# Service Information

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

**Engine platform: M32**
**Engine section: Cylinder Head**
**Engine type: M32 & VM32, GCM34**
**Validity: Until revoked**
**No. 0031com - Issue 1; 6 December 2024**

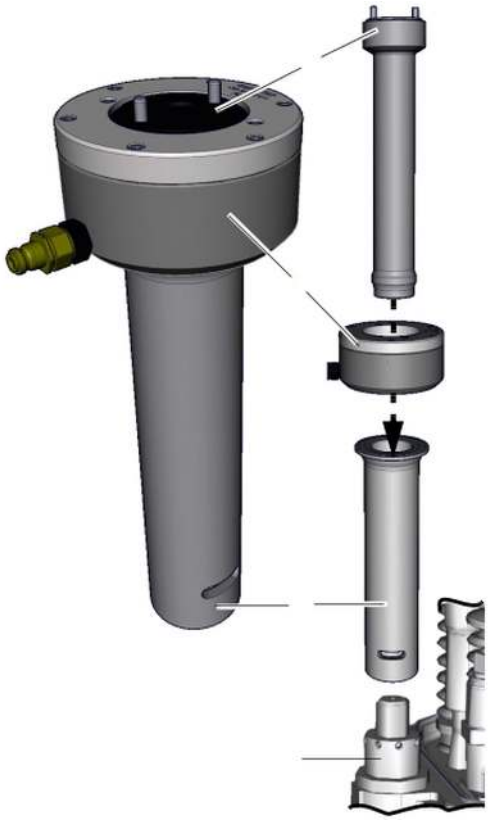
**Action: For your information**

## Standardized tightening pressure for cylinder head studs

The cylinder head tightening instructions for the (V)M32 and GCM34 engine series have been standardized. Practical experience has shown that a higher tightening torque positively affects the service life of the cylinder liner fits and landings.

As part of the standardization, the tightening pressure for the (V)M32 engine series has been increased to **900 bar**, while a standardized tightening pressure of **850 bar** applies to the GCM34 series. The job card **A5.05.13.01.01.10** for these tasks has been adjusted accordingly and can be found on the following pages.

The information in the following job card reflects the status at the time of publication. Minor updates and adjustments are not communicated separately. Therefore, we recommend always using the latest documents. Check regularly, but at the latest before upcoming maintenance work, whether updates are available. The latest manuals can be obtained from your authorized **Caterpillar** dealer.



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## Round Nuts / Loosening and Fixing
Disassembly / Installation

A5.05. **13.01.01.10**

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*See also:*

*Spare parts list:*

***Personnel requirement:*** *2 Pers.*

***Personnel qualification:*** *skilled engine hand / Assistant engine hand*

***Operating medium:*** *Every fuel*

**Activities:**

1. Preparatory work for loosening or fixing of round nuts
2. Loosening of round nuts
3. Fixing of round nuts
4. Troubleshooting
5. Appendix (tables)

**⚠ DANGER**

**Danger to life due to parts breaking off!**

Due to improper handling and / or material failure pressurized components or parts of components may break off, strongly accelerate and cause severe injuries or even death!

- Do not bend over pressurized devices.
- During pressure build-up and 15 seconds thereafter a minimum safety distance of 3 m is to be maintained.
- The pressure indicated in **Table B** (see Appendix) "Stretching Pressure / Prestretching Pressure" for the respective position must not be exceeded.

**⚠ WARNING**

**Risk of injury caused by hydraulic oil leaking under high pressure**

For loosening and fixing of the round nuts the studs are stretched by means of high hydraulic pressure.
If leaks occur due to misuse or improper handling, oil leaking under pressure may cause severe injuries.

- It is absolutely required to wear personal protective equipment (especially safety glasses).
- Do not place any parts of the body above the pressurized devices.
- Establish or loosen connections only in depressurized condition.
- In case of injuries **immediately** see a doctor!



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**CAUTION**

**Property damage due to misuse or improper handling.**
The use of unsuitable or worn parts and inappropriate application may cause property damage!

- High-pressure hoses and their protective jackets must not show any damage.
- Do not let any objects fall onto the high-pressure hoses and do not step on hoses lying on the floor.
- Do not bend the high-pressure hoses sharply. Observe the following minimum bending radii:
-- up to 2000 bar (29008 psi) at least **150 mm**.
-- above 2000 bar (29008 psi) at least **250 mm**.
- **Replace high-pressure hoses latest after 6 years**, even if they do not yet show any damage.
- Do not subject the hose couplings to any bending stress.

***NOTE***

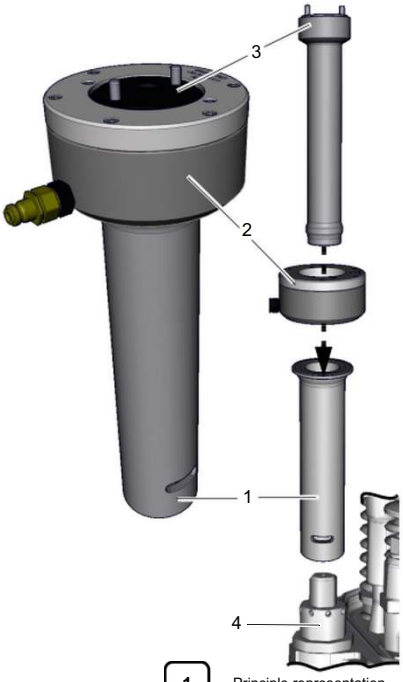
- For the tools needed for the individual jobs please refer to the relevant job cards.
- The illustrations on the following pages are principle representations only. They do not pretend to accurately reproduce the concrete case of application.
- The components reproduced in this document are only intended to illustrate setup and function and may differ in form and size.

**1. Preparatory work for loosening or fixing of round nuts**

1.1 Put in place support ring (**Fig. 1**/1) over the round nut (4).

1.2 Put the hydraulic jack (2) onto the support ring (1).

1.3 Insert threaded sleeve (3) through hydraulic jack and support ring.




1 Principle representation



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1.4 Screw threaded sleeve (**Fig. 2**/3) finger tight onto the stud by means of assembly pins (5) until it reaches end-stop position.

1.5 Check the round nut holes for accessibility. It must be easily possible to insert pin (**Fig. 3**/6) through the slots in the support ring (1) into the holes of the round nut (4). If necessary, align support ring (1) accordingly.

1.6 Connect high-pressure pump (**Fig. 4**/7) with high-pressure hose(s) to the hydraulic jack(s) (2).

1.7 When using several hydraulic jacks at the same time an appropriate distributor (**Fig. 4**/8) is to be used.

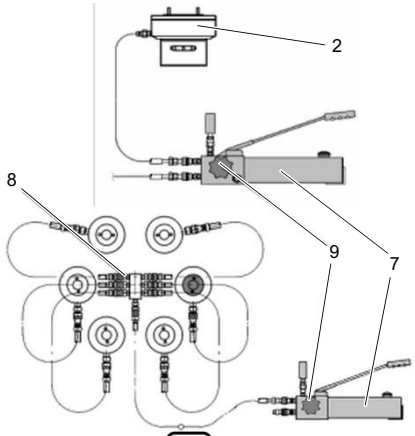
1.8 Open valve (3) of the high-pressure pump (7).

***NOTE***

Depending on the engine variation, corner pieces may be necessary to connect the high-pressure pump (**Fig. 4**/7) and hydraulic jacks.


2 Principle representation


3 Principle representation




4 Principle representation



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1.9 Put in place a suitable lever between assembly pins (**Fig. 5**/5) and turn threaded sleeve (3) onto the stud until it reaches end-stop position.
The ring surface of the threaded sleeve (3) must be flush with the bottom surface of the hydraulic jack (2) or slightly below bottom surface level.

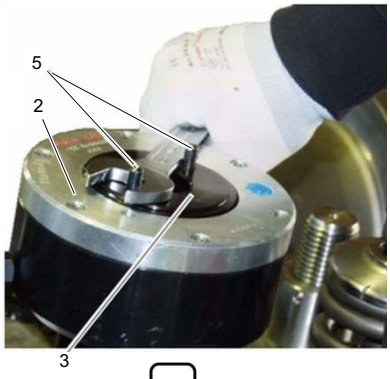
**CAUTION**

**Leaks and stretching errors may occur**

Before using a stretching device the basic position of the hydraulic jack (**Fig. 5**/2) must be established. **Steps 1.1 to 1.9**.
If this basic position is not ensured, there is still oil from a previous application in the pressure chamber of the cylinder. This will increase the prelift of the piston in the hydraulic jack (2) with each use, which will cause leaks and stretching errors.
If several hydraulic jacks (2) are to be pressurized simultaneously, e.g. when disassembling or assembling cylinder head studs, the jacks (2) must be connected to the high-pressure pump (**Fig. 4**/7) one after the other and set to basic position. **Only after** this procedure the hydraulic jacks (2) are to be connected among each other. Otherwise, there is a risk of the excess oil not being pressed back into the high-pressure pump (7) but into another hydraulic jack (2).

***NOTE***

As the hydraulic connection of a hydraulic jack (**Fig. 5**/2) is provided with a non-return valve, the oil can only be removed from the pressure chamber when the high-pressure hose is connected and the valve (**Fig. 4**/9) on the high-pressure pump (7) is open.




5 Principle representation



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**2. Loosening of round nuts**

**CAUTION**

**Damage and malfunctions due to contamination!**

Contamination on connections of hydraulic components causes leaks.
There may occur problems when connecting or loosening the connections as well as malfunctions in the hydraulic system.

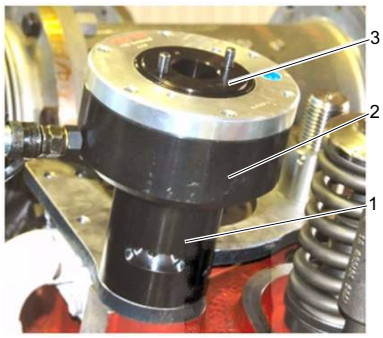
Hydraulic connections are to be plugged upon disassembly of the components.

2.1 Turn back threaded sleeve (**Fig. 6**/3) by the value indicated in **Table A** (see Appendix) for the respective position or adjust the distance by means of a feeler gauge (**Fig. 13**/11).

2.2 Close the valve (**Fig. 4**/9) on the high-pressure pump (7).

2.2.1 Actuate the high-pressure pump (7) and for the time being build up a pressure of **50 - 100 bar** (725 psi - 1450 psi).

2.2.2 Check all connections of the high-pressure hoses on the hydraulic jacks (**Fig. 6**/2), on the high-pressure pump (**Fig. 4**/7) and, if applicable, on the distributor (8) for complete locking (see **Fig. 12**).

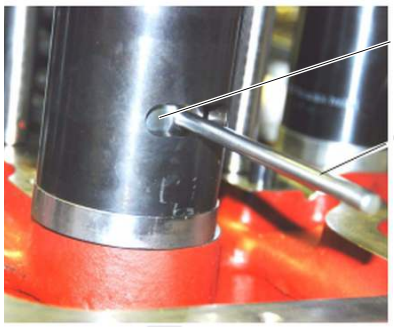



6 Principle representation

2.3 After this check actuate the high-pressure pump (**Fig. 4**/7) again and build up the pressure indicated in **Table B** (see Appendix) for the respective position.
All connected hydraulic jacks (**Fig. 6**/2) are pressurized simultaneously.

2.4 Only after at least 15 seconds loosen the round nuts (**Fig. 7**/4) through the slot in the support ring by means of pin (6).

2.5 Loosen the round nut (4) with the pin (6) until the pin (6) cannot be inserted any more into the holes of the round nut (4). If, in doing so, the round nut (4) reaches the upper end-stop position, turn it back by 3 holes.




7 Principle representation

**CAUTION**

**Risk of tear-off due to overstretching the stud threads!**

If loosening of the round nuts (**Fig. 7**/4) is not possible under the specified pressure, the pressure may be increased by max. **50 bar** (725 psi).

If the pressure is increased further, there is a risk of overstretching the stud threads, which would require the studs to be replaced.

2.6 Slowly open the valve (**Fig. 4**/9) on the high-pressure pump (7).

2.7 Wait until the pressure has fully dropped.

2.8 It must still be possible to turn the round nuts (**Fig. 7**/4) easily by means of the pin (6). If necessary, build up pressure again and turn the round nuts (4) back by further holes, see steps 2.2 to 2.7.

***NOTE***

Before dismounting the hydraulic stretching devices and placing them into the storage box the basic position of the stretching devices has to be established, see steps 1.1 to 1.9.

2.9 Loosen high-pressure hoses from hydraulic jacks (**Fig. 6**/2), high-pressure pump (**Fig. 4**/7) and, if applicable, distributor (8).

2.10 Plug the connections of the high-pressure hoses, hydraulic jacks (**Fig. 6**/2), high-pressure pump (**Fig. 4**/7) and, if applicable, the distributor (8) by means of caps (**Fig. 8**/10).

2.11 Remove threaded sleeve (**Fig. 6**/3), hydraulic jacks (2), and support rings (1).

2.12 Clean all used components and place them into the storage box.


8 Principle representation



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**3. Fixing of round nuts**

**CAUTION**

**Damage and malfunctions due to contamination!**

Contamination on connections of hydraulic components causes leaks.
There may occur problems when connecting or loosening the connections as well as malfunctions in the hydraulic system.

Hydraulic connections are to be plugged upon disassembly of the components.

***NOTE***

When fixing round nuts for crankshaft bearings and balance weights a prestretching pressure has to be applied. For details please refer to the respective job cards.

3.1 Tighten round nuts (**Fig. 9**/4) finger tight with pin (6)before assembly of the hydraulic stretching device.

3.2 Carry out steps 1.1 to 1.9.

3.3 Close the valve (**Fig. 11**/9) on the high-pressure pump (7).

3.3.1 Actuate the high-pressure pump (7) and for the time being build up a pressure of **50 - 100 bar** (725 psi - 1450 psi).

3.3.2 Check all connections of the high-pressure hoses for complete locking (see **Fig. 12**).

3.3.3 Open the valve (**Fig. 11**/9) on the high-pressure pump (7) and wait until pressure has fully dropped.


9 Principle representation

**CAUTION**

**Risk of tightening errors due to dropping pressure.**

When building up the pressure, pause at intervals and observe the pressure gauge.

The pressure that is then reached must remain constant when the high-pressure pump (**Fig. 11**/7) is not actuated. If the pressure drops, this will cause tightening errors.

If necessary, check the lockings of the connections of the high-pressure hoses and the high-pressure pump (7).



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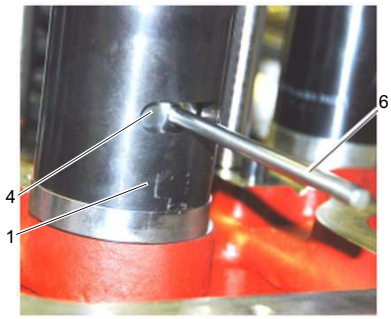
3.4 Close the valve (**Fig. 11**/9) on the high-pressure pump (7) and build up the stretching pressure indicated in **Table B** (see Appendix) for the respective position.

3.5 After about 15 seconds (after pressure build-up) firmly tighten the round nut (**Fig. 10**/4) through the slot in the support ring (1) with the pin (6) and, in doing so, make sure there is ease of movement.

3.6 By slowly opening the valve (**Fig. 11**/9) on the high-pressure pump (7) decrease the pressure by **50 bar** (725 psi).
Loosening of the round (**Fig. 10**/4) nut by means of the pin (6) must not be possible any more.



10 Principle representation

3.7 Slowly open the valve (**Fig. 11**/9) on the high-pressure pump (7) and wait until the pressure has fully dropped.

**NOTE**

Before dismounting the hydraulic stretching devices and placing them into the storage box the basic position of the stretching devices has to be established, see steps 1.1 to 1.9.

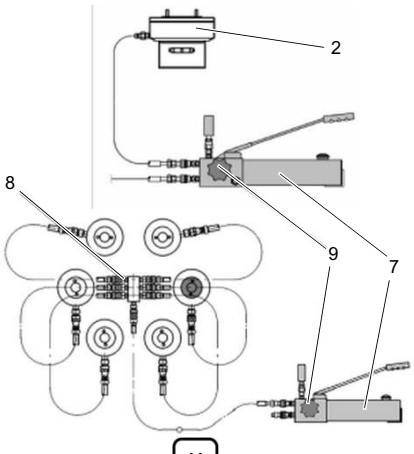
3.8 Loosen high-pressure hoses from hydraulic jacks (**Fig. 11**/2), high-pressure pump (7) and, if applicable, distributor (8).

3.9 Plug the connections of the high-pressure hoses, hydraulic jacks (2), high-pressure pump (7) and, if applicable, the distributor (8) by means of caps (**Fig. 8**/10).

3.10 Disassemble the threaded sleeve (**Fig. 1**/3) of the stretching device.

3.11 Remove hydraulic jacks (2) and support rings (3).

3.12 Clean all used components and place them into the storage box.



11 Principle representation



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**4. Troubleshooting**

For troubleshooting proceed according to the following table:

| Fault | Possible cause | Action |
|---|---|---|
| No pressure build-up in the hydraulic jacks. | High-pressure hoses are not completely locked. | Open valve of the high-pressure pump to bleed pressure completely. Declamp relevant hose couplings, check couplings and reconnect afterwards. Repeat test (work sequence 2.2 / 2.3). Refer to **Fig. 12** for orientation. |
| After pressure decrease the piston of the hydraulic jack does not move back to end position / basic position. | Piston return mechanism damaged. | Send the hydraulic jack to the manufacturer. |
| | There is still hydraulic oil in the pressure chamber of the hydraulic jack. | Mount the hydraulic stretching device completely on a corresponding stud. Connect the device to the high-pressure pump. Establish basic position according to steps 1.1 - 1.9. |
| Basic position according to steps 1.1 - 1.9 cannot be established. | Piston in hydraulic jack tilted. | Send the hydraulic jack to the manufacturer. |
| Built-up pressure is not maintained. | Connections of the high-pressure hoses are leaky. | Reduce pressure completely. Check the connections of the high-pressure hoses.<br><br>In case of a leak:<br>Loosen and reconnect the connections. If necessary, replace high-pressure hoses. |
| | | |
| Oil leaking from the hydraulic jack. | Max. stroke was exceeded. An overflow valve opens and allows oil to drain from the pressure chamber. The hydraulic jack is not defective. | Reduce pressure completely.<br>- The overflow valve is relieved.<br>Clean the hydraulic jack.<br>Build up a test pressure of 250 bar (3626 psi).<br>- If no oil is leaking and the test pressure is maintained for more than 5 minutes the hydraulic jack is usable.<br><br>- If there is an oil leak again, the gaskets are defective. |
| Hydraulic jack leaky. | Gaskets defective. | Replace the gaskets. |



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12 Principle representation

**Fig. 11**/A: Hose connection fully locked.

**Fig. 11**/B: Hose connection not fully locked.

**Fig. 11**/C: In case of continued pressure build-up the connection will partly slip off. The internal valve will be closed.



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**5. Appendix** (tables)

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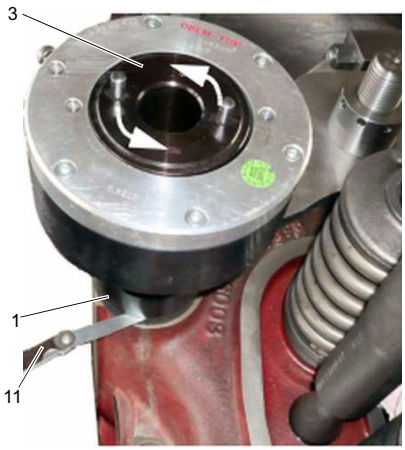
**Table A: Adjusting Values for Threaded Sleeve**

**NOTE**

For loosening a round nut (**Fig. 10**/4) the threaded sleeve (**Fig. 13**/3) that was fastened finger tight has to be turned back by a distance specific to the respective case of application. To avoid inaccuracies this distance is mostly adjusted by means of a feeler gauge (11) between support ring (1) and contact surface. In some cases of application, however, experience has shown that it is more practical to turn back the threaded sleeve (3) by a certain number of turns (see **Table A**).
This prevents jamming of the components of the hydraulic stretching device on the stud after decreasing the stretching pressure.




13 Principle representation

| Table A, M 20 C - GCM34 | | | | | | |
|---|---|---|---|---|---|---|
| **Engine type** | **M 20 C** | **M 25 C<br>M 25 E** | **M 32 C** | **VM 32 C** | **GCM34** | **M 32 E<br>M 34 DF** |
| Cylinder head | 2,5 mm | 3.0 mm | 3.5 mm | 3.5 mm | 3.5 mm | 3,5 mm |
| Lateral studs / crankshaft bearing | | | 1.5 mm | 1/2 turn | 1/2 turn | 1,5 mm |
| Crankshaft bearing bolts | 2,5 mm | 2,0 mm | 2.0 mm | 1/2 turn | 1/2 turn | 2,0 mm |
| Big-end bearing cap (standard) | | | 3/4 turn | 3/4 turn | 3/4 turn | |
| Big-end bearing cap (Marine) | | | | 2,0 mm | | 2,0 mm |

| Table A, M 43 C - VM46 DF | | | | |
|---|---|---|---|---|
| **Engine type** | **M 43 C** | **VM 43 C** | **M 46 DF** | **VM 46 DF** |
| Cylinder head | 1 1/3 turn | 1 1/3 turn | 1 1/3 turn | 1 1/3 turn |
| Lateral studs / crankshaft bearing | 1 1/4 turn or 10 holes back | 1 1/4 turn or 10 holes back | 1 1/4 turn or 10 holes back | 1 1/4 turn or 10 holes back |



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| Table A, M 43 C - VM46 DF | | | | |
|---|---|---|---|---|
| **Engine type** | **M 43 C** | **VM 43 C** | **M 46 DF** | **VM 46 DF** |
| Crankshaft bearing bolts | 1 turn or 8 holes back | 1 turn or 8 holes back | 1 turn or 8 holes back | 1 turn or 8 holes back |
| Big-end bearing cap | 3/4 turn or 6 holes back | 3/4 turn or 6 holes back | 3/4 turn or 6 holes back | 3/4 turn or 6 holes back |

**Table B: Stretching Pressure / Prestretching Pressure**

**NOTE**

When fixing round nuts for crankshaft bearings and balance weights a prestretching pressure has to be applied. For details please refer to the respective job cards.

| Table B, M 20 C / M 25 C / M 32 C / VM 32 C / GCM34 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Enginetyp** | | **M 20 C** | **M 25 C M 25 E** | **M 32 C** | **VM 32 C** | **GCM34 420 kW/ cyl.** | **GCM34 500 kW/ cyl.** | **GCM34 525 kW/ Zyl.** |
| Cylinder head | | 600 bar 8702 psi | 820 bar 11893 psi | 900 bar 13053 psi | 900 bar 13053 psi | 850 bar 12328 psi | 850 bar 12328 psi | 850 bar 12328 psi |
| Lateral studs/ crankshaft bearing | **Pre-stret-ching pres-sure** | | | 150 bar 2176 psi | 150 bar 2176 psi | 150 bar 2176 psi | 150 bar 2176 psi | 150 bar 2176 psi |
| | Stret-ching pres-sure | | | 650 bar 9428 psi | 680 bar 9863 psi | 680 bar 9863 psi | 680 bar 9863 psi | 680 bar 9863 psi |
| Crankshaft bearing bolts | | 750 bar 10878 psi | 980 bar 14214 psi | 1150 bar 16679 psi | 1025 bar 16317 psi | 1025 bar 16317 psi | 1025 bar 16317 psi | 1025 bar 16317 psi |
| Big-end bea-ring *(For connec-ting rod with **upper** shank division)* | **Pre-stret-ching** | | | 100 Nm (mechanically)<br>**Attention!**<br>First read the associated maintenance instructions, see **A5.05.02.04.01.nn** | | | | |
| | Stret-ching pres-sure | | | 1200 bar 17405 psi | 1200 bar 17405 psi | 1200 bar 17405 psi | 1200 bar 17405psi | 1200 bar 17405psi |



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| Table B, M 32 E / VM 32 E / VM 32 C LS* / M 34 DF (*LS = Long Stroke) | | | | | |
|---|---|---|---|---|---|
| **Enginetyp** | | **M 32 E** | **VM 32 E** | **VM 32 C LS*** | **M 34 DF** |
| Cylinder head | | 900 bar<br>13053 psi | 900 bar<br>13053 psi | 900 bar<br>13053 psi | 850 bar (var.-01)<br>12328 psi<br>850 bar (var.-02)<br>12328 psi |
| Lateral studs / crankshaft bearing | **Prestretching pressure** | 150 bar<br>2176 psi | 150 bar<br>2176 psi | 150 bar<br>2176 psi | 150 bar<br>2176 psi |
| | Stretching pressure | 650 bar<br>9428 psi | 680 bar<br>9863 psi | 680 bar<br>9863 psi | 650 bar<br>9428 psi |
| Crankshaft bearing bolts | | 1150 bar<br>16679 psi | 1025 bar<br>16317 psi | 1025 bar<br>16317 psi | 1150 bar<br>16679 psi |
| Big-end bearing *(For connecting rod with **lower** shank division)* | **Prestretching** | 100 Nm (mechanically)<br>**Attention!**<br>First read the associated maintenance instructions, see **A5.05.02.04.02.nn** | | | |
| | Stretching pressure (up to connecting rod variant -19) | 1050 bar<br>15229 psi | 1050 bar<br>15229 psi | 1050 bar<br>15229 psi | 1050 bar<br>15229 psi |
| | Stretching pressure (from connecting rod variant -20) | 850 bar<br>12328 psi | 850 bar<br>12328 psi | 850 bar<br>12328 psi | 850 bar<br>12328 psi |
| Lower shank division (*Connecting rod)* | Stretching pressure (up to connecting rod variant -19) | 1050 bar<br>15229 psi | 1050 bar<br>15229 psi | 1050 bar<br>15229 psi | 1050 bar<br>15229 psi |
| | Stretching pressure (from connecting rod variant -20) | 775 bar<br>11240 psi | 775 bar<br>11240 psi | 775 bar<br>11240 psi | 775 bar<br>11240 psi |

| Table B, M 43 C - VM 46 DF | | | | | |
|---|---|---|---|---|---|
| **Engine type** | | **M 43 C** | **VM 43 C** | **M 46 DF** | **VM 46 DF** |
| Cylinder head | | 2360 bar<br>34229 psi | 2360 bar<br>34229 psi | 2360 bar<br>34229 psi | 2360 bar<br>34229 psi |
| Lateral studs / crankshaft bearing | **Prestretching pressure** | 380 bar<br>5511 | 240 bar<br>3481 psi | 380 bar<br>5511 | 240 bar<br>3481 psi |
| | Stretching pressure | 2250 bar<br>32633 psi | 1900 bar<br>27557 psi | 2250 bar<br>32633 psi | 1900 bar<br>27557 psi |



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| Table B, M 43 C - VM 46 DF | | | | | |
|---|---|---|---|---|---|
| **Engine type** | | **M 43 C** | **VM 43 C** | **M 46 DF** | **VM 46 DF** |
| Crankshaft bearing bolts | | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi |
| Big-end bearing cap | | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi |
| Big-end bearing cap | **Prestretching** | 100 Nm (mechanically)<br><br>**Attention!**<br>First read the associated maintenance instructions, see **A5.05.02.04.01.nn** | | | |
| Big-end bearing cap (**hydraulik jack** 1.9213 **K**) | Stretching pressure | 1670 bar<br>24221 psi | 1670 bar<br>24221 psi | 1670 bar<br>24221 psi | 1670 bar<br>24221 psi |
| Big-end bearing cap (**hydraulik jack** 1.9213 **N**) | Stretching pressure | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi | 2250 bar<br>32633 psi |



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