Service Information

Caterpillar Motoren GmbH & Co. KG product support information for medium-speed engines

Engine platform: M32
Engine section: Connecting rod
Engine type: all variants of M32 and CGM34
Validity: until further notice

No. 0010M32 • Issue 1; August 07, 2019

Information for all recipients of Service Information

Action: At your convenience

Judgement of connecting rod big end bore

Field experience, especially from high loaded generator sets, has shown that the big end bore of the connecting rod tends to deform after very long operation time. The big end bore tends to become lemon-shape and the bearing clearance can be reduced insensitive areas. In extreme cases, fretting marks at the big end bore surface might lead to cracks in the big end bearing cap.

To draw the attention of operation and maintenance personnel to this, point we now include wear limits and instructions for the judgement of big end bore surfaces in the big end bearing assembly / disassembly job card.

Please find the latest respective job card attached and have it added to your current engine maintenance book.

Please note that this new job card is also valid as guidance for older M32 / GCM34 family engine types that are not stated on this new job card. Carry out the judgement according to the new job card AND follow the tightening / assembly sequence according to your job cards on board!

In case fretting marks or ovality values beyond the wear limit are found please contact authorized MaK/CM service providers and inquire about connecting rod rework possibilities.

Caterpillar Motoren GmbH & Co. KG, Kiel, Germany • Phone: +49 (0) 431 3995-3197 • Fax: +49 (0) 431 3995-3894 • E-mail: ju_tecservice@cat.com

02

See also: *A5.05.01.06.01.nn, A5.05.02.06.01.nn, A5.05.01.11.01.nn, A5.05.13.01.01.nn*

Spare parts sheets:

Personnel requirement: *2 pers.*

Personnel qualification: *Skilled engine hand*

Operating medium: *Every fuel*

Activities:

1. Remove the big end bearing
2. Measure the ovality (big end bore)
3. Evaluate the big end bearing bore surface
4. Install the big end bearing

	Tools and auxiliary materials	**Index**	**Tool No.**	
M 32 C	Mounting and removal device:	W1	9.9228 B	
	Suspension 1 (exhaust side)	W1.1	9.9228-407	
	Suspension 2 (camshaft side)	W1.2	9.9228-408	
	Skid	W1.3	9.9228-411	
	Stopper (exhaust side)	W1.4	9.9228-105	
	Assembly tube	W1.11	9.2083-601	***
	Connecting rod clamping device	W2	9.9228 C	
VM 32 C	Mounting and removal device (stroke 460)	W1	9.2185 A	
GCM34	Mounting and removal device (stroke 420):	W1	9.9228 G	
	Suspension (3x)	W1.1	9.9228-403	
	Skid	W1.3	9.9228-405	
	Stopper (optional)	W1.4	9.9228-105	
	Skid (extension)	W1.6	9.9228-406	
	Spacer 55 Spacer 33	W1.8	9.9228-005 9.9228-006	
	Assembly tube	W1.11	9.9228-501	
	Clamping device VM 32 C (2x) GCM34, 12+16 cylinders (2x)	W2	9.9228 F	
	Distributor (part of the set of hydraulic devices)	W3.5	0.9203-004	
GCM34	Clamping holder (20 cylinders; 2x)	W2	341513 A	
*** optional / not included in the standard tool kit				

	Tools and auxiliary materials	Index	Tool No.	
M 32 C VM 32 C GCM34	Set of hydraulic tools:	W3		
	High-pressure hydraulic pump	W3.1	0.9204 D	
	Optional: Portable hydraulic pump		0.9204 N	
	High-pressure hose (1 m)	W3.2	0.9205 B	
	Hydraulic jack	W3.3	0.9213 C	
	Pin	W3.4	0.9203-110	
	Support ring	W3.6	0.9203-209	
	Threaded sleeve	W3.7	0.9203-101	
	Torque wrench 40 - 200 Nm		1.9454-040	*
	Molykote paste “G-Rapid Plus”		1.9493-001	*/**
* no picture				
** or equivalent product				

DANGER

Danger to life in case of improper barring!

- It is forbidden to stay in the crankcase while barring the engine!
- Only bar the engine when it is ensured that no persons are in the crankcase of the engine.

WARNING

Risk of injury in case of improper handling of the hydraulic device!

In case of leaks, hydraulic oil leaking under high pressure may cause severe injuries up to death.

- Do not place any parts of the body above the pressurized devices.
- Use personal protective equipment.

CAUTION

Property damage possible due to misuse or wrongly stored tools.

Misuse of tools may cause damage.

- The bending radius of the high-pressure hoses must not be less than **120 mm**.
- Use only hydraulic oil for operating hydraulic tools.
- Store the devices protected against corrosion.

CAUTION

On V-engines there is a risk of connecting rod collision when barring the engine with piston removed!

After removal of only one piston of a crank pin the engine cannot be barred any more by 360°. During barring there is a risk of shank division collision.

- During barring always make sure that the shank divisions do not touch each other! If necessary, change the direction of rotation.

NOTE

Big end bearing cap, big end bearing bolts, connecting rod, and bearing shells are marked depending on cylinder unit and, if applicable, A and B side and may not be interchanged.

- Always replace the bearing shells **in pairs**; replace the connecting rod only **together** with the big end bearing cap.

1. Remove the big end bearing

1.1 Secure the engine to prevent unintentional starting.

Conventional diesel engine:
- Interrupt the starting air supply.
- Switch off and block the fuel supply to the engine.
- Throw and secure the emergency stop lever (depending on equipment).
- Set the selector switch at the control stand to “Repair” (depending on equipment).

Gas engine:
- Interrupt the starting air supply.
- Mechanically block the main shut-off valve of the gas valve unit.
- Set the key switch at the “Local Data Board“ to “OFF”.
- Remove the key.

1.2 Remove cylinder head and piston (**A5.05.01.06.01.nn, A5.05.02.06.01.nn**).

1.3 Bar the connecting rod to horizontal position so that both round nuts (**1**/1) are freely accessible.

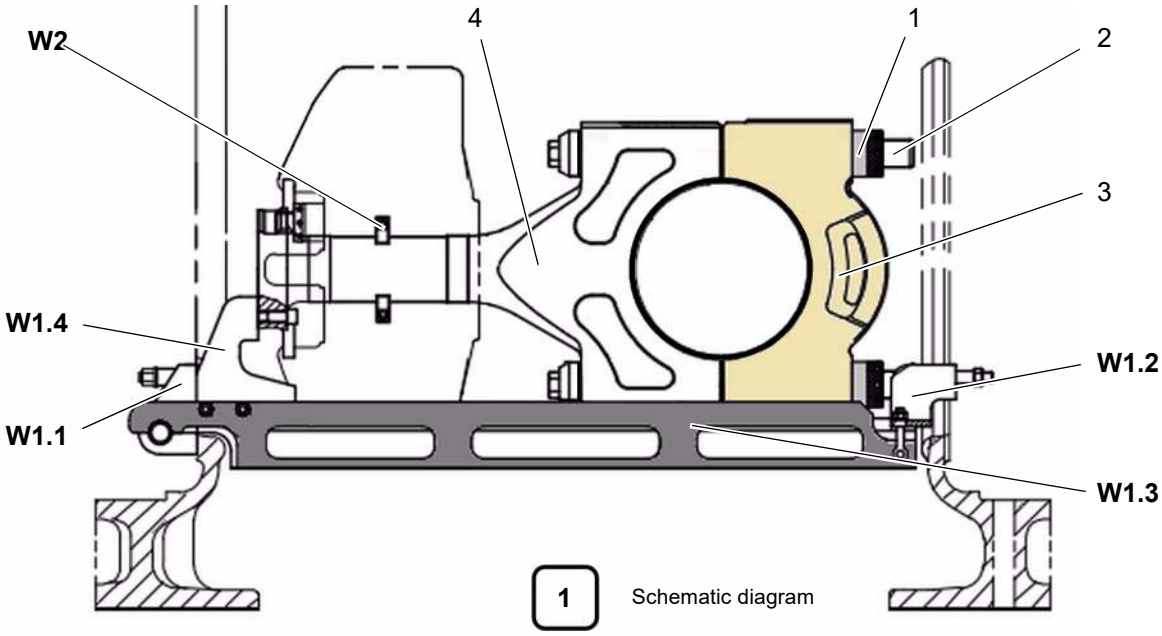
1.4 Loosen the round nuts with the set of hydraulic tools (W3) (**A5.05.13.01.01.nn**).

1.5 Further procedure according to engine type:

M 32 C:	**Continue with 1.6 (Page 4)**
VM 32 C / GCM34:	**Continue with 1.17 (Page 5)**

M 32 C:

1.6 Install the two suspensions (**1**/W1.1 and W1.2) of the mounting and removal device (W1).



1 Schematic diagram

1.7 Insert the skid (**1**/W1.3) into the engine block from the exhaust side, attach it to the suspensions (**1**/W1.1 and W1.2) and align it with the clamping screws so as to be roughly horizontal.

1.8 Carefully bar the connecting rod onto the skid. In doing so, make sure that the skid (**1**/W1.3) rests flatly against the connecting rod (**1**/4) and the big end bearing cap (**1**/3).

1.9 Install the stopper (**1**/W1.4) and screw together the connecting rod (**1**/4) and the stopper (**1**/W1.4).

1.10 Make sure that the stopper (**1**/W1.4) is fitted only to the connecting rod (**1**/4), rests on the skid (**1**/W1.3) and can be freely shifted.

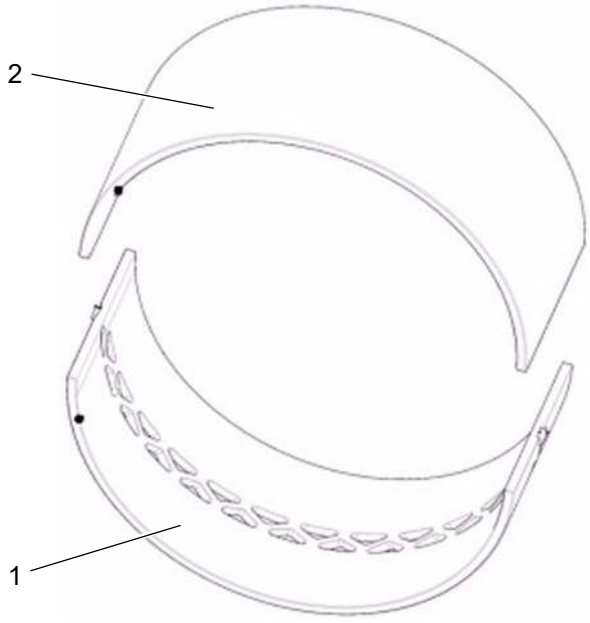
1.11 Remove the connecting rod clamping device (**1**/W2) from the balance weight.

1.12 Remove the round nuts (**1**/1).

1.13 Pull the big end bearing cap (**1**/3) off the crank pin.

1.14 Push the lower bearing shell (**2**/1) aside and take it out of the big end bearing cap (**1**/3).

1.15 Remove the connecting rod bolts (**1**/2) and pull the connecting rod (**1**/4) off the crank pin.



2 Schematic diagram

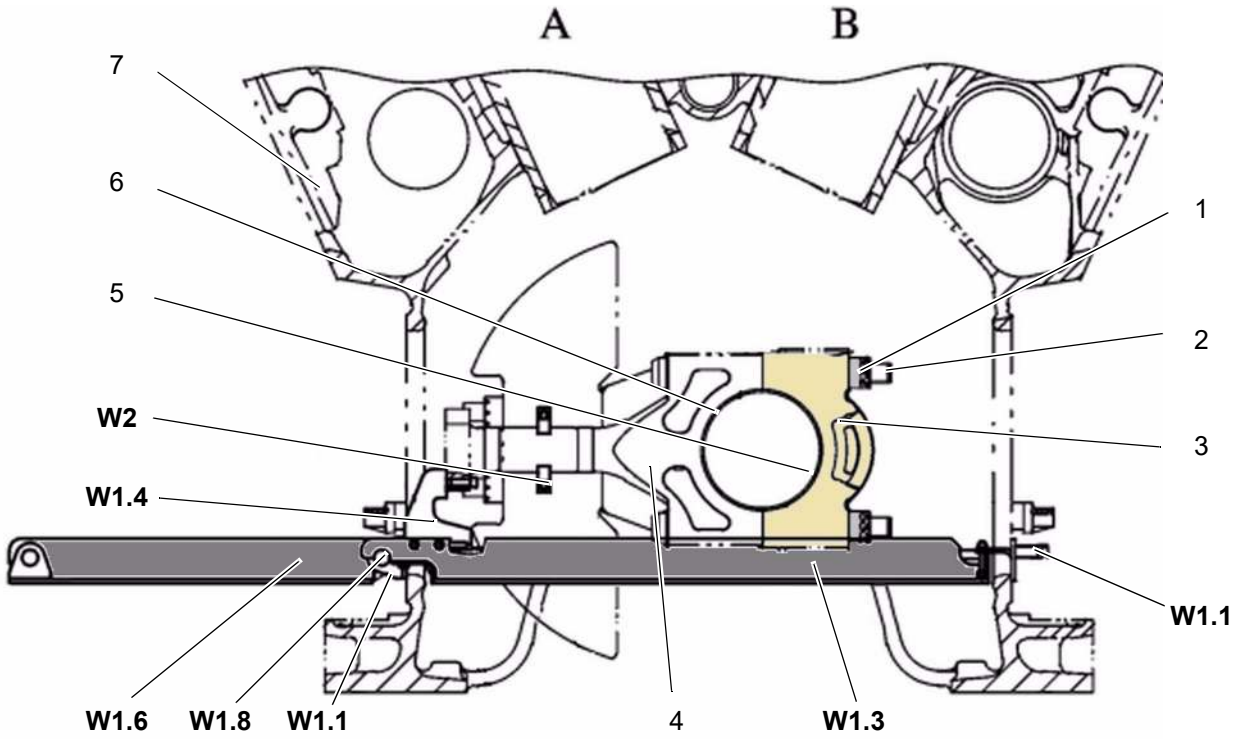
1.16 Push the upper bearing shell (**2**/2) aside and take it out of the connecting rod (**1**/4).

	NOTE
	For an evaluation of the crank pin and bearing shell running surfaces please contact your authorized **Caterpillar** dealer.

VM 32 C / GCM34:

1.17 Install the suspensions (**3**/W1.1) with spacers (**3**/W1.8).

	NOTE
	Figure **3** shows the connecting rod removal device (W1) for dismounting the connecting rod (**3**/4) on the B side. The device can also be installed mirror inverted.



3 Schematic diagram

1.18 Insert the skid (**3**/W1.3) with extension (**3**/W1.6) and clamping screws into the engine block (**3**/7), lift it and attach it to the suspensions.

1.19 Align the skid with clamping screws arranged on the outside.

1.20 Carefully bar the connecting rod onto the skid. In doing so, make sure that the skid rests flatly against the connecting rod (**3**/4) and the big end bearing cap (**3**/3).

1.21 If necessary, install the stopper (**3**/W1.4) and screw together connecting rod (**3**/4) and stopper.

1.22 Make sure that the stopper is fitted only to the connecting rod, rests on the skid and can be freely shifted.

1.23 Remove the clamping device (**3**/W2).

1.24 Remove the round nuts (**3**/1) from the balance weight.

1.25 Remove the upper connecting rod bolt (**3**/2) and insert the assembly tube (**4**/W1.11) into the connecting rod bolt bore. The assembly tube now connects the big end bearing cap and the connecting rod.
Remove the lower connecting rod bolt.

1.26 Pull the big end bearing cap (**3**/3) with the lower bearing shell (**3**/5) off the crank pin.

1.27 Push the lower bearing shell aside and take it out of the big end bearing cap.

1.28 Pull the big end bearing cap (**5**/3) along the assembly tube on the skid (**4**/W1.3) out of the engine.

1.29 Attach the big end bearing cap with suitable means to the crane and place it onto a suitable base in such a way that the marking (**5**/Q) points upwards.

1.30 Pull the connecting rod (**4**/4) off the crank pin.

1.31 Push the upper bearing shell (**3**/6) aside and take it out of the connecting rod.

	***NOTE***
	For an evaluation of the crank pin and bearing shell running surfaces please contact your authorized **Caterpillar** dealer.

1.32 Remove the assembly tube.

1.33 Pull the connecting rod on the skid out of the engine.

2. Measure the ovality (big end bore)

2.1 Attach the connecting rod with suitable means to the crane.

2.2 Remove the stopper (**4**/W1.4); lift the connecting rod (**4**/4) and put it onto a suitable base next to the big end bearing cap (**5**/3) so that it is possible to screw together the connecting rod and the big end bearing cap and the marking (**5**/Q) points upwards.

4 Schematic diagram

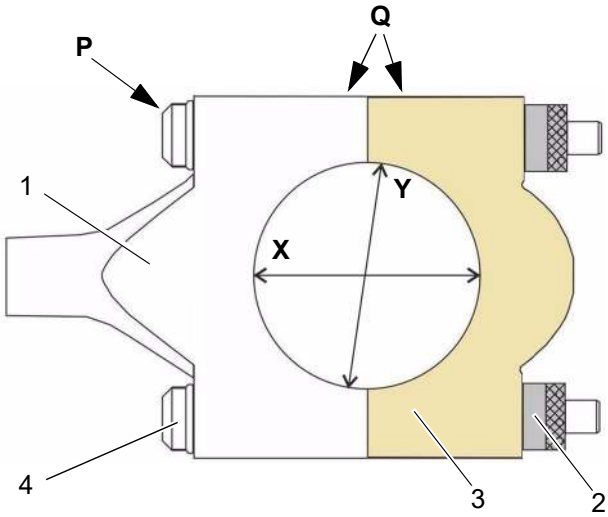
2.3 Join the connecting rod (**5**/1) and the big end bearing cap (**5**/3) in dismounted condition without bearing shells.

2.4 Tighten the round nuts (**5**/2) so as to be finger tight.

2.5 Mechanically pretighten the round nut on camshaft side (see marking) with a torque of **100 Nm** $^{+30\ Nm}$ (74 lb ft $^{+22lb\ ft}$).

2.6 Mark the round nuts in a suitable manner for the final torque angle check (e.g. with chalk).

2.7 Fix the round nuts with the set of hydraulic tools (W3) (**A5.05.13.01.01.nn**).



5 Schematic diagram

2.8 Carry out the torque angle check.
The torque angle must be between **203°** to **225°** / **4.5** to **5** hole spacings.

2.9 Measure the diameter of the big end bore (dimension **5**/X and **5**/Y).
Do not measure dimension **Y** in the area of the division but (as shown in Fig. **5**) approx. **20 mm** away from to the division.

Permissible ovality	
Delta = Y - X ⟶ max. 0.12	
Dimension X (minimal)	292.92 mm
Dimension X (maximal)	293.02 mm
Dimension Y (maximal)	Actual dimension X +0.12 mm

NOTE

If the indicated maximal values are reached or exceeded, please contact your authorized **Caterpillar** dealer.

2.10 Document the measuring results in the measuring sheet (see Appendix).

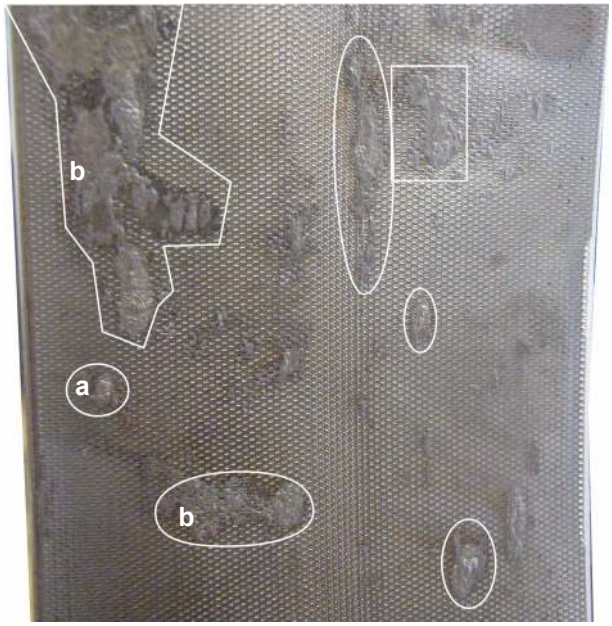
3. Evaluate the big end bearing bore surface

3.1 Check the surface of the big eng bearing bore for fretting marks.

NOTE

In case of any fretting, please contact your authorized **Caterpillar** dealer.
For minor fretting marks (**6**/a) refinishing by the authorized dealer may be possible.
In case of bigger fretting marks (**6**/b) the connecting rod must be replaced.

3.2 Loosen the round nuts (**5**/2) with the set of hydraulic tools (W3) (**A5.05.13.01.01.nn**) and remove them with the connecting rod bolts (**5**/4).



6 Schematic diagram

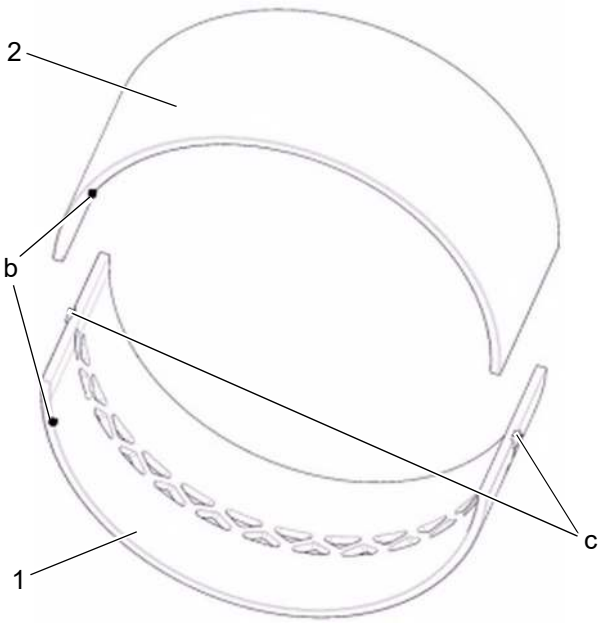
4. Install the big end bearing

4.1 Clean and oil the crank pin.

4.2 If **new** bearing shells (**7**/1 and **7**/2) are used, oil them on the inside.

4.3 Attach the connecting rod (**8**/2) with suitable means to the crane and put it onto the skid (**8**/W1.3).
In doing so, pay attention to the marking (**8**/Q) and correct position of the fixation hole of the spring dowel pin (**8**/4).

4.4 Separate the connecting rod from the crane and remove the sling.



7 Schematic diagram

NOTE

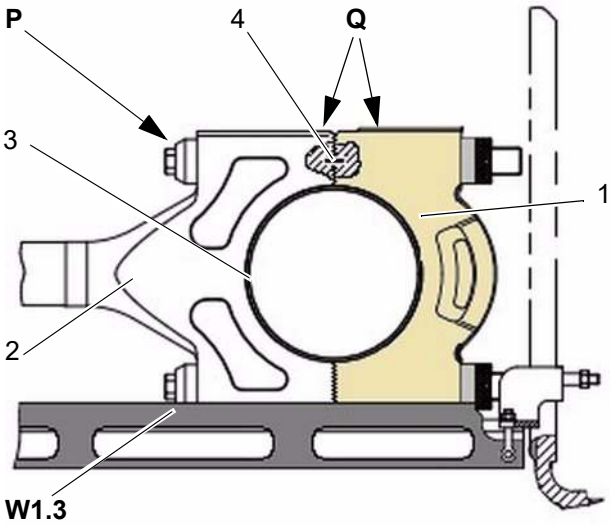
When inserting the bearing shells (**7**/1 and **7**/2) pay attention to the position of the marking (**7**/b); the marking must point towards the driving end.

Additionally, the lower bearing shell (**7**/1) is provided with locating lugs (**7**/c) for fixation in the big end bearing cap.

4.5 Insert the upper bearing shell (**8**/3) into the connecting rod, align it and press it into the basic bore.
In doing so, make sure that the projection of the upper bearing is the same on both sides.

4.6 Carefully push the connecting rod until it contacts the crank pin.

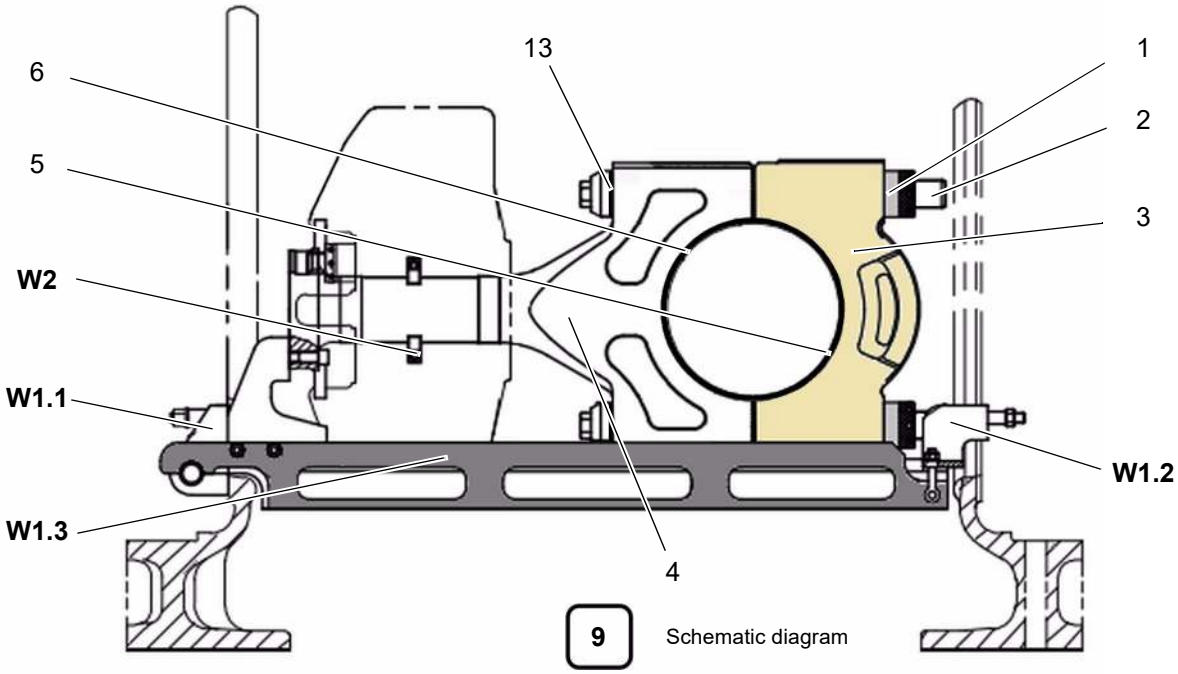
4.7 Insert the assembly tube (**4**/W1.11) into the connecting rod bolt bore.



8 Schematic diagram

4.8 For **M 32 C**: Install the connecting rod clamping device (**9**/W2).
For **VM 32 C / GCM34:** Install the clamping device (**10**/W2) at the balance weight and secure the connecting rod (**10**/4) with the holding screws (**10**/12).

4.9 Attach the dismounted big end bearing cap (**9**/3) with suitable means to the crane and place it onto the skid (**9**/W1.3).



9 Schematic diagram

4.10 Insert the lower bearing shell (**9**/5) into the big end bearing cap, align it and press it into the basic bore.

4.11 Carefully push the big end bearing cap with lower bearing shell along the assembly tube (**4**/W1.11) against the connecting rod (**9**/4).
In doing so, pay attention to the following:

- Spring dowel pin (**8**/4) must be positioned in the bore.
- Locating lugs (**7**/c) of the lower bearing shell (**7**/1) must be positioned exactly in the corresponding pocket of the big end bearing cap.

	NOTE
	When checking the bearing shells pay attention to bearing shell offset! Offset in axial direction is not permissible! • Before tightening the connecting rod bolts eliminate any offset by aligning the bearing shells appropriately.

4.12 Lubricate the thread and contact surfaces of the connecting rod bolts with Molykote.

4.13 Remove the assembly tube (**4**/W1.11).

4.14 Insert the connecting rod bolts if necessary with washer (**9**/13).
The chamfer of the washer must point towards the connecting rod. Furthermore, before hydraulic tightening make sure that the head of the connecting rod bolt is located in the recess of the washer.

4.15 Install the round nuts (**10**/1) and tighten them so as to be finger tight.

4.16 Mechanically pretighten the round nut on camshaft side with a torque of **100 Nm** $^{+30\ Nm}$ (74 lb ft $^{+22lb\ ft}$).

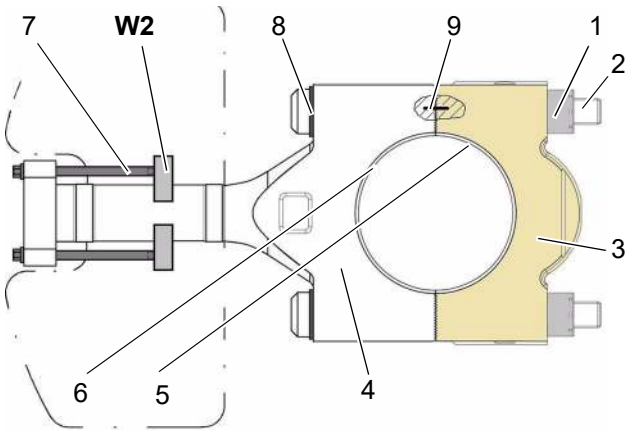
4.17 Mark the round nuts in a suitable manner for the final torque angle check (e.g. with chalk).

4.18 Fix the round nuts with the set of hydraulic tools (W3) (**A5.05.13.01.01.nn**).

4.19 Carry out a visual torque angle check. The torque angle must be between **203° to 225°** / **4.5 - 5 hole spacings**.

4.20 Remove the connecting rod removal device (W1).

4.21 Install piston and cylinder head (**A5.05.02.06.01.nn** and **A5.05.01.11.01.nn**).



10 Schematic diagram

4.22 Lift the measures for securing the engine to prevent unintentional starting.

Conventional diesel engine:

- Reestablish starting air supply.
- Set the emergency stop lever to operating position.
- Reestablish fuel supply to the engine (depending on equipment).
- Set the selector switch on the control stand to “Engine” or “Remote“.

Gas engine:

- Reestablish starting air supply.
- Open the main shut-off valve of the gas valve unit.
- Insert the key into the key switch at the “Local Data Board“.