

# PM

PLOKE ENGINEERING



## Manual

### **Mechanical Multi-Jackbolt Pretensioners (MJP)** *with Mammoth™ Jackbolts*

## Functional description

### Mechanical Multi-Jackbolt Pretensioners (MJP) with *Mammoth™* Jackbolts

Mechanical Multi-Jackbolt Pretensioners (MJP) are designed according to ISO 898-2 and are used for general bolting applications in all areas of industry. Due to the captive mounted *Mammoth™* Jackbolts they are best suited for highly dynamic applications such as turbine runners.

The hexalobular head (Torx®) of the Jackbolts is extremely wear-resistant and safe to handle.

The pretension of the *Mammoth™* Jackbolts generates a high thrust force. The small friction diameters guarantee a minimal torque  $M_A$ .

The Nut Body transfers the loads; it is positioned by hand on the threaded bolt.

The Thrust Washer protects the component from high stress.

The clamping force results from the thrust forces of the Jackbolts and the reaction force of the threaded bolt.

The pretensioning force  $F_V$  at the threaded bolt corresponds with the total of the Jackbolt thrust forces; it is purely axial and therefore free of torsion.





## Instructions

Thank you for using mechanical Multi-Jackbolt Pretensioners (MJP) of the PM series, a safe high-end product of the bolting technology.

These instructions apply to all PM standard series (PM08, PM10, PM12) as well as to all PM special types, unless otherwise mentioned in the corresponding guarantee certificate.

When observing these instructions, the safety during pre-tensioning / unloading as well as the service life of the bolted connection is ensured.

For simplicity and readability, the MJP mechanical Multi-Jackbolt Pretensioner is briefly named MJP in this manual.

<b>Content</b>	<b>page/s</b>
1. Pretensioning	4/5
2. Unloading	6/7
3. Lubrication and tools	8/9
4. Maintenance	10
5. General information	11
6. Advice service / Warranty	12

For very large Multi-Jackbolt Pretensioners please refer to the additional "PLOKE Manual for Large MJP".

## 1. Pretensioning

### 1.1 Tightening torque per Jackbolt

please refer to recommended tightening torque on:

- Internal instruction of the customer
- Guarantee certificate of PLOKE Engineering AG
- Drawing of the installation situation of PLOKE Engineering AG

**Warning:** Always use the recommended tightening torque when pretensioning. The maximum tightening torque is the maximum permissible value for the MJP including all reaction forces. This can be too high for the bolted connection and cause damage.

**Note:** The most reliable value for measuring the preload force obtained is the lengthening of the bolt.

### 1.2 Tools

- Torque wrench, possibly impact wrench
- Heavy impact socket
- Recommended / prescribed lubricant

### 1.3 Preparation

A) Clean and lubricate main thread and contact surface

B) Place the thrust washer

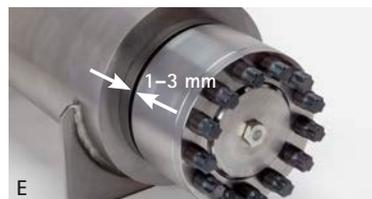
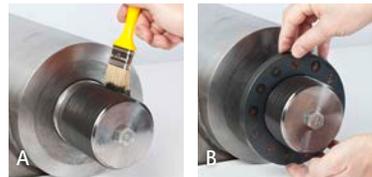
C) Setting the MJP

**Note:** Jackbolts should be well lubricated and sunk in the Nut Body.

D) Screw on the MJP by hand

**Note:** If necessary, help with tools (chain tongs, screwdrivers, rod, crane).

E) Turn MJP slightly back, so that a gap of one to three millimetres is produced.



## 1. Pretensioning (continuation)

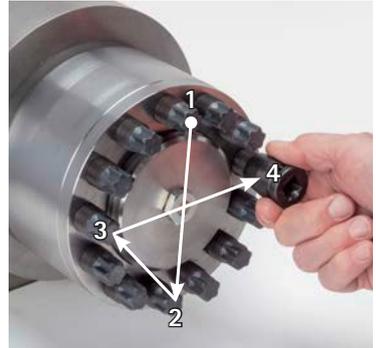
### 1.4 Pre-Tensioning

**Note:** For several screw bolts repeat every activity for each screw bolt. Impact wrenches provide good assistance; refer to paragraph 3.3

**First:**

Setting four Jackbolts crosswise

**Note:** A socket wrench helps.



**Second:**

Pretension the four Jackbolts with 50% of the recommended tightening torque by means of torque wrench crosswise

**Note:** Pretension the four Jackbolts once (do not re-tension).



**Third:**

Pretension the four Jackbolts with the recommended tightening torque by means of a torque wrench

**Note:** Pretension the four Jackbolts once 100% (do not re-tension).



**Fourth:**

Pretension all Jackbolts with the recommended tightening torque by means of a torque wrench circular

**Note:** One Jackbolt after the other is applied 100% (without re-tension).



**Fifth:**

Pretension all Jackbolts with the recommended tightening torque by means of a torque wrench circular

**Note:** Continue to pretension until all Jackbolts are tight (less than 10° angle).

## 2. Unloading

**Warning:** When relieving the preload, gradually relieve the Jackbolts. The Jackbolts must jointly remove the preload force (do not remove them individually!). Overloaded Jackbolts could deform and obstruct unloading. Do not use impact wrenches (Jackbolts relieve too quickly)!



### 2.1 Unloading at temperatures below 100 °C

**Note:** In the case of corrosion, creep oil helps to unload. If there are several screw bolts, repeat each action per screw bolt; refer to paragraph 5.4.

**First:**

Break all Jackbolts circularly

**Note:** The smaller the angle at break-out, the lower the reduction of the preload force. The first round should be approached as carefully as possible.



**Second:**

Relax all Jackbolts circularly

**Note:** Each Jackbolt must be released and brought back into contact with the thrust washer. Usually an angle of 30° is sufficient.



**Third:**

Relax all Jackbolts circularly

**Fourth:**

Relax all Jackbolts circularly

**Note:** Loosen each Jackbolt and unscrew one revolution by hand with little load. The remaining Jackbolts have hardly any preload force. In the case of long screw bolts, it may take one to two more rounds.



**Warning:** Prior to next use, please refer to paragraph 4, Maintenance.

**Warning:** *Mammoth*® Jackbolts are captive mounted and cannot be unscrewed upwards!

## 2. Unloading (continuation)

### 2.2 Unloading at temperatures above 100 °C

**Note:** At high temperatures, the lubricating oil evaporates and little additives remain. Relaxing MJPs becomes difficult. Here helps creep oil before relaxing. If there are several screw bolts, repeat each action per screw bolt. In the case of screw bolts with a central bore, a heating cartridge can simplify the relaxation; refer to paragraph 5.4..



**First:**

Application of creep oil during cooling of the installation

**Note:** Below approx. 150 °C, creep oil can be used, above synthetic oil can be used.

**Second:**

Break all Jackbolts circularly

**Note:** Break only (do not loosen). The smaller the angle at break-out, the lower the reduction of the preload force.

The first round should be approached as cautiously as possible.



**Third:**

Relax all Jackbolts circularly

**Note:** Each Jackbolt must be released and brought back into contact with the thrust washer. Usually an angle of 30° is sufficient.



**Fourth:**

Relax all Jackbolts circularly

**Fifth:**

Relax all Jackbolts circularly

**Note:** Loosen each Jackbolt and unscrew one revolution by hand with little load. The remaining Jackbolts have hardly any preload force. In the case of long screw bolts, it may take one to two more rounds.



**Warning:** Prior to next use, please refer to paragraph 4, Maintenance.

**Warning:** Mammoth® Jackbolts are captive mounted and cannot be unscrewed upwards!

## 3. Lubrication and Tools

### 3.1 Lubricant

...for **Jackbolts**: The Jackbolts are factory lubricated and ready for use. The lubricant is indicated on the guarantee certificate of PLOKE Engineering AG.

**Warning:** For maintenance work only use approved lubricants.

...for **base bodies**: Lubricate the main thread as well with approved lubricants. Prior to next use, please refer to paragraph 4, Maintenance.

...for **thrust washers**: Lubricate the contact surface as well with approved lubricants.

...for **screw bolts**: Lubricate the main thread as well with approved lubricants.



### 3.2 Sockets

For pretensioning, use the included extra-strong sockets for impact wrenches; others are available at any time.

**Warning:** Use only faultless tools. The tightening torques of the Jackbolts are very high and can hardly be compared with conventional screws. Small and worn-out sockets are dangerous.



### 3.3 Impact wrenches

Modern cordless impact wrenches generate high torques and offer good support for the pretensioning of MJPs (refer to paragraph 1.4, Pretensioning, Fourth). Cordless impact wrenches used must achieve approximately three times the recommended tightening torque.

The following dimensions are recommended:

- 3/8" up to 70 Nm tightening torque
- 1/2" up to 200 Nm tightening torque
- 3/4" over 200 Nm tightening torque



## 3. Lubrication and Tools (continuation)

### 3.3 Impact wrenches (continuation)

Pneumatic impact wrenches should also be able to produce at least three times the recommended tightening torque of the Jackbolts in order to continue circular pretensioning, refer to paragraph 1.4, Pretensioning, Fourth.

Heavy duty industrial impact wrenches offer good services, e.g. from Ingersoll-Rand, Atlas Copco, Dino Paoli, etc. Pressure equipment and valves need the greatest possible cross-sections for the large volume flow required, see e.g. Stäubli couplings, and others.

**Note:** Powerful pneumatic impact wrenches have very large air requirements. Often the compressed air network is not sufficient, so that maintenance units and intermediate storage tanks are necessary.

At an output pressure of at least 6.5 bar and a fully open pressure system, the following impact wrenches are recommended:

- 3/8" up to 70 Nm tightening torque
- 1/2" up to 130 Nm tightening torque (**Note:** use pressure regulating valve)
- 1/2" up to 200 Nm tightening torque
- 3/4" up to 270 Nm tightening torque (**Note:** use pressure regulating valve)
- 3/4" more than 270 Nm tightening torque

**A)** The tightening torque per Jackbolt can be easily measured. Using the impact wrench, pre-tighten one Jackbolt to a standstill and measure the torque obtained with a torque wrench.

**B)** If the torque is to be adapted to the impact wrench, this is most easily done with a directly connected maintenance unit. The air pressure for the impact wrench can be adjusted at the pressure control valve.

At higher tightening torques, hydraulic wrenches can be used (e.g. from Gedore), whereby the counter-torque has to be absorbed at the component.

**Note:** Pretensioning with an impact wrench is worthwhile for the work step with the recommended tensioning torque per Jackbolt (refer to paragraph 1.4, Pretensioning, Fourth).

However, the last tightening round (refer to paragraph 1.4, Pretensioning, Fifth) has always to be carried out by hand with a torque wrench!

**Warning:** Do not use impact wrenches when unloading (Jackbolts relieve too quickly)! Refer to paragraph 2, Unloading.



## 4. Maintenance

### 4.1 Monitoring

MJPs are free of settlements. The set preload force is kept constant for years in use. For revisions, it is recommended to check the preload. Using a torque wrench, the recommended tightening torque is tested point by point. In the event of a deviation, the Jackbolts are carefully released; refer to paragraph 2, Unloading, first – but do not relax! After this, all Jackbolts are re-tensioned with the recommended tightening torque, refer to paragraph 1.4, Pretensioning, fifth.

### 4.2 Precautionary measures

MJP can be unloaded during maintenance; to proceed, please refer to paragraph 2, Unloading. Then clean and re-lubricate all components; please refer to paragraph 1.3, Preparing.

**Warning:** Use only recommended / prescribed lubricants (no MoS<sub>2</sub>, such as WD-40 etc.)!

**Note:** Bearing traces on the thrust washers are safe; if necessary, turn the thrust washers or reposition them. MJP re-tensioning; refer to paragraph 1.4, Pretensioning.



### 4.3 Possible problems and their solution

#### Jackbolts are difficult to unload

- it should be possible to loosen at least one Jackbolt, then unload it
- pretension this one again with 110% of the recommended tightening torque per Jackbolt
- the two adjacent Jackbolts should now be able to be unloaded
- pretension these again with 110% of the recommended tightening torque per Jackbolt
- again unload two adjacent Jackbolts
- pretension these again with 110% of the recommended tightening torque per Jackbolt
- etc.
- then unload MJP according to paragraph 2
- remove Jackbolts completely, clean and relubricate them
- clean Nut Body and relubricate threaded holes

**Warning:** *Mammoth*<sup>™</sup> Jackbolts are captive mounted and cannot be unscrewed upwards! Only after dismantling the MJP the *Mammoth*<sup>®</sup> Jackbolts can be removed downwards.

**Note:** In the case of corrosion, creep oil helps to unload.

#### Jackbolts are damaged

- replace with original *Mammoth*<sup>™</sup> Jackbolts by PLOKE Engineering AG

**Warning:** No commercially available screws may be used!

#### Thrust Washer is damaged

- replace with original Thrust Washers from PLOKE Engineering AG

If you have any further questions, please contact PLOKE Engineering AG.



## 5. General information

### 5.1 Odd number of Jackbolts

To pretension MJP with uneven number of pressure screws, pre-tension crosswise, refer to paragraph 1.4, Pretensioning.

### 5.2 Long screw studs

For long tension anchors it may be worth increasing the tightening torque per Jackbolt for the first three cycles to 120%; refer to Paragraph 1.4, Pretensioning.

**Note:** Impact wrenches provide good help; refer to Paragraph 3.3, note above.

Reduce the last cycles to 100%, refer to paragraph 1.4, Pretensioning, fourth / fifth.

### 5.3 Flange seal with long expansion

Sometimes the clamping lengths for MJP are very long. The gasket can be compressed with a few Jackbolts on the entire flange.

**Warning:** Do not manually adjust the remaining, now loose MJP by hand, otherwise they will get stuck when they are unloaded!

Now adjust the remaining Jackbolts by hand and pre-tension with a tool; refer to paragraph 1.4, Pretensioning.

### 5.4 Large flanges or split flanges

Spread two or four people evenly on the flange and pretension.

### 5.5 Spacers

MJPs should be mounted on the top and / or the outer end of the screw bolt for the clamping tool.

**Note:** Spacer sleeves or thick washers make MJP fit into the correct position on the screw bolt. As a positive side effect, the total elongation is increased.

### 5.6 High-temperature use

MJPs do not have to be re-tightened at high temperatures. If, however, loosening occurs, see paragraph 4.1, Monitoring, please contact PLOKE Engineering AG immediately.

### 5.7 Rework screw bolts

Sometimes old screw bolts, especially at higher temperatures, deform and elongate; here post-processing helps, e.g. re-cutting the thread.

### 5.8 Special tools

For small as well as large MJPs, PLOKE Engineering AG offers special tools for simplified handling during pretensioning / unloading, e.g. *Balancer*.

### 5.9 Protective caps

Protective covers made of plastic or steel, optionally stainless steel, additionally filled with grease, provide protection against environmental influences and corrosion of the MJP.

## 5. Advice service / Warranty

PLOKE Engineering AG supports you always with advice and deed. Please contact us if you have any questions or problems concerning mechanical Multi-Jackbolt Pretensioner (MJP).

**Note:** This manual is also available online → [www.ploke.net/downloads](http://www.ploke.net/downloads)

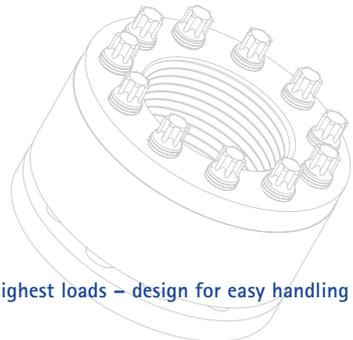
### Warranty

The warranty claims for products delivered amounts to two years. If, within the warranty period a defect in the mechanical Multi-Jackbolt Pretensioner MJP due to a material or manufacturing error occurs, the damage will be repaired free of charge (exceptions are willful damage and acts of God). In case of a functional failure during the warranty period this will be repaired free of charge or replaced free of charge with a new mechanical Multi-Jackbolt Pretensioner MJP. Consequential damage to your system are not covered by the warranty.

### Disclaimer

PLOKE Engineering AG declines any liability for unsuitable product selection, for improper use or for damage caused by failure to observe our instructions and regulations.

Changes in the sense of technical progress are reserved.



engineering for highest loads – design for easy handling