CAT® Marine Power

MaK SERVICE Focused on Customer Needs

Service Information No. 01 / 04

Date: 26.03.2004

Alternative Tightening Instruction for Connection Screws of Camshaft Sections 7 M 43

For the connection screws of the camshaft sections of the 7-cylinder engine the specified tightening torque is **560 Nm** (see job card A5.05.**04.04.01.nn**). For cases where no torque wrench is available for this tightening torque we are offering the following alternative tightening instruction which provides for a lower torque in connection with a torque angle.

Alternative tightening instruction for screws

7M43
Apply Molykote Paste "G-Rapid Plus" to threads and contact surfaces of the screws and tighten the camshaft sections in two steps as follows:

Step 1: Preload the screws with a torque of **M = 250 Nm** (lubricant: Molykote).

Step 2: Mark the screws and continue turning by a torque angle of α **= 30°** by means of a single-end box wrench SW (spanner size) 32 (30° ≈ 1/2 hexagon)

560 Nm = 250 Nm + 30°

We are expressly pointing out that this alternative tightening instruction applies to the M 43 engine with 7 cylinders only.

For M 43 engines with other cylinder numbers the values indicated in the respective operating instruction manual continue to be valid.

Caterpillar Marine Division, Kiel, Germany • Phone: +49 (0) 431 3995-2245 • Fax: +49 (0) 431 3995-2010 • E-mail: ju_tecservice@CAT.com •

See also:	*01.01.01.nn, 01.02.01.nn, 04.01.01.nn, 04.01.02.nn, 07.02.01.nn*
Spare parts list:	*B1.05.04.433120*
Time requirement:	*1 Pers./ 3,00 h*
Personnel qualification:	*skilled engine hand*
Operating medium:	*Heavy fuel and distillate fuel*

Tools:

Sling	W1 *	439230 A
Hex bolts	W2 *	
Torque wrench 120 - 600 Nm	W3 *	
Insert	W4 *	1.9424-030
Reversible ratchet	W5 *	1.9459-033

* no picture

Auxiliary materials:

Molykote Paste “G-Rapid Plus” **

** or equivalent product

Procedure:

Attention:

The camshaft may only be turned after the bolted connection is loosened when
- **the rocker arms of the camshaft section to be replaced and**
- **all rocker arms to the right of the section to be replaced have been removed or raised and secured and**
- **the straight pin (Fig. 1/5) has been removed from the bearing journal (13) or the left camshaft section is removed!**

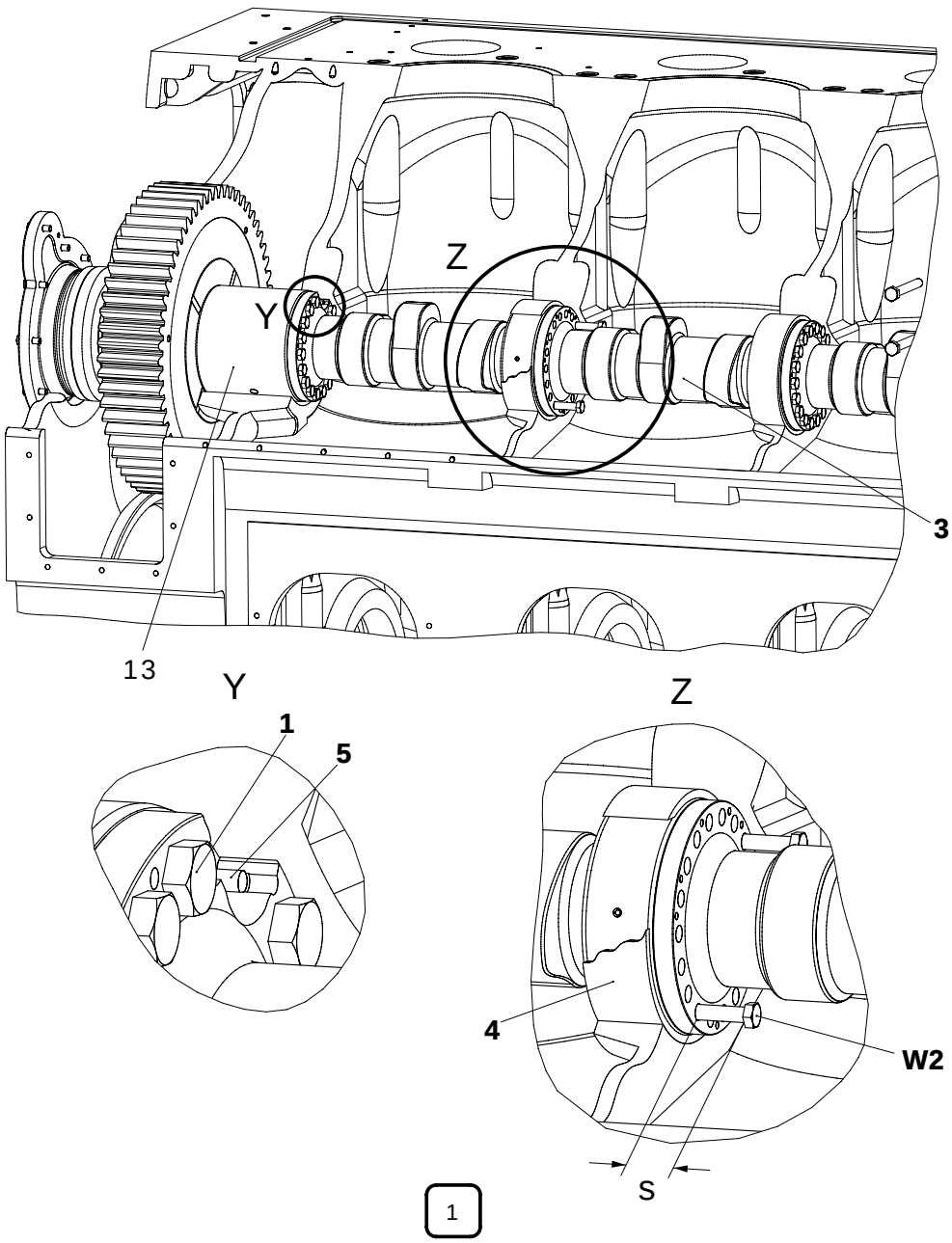
1. Disassembly

1.1 Open the indicator valves and remove the camshaft cover with housing covers and gaskets on the control side.

1.2 Remove all rocker arms for the corresponding cylinder and the rocker arms of all cylinders located to the right of the camshaft section to be removed to relieve the load on the camshaft.

1.3 Remove the injection pump of the corresponding cylinder and for all cylinders to the right of the cylinder being checked (**07.03.01.nn**).

1.4 Remove the lifters and the camshaft section for the corresponding cylinder and all camshaft sections to the right of the camshaft section being removed. Raise and secure the rokker arms for the intake and exhaust valves as well as for the injection pump drives for the corresponding cylinder and all cylinders to the right of this cylinder.



1

1.5 When removing the **last** camshaft section:

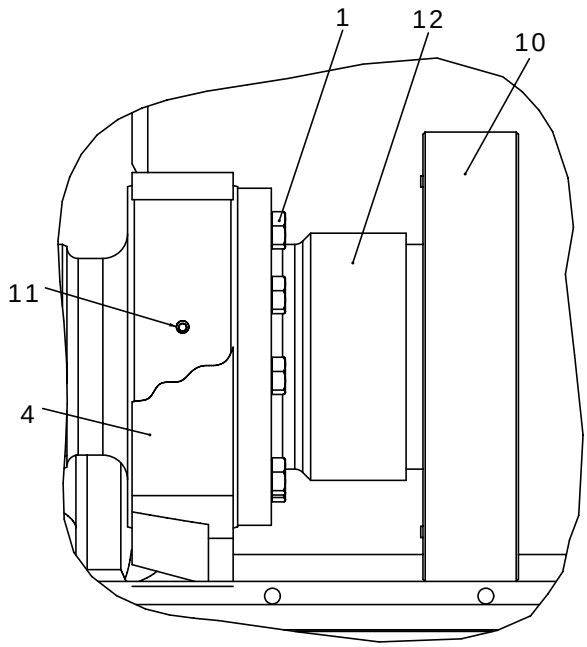
1.5.1 Remove the oscillation damper (**Fig. 2/** 10) (**04.09.01.nn**) and slide to the right as far as possible.

1.5.2 Remove the intermediate piece (12).

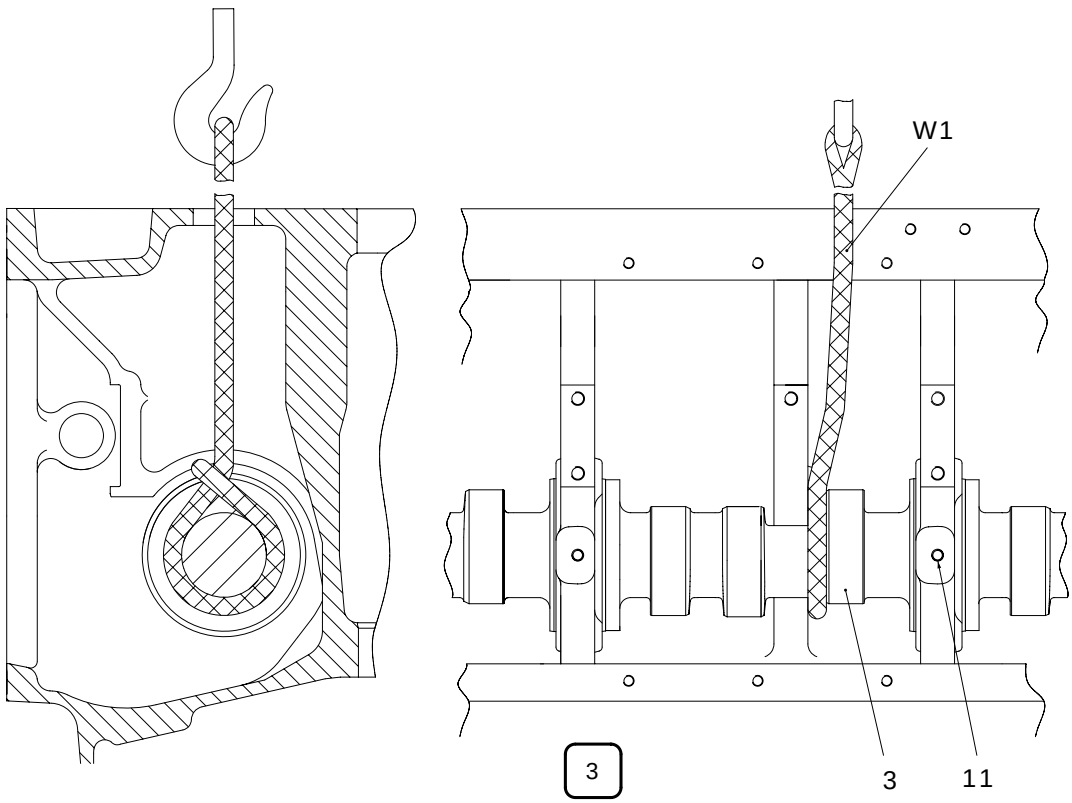
1.6 Place the sling (**Fig. 3/**W1) around the camshaft section (3) between the exhaust cam and injector cam and connect to the lifting unit through the injection pump bore in the crankcase.

1.7 Tighten the sling (W1) with the lifting unit.

1.8 Remove the retaining bolt (11).



2



3

1.9 Drive the right camshaft bearing (**Fig. 1/**4) out of the camshaft section with a suitable wood block and rubber mallet. Fill the camshaft bearing (4) with cardboard.

1.10 Loosen the hex head bolts (**Fig. 1/**1) on both camshaft section (3) flanges.

Turn the engine to make access any inaccessible hex head bolts and remove all bolts from the left flange. Replace two opposing hex head bolts with longer bolts (W2). Set measure "**s**".

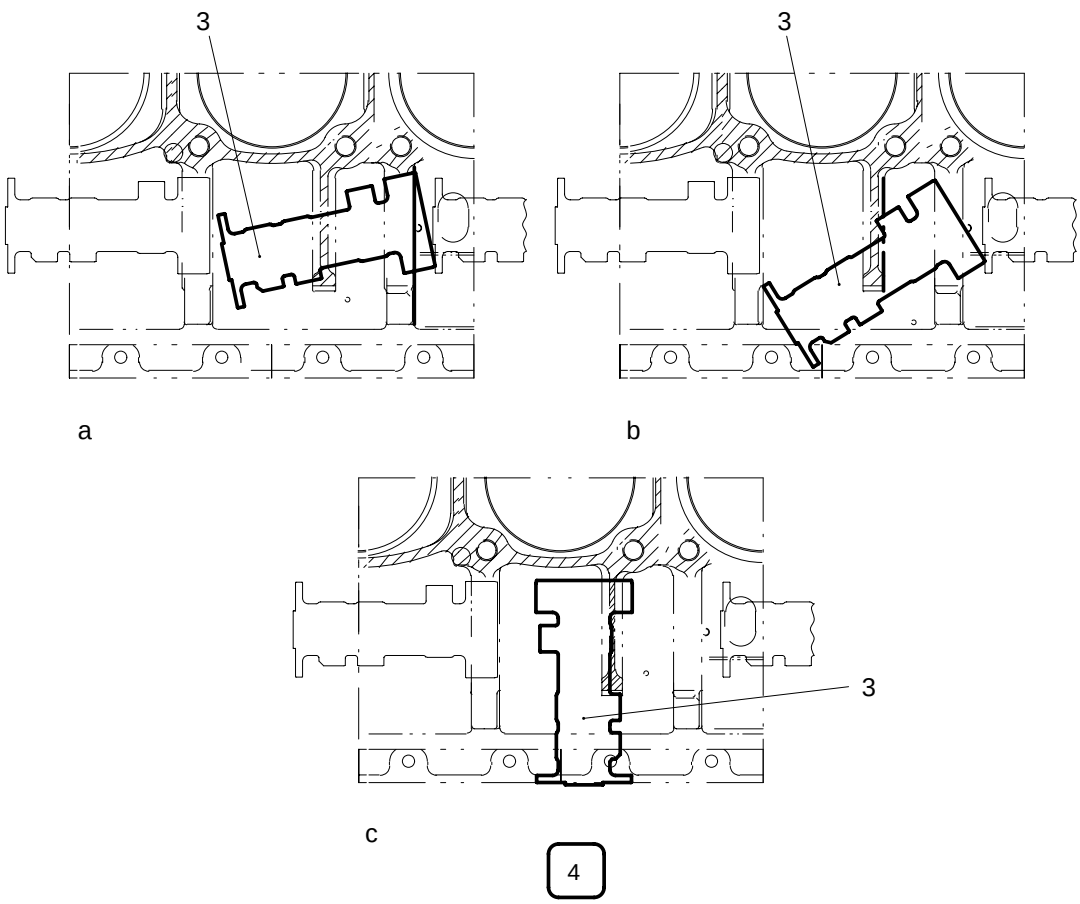
s = 68 ± 0.5 mm

Remove all hex head bolts on the right flange of the camshaft section.

1.11 Place cardboard or similar material around the camshaft bearing journal.

1.12 Slide the camshaft to the right until it stops (distance "**s**") with a strip of wood. Secure the remaining sections.

Distance s = 68 ± 0.5 mm



4

Attention:
Apply no excessive or sudden force when sliding! Do not damage the bearings or bearing journals.

1.13 Secure the right end of the camshaft with wooden wedges.

Attention:
Do not tilt the camshaft sections too much! Be very careful!

1.14 Fill the camshaft trough with cardboard or a similar material.

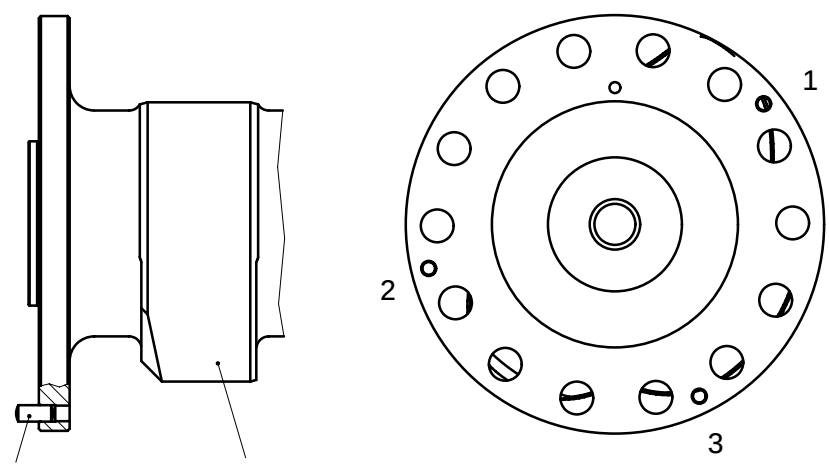
1.15 Pull the camshaft section (**Fig. 4/**3) out of the bearing block to the left while lowering the lifting unit. Swing the camshaft section 90° and lift from the camshaft trough. Note the weight of the section (ca. 200 kg).

1.16 Remove camshaft bearing (4) and inspect (**04.01.02.nn**), replace if necessary.

2. Assembly

2.1 Press the straight pin (**Fig. 5/**5) into the flange until it stops in accordance with the numbering (see table) on the camshaft section flange.

Camshaft section for cylinder	Insert straight pin for code
1	3
2	3
3	1
4	2
5	2
6	1
7	3



5

2.2 Oil the inside and outside of the camshaft bearing (**Fig. 1/**4) thoroughly and place on intake cam of the right camshaft section.

2.3 Place camshaft section (3) facing the coupling side in the corresponding camshaft trough on cardboard or similar material.

2.4 Place the sling (**Fig. 3/**W1) around the camshaft section between the exhaust cam and the injection pump cam and connect to lifting unit through the injection pump bore in the crankcase.

2.5 Raise the lifting unit slowly and slide the camshaft section bearing journal into the bearing bore in the crankcase carefully.

Attention:
Do not tilt the camshaft sections too much! Be very careful!

2.6 Align the camshaft section with the straight pin towards the bore in the bearing journal or in the bearing flange built into the left end of the camshaft section.

2.7 Attach the camshaft section to the right camshaft section flange by tightening two opposing hex head bolts (**Fig. 1/**1) hand tight.

2.8 Slide the camshaft section carefully to the left with a wood strip until the straight pin (5) and the recess in the camshaft section engage securely. **When sliding the camshaft section to the left, the free-hanging camshaft section must be supported**.

Attention:
Apply no excessive or sudden force when sliding! The camshaft gear may not be slid by the camshaft section!

2.9 Apply Molykote to all hex head bolts (1).

2.10 Place the hex head bolts in the left camshaft section flange (as many as possible) and gradually tighten at least three bolts to

M = 560 Nm

crosswise. Bolt the bores which cannot be reached at this time **later**!

2.11 Align the retaining bore in the camshaft bearing with the bore for the retaining bolt (11) in the crankcase.
The notch in the bearing shell must be at the top.

2.12 Drive the camshaft bearing (4) into place evenly with a suitable wood block and rubber mallet. Do not tip the bearing. The bearing shell must face the retaining bore.

2.13 Apply Molykote to the retaining bolt (11) and install. Tighten the bolt to

M = 130 Nm

2.14 Lower the lifting unit and remove the sling (**Fig. 1/**W1).

2.15 Screw the remaining hex head bolts into the right and left camshaft section flanges by hand. (Turn the engine if necessary). Tighten the bolts (1) gradually crosswise to

M = 560 Nm

2.16 After installing the last camshaft section:

2.16.1 Place the intermediate piece (**Fig. 2/**12) on the camshaft section (3) securely. The recess must be placed into the camshaft section completely.

2.16.2 Insert the hex head bolts (1) into the connection between the camshaft section and the intermediate piece. Tighten the bolts hand tight. Then tighten the bolts gradually crosswise to

M = 560 Nm

Alternative Tightening Instruction for Bolts (1):

Apply Molykote Paste "G-Rapid Plus" to threads and contact surfaces of the bolts (1) and tighten them in two steps as follows:

Step 1:
Preload screws with a torque of **M = 250 Nm.**

Step 2:
Mark the screws and continue turning by a torque angle of α = **30°** by means of a single-end box wrench SW (spanner size) 32 (30° ≈ 1/2 hexagon)

560 Nm = 250 Nm + 30°

2.16.3 Install the oscillation damper (10) (**04.09.01.nn**).

2.17 Install valve actuators and the injection pump drives.

2.18 Install the lifters.

2.19 Install the rocker arms and check valve clearance (**01.01.01.nn**).

2.20 Install injection pump (**07.02.01.nn**).

2.21 Check oil flow through camshaft.

2.22 Mount housing cover.

2.23 Close indicator valves.

2.24 Remove turning unit (**12.08.01.nn**).