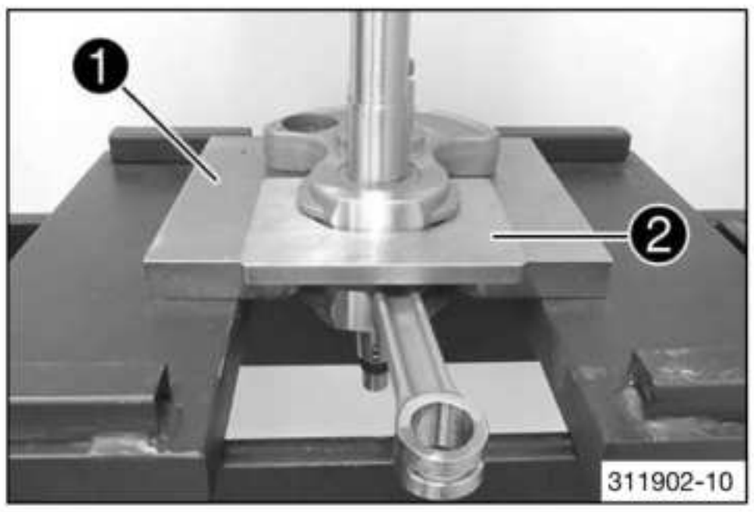


Main work

– Position the crankshaft with special tool ❶ in the press.

Separator plate, base (75029047051) (📖 p. 389)

– Position special tool ❷ between the crankwebs.

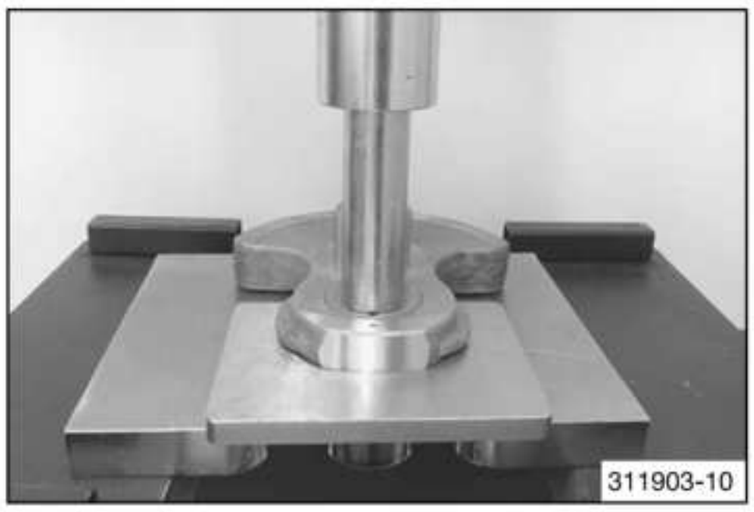
Separator plate, upper part (75029047050) (📖 p. 388)

– Press the crank pin out of the upper crankweb with the push-out drift of the special tool.

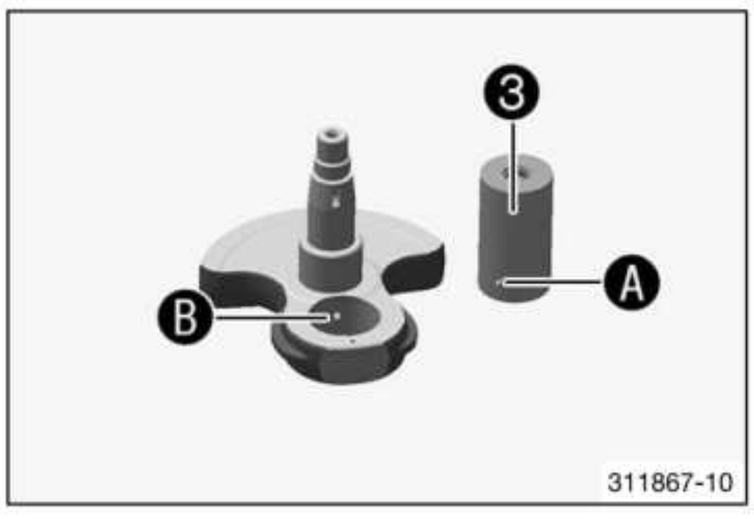
Crankshaft pressing tool (75029047000) (📖 p. 388)

Info
Hold the lower crankweb.

– Remove the connecting rod and bearing.



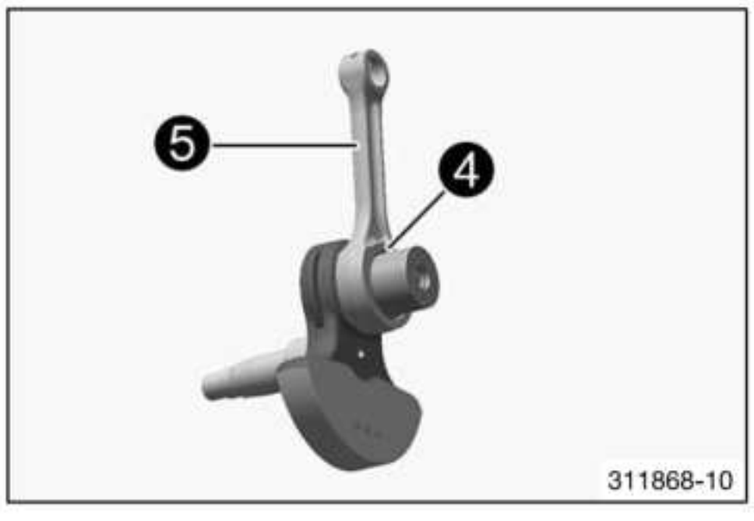
– Press the crank pin out of the crankweb.



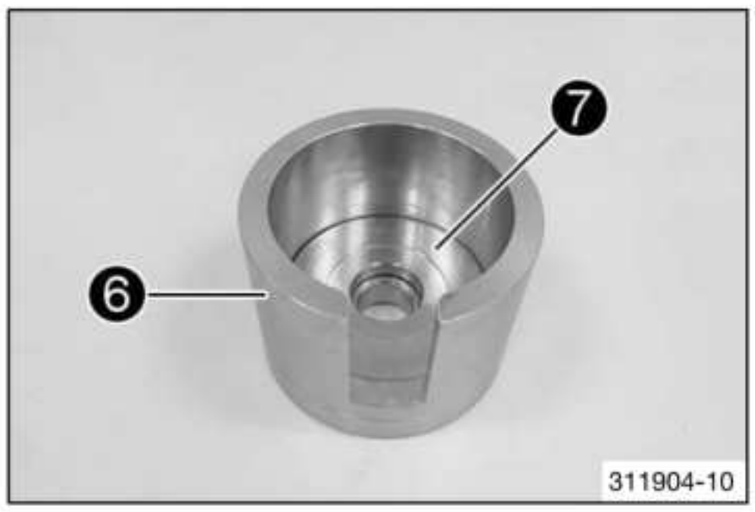
– Press in new crank pin ❸ all the way.

Info
The crank pin must be pressed in so that oil channel Ⓐ is aligned with oil channel Ⓑ.
If the oil channels are not correctly aligned, the conrod bearing will not be supplied with oil.

– Blow compressed air through the oil channel to check that it is clear.



– Thoroughly oil bearing ❹.
– Mount connecting rod ❺.

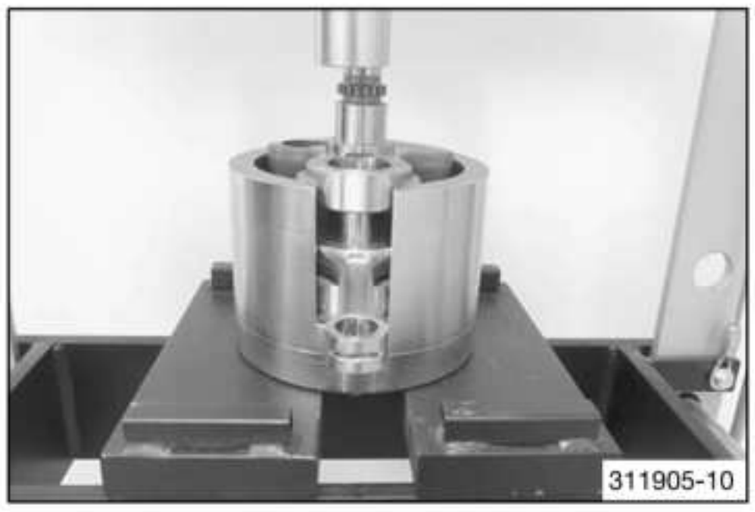


– Position special tool ❻ on the press.

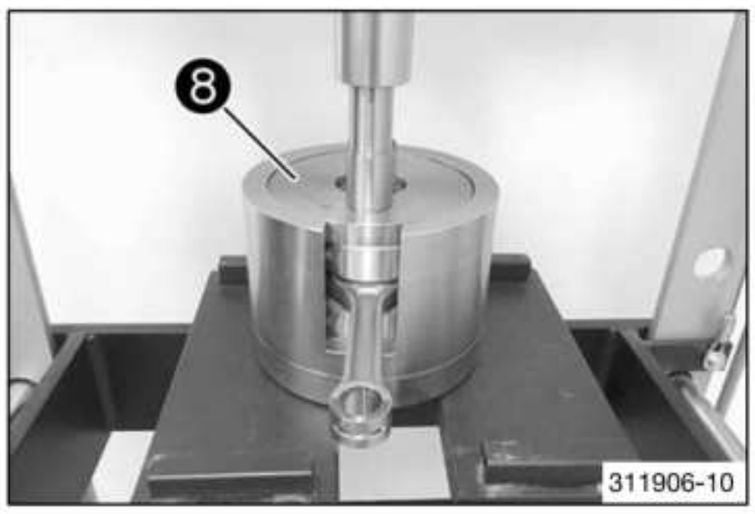
Crankshaft pressing tool (75029047000) (📖 p. 388)

– Position special tool ❼.

Cover for crankshaft pressing tool (76629047003) (📖 p. 392)



– Insert the crankweb with the connecting rod and bearing. Position the second crankweb.



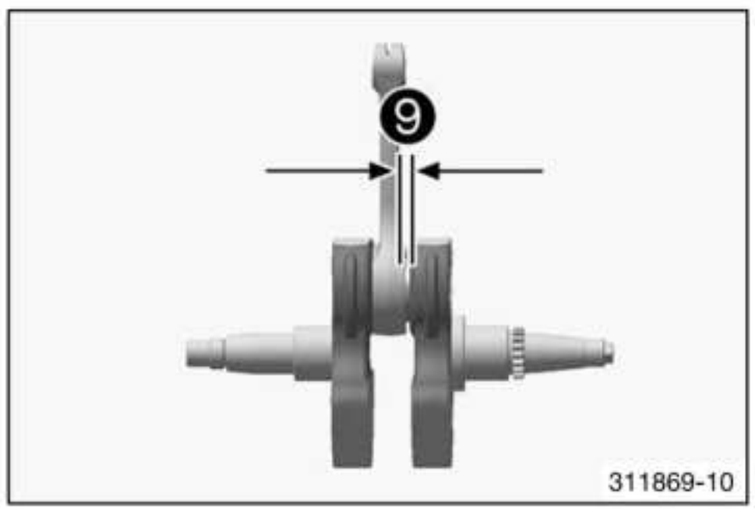
– Position special tool ❽ with the heel pointing down.

Crankshaft pressing tool (75029047000) (📖 p. 388)

– Press in the upper crankweb as far as possible.

Info
The press mandrel must be positioned over the crank pin.

– Take the crankshaft out of the special tool and check that the connecting rod can move freely.



– Measure axial play ❾ between the connecting rod and the crankwebs using the special tool.

Feeler gauge (59029041100) (📖 p. 384)

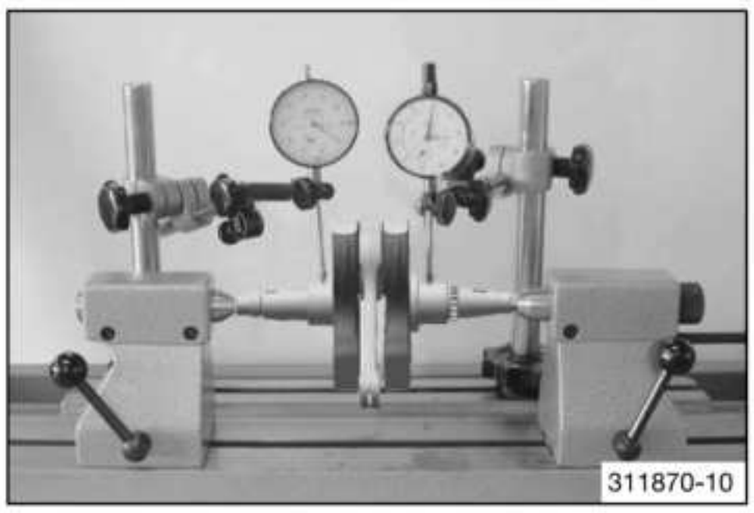
Connecting rod - axial clearance of lower conrod bearing	0.30 … 0.60 mm (0.0118 … 0.0236 in)

» If the measured value is less than the specification:
  – Correct it so the dimension is equal to the specified value.

Finishing work

– Check the crankshaft run-out at the bearing pin. (📖 p. 211)
– Install the drive gear wheel of the balancer shaft. (📖 p. 211)
– Install the crankshaft bearing inner race. (📖 p. 212)
– Measure the axial clearance of the crankshaft and the balancer shaft. (📖 p. 212)

18.4.8 Checking crankshaft run-out at bearing pin

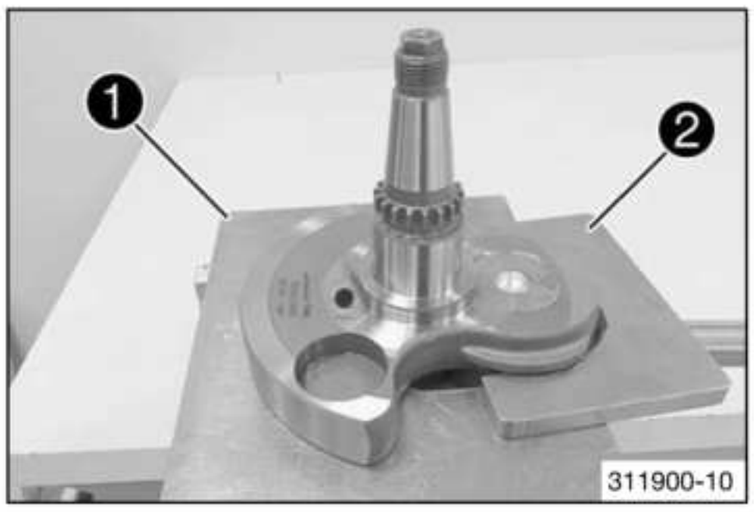


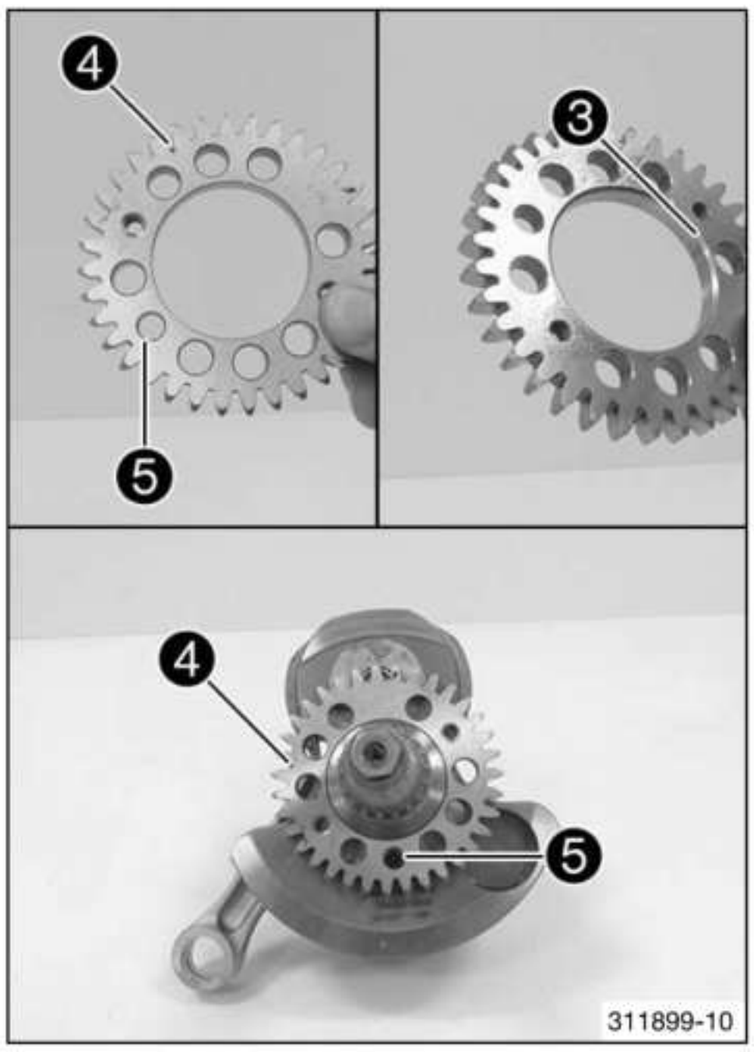
– Position the crankshaft on a roller block.
– Rotate the crankshaft slowly.
– Check the crankshaft run-out at both bearing pins.

Crankshaft run-out at bearing pin	≤ 0.10 mm (≤ 0.0039 in)

» If the crankshaft run-out at the bearing pin is greater than the specified value:
  – Align the crankshaft.

18.4.9 Installing the drive gear wheel of the balancer shaft





Main work

– Fix the crankshaft with special tool ❶ and ❷ secure in the vise.

Separator plate, upper part (75029047050) (📖 p. 388)
Separator plate, base (75029047051) (📖 p. 389)

– Warm up the drive gear wheel.

  Guideline

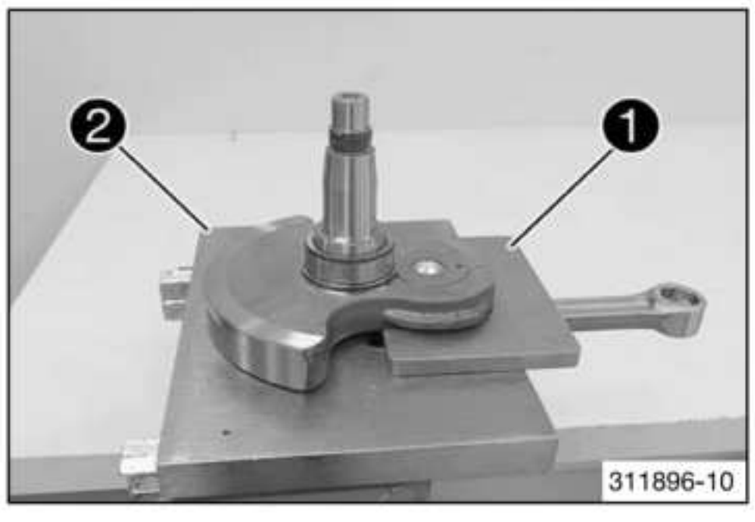
100 °C (212 °F)

– Place the drive gear wheel on the crankshaft.
  ✓ The dowel of the crankshaft must fit in drill hole ❺.
  ✓ The side of the drive gear wheel with punch mark ❹ must be visible after assembly, and the side with bevel ❸ must be in contact with the crankweb.

Finishing work

– Install the crankshaft bearing inner race. (📖 p. 212)
– Measure the axial clearance of the crankshaft and the balancer shaft. (📖 p. 212)

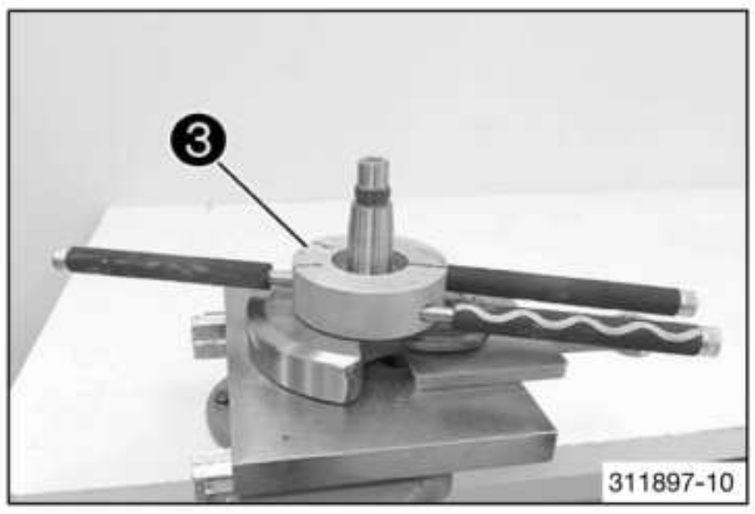
18.4.10 Installing the crankshaft bearing inner race



Main work

– Fix the crankshaft with special tool ❶ and ❷ secure in the vise.

Separator plate, upper part (75029047050) (📖 p. 388)
Separator plate, base (75029047051) (📖 p. 389)



– Position compensating disk.
– Warm-up the inner bearing race in special tool ❸.

  Guideline

120 °C (248 °F)

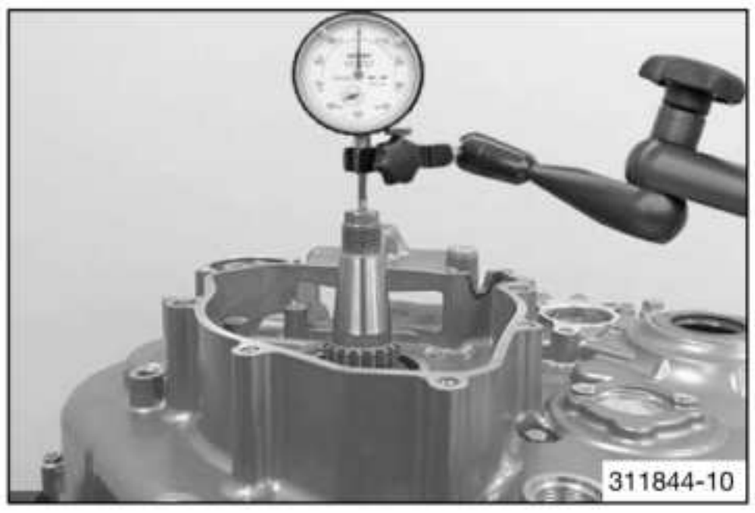
– Mount the inner bearing race.
– Repeat these steps on the opposite side.
– Make sure that the new inner bearing race is installed flush.

Info
After changing the crankshaft bearing and the conrod bearing, measure the crankshaft axial play.

Finishing work

– Measure the axial clearance of the crankshaft and the balancer shaft. (📖 p. 212)

18.4.11 Measuring axial clearance of crankshaft and balancer shaft



– Insert the crankshaft and balancer shaft in the right section of the engine casing.

Info
Do not forget the dowels.

– Mount the left section of the engine case.
– Mount and tighten the screws.

  Guideline

Screw, engine case	M6	10 Nm (7.4 lbf ft)

– Mount the dial gauge support on the engine case and measure and note down the crankshaft axial play.

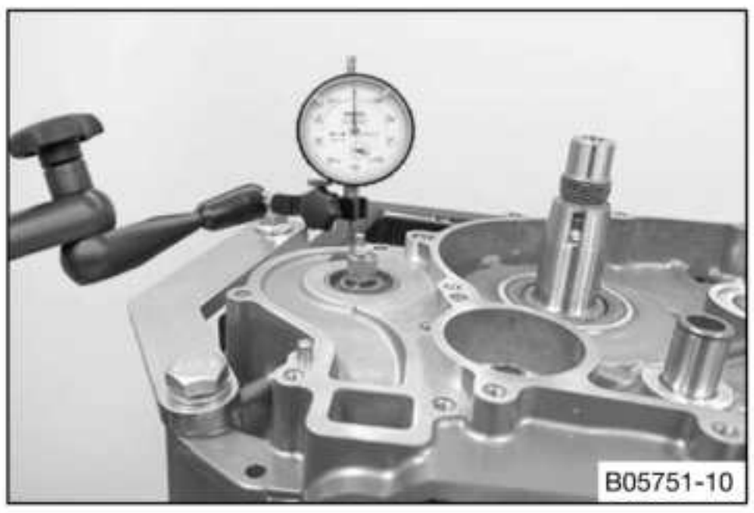
  Guideline

Crankshaft - axial clearance	0.15 … 0.25 mm (0.0059 … 0.0098 in)

» If the measured value does not meet specifications:
  – Remove the crankshaft.
  – Remove the crankshaft bearing inner race. (📖 p. 208)
  – Calculate the thickness of the compensating disks.
  – Add or remove compensating disks equally on both sides.

Info
If the axial play is too small, remove compensating disks.
If the axial play is too large, add compensating disks.

– Install the crankshaft bearing inner race. (p. 212)



– Mount the dial gauge support on the engine case and measure and note the axial play of the balancer shaft.

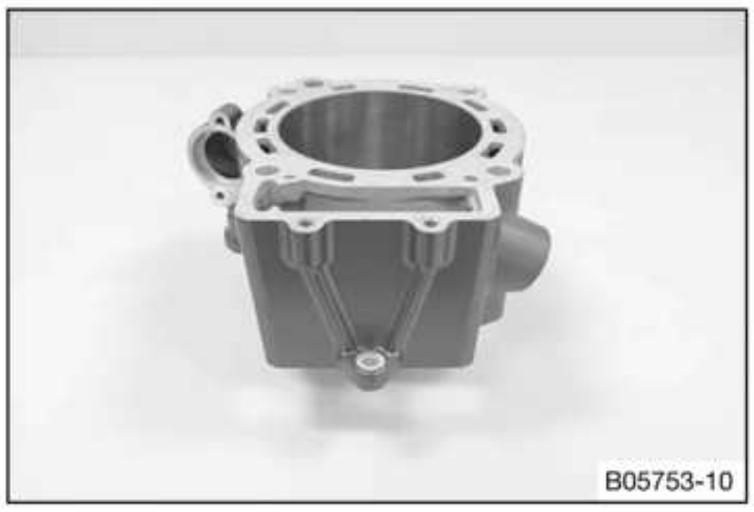
Guideline

Balancer shaft axial clearance	0.15 … 0.25 mm (0.0059 … 0.0098 in)

» If the measured value does not meet specifications:
  – Remove the balancer shaft.
  – Calculate the thickness of the compensating disks.
  – Add compensating disks to the ignition side only.

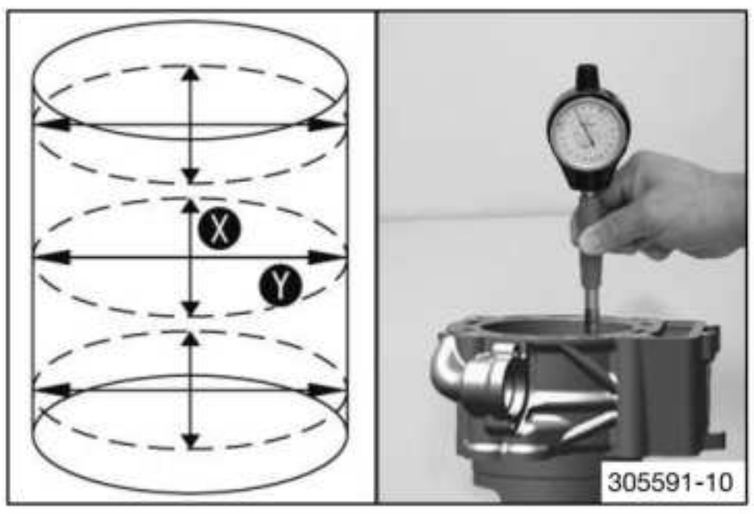
Info
If the axial play is too small, remove compensating disks.
If the axial play is too large, add compensating disks.

18.4.12 Cylinder - Nikasil® coating



Nikasil® is a surface protection layer for a coating procedure developed by Mahle. The name is derived from the two materials used in this procedure - a layer of nickel into which is embedded the particularly hard silicone carbide.
The most important advantages of the **Nikasil®** coating are very good heat conductivity, resulting in much improved performance, low wear, and a lightweight cylinder.

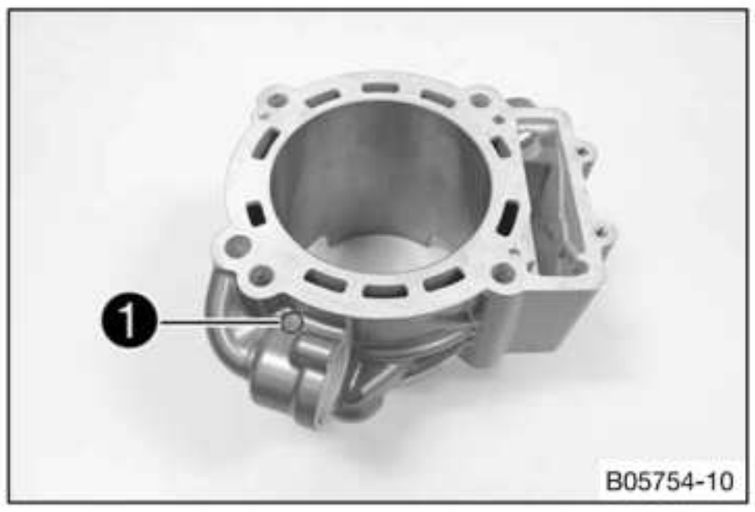
18.4.13 Checking/measuring the cylinder



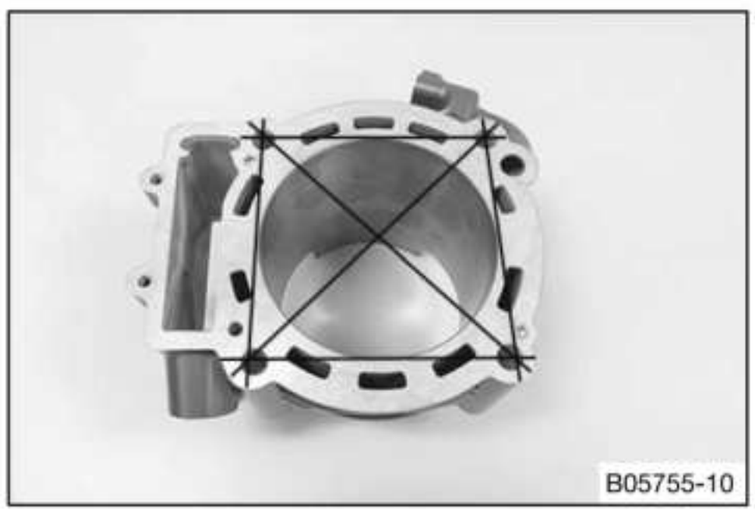
– Check the O-ring of the chain adjuster for damage and wear.
  » If there is damage or wear:
    – Change the O-ring.
– Check the cylinder bearing surface for damage.
  » If the cylinder bearing surface is damaged:
    – Change the cylinder and piston.
– Measure the bore diameter at several locations on the X-axis and Y-axis using a micrometer to identify oval wear.

Guideline

Cylinder - bore diameter	
Size I	105.000 … 105.012 mm (4.13385 … 4.13432 in)
Size II	105.013 … 105.025 mm (4.13436 … 4.13483 in)



– The cylinder size ❶ is marked on the side of the cylinder.

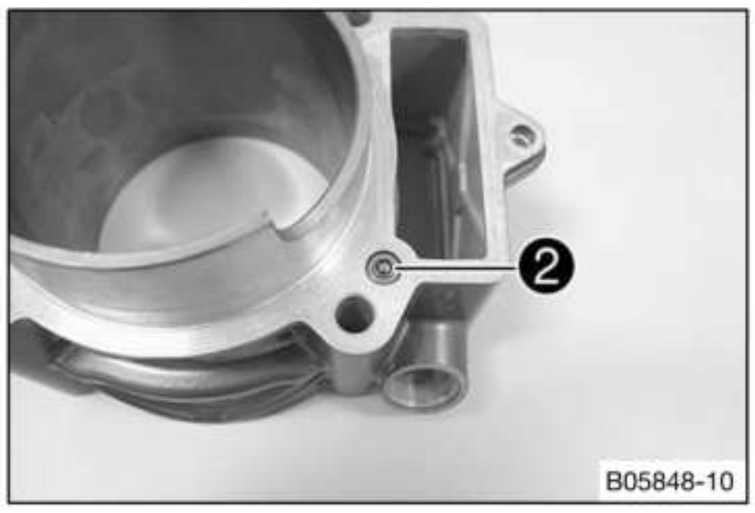


– Using a straightedge and the special tool, check the sealing surface of the cylinder head for distortion.

Feeler gauge (59029041100) (📖 p. 384)

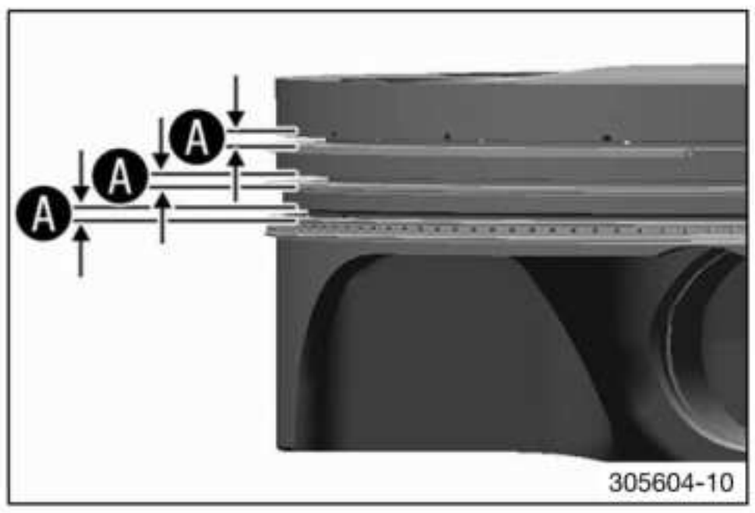
Cylinder/cylinder head - sealing area distortion	≤ 0.10 mm (≤ 0.0039 in)

» If the measured value does not meet specifications:
  – Change the cylinder.



– Check the check valve ❷ for smooth operation and wear.
» If the check valve moves easily or if wear is apparent:
  – Change the cylinder.

18.4.14 Checking/measuring the piston



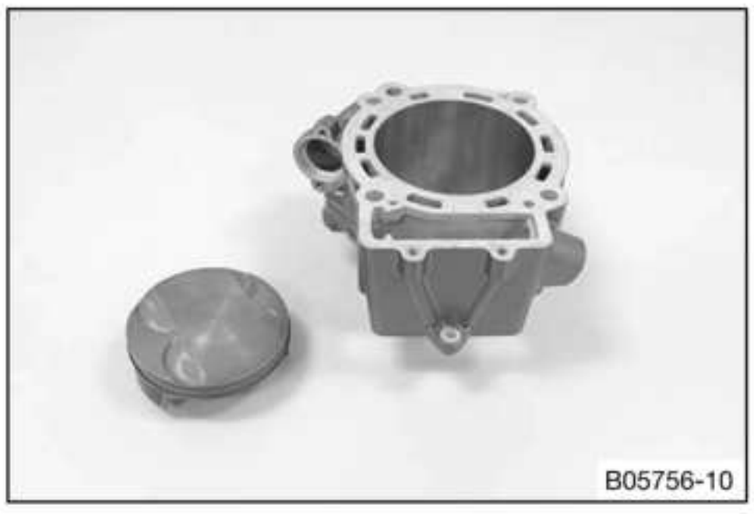
– Use the special tool to measure play Ⓐ of the piston rings in the piston ring groove.

Guideline

Piston ring - groove clearance	≤ 0.08 mm (≤ 0.0031 in)

Feeler gauge (59029041100) (📖 p. 384)

» If play Ⓐ is greater than the specified value:
  – Change the piston and piston rings.
  – Check/measure the cylinder. (📖 p. 213)



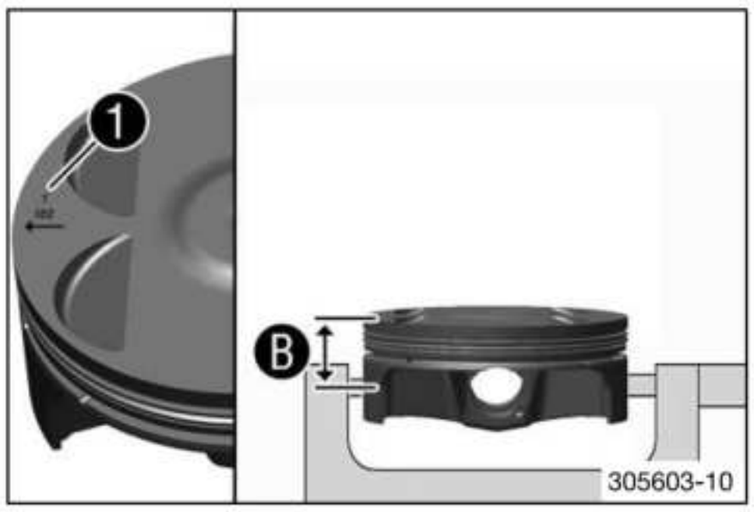
– Check the piston bearing surface for damage.
  » If the piston bearing surface is damaged:
    – Change the piston and, if necessary, the cylinder.
– Check that the piston rings can move easily in the piston ring grooves.
  » If the piston ring is stiff:
    – Clean the piston ring groove.

Tip
Use an old piston ring to clean the piston ring groove.

– Check the piston rings for damage.
  » If the piston ring is damaged:
    – Change the piston ring.

Info
Mount the piston ring with the marking facing upward.

– Check the piston pin for discoloration or signs of wear.
  » If the piston pin has strong discoloration/signs of wear:
    – Change the piston pin.
– Insert the piston pin into the connecting rod and check the bearing for play.
  » If the piston pin bearing has too much play:
    – Change the connecting rod and the piston pin.



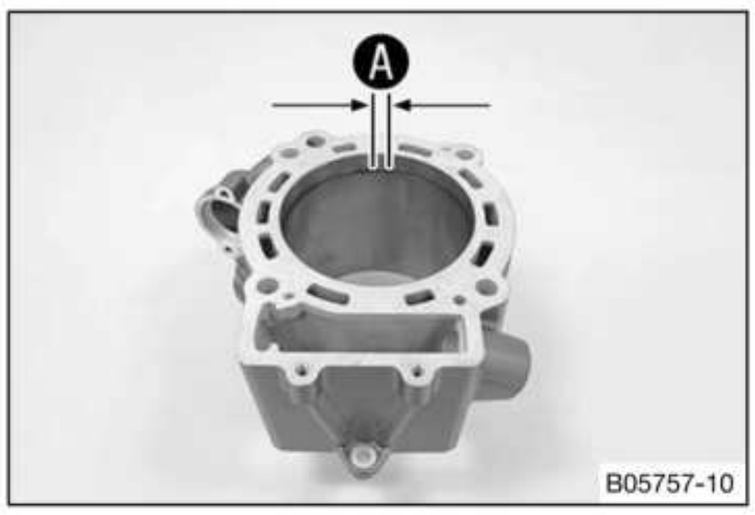
– Measure the piston at the piston skirt, at right angles to the piston pin, at a distance Ⓑ.

Guideline

Distance Ⓑ	31.5 mm (1.24 in)
Piston - diameter	
Size I	104.955 … 104.965 mm (4.13208 … 4.13247 in)
Size II	104.965 … 104.975 mm (4.13247 … 4.13287 in)

Info
Piston size ❶ is marked on the piston head.

18.4.15 Checking the piston ring end gap



– Remove the piston ring from the piston.
– Place the piston ring in the cylinder and align with the piston.

Guideline

Below the upper edge of the cylinder	10 mm (0.39 in)

– Measure end gap Ⓐ with a feeler gauge.

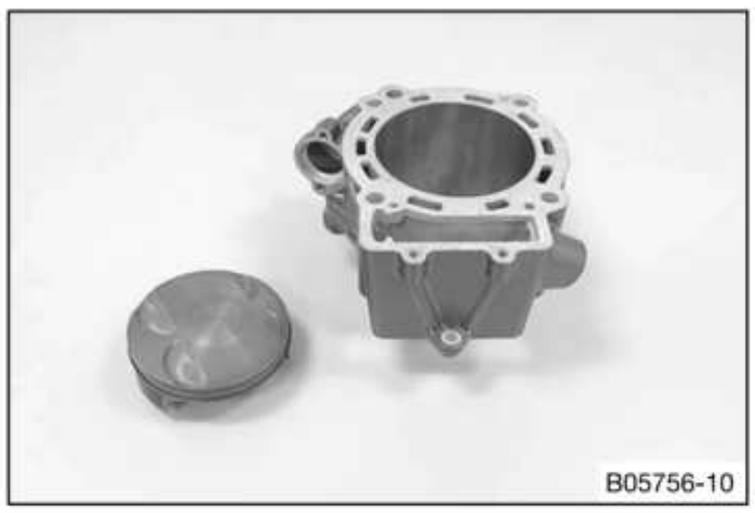
Guideline

Piston ring end gap	
Compression rings	≤ 0.80 mm (≤ 0.0315 in)
Oil scraper ring	≤ 1.00 mm (≤ 0.0394 in)

» If the end gap is greater than the specified measurement:
– Check/measure the cylinder. (📖 p. 213)
» If cylinder wear lies within the specified tolerance:
– Change the piston ring.

– Mount the piston ring with the marking facing toward the piston head.

18.4.16 Determining the piston/cylinder mounting clearance



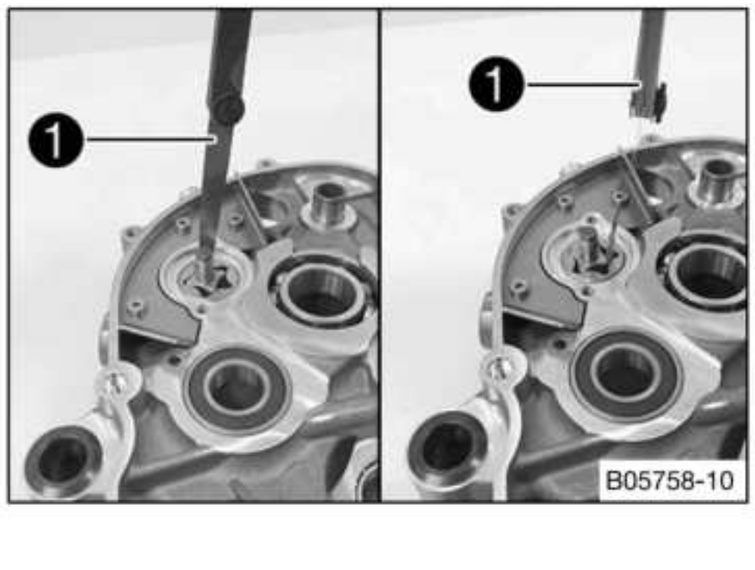
– Check/measure the cylinder. (📖 p. 213)
– Check/measure the piston. (📖 p. 214)
– The smallest piston/cylinder mounting clearance is the result of the smallest cylinder bore diameter minus the largest piston diameter. The largest piston/cylinder mounting clearance is the result of the largest cylinder bore diameter minus the smallest piston diameter.

Guideline

Piston/cylinder - mounting clearance	
New condition	0.035 … 0.060 mm (0.00138 … 0.00236 in)
Wear limit	0.10 mm (0.0039 in)

18.4.17 Checking oil pumps for wear

Info
The oil pump wear check shown here is on the suction pump but it applies to all oil pumps.

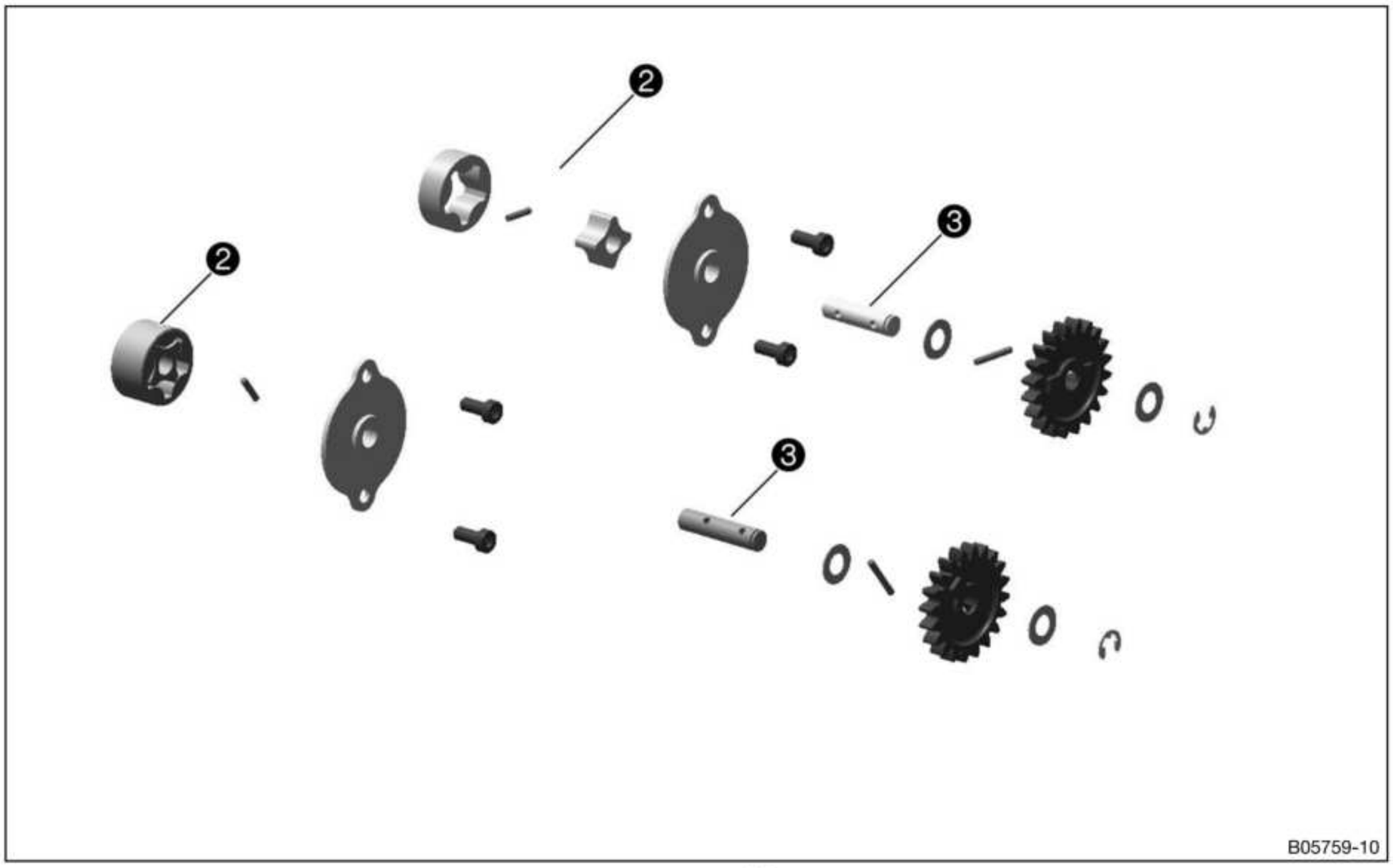


– Use a feeler gauge ❶ to measure the play between the external rotor and the engine case as well as between the external rotor and the internal rotor.

Oil pump	
Clearance between external rotor and engine case	≤ 0.20 mm (≤ 0.0079 in)

Clearance between external rotor and internal rotor	≤ 0.20 mm (≤ 0.0079 in)
Axial clearance	0.04 … 0.08 mm (0.0016 … 0.0031 in)

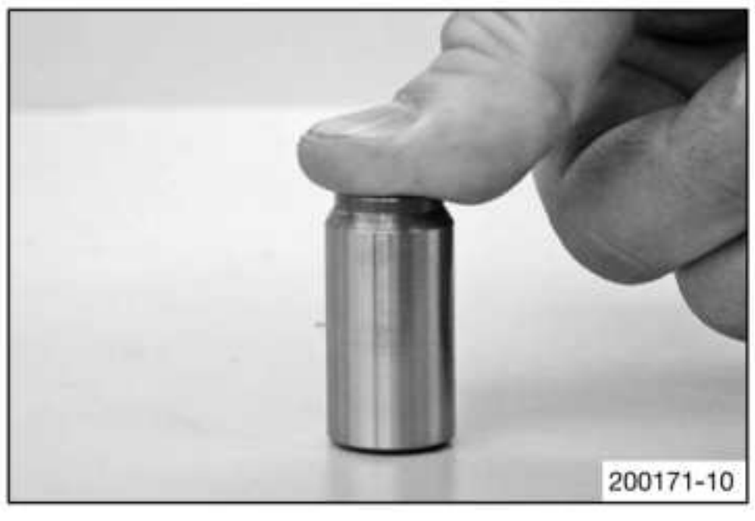
» If the measured value does not meet specifications:
  – Change the oil pump and, if necessary, the engine case.



B05759-10

– Check the internal rotor and external rotor of oil pumps ❷ for damage and wear.
  » If there is damage or wear:
    – Change the oil pumps.
– Check oil pump shafts ❸ for damage and wear.
  » If there is damage or wear:
    – Change the oil pump shaft.
– Check both oil pump covers for damage and wear.
  » If there is damage or wear:
    – Change the oil pump cover.

18.4.18 Preparing timing chain tensioner for installation



– Fully compress the timing chain tensioner.

Info
This requires considerable force since the oil has to be pressed out.

– Release the timing chain tensioner.

✓ Without pressure, the timing chain tensioner expands fully.

– Place two compensating disks or similar aids next to the piston of the timing chain tensioner. This should ensure that when pushed down, the piston does not fully withdraw.

Guideline

Thickness of the compensating disks	2 … 2.5 mm (0.08 … 0.098 in)

– Release the timing chain tensioner.

✓ The latching system locks and the piston stops moving.

End position of piston after latching	3 mm (0.12 in)

Info
This position is necessary for installation.
If the timing chain tensioner is now pressed in once more (while it is installed) and then pulled out no more than halfway (preventing it from coming out fully), the latching system locks and the timing chain tensioner can no longer be compacted; this function is necessary to ensure sufficient tension of the timing chain, even at low oil pressure.