

**Special tools required:**

- [00 2 590](#)
- [00 9 120](#)

**Important!**

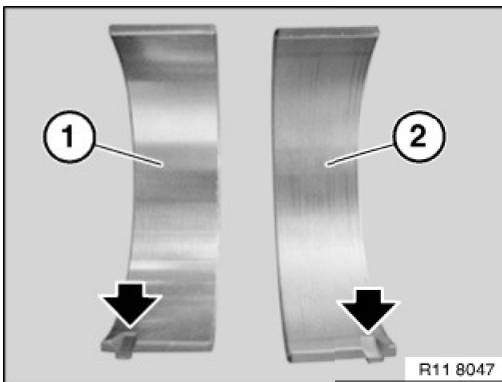
Different connecting rod bearing shells.

Connecting rod and connecting rod bearing cap are **different**.

Replace connecting rod bolts.

**Necessary preliminary tasks:**

- Remove all [pistons](#).

**Important!**

Note [grinding stages on crankshaft](#).

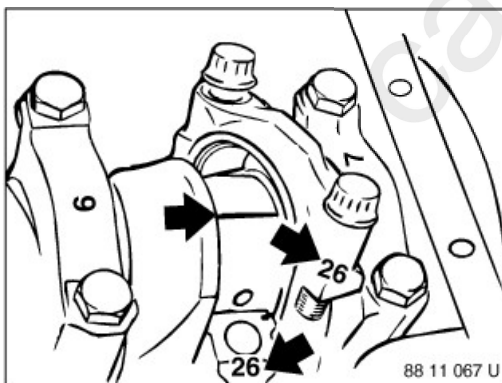
Insert one bearing shell for each connecting rod.

Connecting rod bearing (1) is for the connecting rod bearing cap.

Connecting rod bearing (2) is for the connecting rod.

Installation note:

Observe encoding of connecting rod bearing shells.

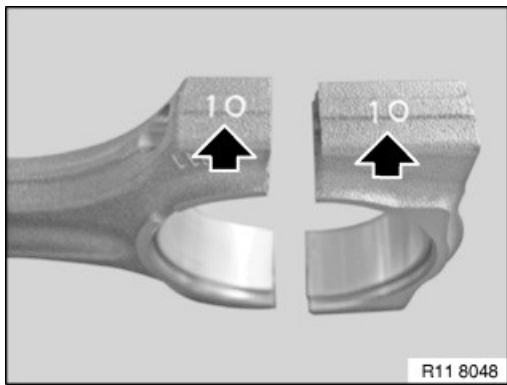


Install piston with connecting rod.

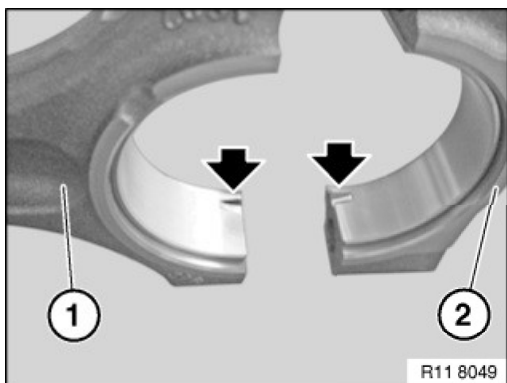
Check connecting-rod bearing play.

Piston in BDC position.

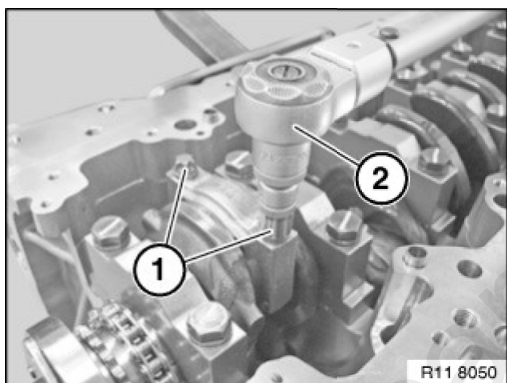
Fit special tool [00 2 590](#) (Plastigage type PG 1) to oil-free crankshaft.



Fit connecting rod bearing cap so that matching numbers match.



Both encodings (anti-twist lock) on connecting rod big end (2) and on connecting rod (1) must point to each other.



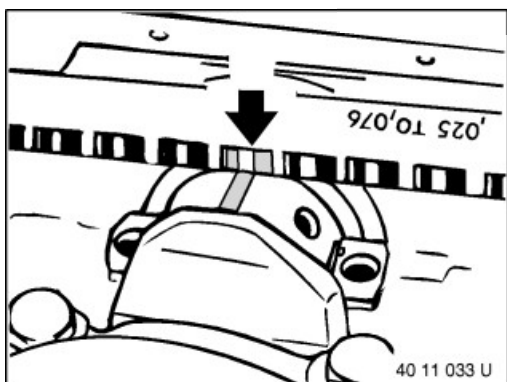
Important!

Do not turn the connecting rods or crankshaft.

To check connecting-rod bearing play, use old connecting rod bolts.

Tighten down connecting rod bolts (1) with special tool [00 9 120](#).

Tightening torque [11 24 1AZ](#).

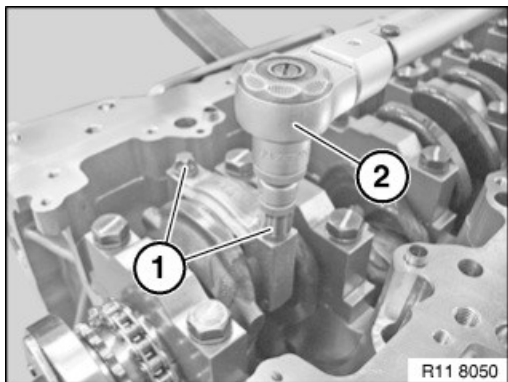


Unscrew connecting rod bearing cap.

Read off bearing clearance at width of crushed plastic thread (Plastigage) with aid of measuring scale.

[Connecting-rod bearing play.](#)

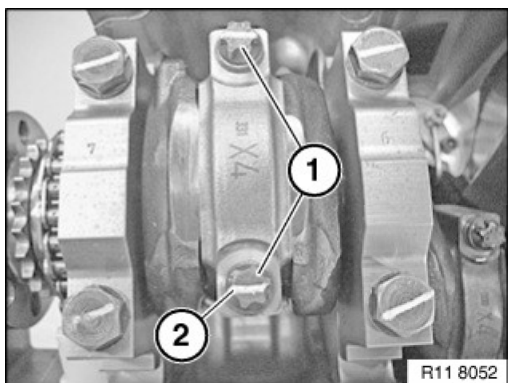
Remove Plastigage.



Install new connecting rod bolts (1).

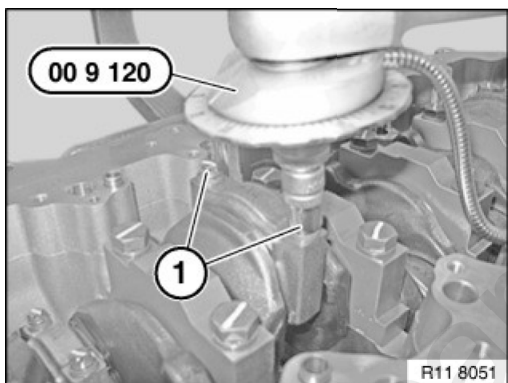
Join connecting rod bolts (1).

Tightening torque: [11 24 1 AZ](#).



Mark all connecting rod bolts (1) with a coloured mark (2) in the same axial direction. *Installation note:*

See illustration.



Secure connecting rod bolts (1) with special tool [00 9 120](#).

Tightening torque: [11 24 1 AZ](#).

Installation note:

Visually check connecting rod bolt connection.



Assemble engine.

**Special tools required:**

- [00 2 530](#)
- [11 5 464](#)
- [11 8 140](#)
- [11 8 831](#)
- [11 8 860](#)

**Warning!**

Protective goggles must be worn when working on the piston pin circlip.

*Necessary preliminary work*

- Remove [engine](#).
- Remove [cylinder head](#).
- Removing [oil sump](#).
- Remove [oil pump with vacuum pump](#).

**Attention!**

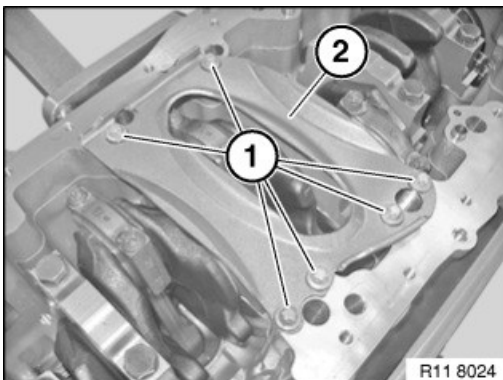
Risk of damage to cylinder barrel.

If pistons, connecting rods and bearing shells are reused, they must be reinstalled in the same places.

Individual connecting rod replacement is not permitted; they are classified by weight class.

Connecting rods and connecting rod bearing caps are denoted with the same pairing letters; mixing them up will result in engine damage.

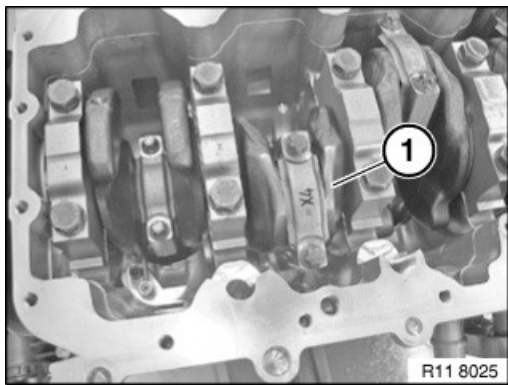
Piston and gudgeon pins are paired and must not be fitted individually.



Release screws (1).

Tightening torque: [11 00 4 AZ](#).

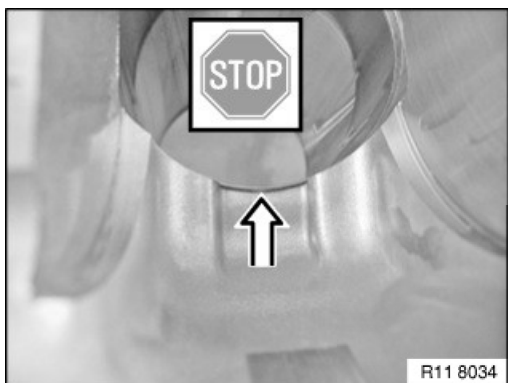
Remove reinforcement plate (2).



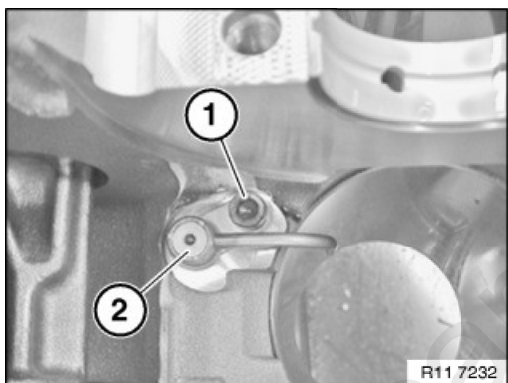
Attention!

Position crankshaft (1) vertically on piston to be removed.

Proceed with care at the cylinder wall and oil spray nozzles **Risk of damage!**



Carefully remove piston with connecting rod **Risk of damage!** from cylinder barrel (see arrow).

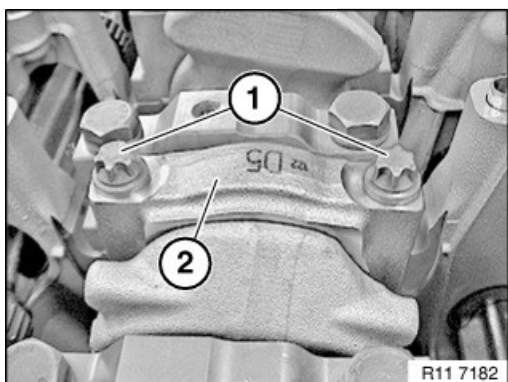


Attention!

Do not release screw (1).

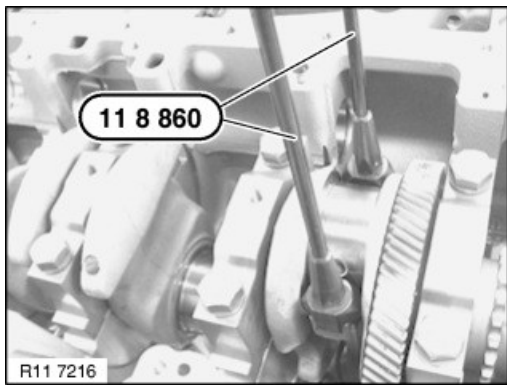
Oil spray nozzles (2) must not be maladjusted or bent.

A bent oil spray nozzle cannot be adjusted and must be replaced.



Undo connecting rod bearing bolts (1).

Remove connecting rod bearing caps (2) and set down in neat order.

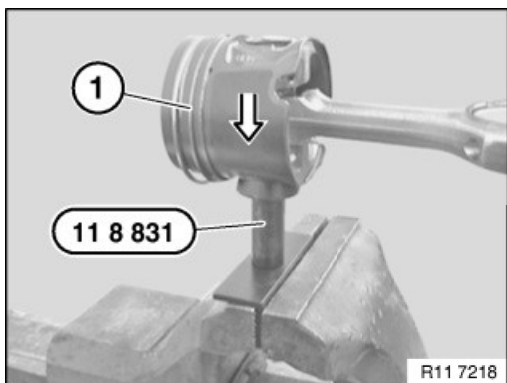


Screw special tool [11 8 860](#) in at large connecting rod eye.

Installation note:

Pay attention to protective edge.

Remove piston with connecting rod towards bottom.

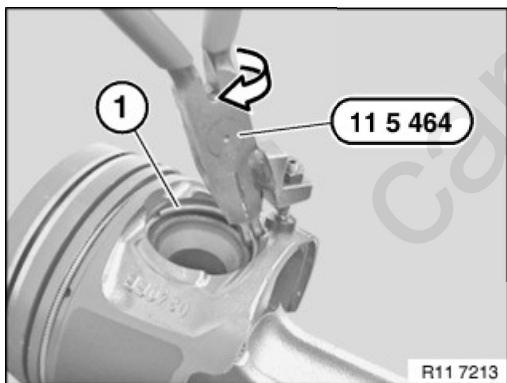


Position piston (1) with connecting rod on special tool [11 8 831](#).



Warning!

Safety goggles must be worn for the next operation.



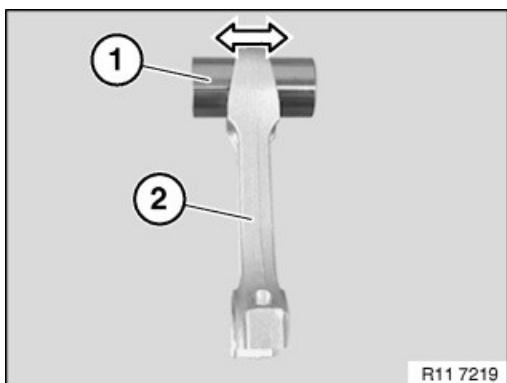
Warning!

Safety goggles must be worn.

Lever out piston circlip (1) with special tool [11 5 464](#) in direction of arrow. **Attention!**

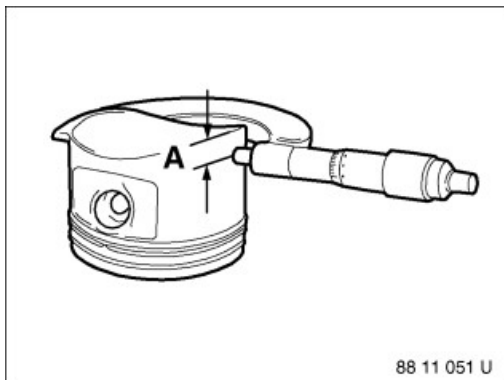
Piston and gudgeon pin are matched to each other.

They must not be mixed up.



If necessary, replace connecting rods. *Installation note:*

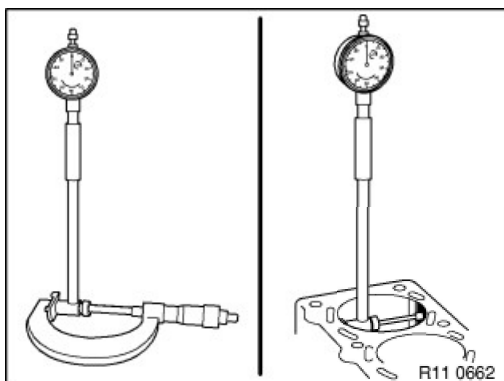
It must be possible to press gudgeon pin (1) through the bush (small connecting rod eye) and must not display any significant play.



Before installation, measure piston installation clearance. Measure piston diameter with micrometre at measuring point A from lower edge of piston and offset at 90° to the axis of the gudgeon pin.

Distance A,

[Refer to Technical Data.](#)



Adjust micrometre to cylinder bore of engine block. Set internal measuring device on micrometre to zero. Measure bottom, centre and top of cylinder bore in direction of travel and direction of rotation.

Diameter of the cylinder bore,

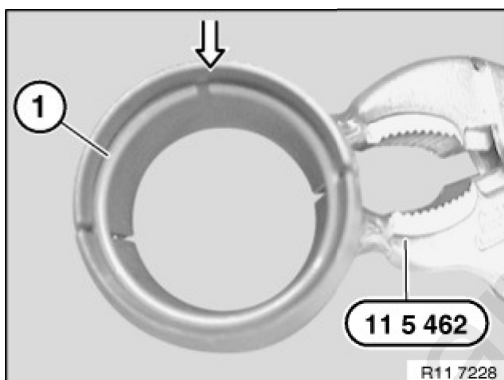
[Technical Data.](#)

Piston installation clearance,

[Technical Data.](#)

Permitted total wear clearance,

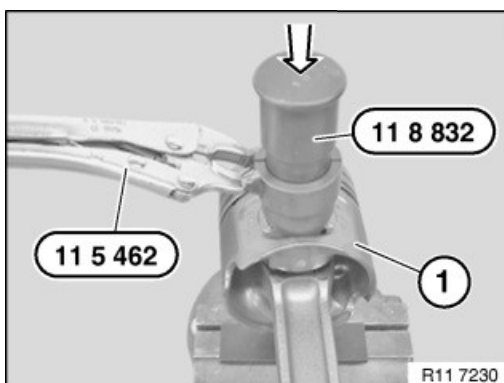
[Technical Data.](#)



Warning!

Safety goggles must be worn.

Fit gudgeon pin retaining ring (1) in connecting rod at the piston.

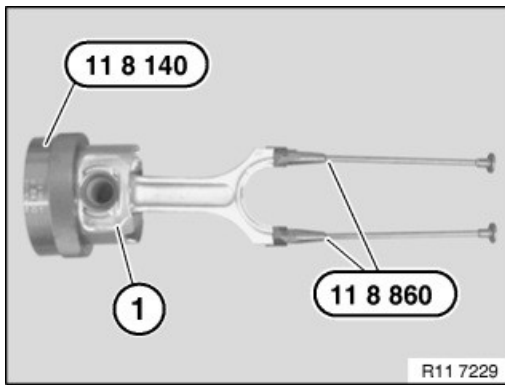


Attention!

Piston and gudgeon pin are matched to each other.

They must not be mixed up.

Install circlip so that opening is opposite recess.

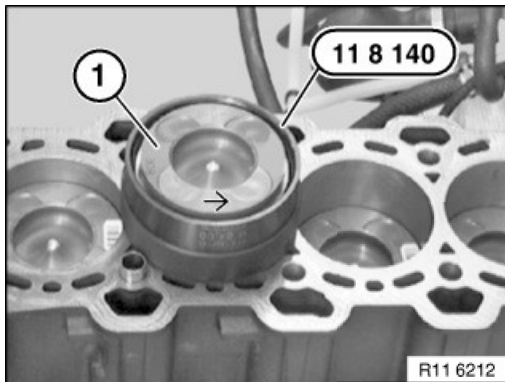


Align contact points of [piston rings](#) (offset at approx. 120°, but do not arrange over gudgeon pin boss).

Oil piston and piston rings.

Prepare piston with piston rings on special tool [11 8 140](#).

Screw special tool [11 8 860](#) on at large connecting rod eye.



Insert piston (1) with connecting rod in cylinder.

Attention!

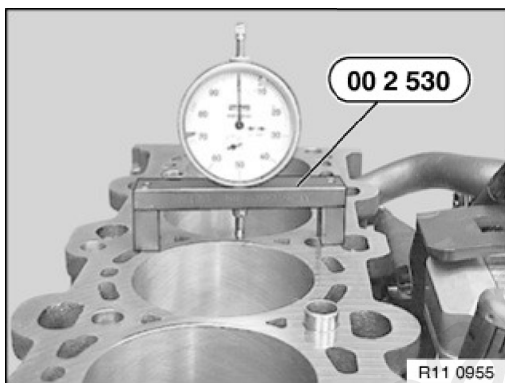
Risk of piston ring breakage.

Risk of damage to oil spray nozzle.

Press in piston with finger force only, do **not** knock in.

Install piston so that arrow points forward in direction of travel.

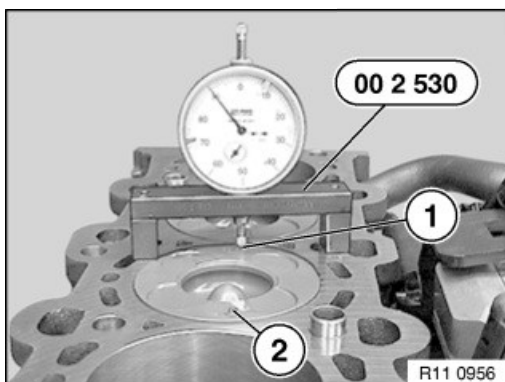
Bolt piston (1) with [connecting rod](#) to crankshaft.



The gasket thickness must be recalculated when repair work is carried out on the crankshaft drive or pistons.

Measuring the **piston protrusion**:

Fit dial gauge with measuring fixture special tool [00 2 530](#) on cleaned engine block sealing surface and set to zero under preload.



Position piston at TDC.

Clean piston at measuring points (1 and 2).

Fit dial gauge at measuring point (1) on piston and determine highest point by rotating crankshaft.

Measure and note down piston protrusion at measuring points (1 and 2) on all pistons.

Determine [thickness of cylinder head gasket](#).



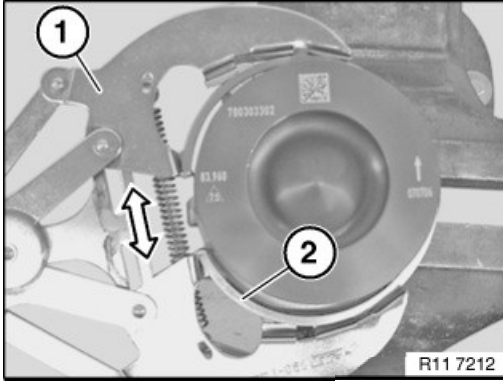
Assemble engine.

Check engine function and check for leak tightness.



Necessary preliminary work:

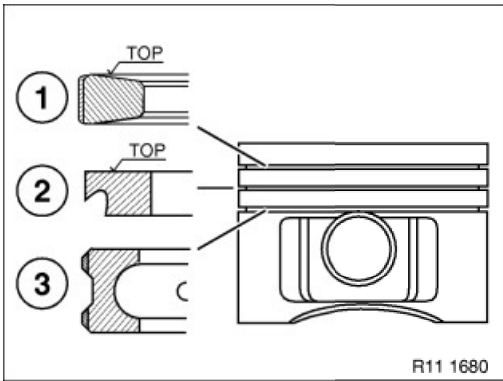
- Remove [pistons](#).



Remove all piston rings (2) with piston ring pliers (1). **Note:**

It might not be possible to find the identification on used piston rings.

Put aside piston rings in correct sequence and installation position.

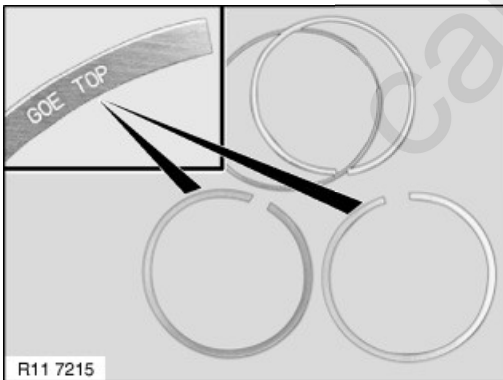


Installation note:

Install piston rings with "TOP" to piston crown.

1. Taper face compression ring
2. Stepped ring
3. Bevelled roof ring with spiral expander

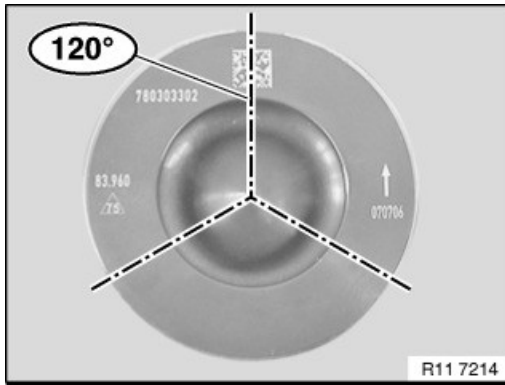
Arrange piston ring contact points with offset of approx. 120° to one another, but not over gudgeon pin boss.



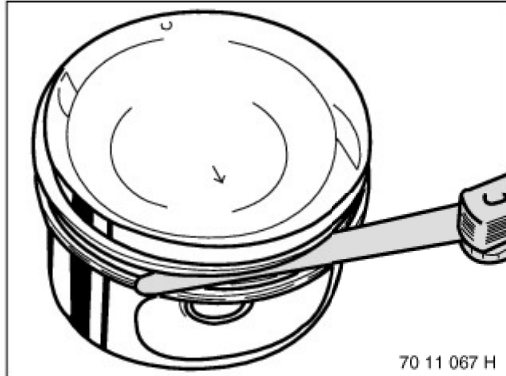
Installation note:

Marking (TOP) must point towards piston crown.

The oil scraper ring has no identification marking and can be installed in any position.

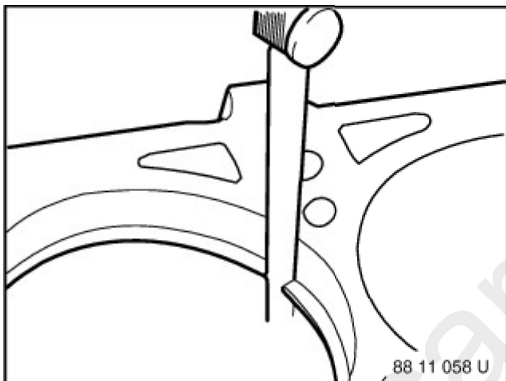


Position piston rings offset **120°** to each other.



Measure side clearance.

[Refer to Technical Data.](#)



Measure end clearance.

[Refer to Technical Data.](#)



Assemble engine.