NORD-LOCK GROUP

Typhoon+ Hydraulic Bolt Tensioners

USER MANUAL

Boltight Limited
Tel: +44 4(0) 1922 669 222
Email: sales.boltight.uk@nord-lock.com
www.nord-lock.com/boltight

BOLTIGHT™

FOREWORD

Thank you for choosing Boltight hydraulic bolt tensioning equipment.

Before using the equipment you are advised to study this manual carefully.

Boltight Limited is an ISO 9001:2015 company and our bolt tensioning equipment has been designed to comply with the European Pressure Equipment Directive and the UK Pressure Equipment Regulations and is CE marked and UKCA marked respectively. The pressures and forces involved with the use of this equipment are high and it is therefore imperative that users of the equipment read and understand the operating manual, paying particular attention to the safety information in **Section 1.**

CONTENTS

SECTION 1 – HEALTH & SAFETY INSTRUCTIONS

1.1 SAFETY NOTES

Hydraulic bolt tensioning tools are very powerful and capable of inducing very high bolt stresses. This equipment will give many years of safe tensioning when used in accordance with these instructions.

Anyone using hydraulic bolt tensioning equipment must be properly trained to use the equipment and must take adequate steps to ensure their own safety and the health and safety of others where bolt tensioning operations are being performed. Boltight can offer training courses either at its UK base or on site anywhere in the world.

Please read the manual before attempting to use the equipment. Do not use the equipment if you are **not** already an experienced user of hydraulic bolt tensioning equipment. Your attention is particularly drawn to the notes in **RED**.

When using hydraulic bolt tensioners, loads of many hundreds of tonnes or even thousands of tonnes can be induced. If the bolt material is incorrect or faulty or the tool is incorrectly installed, the broken bolt could be propelled at high speed along the axis of the bolt. This is a very rare occurrence. If there is a failure, anyone standing near the bolt tensioning tool or in line with the axis of the bolt during the tensioning operation will suffer critical, possibly fatal, injury. It is therefore essential that anyone operating this equipment is properly trained and takes every precaution to ensure that nobody is allowed to stand, work or stray near to or in line with the axis of any hydraulic bolt tensioning tool during the bolt tensioning operation.

At no time should anyone allow any part of their body to be positioned over the bolt tensioning tool, whilst the pressure is rising or when it is pressurised. In the case of studbolts with nuts at each end it is important that nobody stands in line with the long axis of the bolt at either end during the tensioning operation.

Do not approach a bolt tensioning tool whilst it is being pressurised. Remember a damaged bolt or tool is most likely to fail at this critical time. When the operating pressure has been reached, approach a pressurised bolt tensioning tool only for as long as it takes to turn the permanent nut always keeping away from the axis of the bolt and the bolt tensioning tool.

Bolt Tensioning tools **MUST** always be used with a hydraulic pump which has a pressure limiting device. Always check that the pump stall pressure is set at or below, the maximum working pressure for the tool being used.

Clear all personnel from the area where the bolt tensioning operation is to be performed. Position the pump a safe distance away from the bolt tensioning tools. Set up barriers and warning signs, or make other adequate arrangements to prevent unauthorised personnel from accidentally straying into the bolt tensioning area.

Never leave a pressurised bolt tensioning tool unattended. Keep the bolt tensioning tools under pressure for the minimum time necessary to complete the bolt tightening job. The tools should only be used as a bolt tensioning tool. **DO NOT** use the tools as hydraulic jacks or for any other purpose.

Take care when handling the tools. Large tools may be heavy and require the use of lifting equipment. The bridge and load cell of the larger tools are not held together. The load cell and bridge are easily taken apart.

Do not try to tighten a leaking hydraulic connection when it is under pressure. First release the pressure then repair the leak.

1.2 EUROPEAN PRESSURE EQUIPMENT DIRECTIVE

The Typhoon+ range of hydraulic bolt tensioners are designed to operate at pressures up to 1350 bar with Group 2 liquid (hydraulic oil ISO 32 or ISO 46) with a volume less than 10 litres. This equipment aligns with:

- Category 1:- 2014/68/EU European Pressure Equipment Directive
- Category 1:- UK Pressure Equipment (Safety) Regulations 2016.

Under these regulations the equipment must therefore:

a) be safe;

b) meet the essential safety requirements covering design, manufacture and testing;

d) be accompanied by adequate instructions for use;

e) be marked to identify the manufacturer and CE marked and the UKCA mark respectively.

The regulations call for pressure equipment to be pressure tested at 1.43 times the maximum pressure. However, the regulations recognise that in some cases this may be harmful or impractical. Due to the very high bolt stresses developed, it is impractical to pressure test the equipment at 1.43 times the maximum pressure. It would also be harmful to the seals if the equipment was tested at these pressures. All equipment has been tested to 1.1 times the maximum pressure where appropriate and a test certificate has been issued.

1.3 USING QUICK CONNECTORS

DO NOT pressurize the connectors when they are disconnected.

Check that there is no pressure in the system before attempting to connect or disconnect the couplings.

To connect the quick connect coupling and nipple, first check there is no pressure in the system. Pull back the shroud by hand and push the coupling onto the nipple. When together, release the shroud which will spring back to connect the coupling and nipple together. The coupling should now be locked using the safety locking sleeve (SLS). To disconnect, again check there is no pressure in the system. Pull back the shroud by hand, and pull the coupling and nipple apart. Once apart release the shroud.

Pull the shroud into the retract position

Insert the nipple into the coupling whilst the shroud is in the retract position

Allow the shroud to spring back into the forward position

Check the red line is not visible – if red line is visible the connection is not safe to use

To close the safety locking sleeve (SLS) push the shroud forward to the back of the collar and rotate – release to lock

This image shows the SLS in the locked position – this joint is now safe to use

1.4 HOSES

Boltight supply flexible hydraulic hoses which have a small plastic core tube surrounded by multiple high tensile steel spiral windings. The outside of the hose is moulded with a coloured plastic coating. Most hoses also have a clear plastic cover which provides additional protection against damage when in use. Each hose is identified with a serial number. All hoses are pressure tested and test certificates are issued.

Three types of hose are available which are identified by the colour of the molded plastic coating beneath the clear plastic cover. The maximum working pressure for the hose is sometimes marked on the outside of the coloured plastic coating; however, this is the working pressure of the hose **ONLY** and not the hose **ASSEMBLY.**

The maximum working pressure of a hose assembly is often limited by the pressure rating of the quick connect couplings and/or the fittings on the end of the hose. Although the hose may be capable of operating at higher pressures the limit you must observe is shown below along with the minimum bend radius.

COLOUR	MAX WORKING PRESSURE	MIN BEND RADIUS
GREEN	1000 bar	95 mm
BLUE	1500 bar	130 mm
RED	2500 bar	200 mm

Hoses are fitted with self sealing quick connect couplings at one or both ends.

YOU MUST OBSERVE THE FOLLOWING HEALTH & SAFETY INSTRUCTIONS WHEN USING HYDRAULIC HOSES:

- Discard and do not use any hose that does not have an identifying serial number.
- Discard and do not use any hose that shows any sign of damage:
  - **to the coloured moulded plastic coating;**
  - **where the spiral windings are exposed;**
  - **where the spiral windings are damaged or broken;**
  - **where there is damage to the swaged metal ends;**
  - **do not allow any hose to be kinked or knotted.**
- Hoses which have been kinked or knotted will have suffered damage and must be discarded.
- Do not allow heavy objects to fall on, rest on, or roll over the hoses.
- Do not allow hoses to be subjected to temperatures higher than 60°C.
- Discard and do not use any hose which has been subjected to heat or fire.
- Do not bend the hose tighter than the minimum bend radius of the hose or it will be kinked.
- Do not exceed the maximum working pressure of the hoses.
- Only use the hoses for their intended purpose – for use with Boltight hydraulic equipment.
- After use check the hoses for damage, wipe to remove dirt and oil, refit dust caps and prepare for storage.
- When not in use store the hoses in a safe place where they cannot easily be damaged.
- Do not mix the coloured hoses. The end fittings /quick disconnect couplings have different pressure ratings.
- Never move hose end connectors or quick disconnects from one colour hose to another.
- All Boltight tools are marked with maximum operating pressure - ensure tools are compatible with the hoses you are using.
- Never use the hoses as a handle to carry or pick up the bolt tensioning tools.

If in doubt contact your representative for further information.

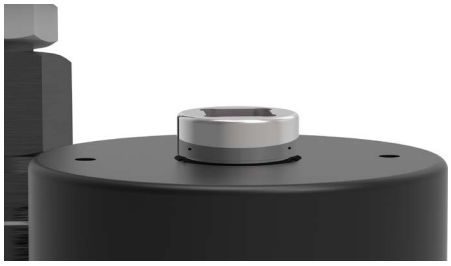
1.5 HYDRAULIC BOLT TENSIONING TOOLS

Maximum pressure

This can be found etched directly onto the tensioner, on the general assembly drawing for the tensioner or the pressure vs load graph. The bolt being tensioned may have a maximum load less than that generated by the tensioner at maximum working pressure. The operator needs to confirm and check what the maximum pressure is for the particular application being tensioned. See **Section 4** for more information.

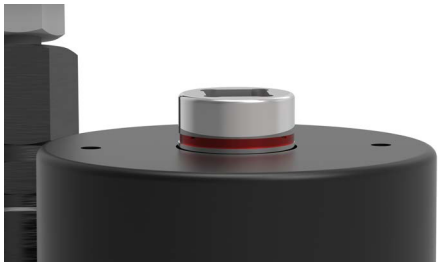
Do not exceed the maximum working pressure.

<= Maximum



✔ **CORRECT AND SAFE** Indicator ring not visible. Stroke available.

> Maximum



✖ **WRONG AND DANGEROUS** Indicator ring visible. Stop the pump.

The operator is alerted that maximum stroke has been achieved by the indicator ring which is mounted in the shaft of the puller bar.

When the tool reaches maximum stroke -when this indicator is visible to the operator, the operator should stop the pump and tighten the nut. No further benefit is gained by increasing the pressure at maximum stoke as the bolt cannot be stretched any further.

See **Section 4** for more information on pressure vs initial bolt stress graph. The tooling has been issued with a pressure/load certificate. Never exceed the tested load or pressure, whichever is lower.

1.6 PERSONAL PROTECTIVE EQUIPMENT (PPE)

When using bolt tensioning tools the operator should ensure that they are wearing the correct Personal Protective Equipment (PPE).

This equipment includes (but is not limited to):

- eye protection
- gloves
- overalls
- hard hat
- steel toe-capped boots or shoes
- any other site specific PPE required

SECTION 2 – OPERATING INSTRUCTIONS

Introduction

A hydraulic bolt tensioner is simply an annular jack with a hollow bore. Much like a jack, a hydraulic pushing force is generated, however instead of lifting a heavy object the force is transferred into stretching a bolt. To allow the transfer of force into the bolt a hydraulic tensioner utilises a threaded puller, bridge and nut rotating socket to effectively transfer and lock in the tensioned load within a joint.

Unlike conventional tightening methods bolt tensioning does not use torque and does not require any forceful turning of the nut or bolt, like impact wrenches, flogging spanners or hydraulic torque wrenches. All of these methods have one common limitation, **FRICTION**.

Friction accounts for up to 80% of the energy lost when torque tightening a joint, giving only 20% transferable energy for bolt tension.

Bolt tensioning tools can be grouped together to enable multiple bolts to be tightened simultaneously, to the same high and accurate pre-load. This is particularly useful when compressing gaskets in pipeline or pressure vessel flanged connections. The high load developed from the multiple bolt tensioning tools, is evenly distributed around the joint causing the gasket to flow into the surface irregularities of the flange giving a much better seal.

Flexible hoses with self sealing quick connect couplings are used to group the bolt tensioning tools together to form a hydraulic ring main. The ring main and tensioning tools are pressurised using an air driven pump working from a compressed air supply or an electric pump.

Tool Description

The pressure equipment covered by this operating manual is a Typhoon+ Multi-Stage hydraulic bolt tensioning tool. The Typhoon+ multi-stage range has been engineered to provide maximum load capacity under minimal radial envelope conditions.

A multi-stage bolt tensioning tool comprises axially-stacked interlocking load cells (each comprising a body, piston and inner/outer seal), a common central puller (comprising a reaction nut and 1/2” drive socket), a spring retraction system and interconnecting bridge. The bridge incorporates a gear-driven nut rundown mechanism for convenience, also incorporating a ½” drive socket. The tensioner incorporates a mechanical anti-overstroke protection facility, and also features a maximum stroke indicator. The load cells are pressurised simultaneously via a radially mounted manifold block of vertical CEJN 116 nipple configuration.

The different sizes of multi-stage tools have different maximum strokes. Refer to the information in **Section 4** to confirm the maximum stroke, operating pressure and maximum force for the equipment.

The tensioner must not be modified by any type of machining and no attachment can be made to the tools by any form of welding or brazing.

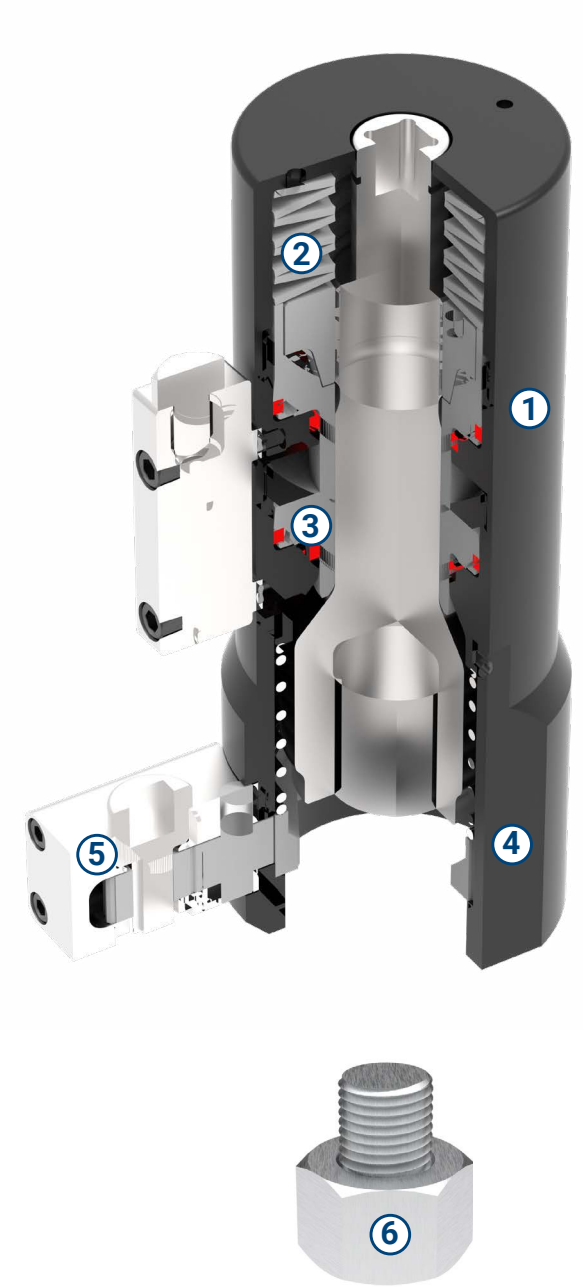
IMPORTANT NOTICE

The tools feature a safe failure mechanism. In the event that the fatigue life of the tool expires, it has been engineered to fail safely and remain in-situ upon the bolt, posing no threat to adjacent personnel or equipment. The maximum tool pressure cycle is indicated with the tool technical data.

A record of pressure cycles should be kept and the tool returned for puller replacement before reaching this limit. A cycle counter can be fitted to the tensioner, to assist with quantifying the number of cycles the tool has experienced.

The tools are subjected to a one-off pressure test prior to despatch, and a test certificate issued to certify this. **PLEASE NOTE** this is not tested at the maximum operating pressure and it is strongly advised that the tool is **NEVER** operated above its maximum. Re-testing is not required during its working life, even after fitting new seals. If the user wishes to conduct a pressure test, the tensioner should returned to the manufacturer for recertification.

2.1 MAIN COMPONENT PARTS



1 Hydraulic load cells

A multi-stage bolt tensioning tool comprises axially-stacked interlocking load cells (each comprising a body, piston and inner/outer seal), a common central puller (comprising a reaction nut and 1/2" drive socket) and a spring retraction system.

The load cells are pressurised via a radial manifold block, using a CEJN 116 high pressure nipple. Within the tensioner, the hydraulic load cells are interlocked for simultaneous pressurisation and are supported by the bridge.

2 Spring actuated piston return

The tool features a spring actuated piston return facility. The spring retraction system comprises heavy duty springs, which are contained within the spring cap. The spring system should not require attention during the working life of the tool. When the pressure within the tool is returned to zero the spring force will retract the pistons fully back into the outer bodies.

3 Seals

Each cell is fitted with red polymer lip seals with an anti-extrusion ring.

4 Bridge

The bridge incorporates a spring-loaded gear-driven nut rundown mechanism for convenience, also incorporating a ½" square drive socket.

5 Gear driven socket

The gear driven socket within the bridge has been designed to interface snugly with the across flats dimensions of nuts as supplied by the customer, and nut rundown following pressurisation is achieved by rotating the gear driven socket. This is performed via the ½" square drive socket located at the top of the gearbox. This gearbox and geared socket mechanism can also be utilised to unwind nuts during de-tensioning procedures.

6 Nut and bolt

Tensioners can be used with standard hex nuts, large width hex nuts, round nuts or special nuts. The correct tool must be selected in accordance with the application.

An extra length of thread must protrude through the nut for the tensioner to screw onto and apply the bolt tension. The length of the bolt is very important. Details are given in **Section 2.3 Step 1. NOTE:** Good quality bolts and nuts will make the tensioning operation quicker and more accurate.

2.2 RECOMMENDED PRACTICES

To obtain the best results from your hydraulic bolt tensioning equipment you should carefully follow the operating instructions given in the following pages. You should also observe the instructions given below.

DO NOT Do not try to pressurise the hydraulic tensioner unless it is properly seated on its bridge, the bridge is in full contact with the application and the puller bar has been correctly engaged onto the bolt to be tightened or released else the tensioner may be damaged beyond safe or repairable use.

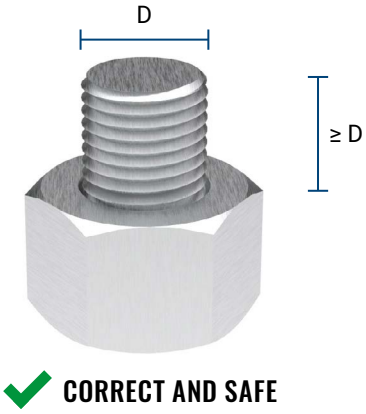
2.3 TENSIONING A BOLT

Step 1

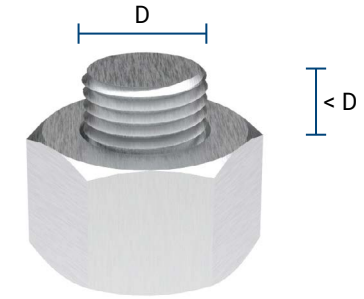
Please follow all safety instructions set out in **Section 1**. Ensure the joint has been assembled using the correct nuts and bolts required for tensioning.

To ensure the safe and effective use of the hydraulic bolt tensioner ensure that a minimum of 2 x bolt diameters of bolt length is protruding from the surface of the joint face. Bolt protrusion should not exceed maximum stated on general arrangement drawing.

It is imperative that the correct bolt length is available prior to the hydraulic tensioner activation as failure to do so may result in the threads stripping off the bolt and the bolt tensioner puller bar.



CORRECT AND SAFE



WRONG AND DANGEROUS

HEALTH & SAFETY WARNING

If only a few threads protrude and an attempt is made to apply tension the bolt threads will strip and components of the tensioner could be propelled with the possibility of serious injury and may cause damage to the bolt and tensioner.

Step 2

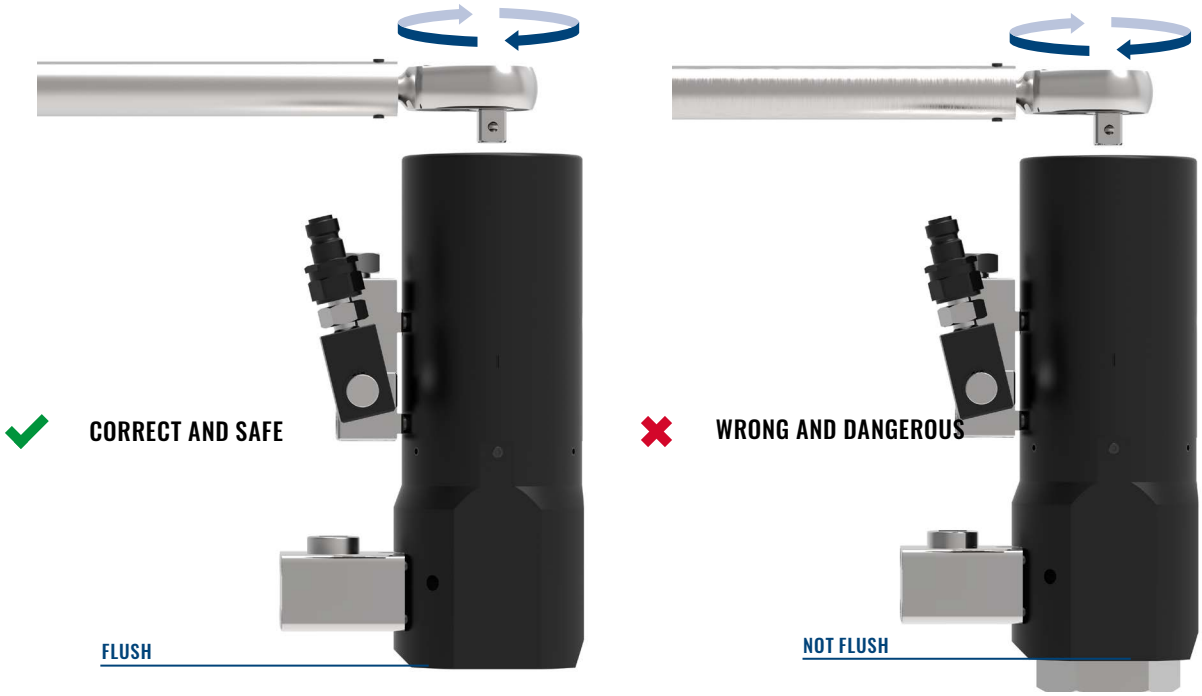
Position the tensioner over the bolt to be tightened. Position the tensioner so that manifold is accessible, and such that the bridge allows access to the gear box.

Step 3

Engage the puller bar with the bolt. A ½" square drive socket is provided - insert into the top of the puller bar so that the tensioner orientation can be maintained whilst the puller bar engages the bolt.

Step 4

Continue rotating the puller bar, increasing its engagement with the bolt until the bridge is flush with the application surface. To ensure the tool is fully flush, it may be necessary to rotate the gearbox slightly whilst lowering to fully engage the gear driven socket with the nut. Make sure that the bridge is seated on a flat and level surface and avoids any adjacent nuts or application obstructions.



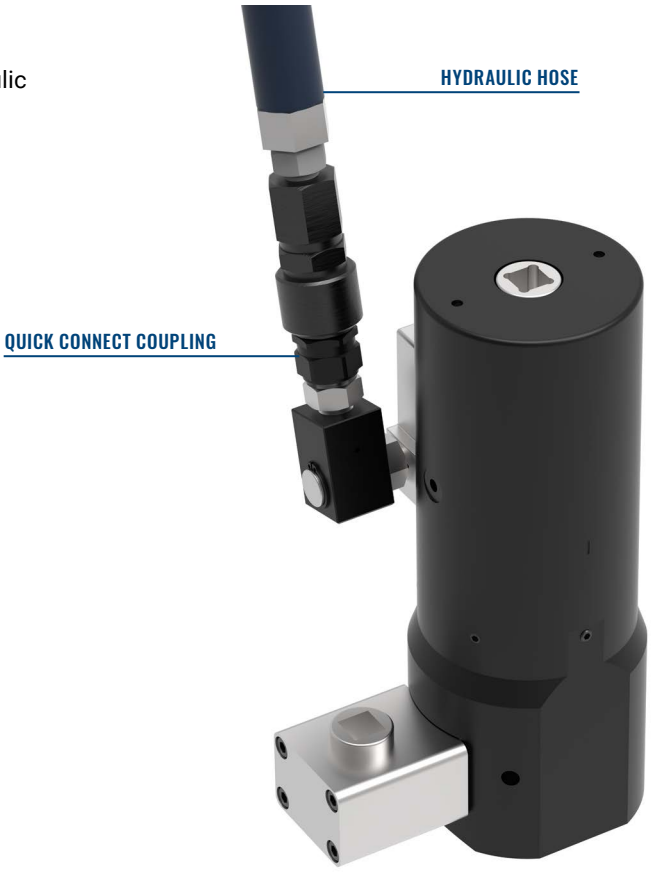
Step 5

Once the tensioner is in situ, it should still be possible to rotate the bridge to a suitable angle to access the bolt if required.

Step 6

Connect the tensioner to corresponding hydraulic hose and pump unit.

Make sure the quick connect coupling is fully engaged. See **Section 1.3**.



TENSIONING A BOLT – HEALTH & SAFETY

The bolt tensioning tool is now ready to be pressurised. Before proceeding read the Health & Safety Instructions given in **Section 1** of this manual then proceed as follows:

- Ensure suitable PPE has been utilised prior to pressurisation.
- Clear all personnel from the area where the bolt tensioning operation is to be performed. Position the pump a safe distance away from the bolt tensioning tools. Set up barriers and warning signs, or make other adequate arrangements to prevent unauthorised personnel from accidentally straying into the bolt tensioning area.
- Release the oil pressure immediately if any unauthorised person moves into the bolt tensioning area and especially is anyone stands in front of a bolt tensioning tool under pressure or stands in line with the long axis of a bolt being tensioned.
- Determine the correct working pressure for the bolts to be tightened. Proceed with the following operations keeping the bolt tensioning tools under pressure for the minimum time necessary to complete the bolt tightening operation.

Step 7

Utilising the pressure load information as shown on the pressure load graph supplied with the tool, slowly activate the hydraulic pump to raise the hydraulic pressure within the tensioner. During activation the puller bar will move out of the load cell as the bolt is stretched and the joint is compressed.

DO NOT exceed the maximum piston stroke. This is indicated by a red line around the puller bar.

DO NOT exceed the maximum pressure for the tool.

DO NOT stand in line with the axis of the bolt and the bolt tensioning tool when it is under pressure.

If the indicator shows the tensioner has reached maximum stroke before the correct hydraulic pressure has been achieved, stop the pump and proceed as follows:

- Tighten the Nut
- Release the Pressure
- Allow the tensioner to retract fully
- Reengage the tool
- Apply the correct Pressure

If necessary repeat this sequence until the bolt tensioning tool reaches the correct oil pressure without reaching the maximum piston stroke.

DO NOT continue increasing the oil pressure when the bolt tensioning tool has reached maximum stroke. Increasing the pressure achieves no increase in bolt tension because no further elongation can be achieved.

Step 8

Using a ½" square drive socket insert into drive hole situated on the top of the gearbox. Rotate the until the nut is firmly seated on the application.

Step 9

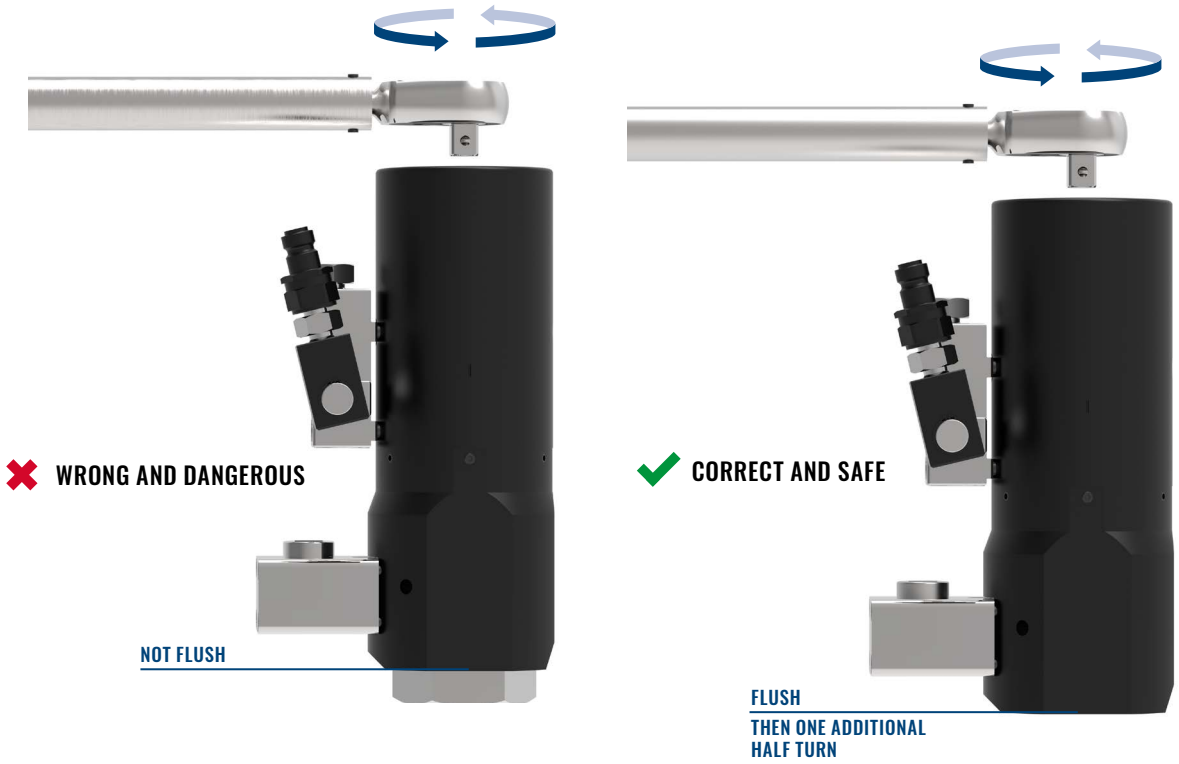
Slowly release the hydraulic pressure by opening the pressure release valve on the hydraulic pump.

The spring return system will now fully retract the tensioning tool. The top of the puller bar will be flush with the spring cap at zero stroke.

DO NOT disconnect the hose from the tensioner as this will prevent the tool from retracting.

Step 10

The Tensioner will have retracted upwards as the bolt will have elongated. The tool will need reengaging onto the flange. Using the ½" square drive socket, reengage the puller onto the stud until the tool is flush with the flange.



Step 11

Apply the correct hydraulic pressure and wind the nut clockwise again once this is achieved.

Do not exceed the maximum working pressure for the tool.

The operator is alerted that maximum stroke has been achieved by the indicator ring which is mounted in the shaft of the puller bar.

Step 12

Slowly release the hydraulic pressure by opening the pressure release valve on the hydraulic pump'

The spring return system will now fully retract the tensioning tool. The top of the puller bar will be flush with the spring cap at zero stroke.

DO NOT disconnect the hose from the tensioner as this will prevent the tool from retracting.

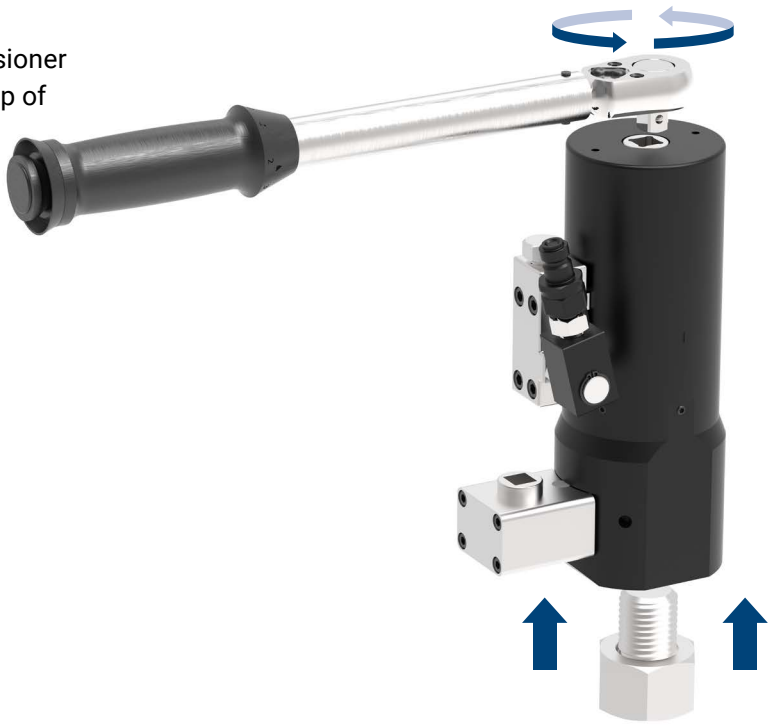
Remove the hose once the stroke has returned to zero.

Step 13

Remove the hose once the stroke has returned to zero.

Step 14

Turning anti-clockwise remove the tensioner using the ½" square drive socket in the top of the puller.



2.4 DE-TENSIONING A BOLT

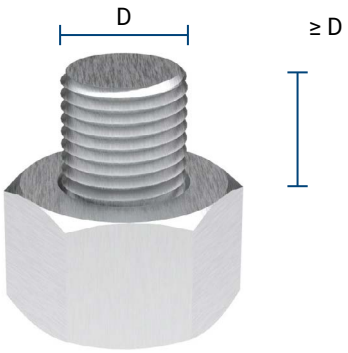
Step 1

De-tensioning of a bolt follows many of the steps as shown in the previous section. There are however a few key differences in the process which are explained within the following section.

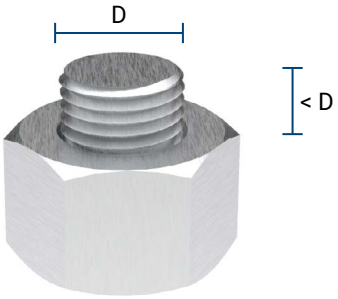
Follow all safety instructions set out in **Section 1** then visually inspect the bolts to be de-tensioned. To ensure the safe and effective use of the hydraulic bolt tensioner ensure that a minimum of 2 x bolt diameter of bolt length is protruding from the surface of the joint face. Bolt protrusion should not exceed maximum stated on general arrangement drawing.

It is imperative that the correct bolt length is available prior to the hydraulic tensioner activation as failure to do so may result in the threads stripping off the bolt and the bolt tensioner puller bar.

Next ensure that the threads are clean and have not been damaged. Any damage to the threads should be rectified with a thread file or die nut before attempting to assemble the hydraulic bolt tensioning tool onto the bolt.



CORRECT AND SAFE



WRONG AND DANGEROUS

HEALTH & SAFETY WARNING

If only a few threads protrude and an attempt is made to apply tension the bolt threads will strip and components of the tensioner could be propelled with the possibility of serious injury and may cause damage to the bolt and tensioner.

Step 2

Position the tensioner over the bolt to be loosened. Position the tensioner so that manifold is accessible, and that the bridge allows access to the gear box.

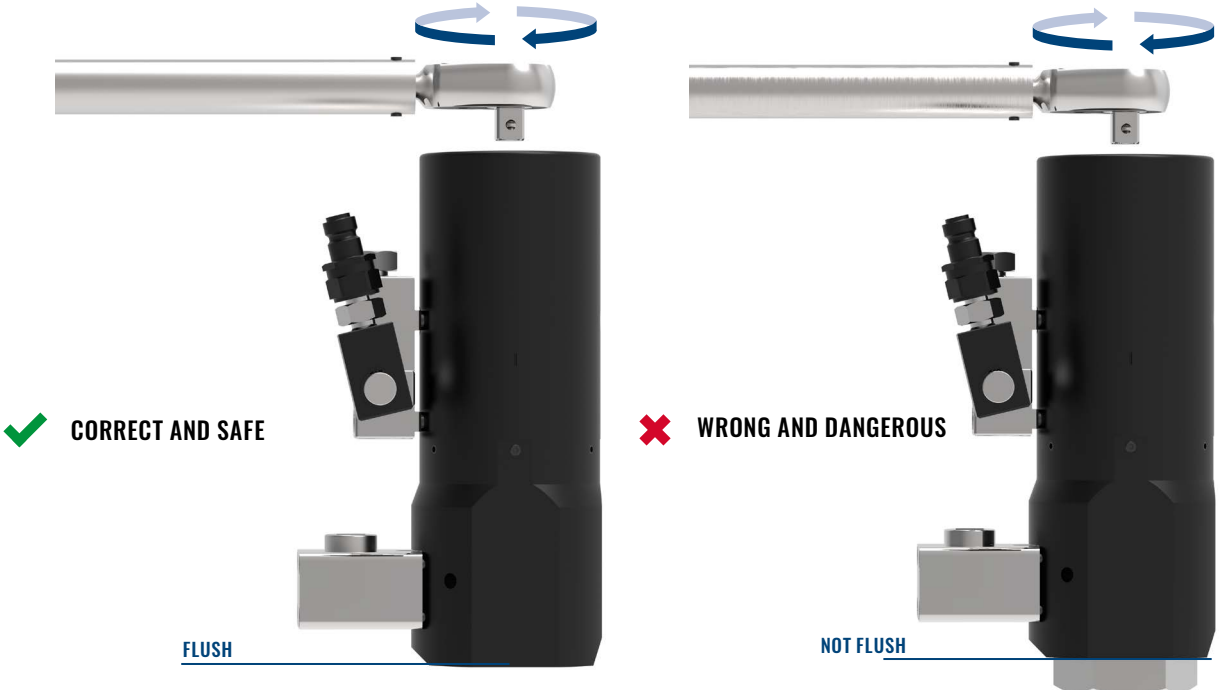
Step 3

Engage the puller bar with the bolt. A ½" square drive socket is provided - insert into the top of the puller bar so that the tensioner orientation can be maintained whilst the puller bar engages the bolt.

During the rotation of the puller, ensure that the bolt remains stationary as failure to do so could result in a reduced thread engagement in both the puller or application.

Step 4

Continue rotating the puller, increasing its engagement with the bolt until the bridge is flush with the application surface. To ensure the tool is fully flush, it may be necessary to rotate the gearbox slightly whilst lowering to fully engage the gear driven socket with the nut. Make sure that the bridge is seated on a flat and level surface and avoids any adjacent nuts or application obstructions. Ensure the bridge does not largely overhang or react off uneven surfaces.



Step 5

Now rotate the Puller anti-clockwise by half a turn

This is to prevent the tensioner from locking onto the stud. This will raise the tensioner slightly so the bridge is no longer flush with the application surface.

Once the tensioner is in situ, it should still be possible to rotate the bridge to a suitable angle to access the bolt if required.

Step 6

Connect the tensioner to corresponding hydraulic hose and pump unit.

Make sure the quick connect coupling is fully engaged. See **Section 1.3**.

DE-TENSIONING A BOLT – HEALTH & SAFETY

The bolt tensioning tool is now ready to be pressurised. Before proceeding read the Health & Safety Instructions given in **Section 1** of this manual then proceed as follows:

- Ensure suitable PPE has been utilised prior to pressurisation.
- Clear all personnel from the area where the bolt tensioning operation is to be performed. Position the pump a safe distance away from the bolt tensioning tools. Set up barriers and warning signs, or make other adequate arrangements to prevent unauthorised personnel from accidentally straying into the bolt tensioning area.
- Release the oil pressure immediately if any unauthorised person moves into the bolt tensioning area and especially is anyone stands in front of a bolt tensioning tool under pressure or stands in line with the long axis of a bolt being tensioned.
- Determine the correct working pressure for the bolts to be tightened. Proceed with the following operations keeping the bolt tensioning tools under pressure for the minimum time necessary to complete the bolt tightening operation.

Step 7

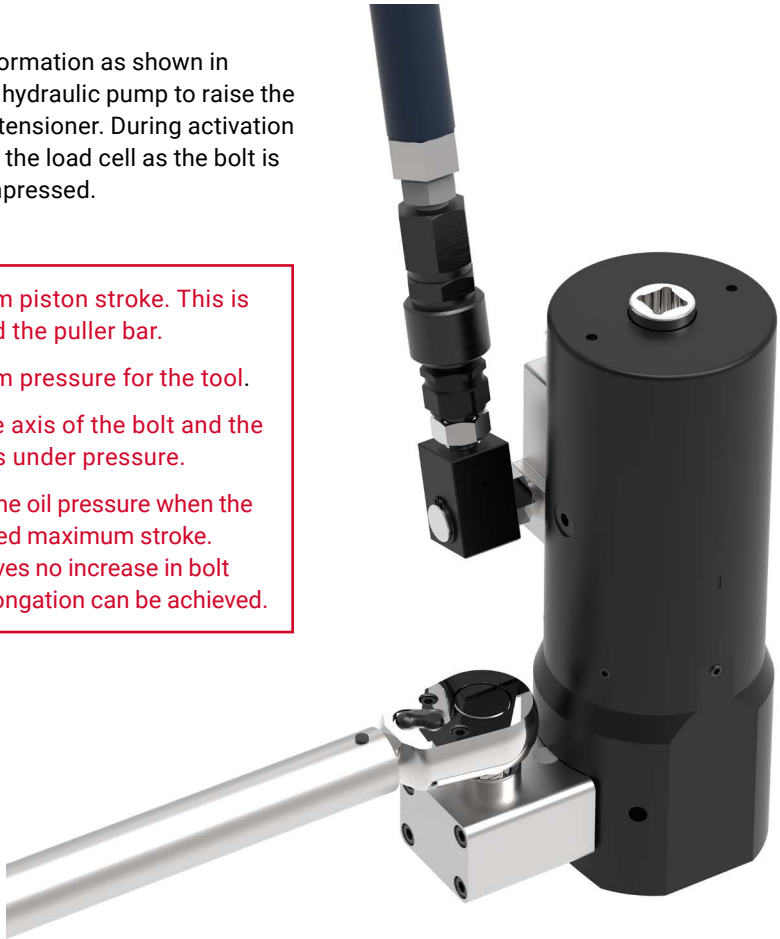
Utilising the pressure load information as shown in **Section 4**, slowly activate the hydraulic pump to raise the hydraulic pressure within the tensioner. During activation the puller bar will move out of the load cell as the bolt is stretched and the joint is compressed.

DO NOT exceed the maximum piston stroke. This is indicated by a red line around the puller bar.

DO NOT exceed the maximum pressure for the tool.

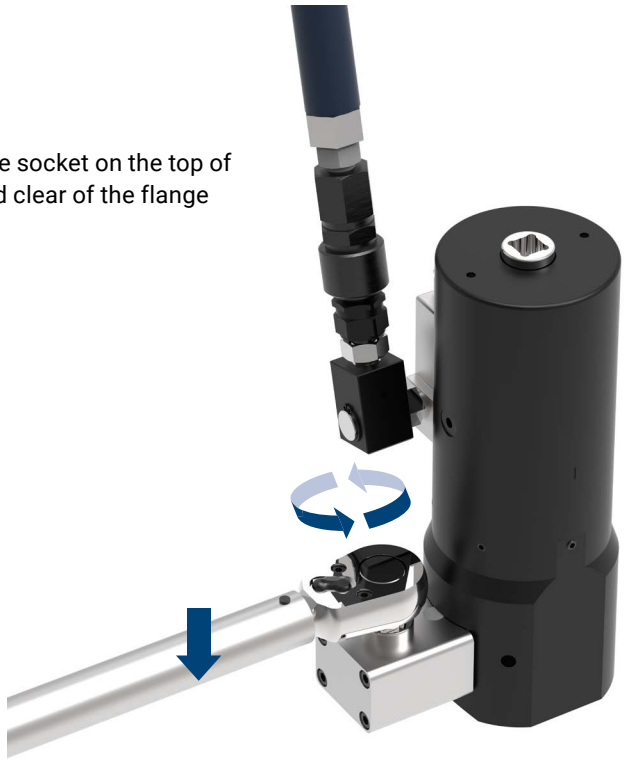
DO NOT stand in line with the axis of the bolt and the bolt tensioning tool when it is under pressure.

DO NOT continue increasing the oil pressure when the bolt tensioning tool has reached maximum stroke. Increasing the pressure achieves no increase in bolt tension because no further elongation can be achieved.



Step 8

Using a ½" square drive socket insert into the socket on the top of the gearbox. Rotate until the nut is loose and clear of the flange



Step 9

Slowly release the hydraulic pressure by opening the pressure release valve on the hydraulic pump'

The spring return system will now fully retract the tensioning tool. The top of the puller bar will be flush with the spring cap at zero stroke.

DO NOT disconnect the hose from the tensioner as this will prevent the tool from retracting.

Step 10

Remove the hose once the stroke has returned to zero.

Step 11

Turning anti-clockwise remove the Tensioner using the ½" square drive socket at the top of the puller.

2.5 SIMULTANEOUS BOLT TENSIONING

Ensure you have read and understood both the bolt tensioning and de-tensioning methods as shown in the previous sections prior to conducting a simultaneous bolt tensioning operation.

Simultaneous bolt tensioning improves the speed and efficiency when performing a tensioning operation on a multi stud application. Boltight recommend a minimum of 25% bolt coverage when tensioning a joint, with 100% coverage giving the largest advantage in speed and accuracy. When it is not possible to fit 1 tensioner per bolt, Boltight recommend reducing to 50% bolt coverage.

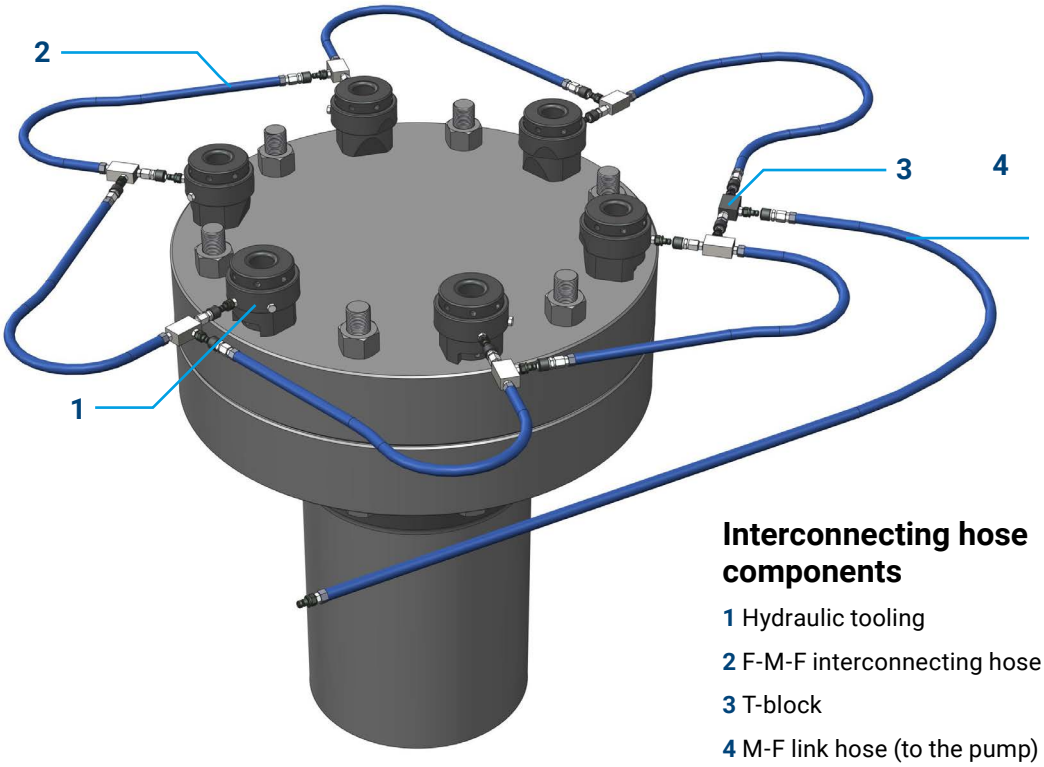
When tensioning bolts simultaneously the tensioning procedure is the same as tensioning a single bolt, however the hydraulic hose setup is different. The hydraulic hoses need to be interconnected in a pattern to allow effective oil flow and oil feed into each hydraulic tensioner simultaneously from a common pump unit.

The following section demonstrates examples of commonly utilised link hose setup. There are multiple ways hoses can be connected however the common objective is to ensure that oil is safely supplied to each tool simultaneously. Ensure all hose safety instructions are understood and that the minimum bend radius is utilised when selecting the hose setup.

If in doubt contact your representative for further information.

Interconnecting hose arrangement

The interconnecting hose arrangement is the most commonly recommended hose setup. It is well suited for multiple tensioning tools in large groups. As the setup is 100% external, forming a hydraulic ring-main, it allows easy manual piston reset or quick reset for auto return tensioners.



Interconnecting hose components

1 Hydraulic tooling

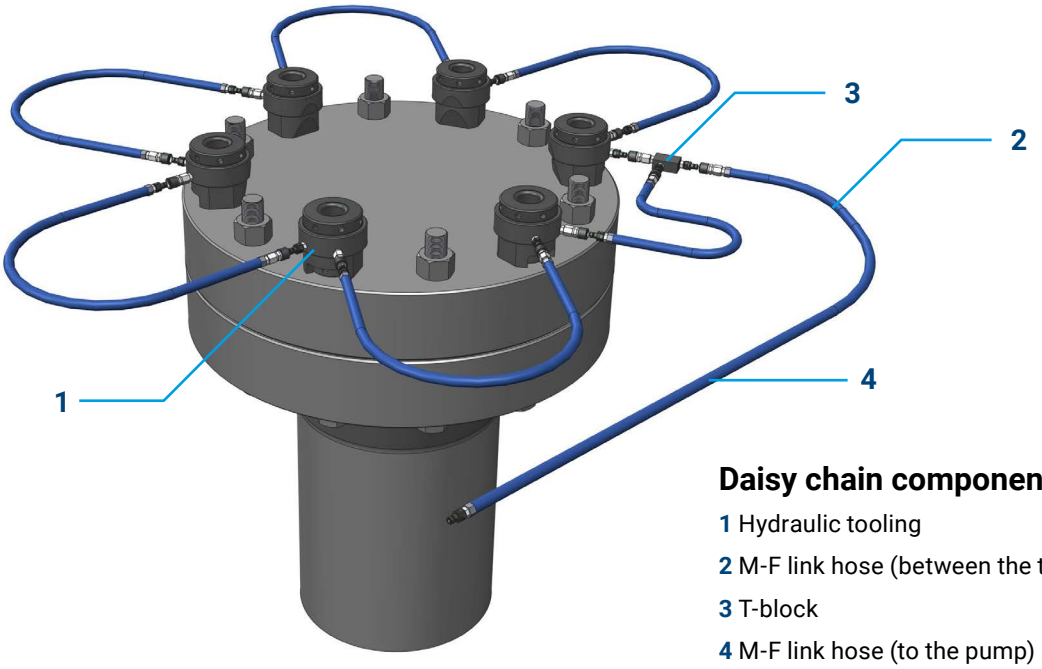
2 F-M-F interconnecting hose

3 T-block

4 M-F link hose (to the pump)

Daisy chain arrangement

The daisy chain arrangement is an affordable method of connecting multiple tools. It is best for simplicity, as only one type of hose needs to be specified, however with this setup oil must pass through every hydraulic cylinder increasing the resistance for manual piston reset or increasing the time reset takes for auto return tensioners.



Daisy chain components

1 Hydraulic tooling

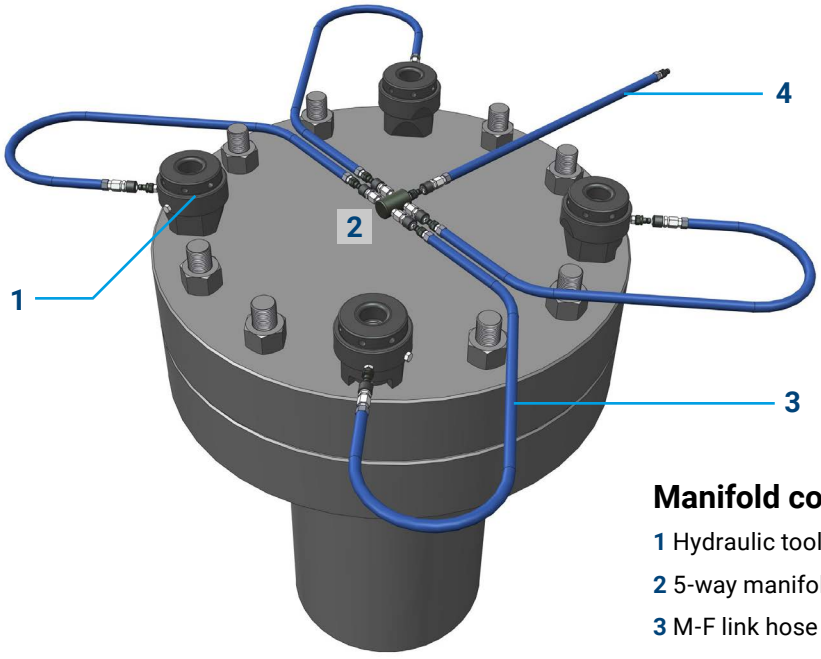
2 M-F link hose (between the tools)

3 T-block

4 M-F link hose (to the pump)

Manifold arrangement

The manifold arrangement is well suited to small groups of tensioning tools, particularly where the tensioner coverage pattern is spread out.



Manifold components

1 Hydraulic tooling

2 5-way manifold

3 M-F link hose (to the tools)

4 M-F link hose (to the pump)

SECTION 3 – MAINTENANCE & STORAGE

Introduction

A hydraulic bolt tensioning tool will provide many years of trouble free service if used, maintained and stored correctly.

3.1 STORAGE

Typhoon+ has a unique surface finish as standard which provides long lasting protection in harsh and hardworking environments. It is recommended that, before storage, the tools should be checked for damage and if OK, lightly oiled.

Prior to storage, the tensioner must be retracted to zero stroke and the hydraulic connection must have its plastic protective cap fitted. The hydraulic bolt tensioner should be stored upright in a clean, dry environment. If the tensioners were delivered in wooden cases these can be used to store the tools.

3.2 MAINTENANCE

Very little maintenance is required for a bolt tensioning tool. The only items which may require changing will be the seals and the quick connect fittings. However, the seals have a very long life and are not expected to require attention during the life of the bolt tensioning tool. If the seals fail to hold pressure it may be necessary to change them, owing to the complexity of the tensioner it is **not** recommended that the tools are dismantled and any maintenance performed by the customer.

Please contact your representative for details.

Puller bar lubrication

To keep the Typhoon+ puller bar running smooth and freely it should be well lubricated, the Typhoon+ will be already lubricated when purchased but on-going lubrication is recommended.

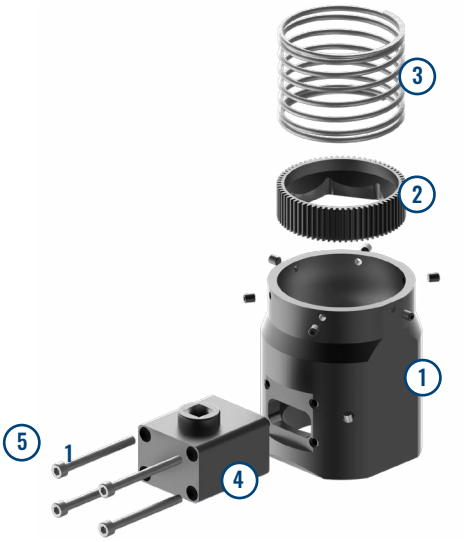
This process involves using a spray lubricant, we recommend Arrow ZX-54 (or equivalent) with a thin attachment that can reach the internal diameter of the Typhoon+.

Where to apply the lubricant

- Turn the tensioner upside down and remove the bridge assembly by unscrewing the grub screws holding it onto the hydraulic cylinder, the puller bar will now be exposed and protruding.
- Spray the lubricant down the side of the puller bar where puller bar and the lower piston meet, spray around the whole circumference of the puller bar.
- Rotate the puller bar to distribute evenly then leave standing for a short time to allow the lubricant to cover the puller bar.
- Replace the bridge assembly and carry on using the tensioner as normal.

3.3 PARTS BREAKDOWN

ITEM #	PART NUMBER	DESCRIPTION	QTY
1	TTMP-PT-XX-03	Puller Bar	1
2	TTMP-PT-XX-01	Lower Body	1
3	TTMP-PT-XX-SK	Seal Kit	1
4	TTMP-PT-XX-02	Lower Piston	1
5	TTMP-PT-XX-11	Upper Body	1
6	TTMP-PT-XX-12	Upper Piston	1
7	TTMP-PT-XX-07	Reaction Nut	1
8	SSS-M005-006	Socket Set Screw	1
9	Contact Boltight	Disc Springs	-
10	TTMP-PT-XX-06	Spring Cap	1
11	BS007	O Ring	2
12	SHC-M006-030	Socket Head Cap Screw	4
13	BT-1561-01	Swivel Block	1
14	TTMP-PT-XX-40	Manifold Block - Non Cycle Counter	1
15	BT-1512	Blanking Plug	1



ITEM #	PART NUMBER	DESCRIPTION	QTY
1	TTMP-PT-XX-04	Bridge	1
2	Contact Boltight	Socket	1
3	Contact Boltight	Spring	1
4	Contact Boltight	Gearbox	1
5	Contact Boltight	Socket Head Cap Screw	4

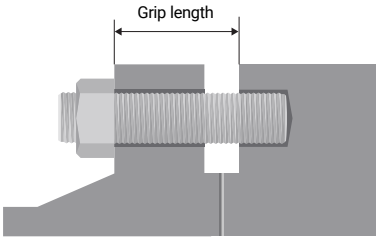
Replace PT with puller thread - IE Metric M36 = M036, Imperial 1-1/2” = 1250

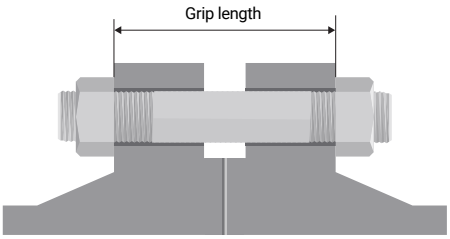
Replace XX with tensioner model number - IE for TTMP-M036-21-00 use 21

SECTION 4 – TECHNICAL INFORMATION

4.1 OIL PRESSURE CALCULATIONS

The formula widely used to calculate the oil pressure to be used with a bolt tensioning tool is given below along with definitions of the terms used:





Bolt load
Residual Bolt Load required when the tensioning operation is complete.

Tensioning force
The load that will be applied by the bolt tensioner during the tensioning operation.

Load transfer factor
The ratio of **tensioning force** to **bolt load**.

$$\text{Load transfer factor} = \frac{\text{Tensioning force}}{\text{Bolt load}} = 1.01 + \frac{\text{Bolt diameter (mm)}}{\text{Grip length (mm)}}$$

If the **Load transfer factor** calculates to less than 1.10 then use 1.10
Tensioning force = Bolt Load × Load Transfer Factor

$$\text{Oil Pressure (bar)} = \frac{10 \times \text{Tensioning Force (Newtons)}}{\text{Tool Pressure Area (mm}^2\text{)}}$$

Always check that the tensioning force will not exceed 95% of the yield strength of the bolt material. If it does, the grip length of the bolt must be increased. Please contact your representative for advice on this.

4.2 PRESSURE LOAD GRAPHS

Oil pressure graphs are always provided with each hydraulic tensioner and are specific to the size of the hydraulic tensioner supplied.

One graph will show the theoretical tensioning force developed by the tool against the oil pressure applied.

The next graph shows the initial bolt stress developed by the tool against the oil pressure applied for each bolt size. This graph is provided to check that the tensioning force does not exceed 95% of the yield strength of the bolt material.

Users who require highly accurate residual bolt stresses should perform a bolt extension measurement before and after tensioning. In this way residual bolt stresses can be calculated from the actual bolt extensions measured.

Boltight Limited
Tel: +44 4(0) 1922 669 222
Email: sales.boltight.uk@nord-lock.com
www.nord-lock.com/boltight
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