

Health & Safety, Operating and Maintenance Instruction Manual



T25 M72 Hydraulic Bolt Tensioner



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BOLTIGHT®

HYDRAULIC BOLT TENSIONING

FCO 007 A

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Boltight Limited,
Unit 2, Junction 10 Business Park,
Bentley Mill Way,
Walsall WS2 0LE,
West Midlands
UK

Tel +44 (0)845 500 5556
Fax +44 (0)845 500 5557
Email sales@boltight.com
Web www.boltight.com

Foreword

Thank you for purchasing or renting Boltight Bolt Tensioning Equipment.

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

Boltight Limited is an ISO9001 company and the bolt tensioning equipment has been designed to comply with the European Pressure Equipment Directive and is CE marked. However the pressures and forces involved with the use of this equipment are high and it is imperative that use users of the equipment read and understand the operating manual, paying particular attention to the safety information in Section 1.0.

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Section 1

Health & Safety

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Important Notice



THINK SAFETY

Thank you for purchasing or renting your hydraulic bolt tensioning equipment from **BOLTIGHT**. Bolt tensioning tools are very powerful and capable of inducing very high bolt stresses. This equipment has been designed to give many years of safe tightening of bolted connections when used in accordance with these instructions.

Persons using hydraulic bolt tensioning tools must be properly trained in the correct use of the equipment and must take adequate steps to ensure their own safety, and the Health and Safety of others working in the area where bolt tensioning operations are being performed. **BOLTIGHT** will be pleased to quote for the provision of training courses either at its UK base or on site anywhere in the world.

Operators must read all of this instruction and maintenance manual before attempting to use the equipment. Do not use the equipment if you are not already an experienced user of hydraulic bolt tensioning tools or if you have not already received proper training. Your attention is particularly drawn to the notes in **RED**.

When using bolt tensioners, loads of many hundreds of tonnes and 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 launched at high speed along the axis of the bolt. This is a very rare occurrence. If there is a failure, anyone standing near to 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 in its safe use and takes every precaution to ensure that nobody is allowed to stand, work or stray near to or into line with the axis of any bolt tensioning tool during the bolt tensioning operation.

Bolt tensioning tools are powerful and use high pressure hydraulics it is essential that you are trained in the correct use of the equipment and adhere fully with the Health and Safety Instructions.

Fatigue Life

The Puller of the Bolt Tensioning Tool is subject to fatigue loading during normal operation of the equipment. The Pullers provided have a fatigue life of 10,000 cycles at full operating pressure. Provision should be made to replace the Pullers before 10,000 pressure cycles.

The Pullers should be examined yearly for any sign of fatigue. Depending on the intended usage frequency the user is advised to determine a safe replacement interval for the Pullers. If the tools are being used to support a hire operation it is important to change the Pullers every 5 years.

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European Pressure Equipment Directive

The 1500 bar range of BOLTIGHT hydraulic bolt tensioning tools have been designed to operate at pressures up to 1500 bar with Group 2 liquid (hydraulic oil ISO10) and volume less than 10 litre. This equipment falls into category 1 of the specified pressure volume thresholds. Under the regulations the equipment must therefore:-

a) be safe
b) meet the essential safety requirements covering design, manufacture and testing
c) satisfy the appropriate conformity assessment procedure
d) be accompanied by adequate instructions for use
e) be marked to identify the manufacturer and CE marked

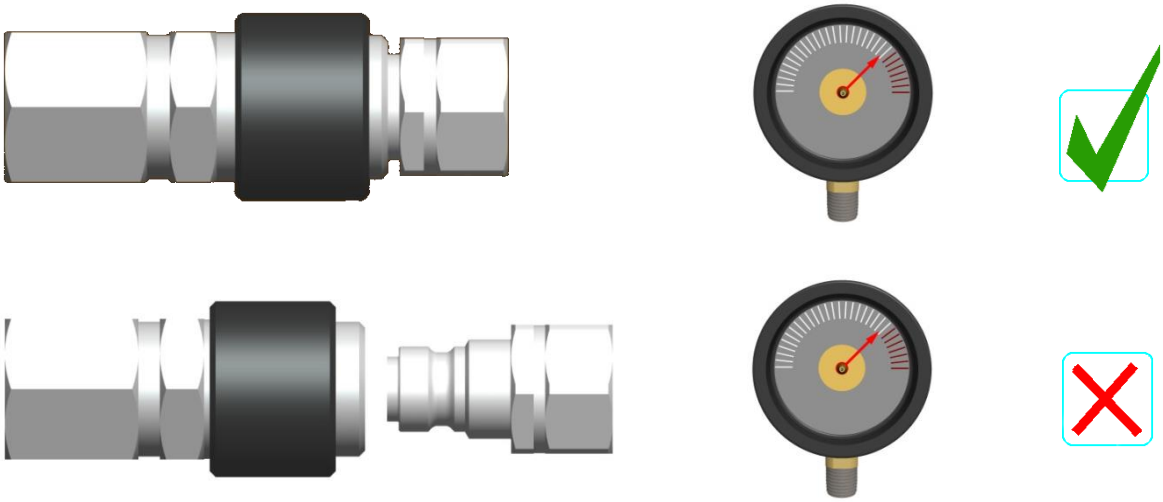
The pressure equipment directive calls for the pressure equipment to be pressure tested at 1.43 times the maximum pressure. However the directive recognises that in some cases this may be harmful or impractical. Because of the very high bolt stress developed, it is impractical to pressure test the equipment above 1650 bar. It would also be harmful to the oil seals if a pressure test of 2145 bar were applied.

The 1500 bar max pressure hydraulic cylinders have been pressure tested at 1650 bar and a test certificate has been issued. The CE mark has been applied.

Quick Connectors

DO NOT pressurise the connectors when they are disconnected.

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



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Hoses

The flexible hydraulic hoses supplied by **BOLTIGHT** 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 are also given a clear plastic cover to provide additional protection against damage when in use. Each hose is identified with a serial number. All hoses are pressure tested when manufactured and test certificates can be issued.

BOLTIGHT supplies three types of high pressure flexible hydraulic hose and they are easily identified by the colour of the moulded 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**

Each type of hose is 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 either:-
  a) To the coloured moulded plastic coating
  b) Where the spiral windings are exposed
  c) Where the spiral windings are damaged or broken
  d) 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 to the windings 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 1000 bar for the GREEN colour hose, 1500 bar for BLUE colour hose, and 2500 bar for RED colour hose.
- 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.

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- When not in use store the hoses in a safe place where they cannot easily be damaged.
- Do not mix the **GREEN**, **BLUE**, **RED** colour coded hoses. The end fittings and quick disconnect couplings on these hoses have different pressure ratings.
- Never move hose end connectors or quick disconnects from one colour hose to another.
- Check the bolt tensioning tools you are using are compatible with the hoses you are using. All **BOLTIGHT** tools are marked with the maximum operating pressure.
- Never pressurise a quick disconnect coupling or nipple when disconnected.
- Do not take apart any ring main harness component or hose assembly. These are filled with oil and pressure tested after assembly. When taken apart the integrity of the assembly is lost and the pressure test invalidated. Return any parts that need attention to **BOLTIGHT** where the correct specification parts will be used to effect repairs, followed by pressure testing and certification before return.
- Never use the hoses as a handle to carry or pick up the bolt tensioning tools.

Bolt Tensioning Tools – Maximum Pressure

DO NOT exceed the maximum working pressure.

The maximum pressure for the hydraulic bolt tensioners can be found in section 4.

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.

Bolt Tensioning Tools – Maximum Stroke

DO NOT exceed the maximum piston stroke.

A highly visible red line indicates when the piston has reached its maximum stroke. Stop the pump as soon as the red indicator can be seen. The maximum stroke for the tooling can be found in section 4.



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Bolt Tensioning Tools – Safety Notes

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.

Make certain that nobody is allowed to stand near to a bolt tensioning tool during the pressurisation process. At no time should anyone allow any part of their body to be positioned over the Puller of a bolt tensioning tool, whilst the pressure is rising or when it is pressurised. Do not allow anyone to stand anywhere near a direct line with the long axis of a bolt during the tensioning operation. 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 that 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 Puller.

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 Cylinder of the larger tools are not held together. The Cylinder and Bridge are easily taken apart. When handling the tools always support the Bridge and the Cylinder, otherwise the Bridge may become detached from the Cylinder and fall.

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

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Personal Protective Equipment

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

This equipment includes (but is not limited to):

- Eye Protection
- Gloves
- Overalls
- Hard Hat
- Steel Toe-Capped boots or shoes.
- Any other site specific P.P.E. required.

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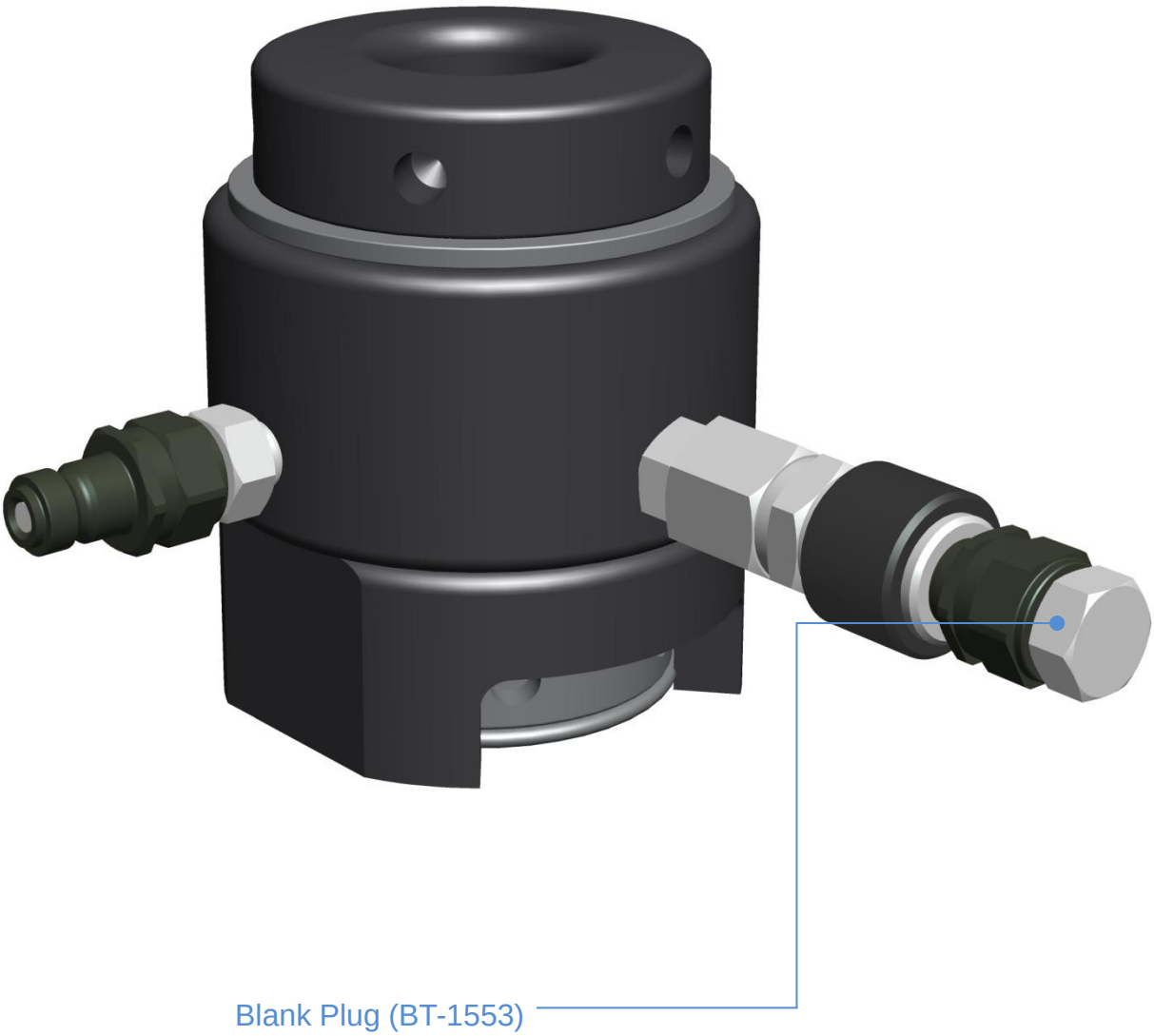
Section 2

Operating Instructions

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Important Notice

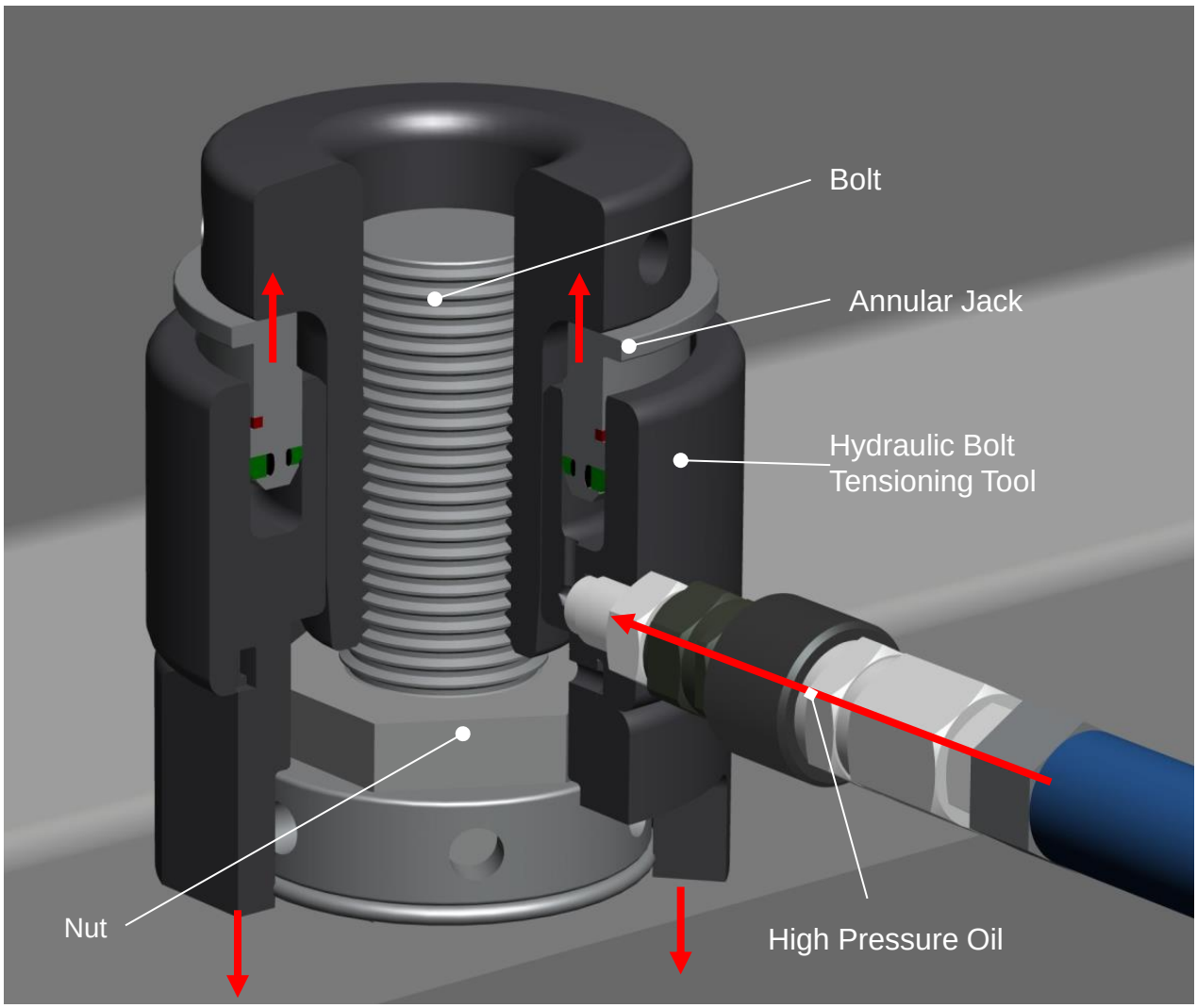
The drawings and photographs in this section of the manual show tools with only one hydraulic connection. However the instructions apply equally well to having two hydraulic connections.
It must be remembered that when working with a tool with two hydraulic connections it is necessary to fit a blank plug (BT-1553) to the quick connect coupling before applying any pressure.



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Introduction

A hydraulic bolt tensioning tool provides a quick and easy method for tightening large diameter bolts to high and accurate pre-loads. Unlike conventional methods it 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 enemy, FRICTION. Overcoming thread friction and friction between the nut and the washer uses up over 80% of the torque energy applied to the nut or bolt, leaving less than 20% of the energy to produce useful tension in the shank of the bolt. Variations in the friction loss, from bolt to bolt causes non uniform tension in the bolts that have been tightened to the same torque or impact wrench settings.



A hydraulic bolt tensioner is an annular jack which fits over the bolt and nut to be tightened. The jack pushes against the bolted joint and pulls on the end of the bolt, which needs to be at least one diameter longer to accommodate the bolt tensioning tool. Because the force produced by, the jack, is applied directly to the end of the bolt, a tension equal to the load generated by the jack is developed in the shank of the bolt. With the jack applying tension, it is possible to the nut with zero torque until it is tight. The load applied by the jack is then relaxed and a high percentage, depending on the length of the bolt and its diameter, is retained in the shank of the bolt.

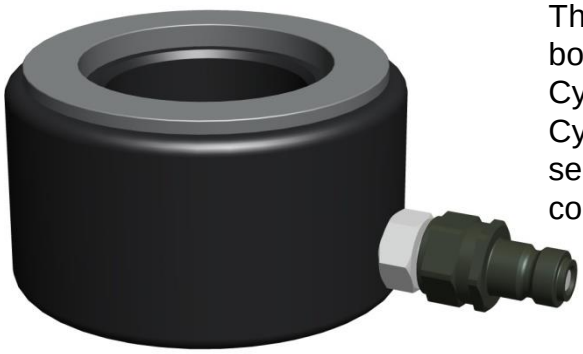
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Bolt tensioning tools can be ganged together to enable multiple bolts to be tightened simultaneously, to the same high and accurate pre-load. This is particularly useful when compressing gaskets in pipeline or pressure vessel flanged connections. The high load developed be 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 gang the bolt tensioning tools together to form a hydraulic ring main. The ring main and tensioning tools are pressurised using and air driven pump working from a compressed air supply.

Main Component Parts



The Puller has an internal thread to suit the bolt. The outside edge is knurled to assist rotation by hand and tommy bar holes are provided for final tightening. The Puller has a nose to assist location into the centre of the Cylinder and onto the bolt. The Puller transfers the force developed by the Cylinder into tension in the bolt.



The cylinder is an annular hydraulic jack. The bolt and Puller pass through the centre of the Cylinder. A recess is provided in the base of the Cylinder to accept the Bridge. One or two self sealing quick connectors are provided for connecting the hydraulic hoses.

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The Bridge supports the Cylinder over the bolt, not and Socket. A circular groove has been added to fit a socket retaining ring which optionally retains the Socket within the Bridge. Flats on each side of the Bridge give clearance for adjusting nuts. An angled flat at the rear clears the welding neck of a flange or other obstruction. A cut out in the front of the Bridge allows access to the Socket with a tommy bar, to turn the nut when the bolt is tensioned.



The Socket fits over the hexagon nut and inside the Bridge. It has tommy bar holes to avoid the need to drill holes in the flat of the hexagon nut.



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 the instructions to follow. Good quality bolts and nuts will make the tensioning operation quicker and more accurate.



This diagram shows a tool with single hydraulic connection, fully assembled onto a bolt and nut ready for the hydraulic hose to be connected and the tensioning operation to commence. Through the Bridge the tommy bar holes in the Socket are seen. The following pages describe fully each stage of the tool assembly and bolt tightening operation.

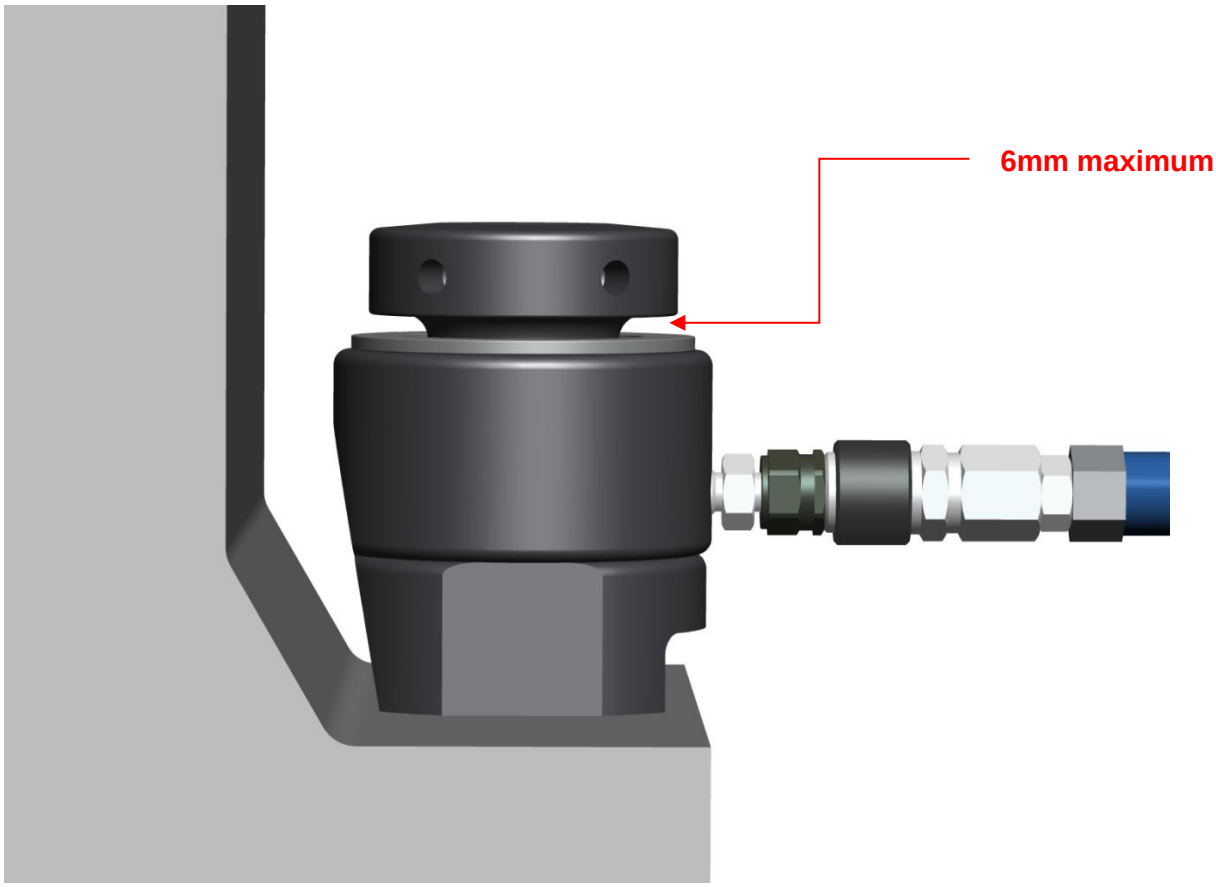
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Recommended Practices

To obtain the best results from your 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 try to pressurise the Hydraulic Cylinder unless it is properly seated on its Bridge and the Puller has been correctly fitted onto the bolt to be tightened or released. If the Hydraulic Cylinder is pressurised when it is not on a Bridge or when a Puller is not properly fitted, the Hydraulic Cylinder may be so badly damaged that it cannot be used again.
6mm maximum

DO NOT try to use the pump to push the Piston out of the Hydraulic Cylinder at zero load, by more than **6mm** before it comes into contact with the Puller. If you do want to push out the Piston by more than 6mm do so only in 6mm stages and ensure the Piston is bought back into alignment with the Hydraulic Cylinder by use of the Puller at the end of the each 6mm of travel. Failure to do so may cause the Piston to score the Cylinder Body. The Hydraulic Cylinder may be so badly damaged that it cannot be used again.



When extending the piston under zero load, only do so in 6mm stages.

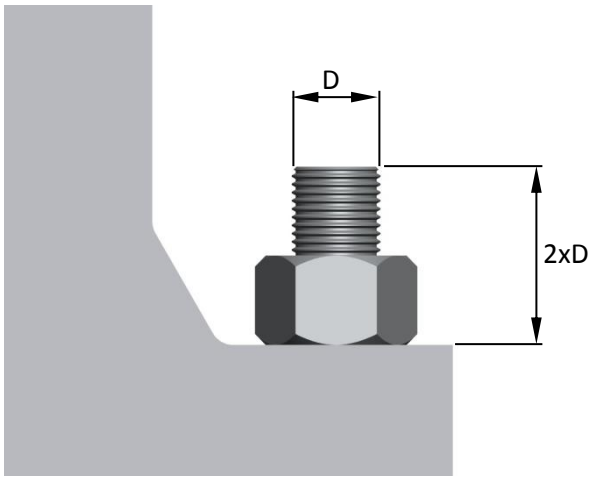
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Tightening a Bolt – Step 1

Assemble the joint with the bolts and nuts to be tightened.

Make sure thread length equal to a minimum of two bolt diameters is protruding from the surface of the flange or joint on the side the bolt tensioning operation is to be performed. The bolt tensioner is designed to cope with thread lengths in excess of two diameters.

It is very important this operation is performed properly otherwise the thread engagement between the bolt tensioner and the bolt will be less than one diameter, which could cause the bolt and/or bolt tensioner threads to be stripped.



CORRECT & SAFE





WRONG & 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 launched with the possibility of serious injury.

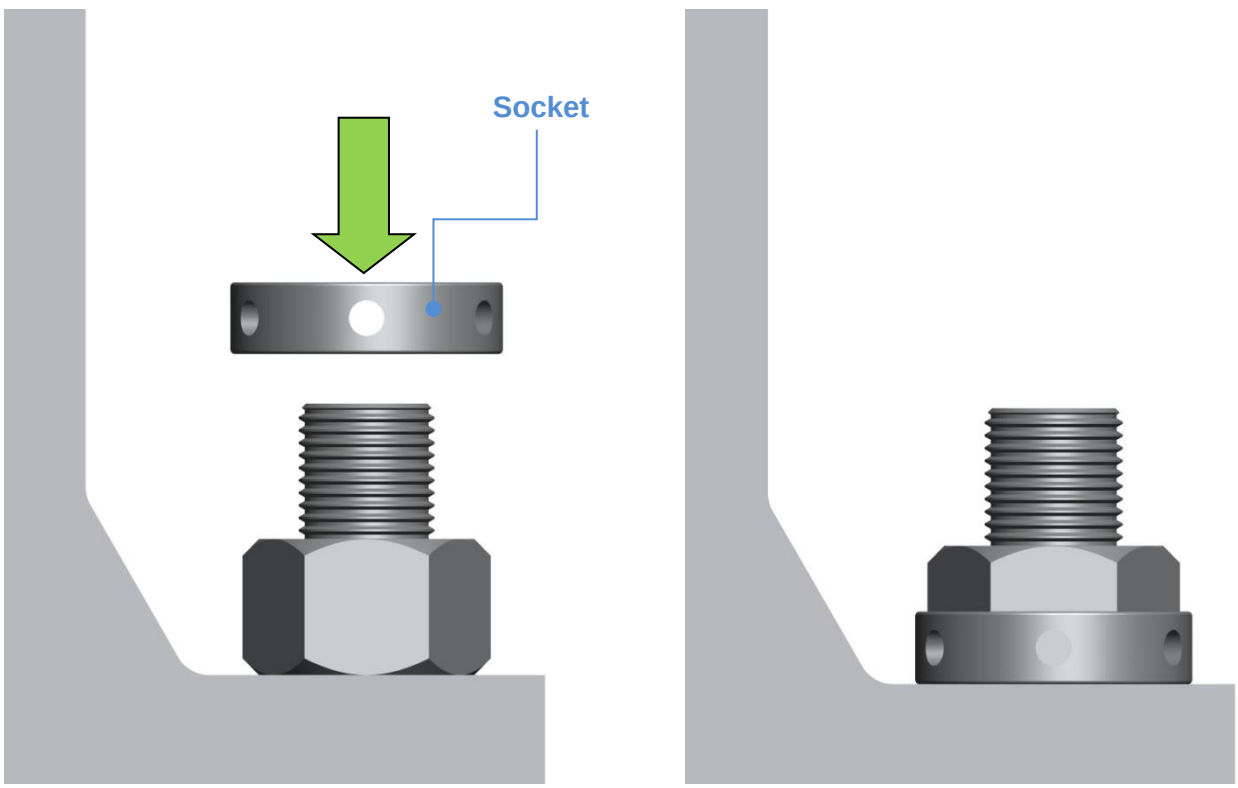
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Tightening a Bolt – Step 2

Place the Socket over the nut to be tightened.
When tensioning bolts with hexagon nuts it is normal to use the Socket, which is drilled with tommy bar holes, as the method for turning the nut when the bolt tension is applied.

On some tools there is a circular groove in the Bridge to fit a socket retaining ring, which gives the option of captivating the Socket within the Bridge. If this option is chosen there is no need to place the Socket over the nut separately to the Bridge and this step can be ignored.

Also in some circumstances and applications the hexagon nuts are pre drilled with tommy bar holes in the flats of the nut. Sometimes circular or ring nuts are used instead of hexagon nuts and these will also be pre drilled with tommy bar holes. In these circumstances the Socket is not required at all and this step can be ignored.



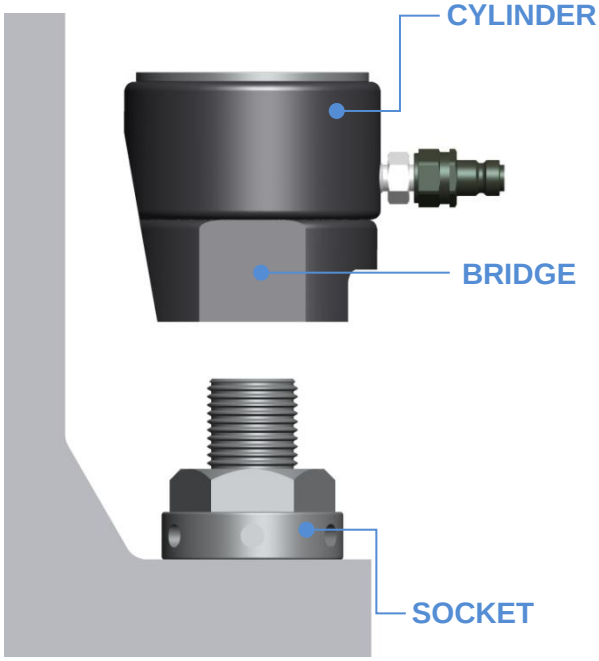
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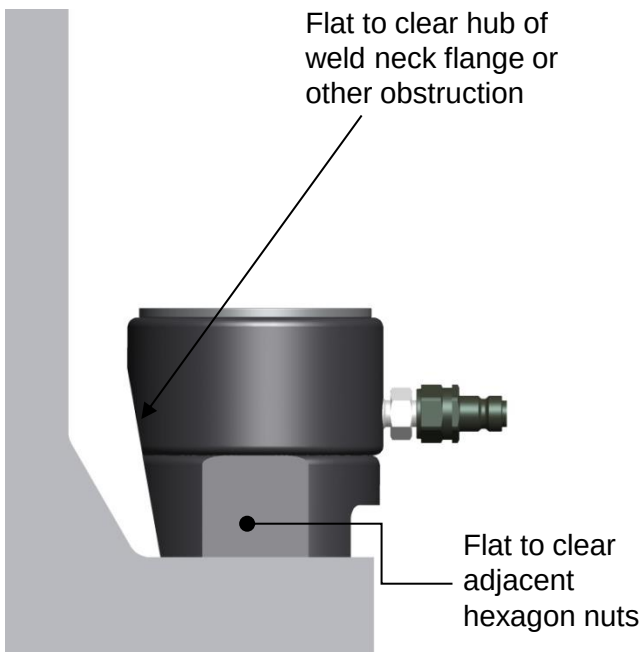
Tightening a Bolt – Step 3

Place the Cylinder and Bridge assembly over the nut, bolt and Socket.

The Cylinder and Bridge are assembled together using spring loaded ball screws around the outside of the base of the Cylinder. The Bridge and Cylinder can be rotated relative to each other. This allows the self sealing quick connect hydraulic connection on the Cylinder to be positioned in the best position for connecting the flexible hydraulic hose. In applications where space is limited above the bolt, it may be helpful to separate the Bridge and the Cylinder, placing them individually onto the bolt. Pull the Bridge away from the Cylinder to remove it. Push the two back together again afterwards.

The Bridge has a recess to accept the Socket, nut and bolt. A window in the front of the Bridge allows access to the Socket with a tommy bar. The Bridge may have flats on each side to clear the adjacent nuts. The Bridge and Cylinder may have an angled flat at the back to clear any obstruction behind the bolt and nut, such as the hub of a weld neck flange.



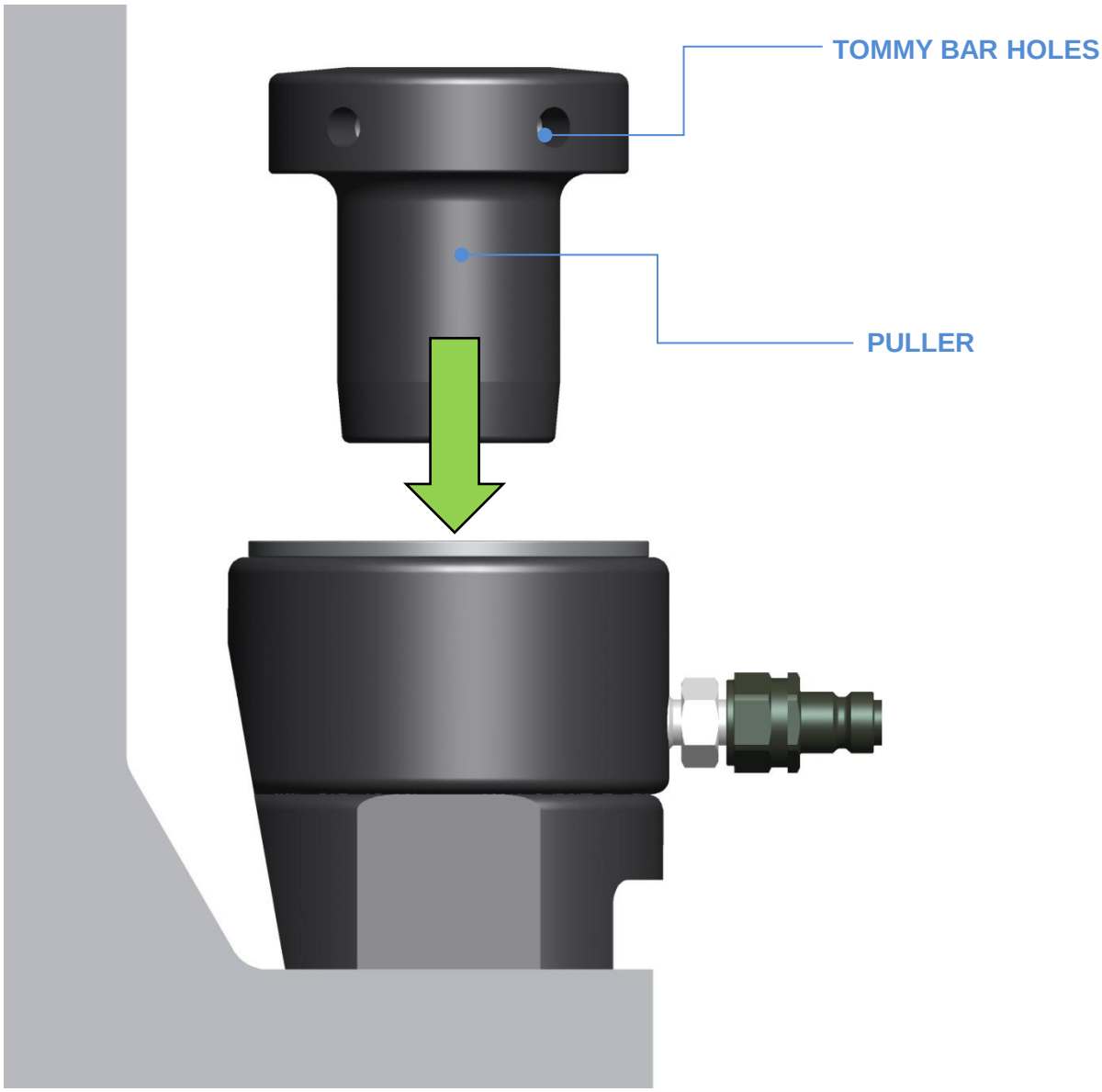


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Tightening a Bolt – Step 4

Place the Puller into the centre of the Cylinder and Bridge and engage the Puller thread with the end of the bolt. The Puller has a nose to assist this operation.

Take care the Puller and bolt threads are properly engaged and do not become crossed. Do no force the Puller onto the bolt. The Puller should turn freely on the bolt.

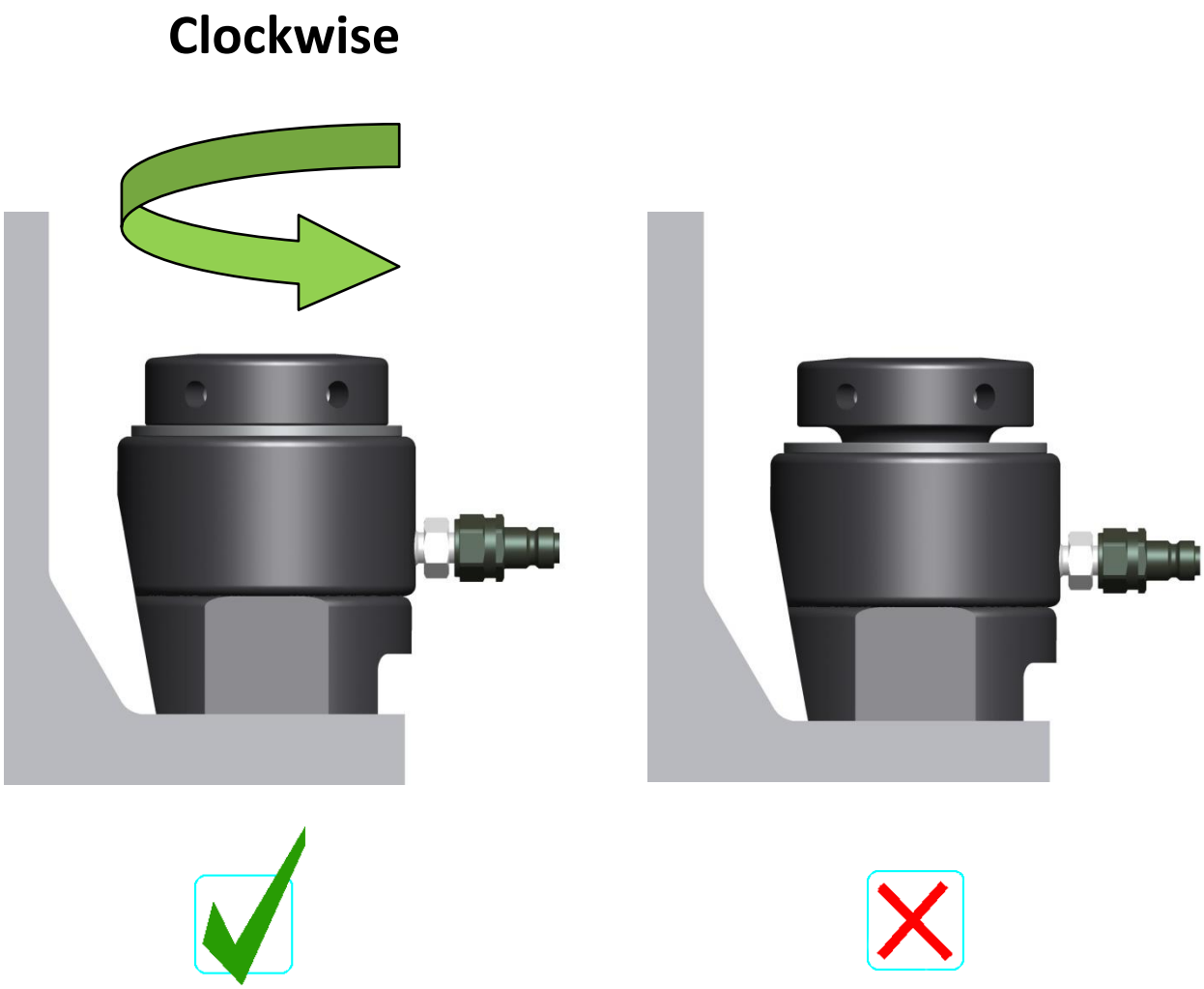


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Tightening a Bolt – Step 5

Screw the Puller fully down onto the top surface of the Cylinder. The Puller will normally be turned by hand but the final nip onto the Cylinder may require the help of a tommy bar.

Take extra care to stop the bolt turning with the Puller which would reduce the thread engagement on the bolt. In the worst case the Puller could even be left with only one or two threads engaged even though two diameters of thread were protruding through the bolted joint.

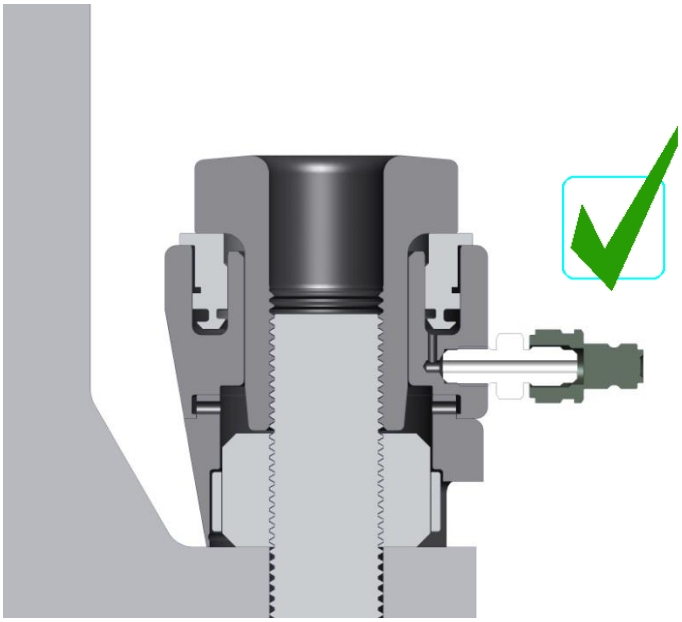


The Puller is not fully in contact with the top of the Cylinder

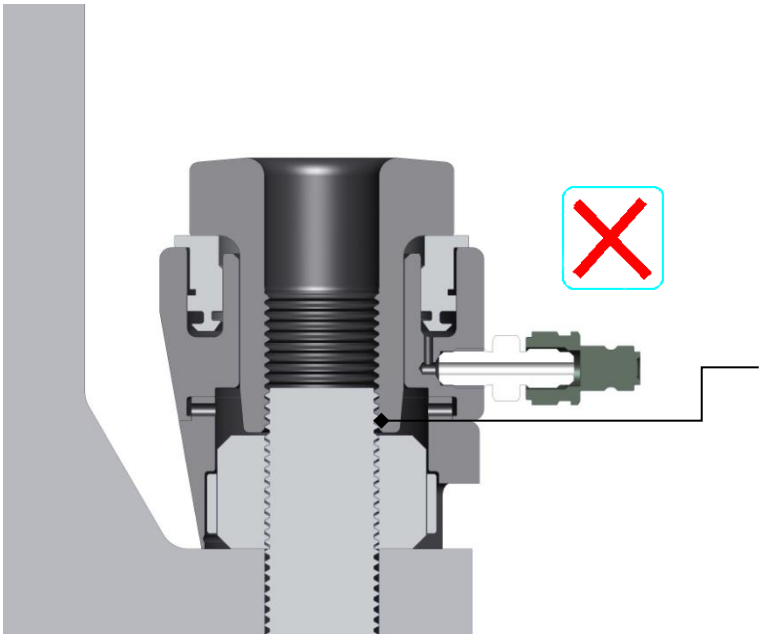
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Tightening a Bolt – Step 6

Once the Puller has been screwed down, double check the thread engagement with the bolt is still correct.



CORRECT



WRONG & DANGEROUS

The Bolt has turned with the Puller and the thread engagement between the Bolt and Puller has been reduced.

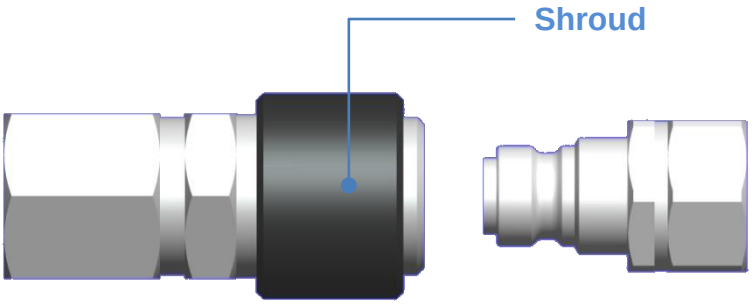
If pressure is applies the Puller threads might strip and cause injury.

The bolt tensioner is now locked in place and cannot fall off. The tool is now ready for the hydraulic hose to be connected.

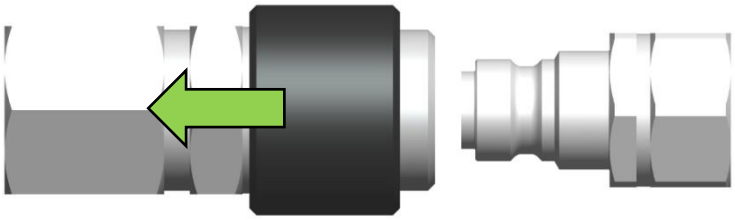
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Using Quick Connectors

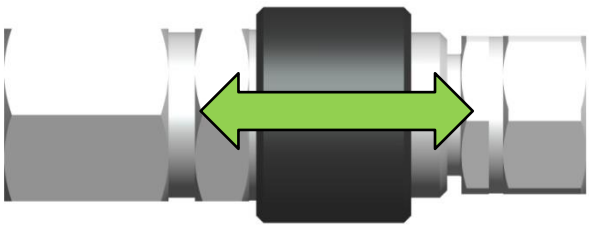
Before using Quick Connectors the operator should ensure that they have read and understood the Quick Connectors Health and Safety instructions in section 1.
To connect the Quick Connect Coupling and Nipple, first check there is no pressure in the system. Then pull back the shroud by hand and push the coupling onto the nipple. When together, release the shroud which will spring back to lock the Coupling and Nipple together. To disconnect, first check there is no pressure in the system. Pull back the shroud, by hand, and pull the coupling and nipple apart. Release the shroud when apart.



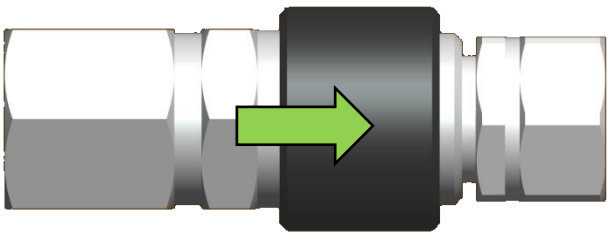
Pull the shroud back to retract.



Coupling and nipple with the shroud retracted.



Coupling and nipple pushed together with the shroud retracted.



Shroud released, coupling and nipple are now locked together and safe to use.

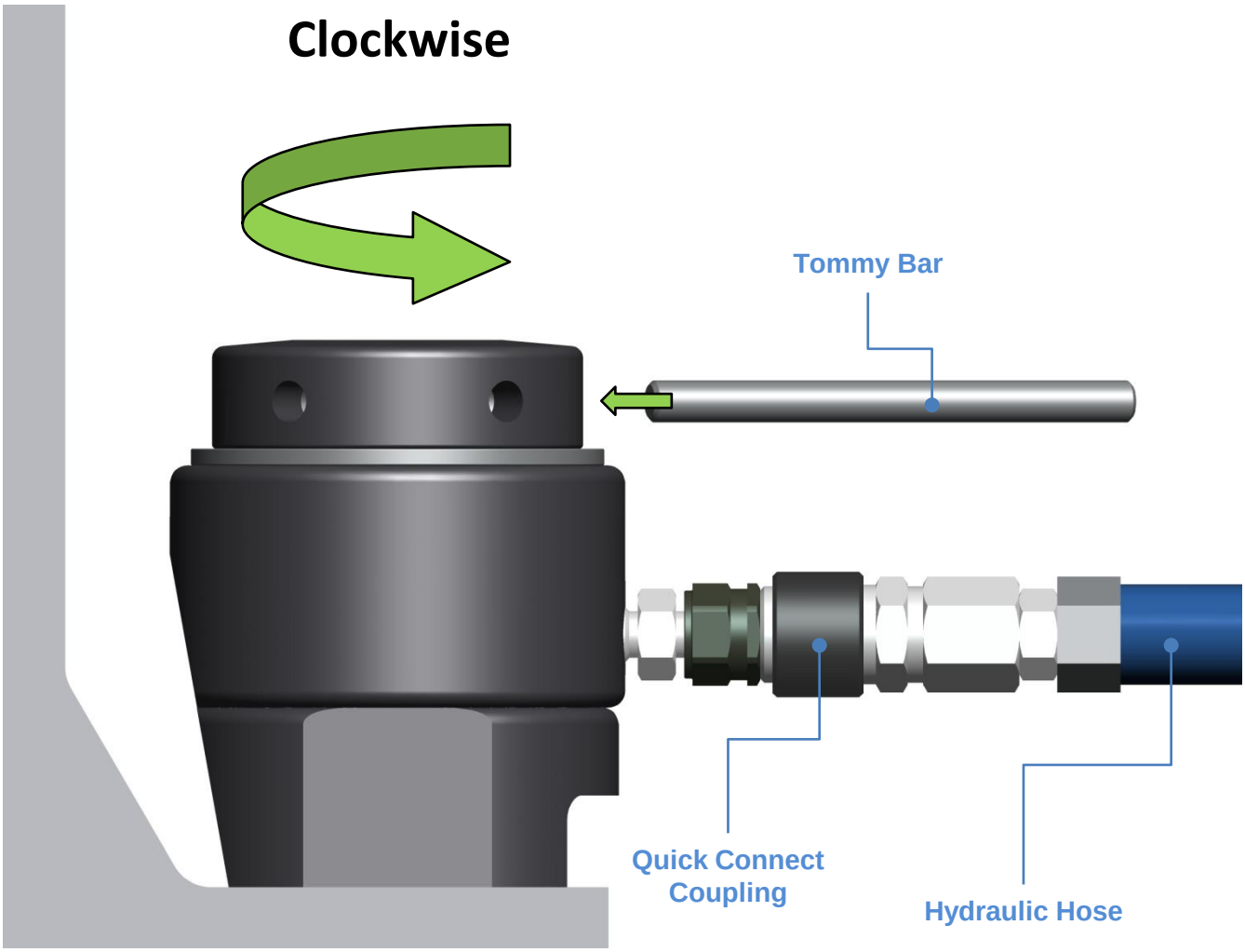
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Tightening a Bolt – Step 7

Connect the hydraulic hose.

Make sure the quick connect coupling is fully engaged.

Tighten the Puller with the tommy bar.



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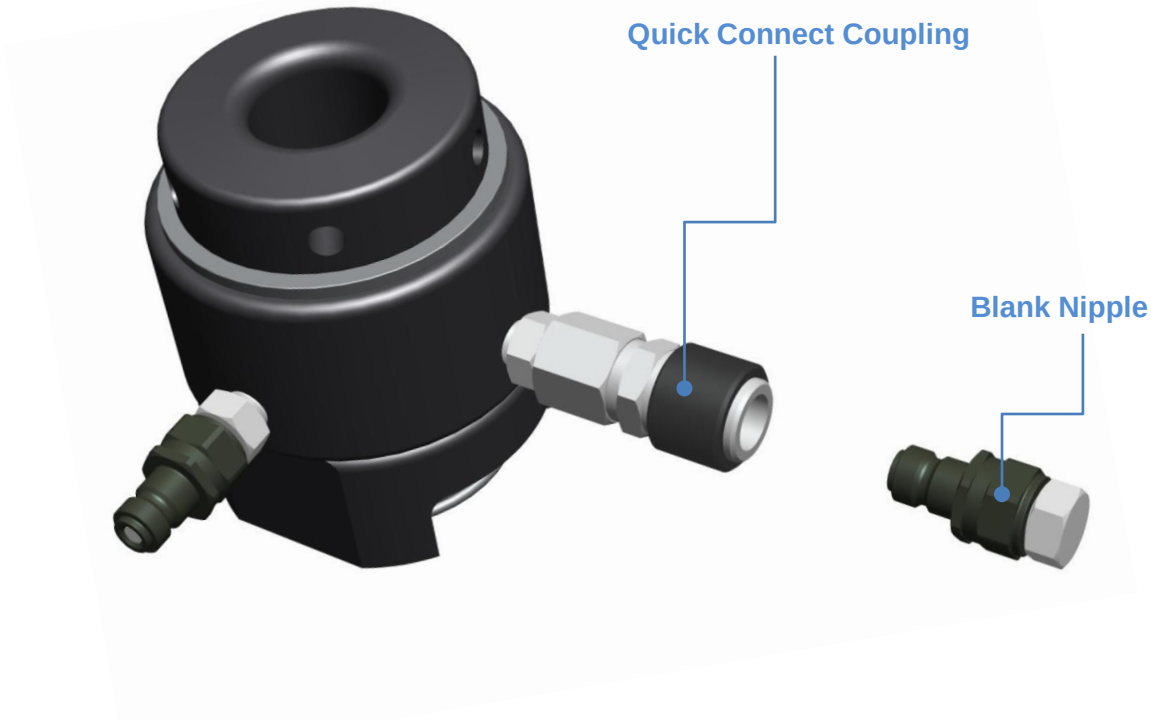
Tightening a Bolt – Step 7a

If applicable fit a blank nipple to the quick connect coupling.

Make sure the nipple is fully engaged.

Only when the second hydraulic connection has been plugged can the tool be pressurised.

A later section of the manual will show how to use multiple tooling for simultaneous bolt tightening operations.





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Tightening a Bolt – Health & Safety



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

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.

Make certain that nobody is allowed to stand near to a bolt tensioning tool during the pressurisation process. At no time should anyone allow any part of their body to be position over the Puller of a bolt tensioning tool, whilst the pressure is rising or when it is pressurised. Do not allow anyone to stand anywhere near a direct line with the long axis of a bolt during the tensioning operation. 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 that bolt or tool failure is most likely to happen 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 Puller.

Wear eye protection, gloves, overalls and a hard hat.

Never leave a pressurised bolt tensioning tool unattended.

Release the oil pressure immediately is any unauthorised person moves into the bolt tensioning area and especially is anyone stands in front of the Puller 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 job.

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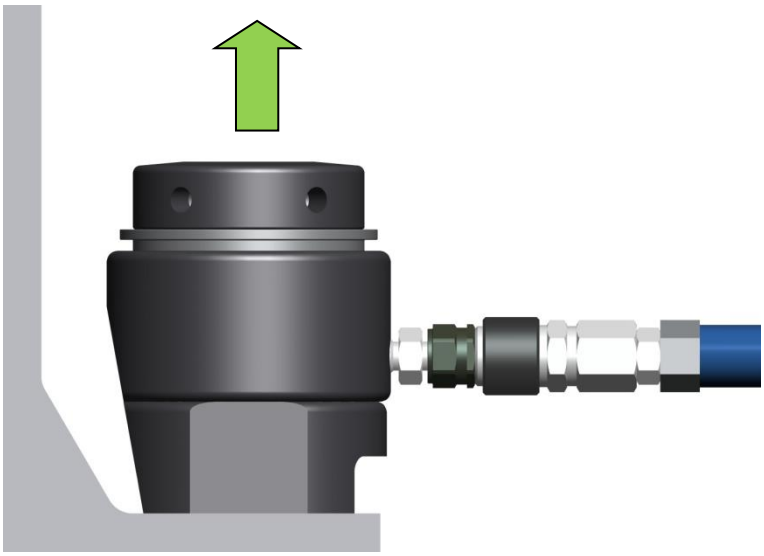
Tightening a Bolt – Step 8

Apply the correct hydraulic pressure, observing the Health and Safety Instructions. The Piston will move out of the Cylinder as the bolt is stretched and the bolted joint is compressed.

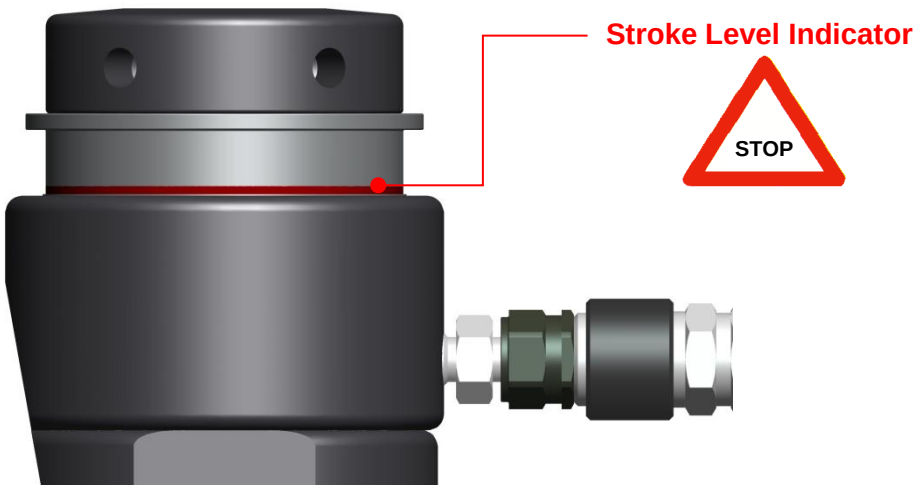
DO NOT exceed the maximum piston stroke. This is indicated by a red line around the piston.

DO NOT exceed the maximum pressure for the tool.

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



Observe the piston. If the maximum piston stroke indicator is seen you MUST stop the pump and go to STEP 9 then STEP 11 then back to STEP 8.



A highly visible red line indicates when the piston has reached its maximum stroke. Stop the pump as soon as the red indicator can be seen.

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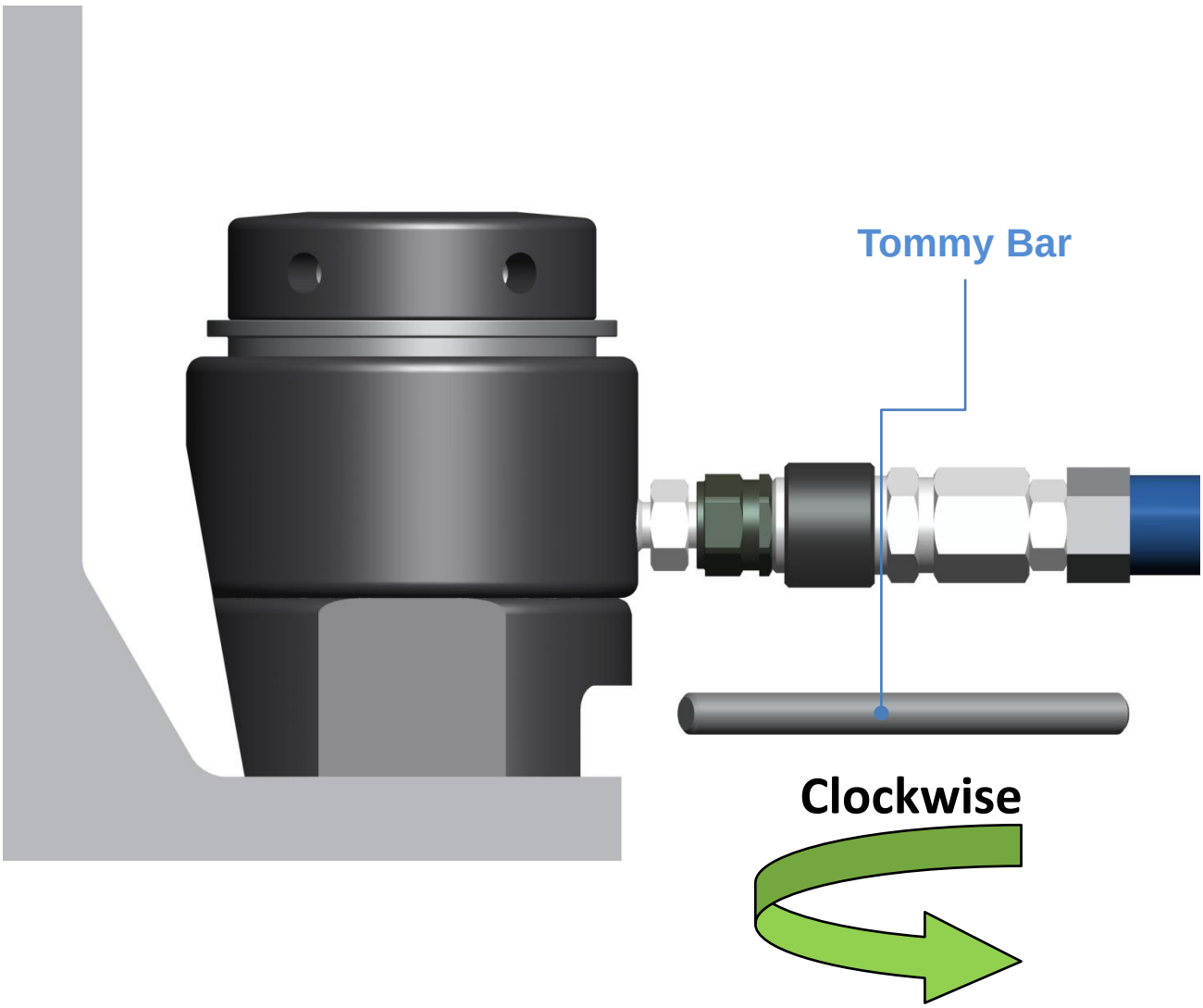
Tightening a Bolt – Step 9

Use a tommy bar to turn the Socket clockwise, to tighten the nut.

Insert the tommy bar through the window in the Bridge until it engages with a hole in the Socket.

Turn the Socket clockwise as far as it will go. If the tommy bar comes into contact with the Bridge, remove it and engage the next hole in the Socket.

Continue turning the Socket until the nut is tight.



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Tightening a Bolt – Step 10

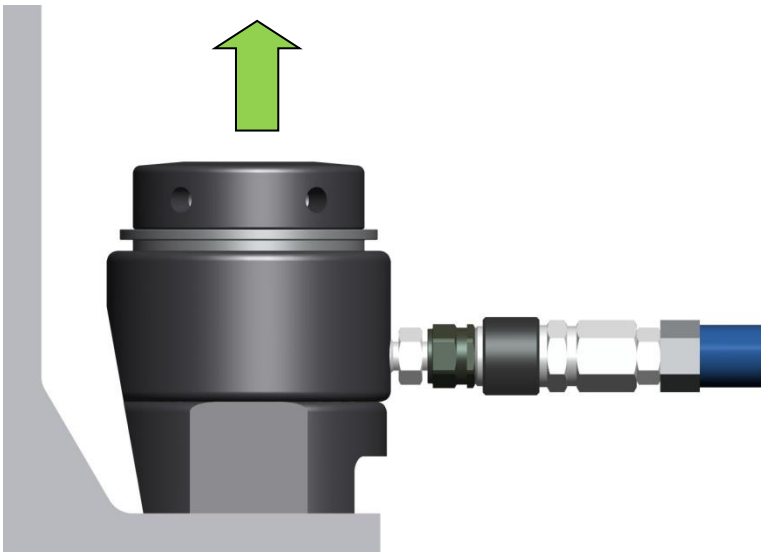
Release the pressure slowly.

Apply the correct hydraulic pressure again. Observe the Health & Safety Instructions.

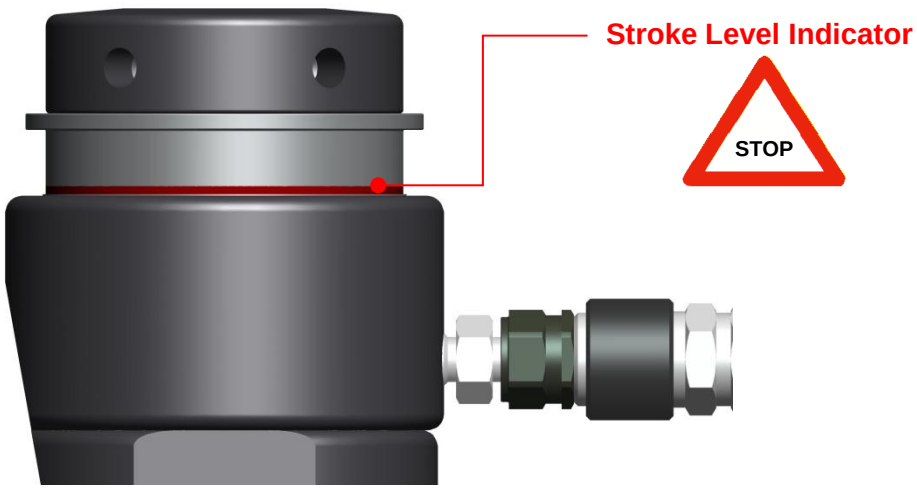
DO NOT exceed the maximum piston stroke. This is indicated by a red line around the piston.

DO NOT exceed the maximum pressure for the tool.

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



Observe the piston. If the maximum piston stroke indicator is seen you MUST stop the pump and go to STEP 9 then STEP 11 then back to STEP 8.



A highly visible red line indicates when the piston has reached its maximum stroke. Stop the pump as soon as the red indicator can be seen.

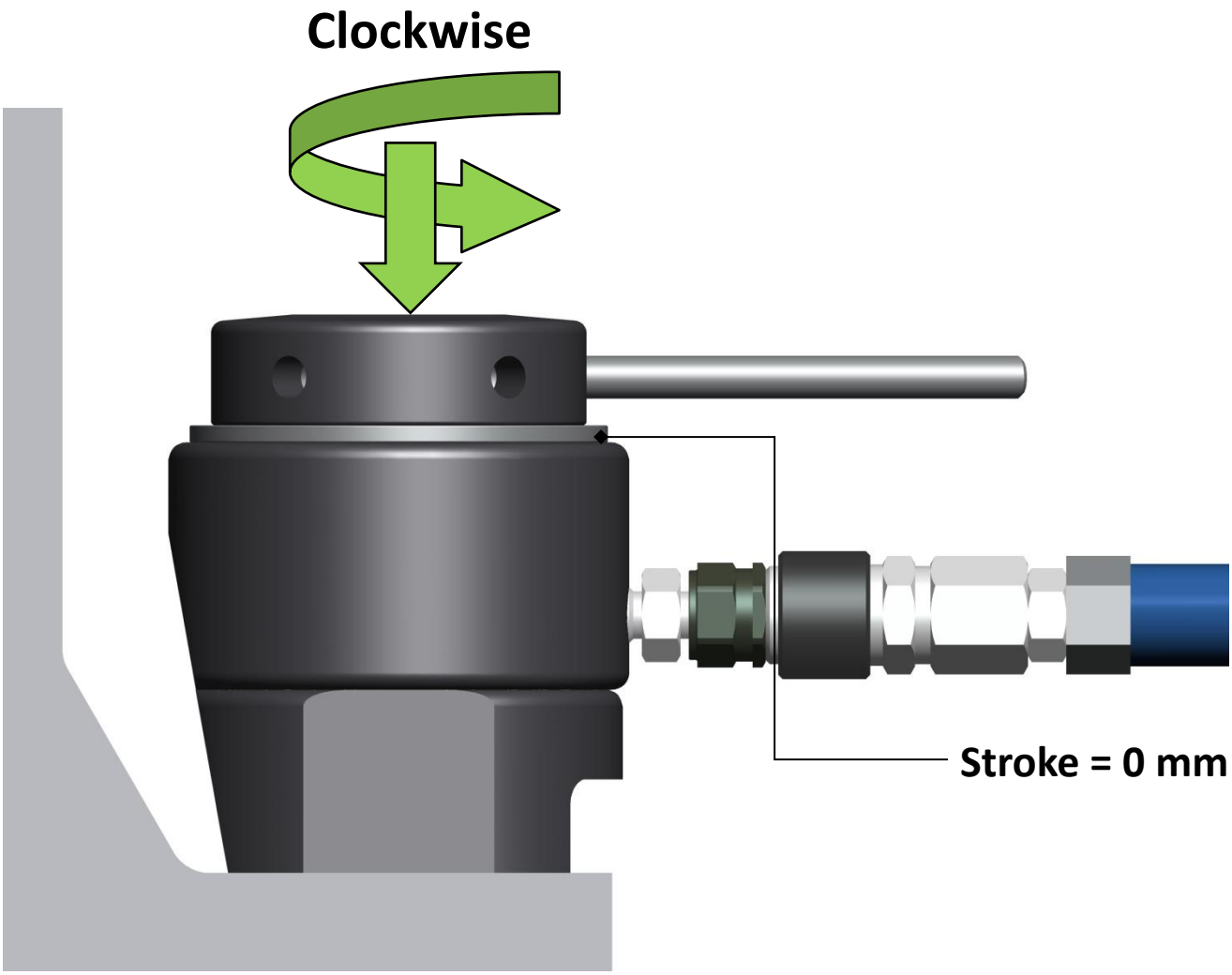
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Tightening a Bolt – Step 11

Release the pressure slowly.

Fully open the oil pressure release valve on the pump.

Use the tommy bar to tighten the PULLER until the Piston is fully returned into the CYLINDER.

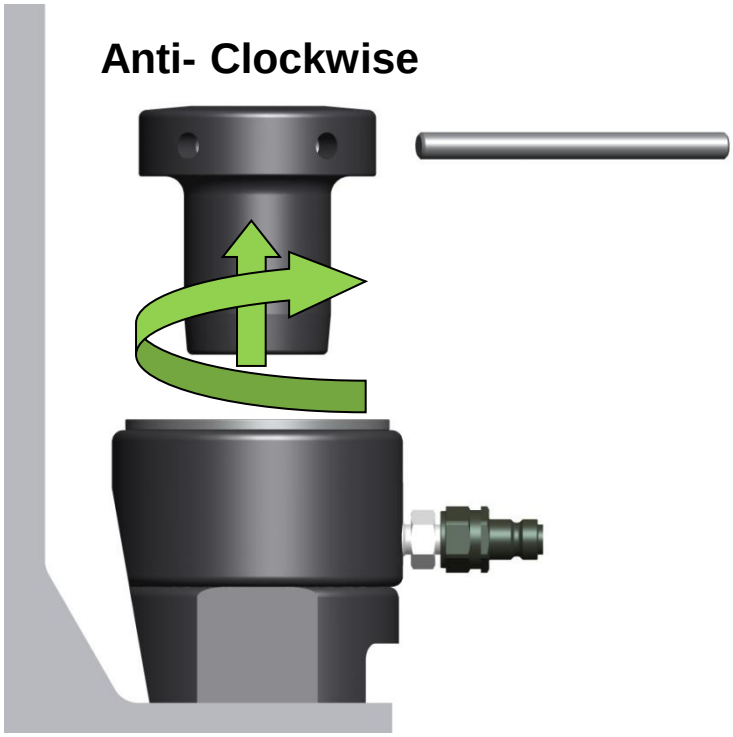


Once the piston is all the way down, remove the Hydraulic Hose.

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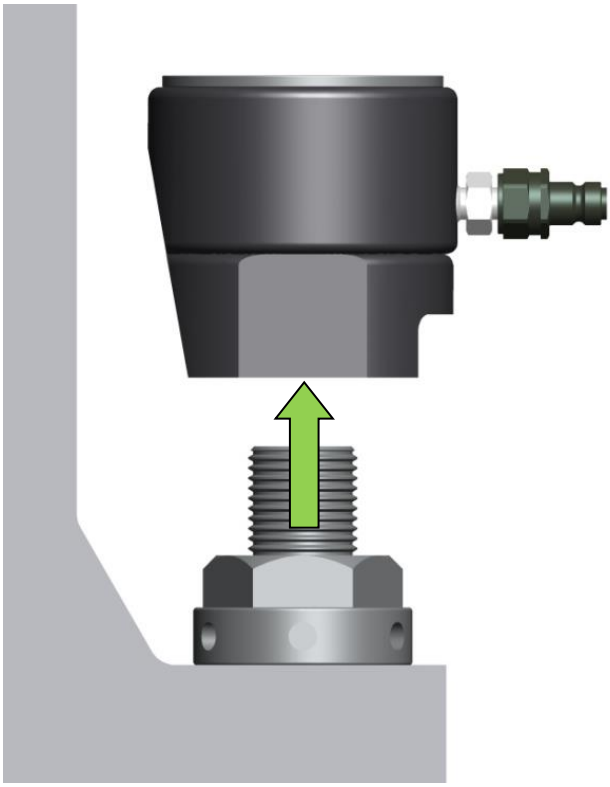
Tightening a Bolt – Step 12

Use the tommy bar to release and remove the Puller.



Tightening a Bolt – Step 13

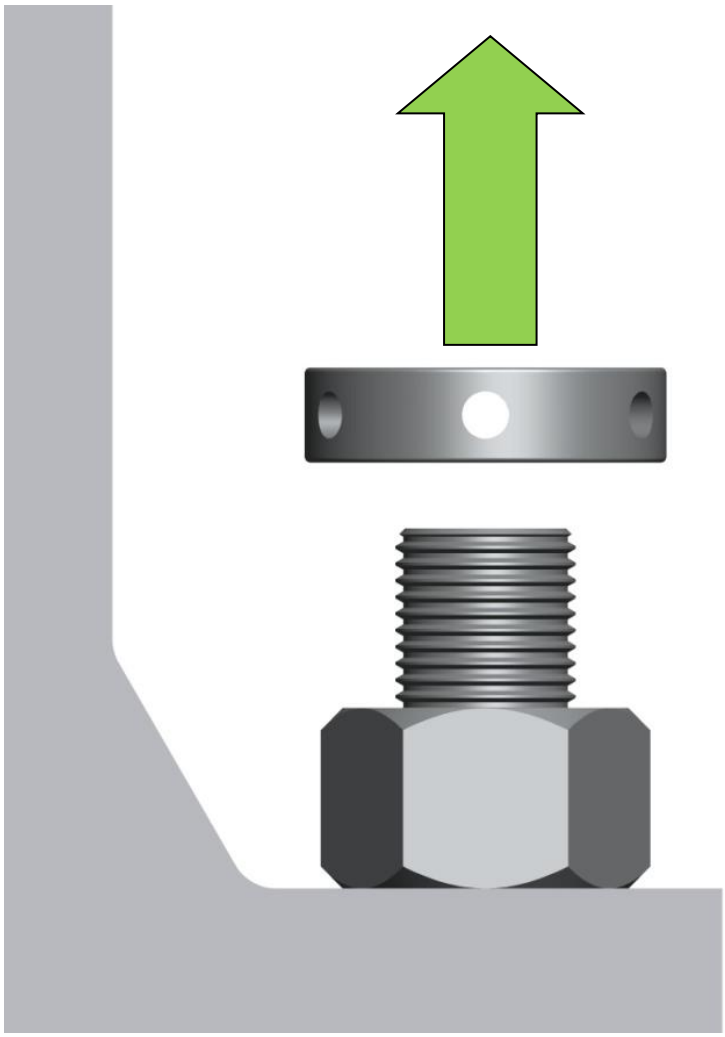
Remove the Cylinder and Bridge.



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Tightening a Bolt – Step 14

Remove the socket.



The bolt is now tensioned.

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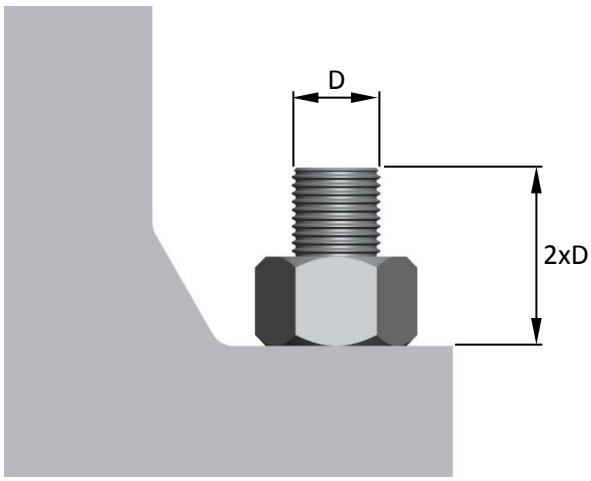
Loosening a Bolt – Step 1

Loosening bolts with a bolt tensioning tool is almost the reverse of the tightening operation but there are a couple of very important additions to the procedure. Failure to observe them will the nut loose, but the tensioning tool locked onto the bolt which remains tight.

Check the bolts to be loosened. Make sure there is sufficient thread length protruding through the nut and the thread is not damaged. Any bruising of the thread should be rectified with a thread file or die nut before attempting to assemble the hydraulic bolt tensioning tool onto the bolt.

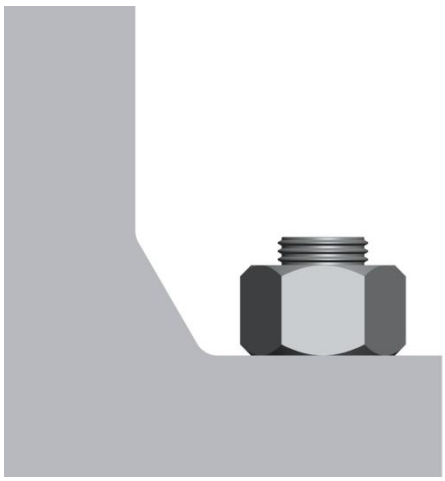
Make sure a thread length equal to a minimum of two bolt diameters is protruding from the surface of the flange or joint on the side the operation is to be performed. The bolt tensioner is designed to cope with thread lengths in excess of two diameters.

If the bolts have been tightened with a bolt tensioner it is most likely that sufficient thread length will be available however, it is very important this check is performed otherwise the thread engagement between the bolt tensioner and the bolt might be less than one diameter, which could cause the bolt and/or bolt tensioner threads to be stripped.



CORRECT & SAFE





WRONG & 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 launched with the possibility of serious injury.

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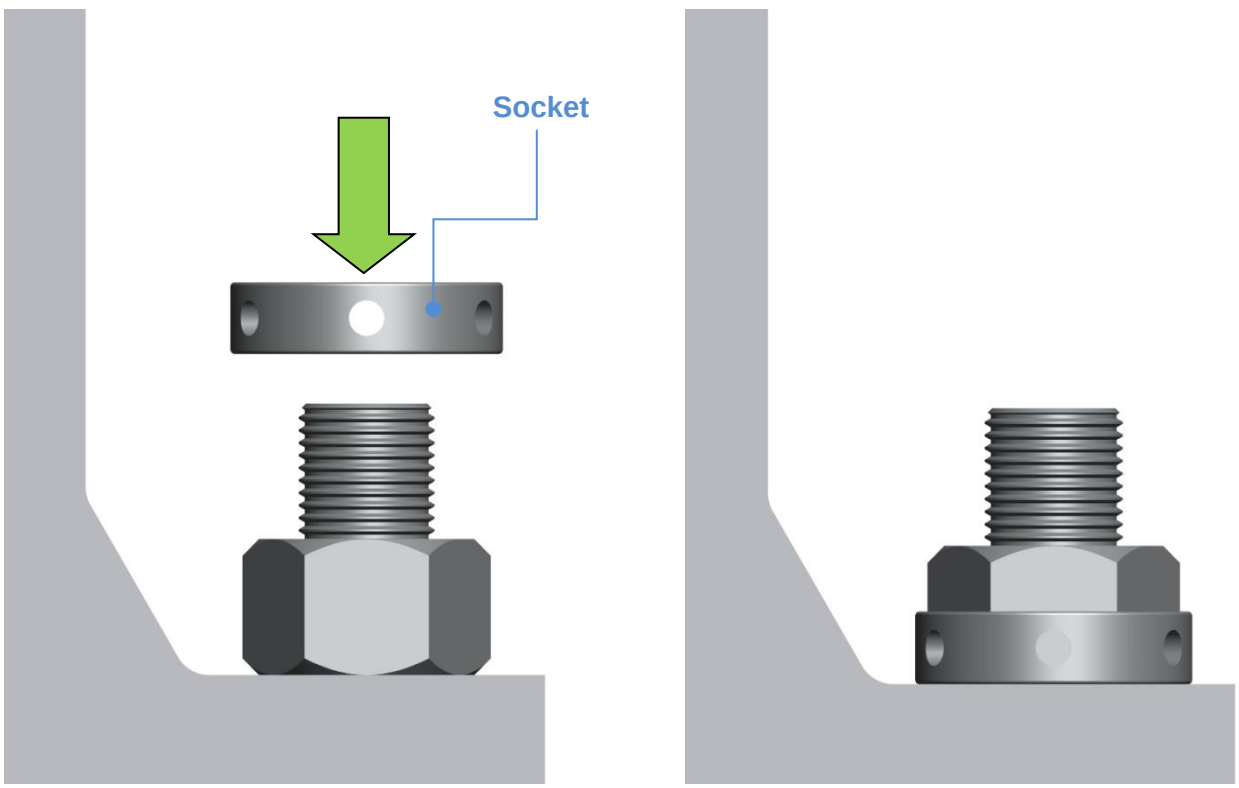
Loosening a Bolt – Step 2

Place the Socket over the nut to be loosened.

When loosening bolts with hexagon nuts it is normal to use the Socket, which is drilled with tommy bar holes, as the method for turning the nut when the bolt tension is applied.

On some tools there is a circular groove in the Bridge to fit a socket retaining ring, which gives the option of captivating the Socket within the Bridge. If this option is chosen there is no need to place the Socket over the nut separately to the Bridge and this step can be ignored.

Also in some circumstances and applications the hexagon nuts are pre drilled with tommy bar holes in the flats of the nut. Sometimes circular or ring nuts are used instead of hexagon nuts and these will also be pre drilled with tommy bar holes. In these circumstances the Socket is not required at all and this step can be ignored.



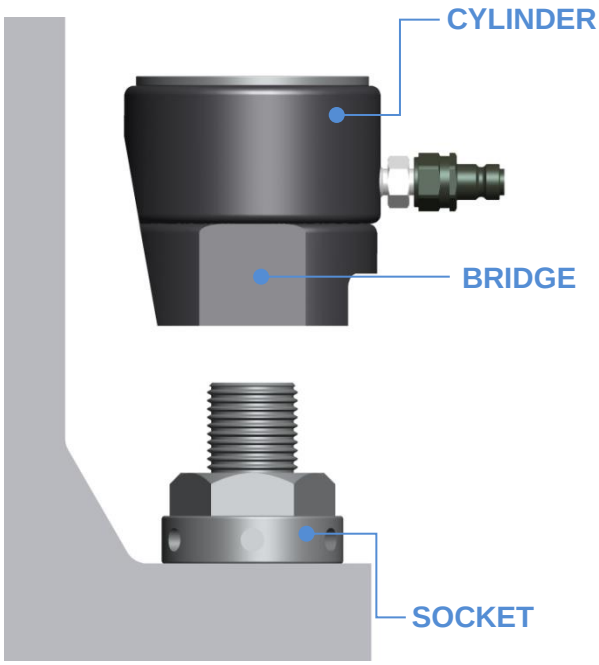
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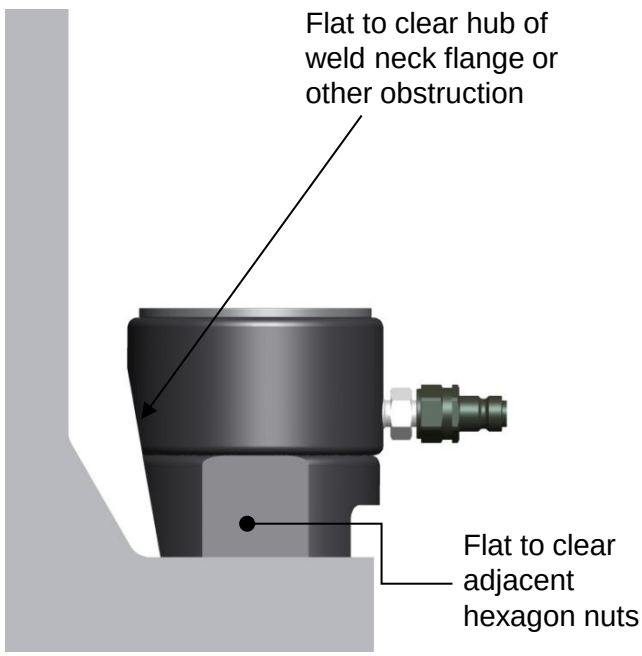
Loosening a Bolt – Step 3

Place the Cylinder and Bridge assembly over the nut, bolt and Socket.

The Cylinder and Bridge are assembled together using spring loaded ball screws around the outside of the base of the Cylinder. The Bridge and Cylinder can be rotated relative to each other. This allows the self sealing quick connect hydraulic connection on the Cylinder to be positioned in the best position for connecting the flexible hydraulic hose. In applications where space is limited above the bolt, it may be helpful to separate the Bridge and the Cylinder, placing them individually onto the bolt. Pull the Bridge away from the Cylinder to remove it. Push the two back together again afterwards.

The Bridge has a recess to accept the Socket, nut and bolt. A window in the front of the Bridge allows access to the Socket with a tommy bar. The Bridge may have flats on each side to clear the adjacent nuts. The Bridge and Cylinder may have an angled flat at the back to clear any obstruction behind the bolt and nut, such as the hub of a weld neck flange.





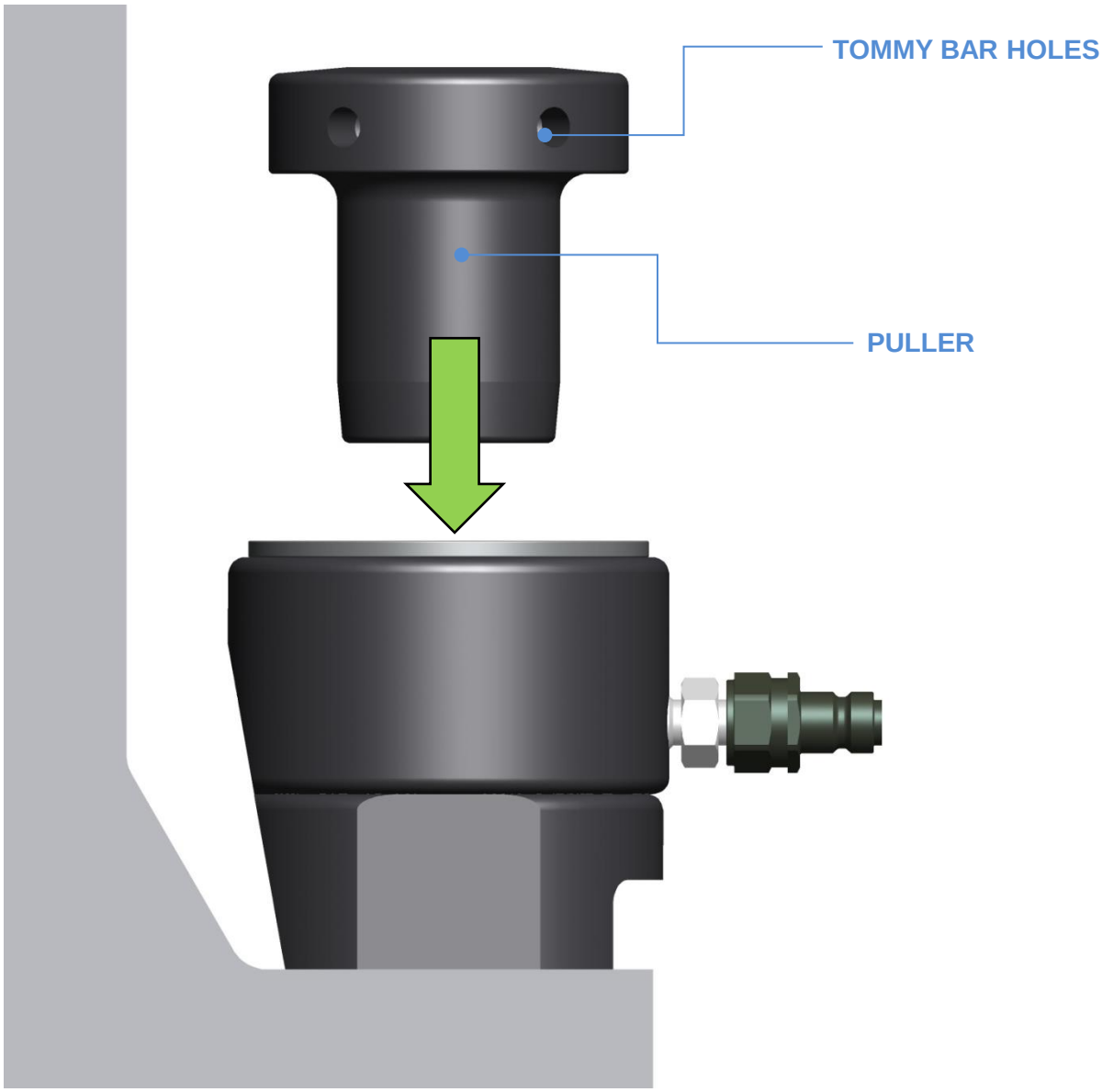
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Loosening a Bolt – Step 4

Place the Puller into the centre of the Cylinder and Bridge and engage the Puller thread with the end of the bolt. The Puller has a nose to assist this operation.

Take care the Puller and bolt threads are properly engaged and do not become crossed. Do no force the Puller onto the bolt. The Puller should turn freely on the bolt. Screw the Puller fully down onto the top surface of the Cylinder.

The Puller will normally be turned by hand but the final nip onto the Cylinder may require the help of a tommy bar. Once the Puller has been screwed down the tool is locked in place and cannot fall off.

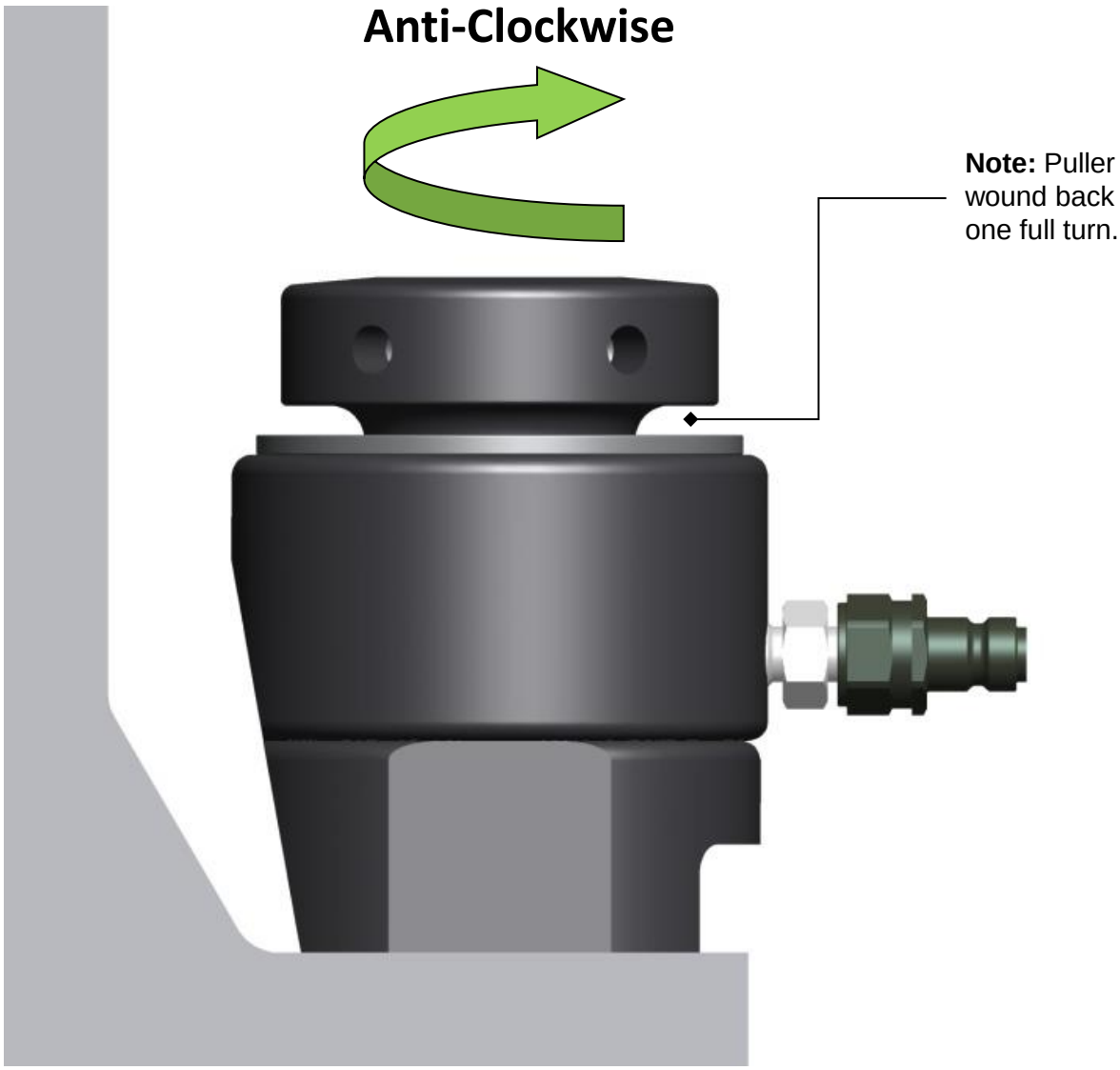


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Loosening a Bolt – Step 5

Now turn back the Puller at least one full revolution. The bolt tensioning tool will still be captive on the end of the bolt but it will be free to slide along the Puller. This operation ensures the Piston can retract into the Cylinder when the bolt becomes free and needs to return to its original length.

If you do not do this the load in the bolt will simply be transferred from the nut to the Puller during the loosening operation. It will be impossible to remove the bolt tensioning tool from the bolt. If this happens, re-tighten the bolt using the bolt tensioner, tighten the nut using the tommy bar and release the oil pressure. The Puller can then be wound back the one full turn necessary to avoid this situation arising again.

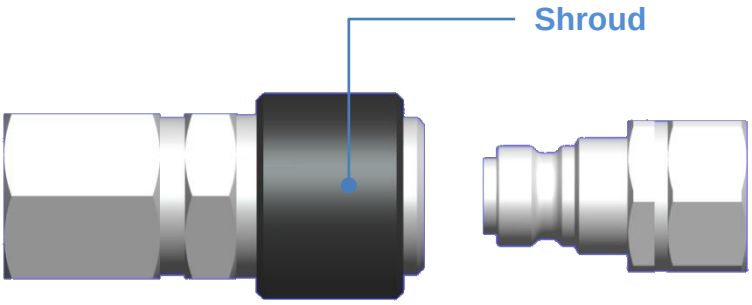


The tool is now ready for the hydraulic hose to be connected.

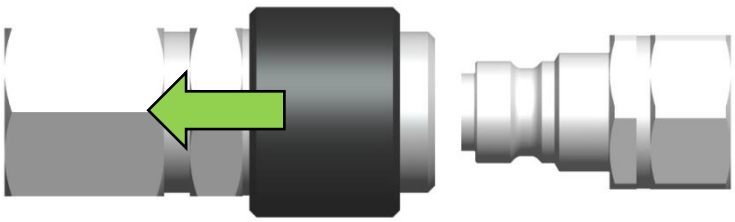
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Using Quick Connectors

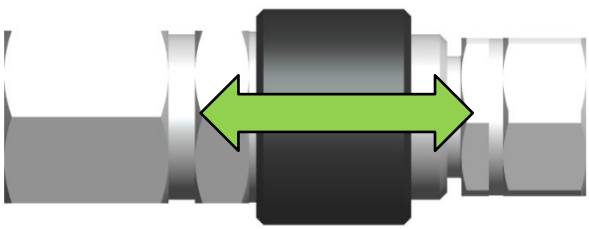
Before using Quick Connectors the operator should ensure that they have read and understood the Quick Connectors Health and Safety instructions in section 1.
To connect the Quick Connect Coupling and Nipple, first check there is no pressure in the system. Then pull back the shroud by hand and push the coupling onto the nipple. When together, release the shroud which will spring back to lock the Coupling and Nipple together. To disconnect, first check there is no pressure in the system. Pull back the shroud, by hand, and pull the coupling and nipple apart. Release the shroud when apart.



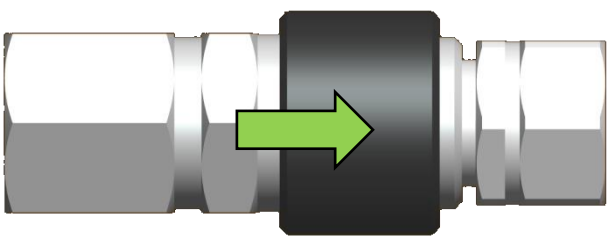
Pull the shroud back to retract.



Coupling and nipple with the shroud retracted.



Coupling and nipple pushed together with the shroud retracted.



Shroud released, coupling and nipple are now locked together and safe to use.

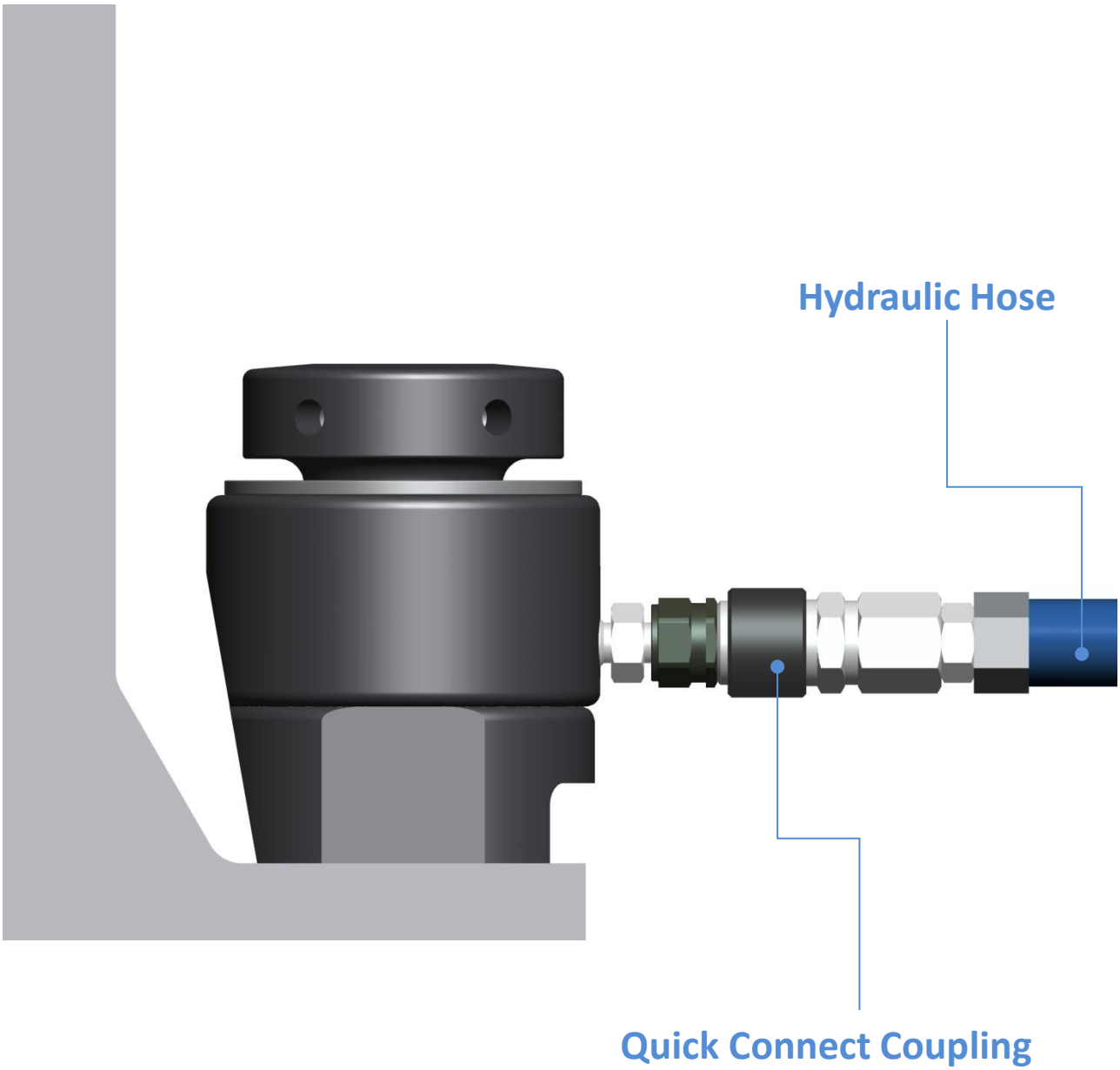
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Loosening a Bolt – Step 6

Connect the hydraulic hose.

Make sure the quick connect coupling is fully engaged.

DO NOT tighten the Puller with the tommy bar.



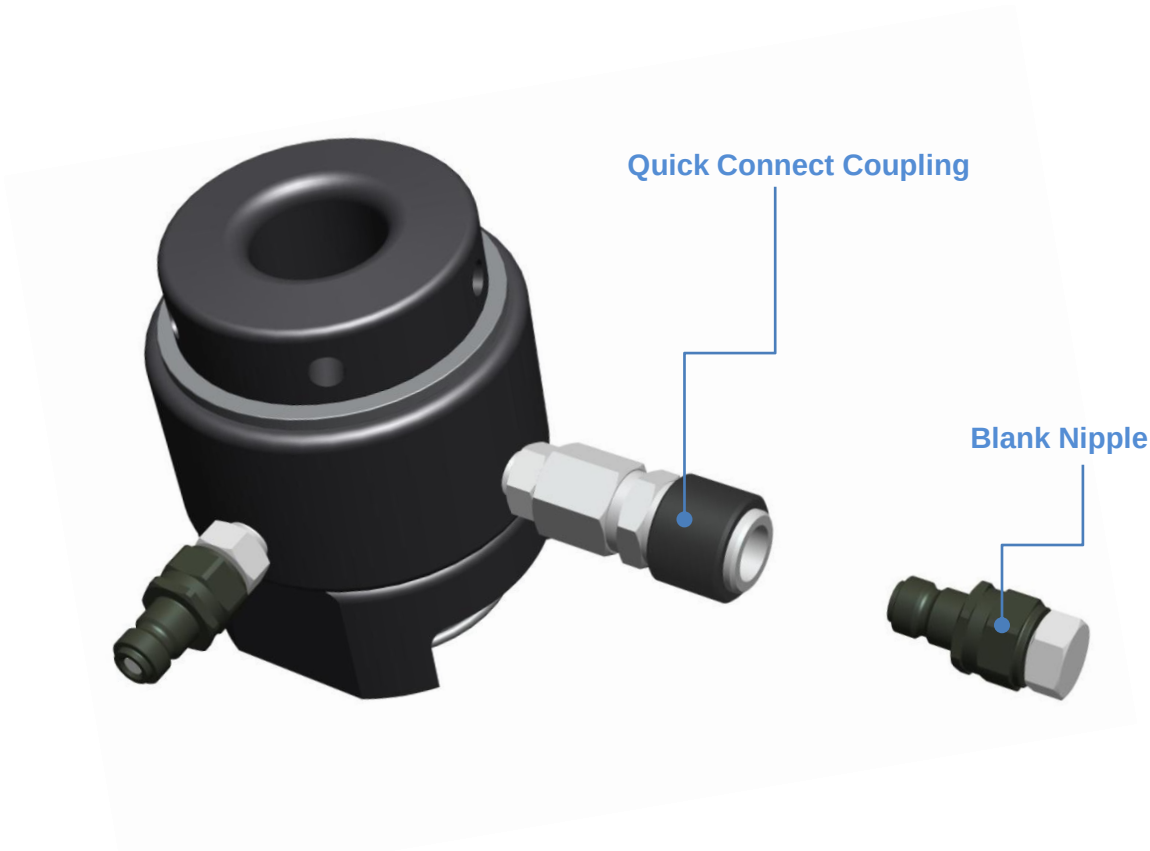
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Loosening a Bolt – Step 6a

If applicable fit a blank nipple to the quick connect coupling.

Make sure the nipple is fully engaged.

Only when the second hydraulic connection has been plugged can the tool be pressurised.





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Loosening a Bolt – Health & Safety



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

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.

Make certain that nobody is allowed to stand near to a bolt tensioning tool during the pressurisation process. At no time should anyone allow any part of their body to be position over the Puller of a bolt tensioning tool, whilst the pressure is rising or when it is pressurised. Do not allow anyone to stand anywhere near a direct line with the long axis of a bolt during the tensioning operation. 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 that bolt or tool failure is most likely to happen 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 Puller.

Wear eye protection, gloves, overalls and a hard hat.

Never leave a pressurised bolt tensioning tool unattended.

Release the oil pressure immediately is any unauthorised person moves into the bolt tensioning area and especially is anyone stands in front of the Puller 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 loosened.
Proceed with the following operations keeping the bolt tensioning tools under pressure for the minimum time necessary to complete the bolt loosening job.

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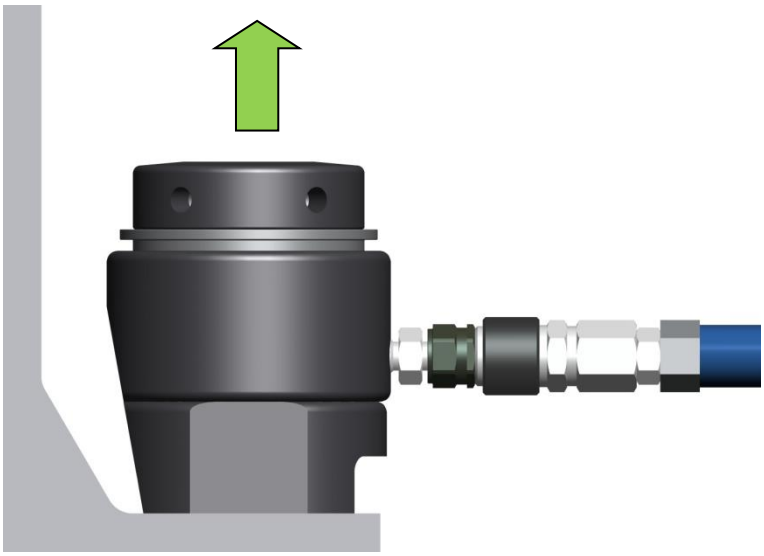
Loosening a Bolt – Step 7

Apply the correct hydraulic pressure, observing the Health and Safety Instructions.

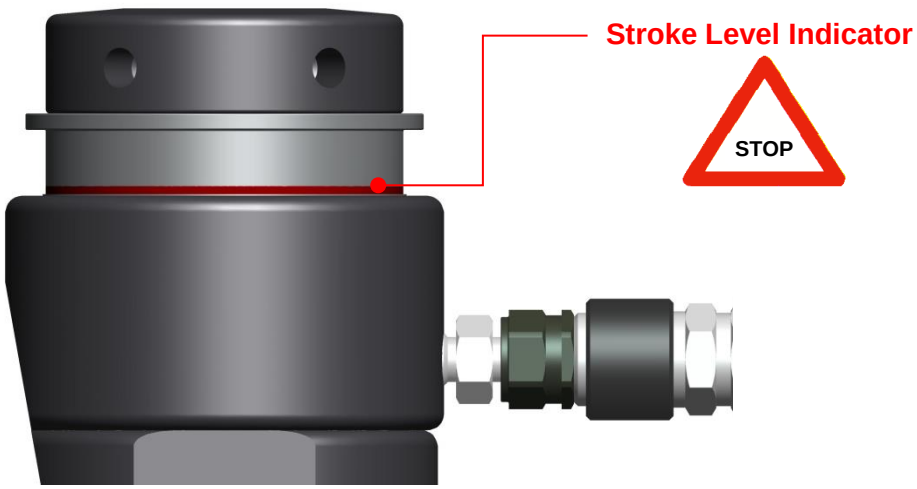
DO NOT exceed the maximum piston stroke. This is indicated by a red line around the piston.

DO NOT exceed the maximum pressure for the tool.

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



Observe the piston. If the maximum piston stroke indicator is seen you MUST stop the pump.



A highly visible red line indicates when the piston has reached its maximum stroke. Stop the pump as soon as the red indicator can be seen.

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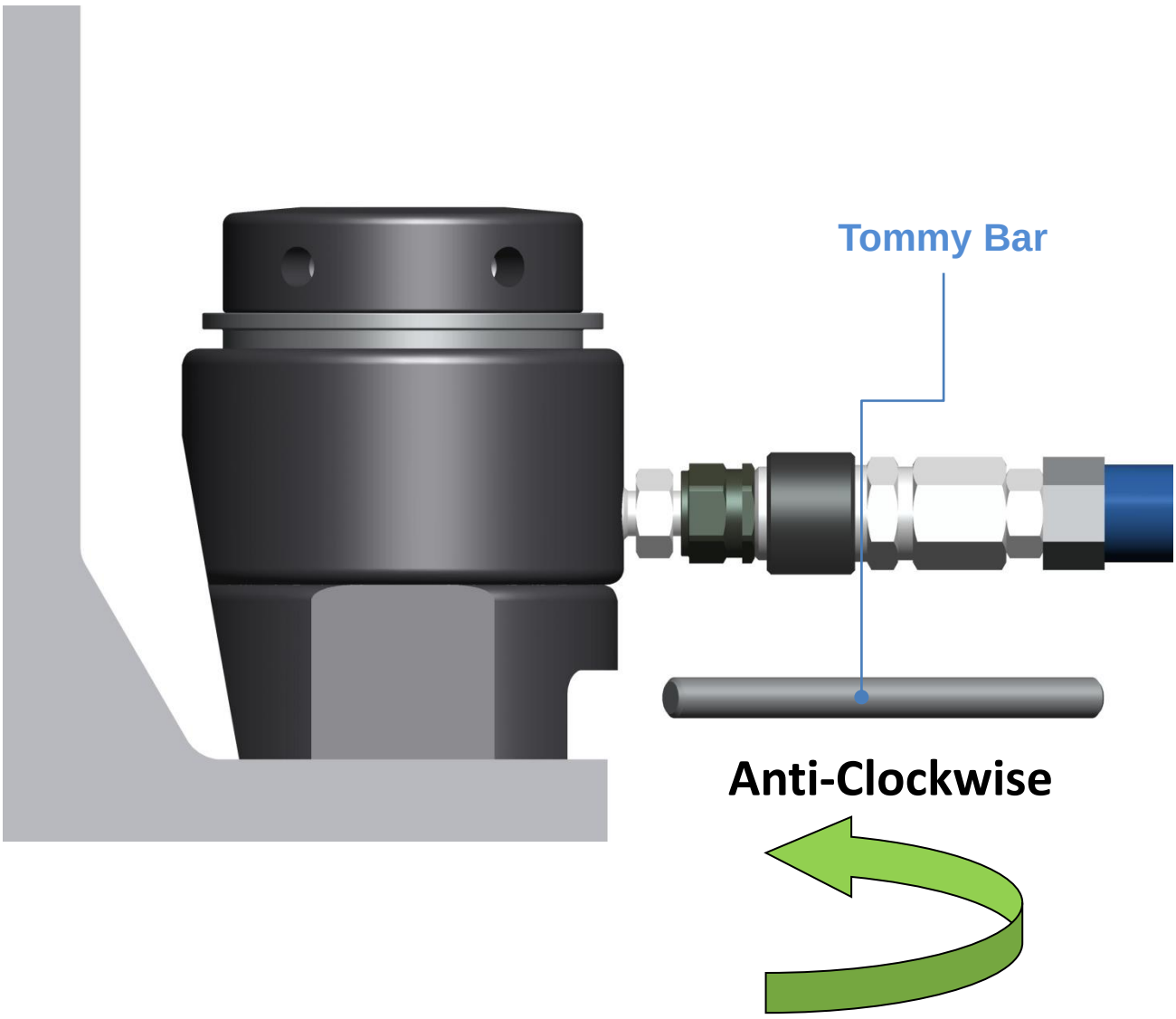
Loosening a Bolt – Step 8

Use a tommy bar to turn the Socket anti-clockwise, to loosen the nut.

Insert the tommy bar through the window in the Bridge until it engages with a hole in the Socket.

Turn the Socket anti-clockwise. If the tommy bar comes into contact with the Bridge, remove it and engage the next hole in the Socket.

Continue turning the Socket until the nut has been undone one full turn. Do not let the nut come into contact with the Puller.



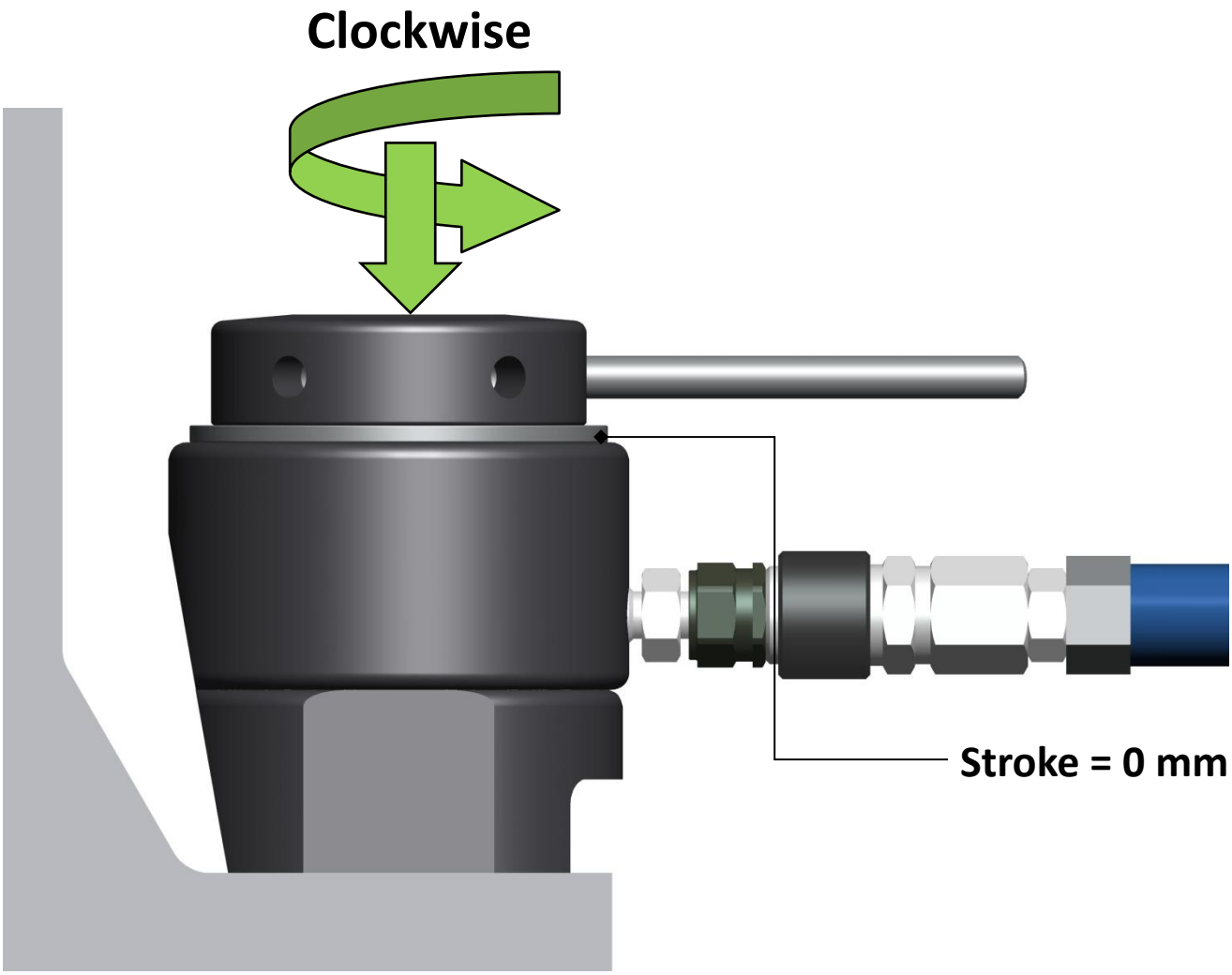
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Loosening a Bolt – Step 9

Release the pressure slowly.

Fully open the oil pressure release valve on the pump.

Use the tommy bar to tighten the PULLER until the Piston is fully returned into the CYLINDER.

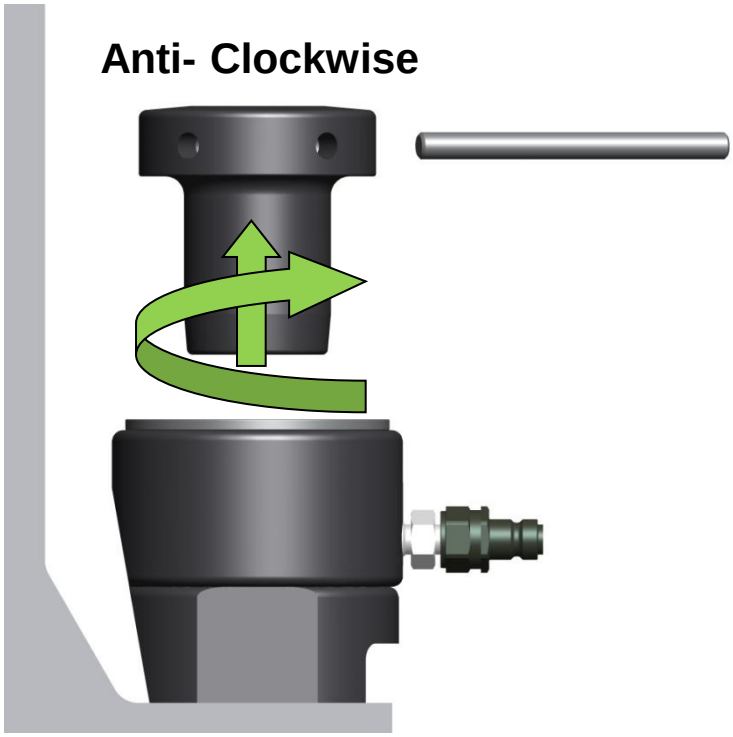


Once the piston is all the way down, remove the Hydraulic Hose.

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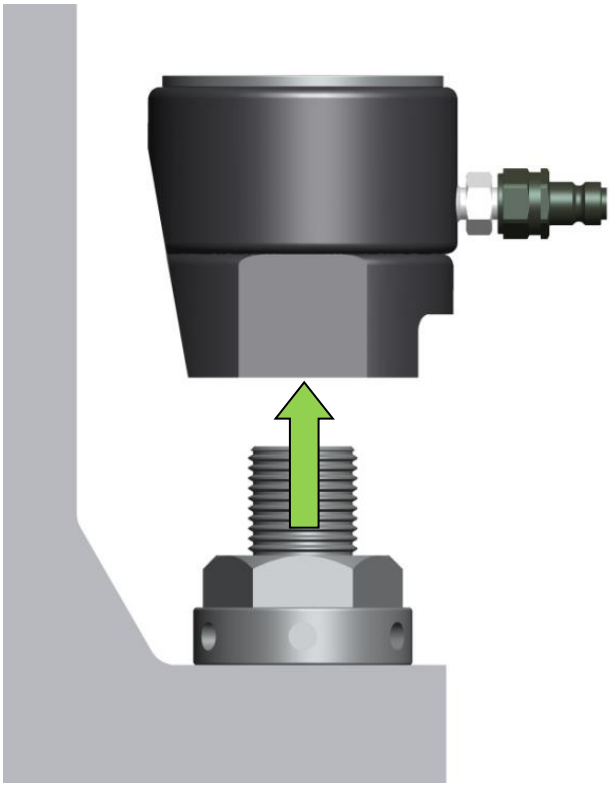
Loosening a Bolt – Step 10

Use the tommy bar to release and remove the Puller.



Loosening a Bolt – Step 11

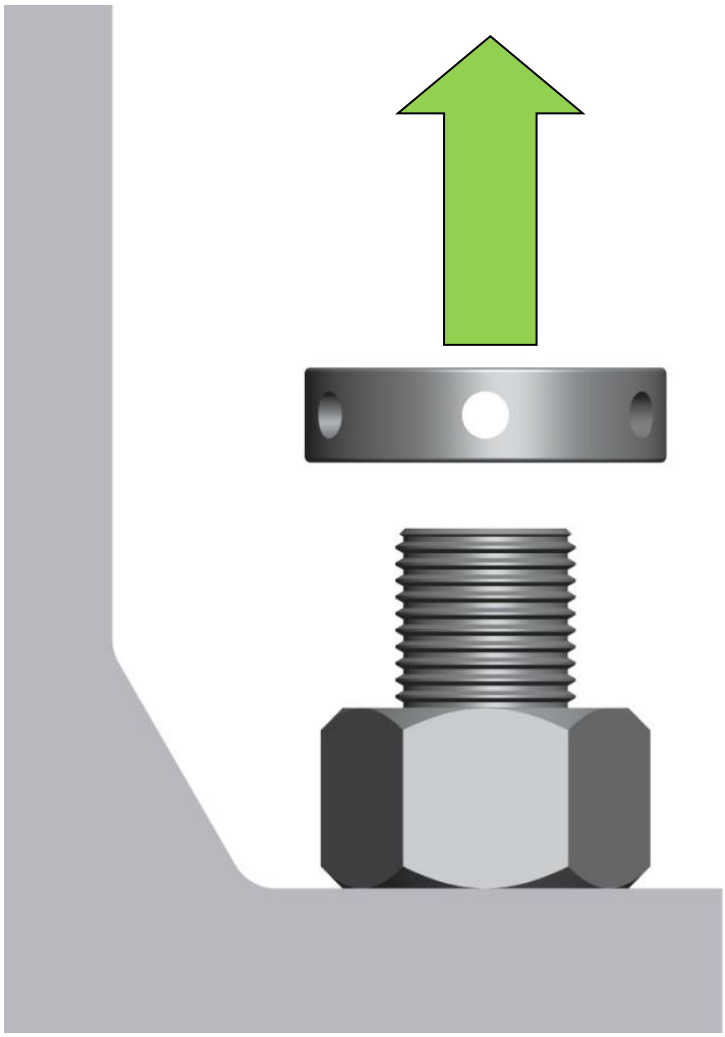
Remove the Cylinder and Bridge.



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Loosening a Bolt – Step 12

Remove the socket.



The nut is now loose.

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Simultaneous Bolt Tensioning

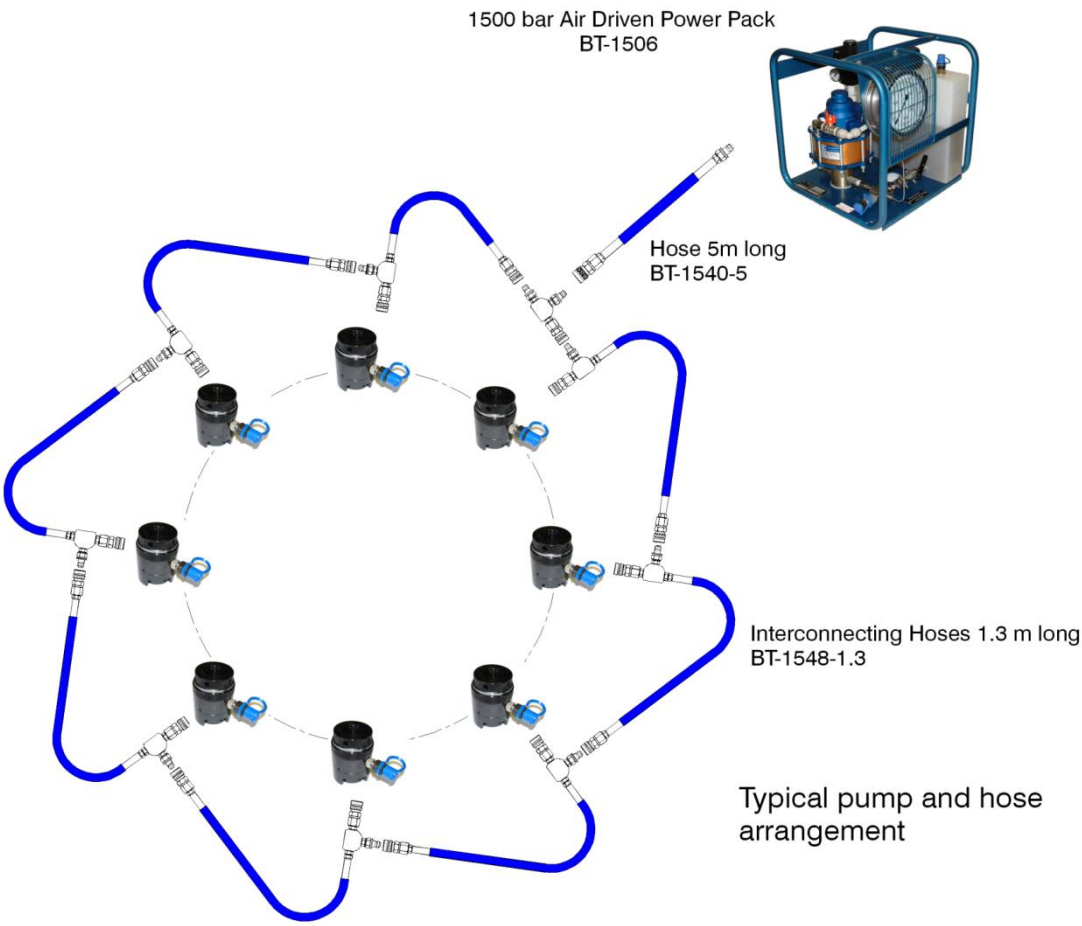
You should have read and understood **tightening & loosening bolts** before attempting to use multiple tools for simultaneous operation.

Simultaneous bolt tensioning may involve the use of any number of bolt tensioning tools from two to more than twenty, depending on the number of the bolts in the joint and the percentage of bolts to be tightened simultaneously. In flanged applications, BOLTIGHT strongly recommends simultaneous tensioning of 100% of the bolts.

The method for simultaneous tensioning is similar to tightening one bolt, but requires a number of additional operations. These simply involve the ganging of the tools together with flexible hydraulic hoses and tee blocks to construct a hydraulic main which will supply oil under pressure to all of the tools simultaneously.

The diagrams in this section show one way of connecting the tools for simultaneous operation.

The user may construct a hydraulic main to suit their circumstances. The hoses and tee blocks may be connected together in any combination as long as the end result is a hydraulic main which will supply oil to all of the bolt tensioning tools simultaneously.



Typical pump and hose arrangement

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Section 3

Maintenance & Storage Instructions

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Introduction

The drawings and photographs in this section of the manual show tools with only one hydraulic connection. However, the instructions apply equally well to tools having two hydraulic connections.

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

Storage

Each tool is chemically blacked before leaving the factory. This provides a degree of corrosion protection but additional protection should be applied when the tools are to be stored for any period of time. It is recommended that, before storage, the tools should be dismantles into their four major components:-

1. Puller
2. Cylinder
3. Bridge
4. Socket

Each of these items should be checked for damage and if OK, lightly oiled and the tool reassembled.

The reassembled tool must have the piston returned to the zero stroke position and the hydraulic connection must have its plastic protective cap fitted. The hydraulic bolt tensioner should be stored upright in a clean, dry environment.

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.

Maintenance – Changing Seals

Each bolt tensioning tool has an inner and an outer seal set. Each seal set consists of a rubber “O” ring and an elastomeric seal. If the seals are damaged or badly worn, the complete set (“O” ring and seal) must be changed. It is recommended that both inner and outer sets are changed at the same time.

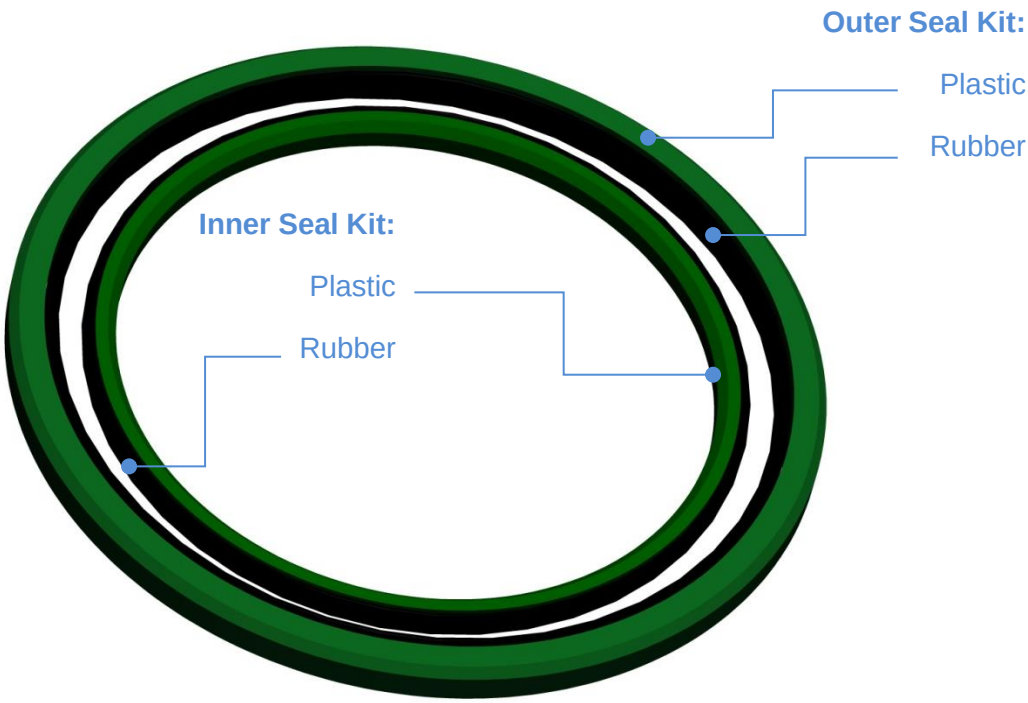
To change the seals, the piston must be withdrawn from the cylinder. If the seals are not badly damaged this may be achieved by carefully blowing compressed air into the cylinder through the quick connect nipple. All applicable Health & Safety precautions relating to the use of compressed air must be observed. In addition suitable safe provision must be made to catch the piston and any escaping oil when it leaves the cylinder.

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If the seal damage is too great to allow air to be used, the piston may be removed by making a simple piston extraction tool from a bar of steel. The bar must be drilled with two holes to align with the threaded holes found in the top of the piston. Two screws can be used to secure the bar to the piston. The piston can then be pulled from the body using the bar.

The seals used do not run dry. They are self lubricating and will always exhibit a small amount of oil around the inner and outer edges of the piston. The presence of a small amount of a small volume of oil around the piston is NOT a signal the seals need to be changed. It is normal and to be expected. The oil lubricates the cylinder wall, reduces the force required to return the piston and helps to prevent corrosion. After extensive use as much as 5 ml of oil may be present around the piston. Simply wipe away any oil when the tools have been used. The seals will need to be changed only if the tool will not pressurise or a very large volume of oil escapes whilst the oil pressure is being increased, or it the tools will not hold pressure.

Each bolt tensioning tool has an inner and an outer seal kit. Each seal kit consists of a rubber “O” ring and a plastic seal. If the seals are damaged or badly worn, the complete set (“O” ring and seal) must be changed. It is recommended that both inner and outer sets are changed at the same time.



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Maintenance – Changing the Inner Piston Seal

The old seal set must be removed by cutting through the seal with a knife. The “O” ring can be removed by cutting or by levering it out. Both items should be discarded.

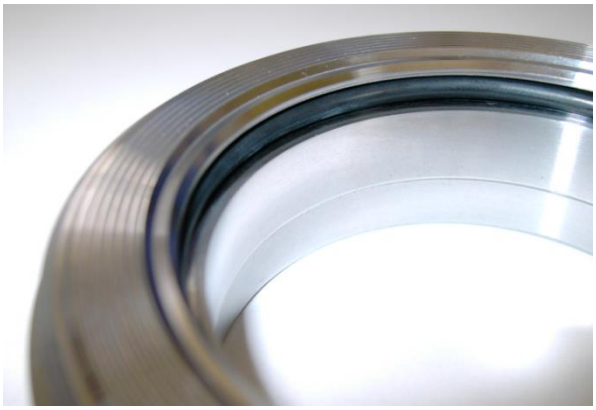
Lubricate the “O” ring with grease. Ensure the seal groove is clean.



Place the Piston on a clean surface and insert the Rubber “O” ring into the seal groove.

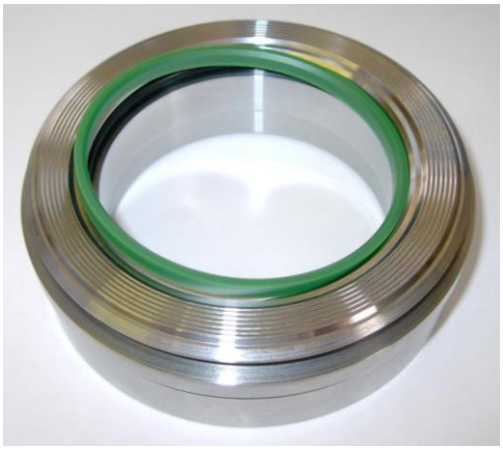


Fit the “O” ring into the Seal groove.



Pack the “O” ring with grease.

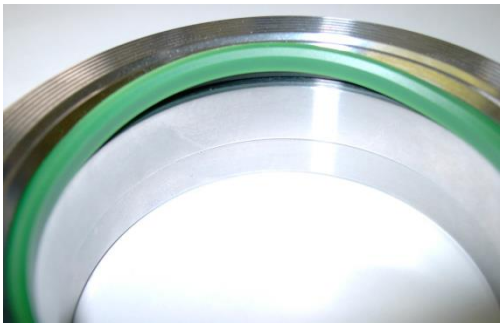
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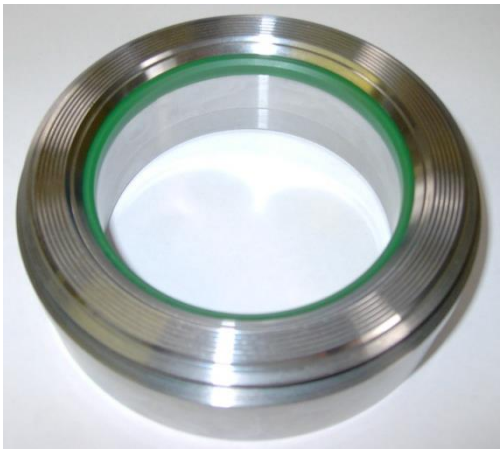
Insert the green plastic seal into the seal groove. Make sure the chamfer is at the top.



Work the seal into the groove using hand force only.



The seal will snap into the seal groove.



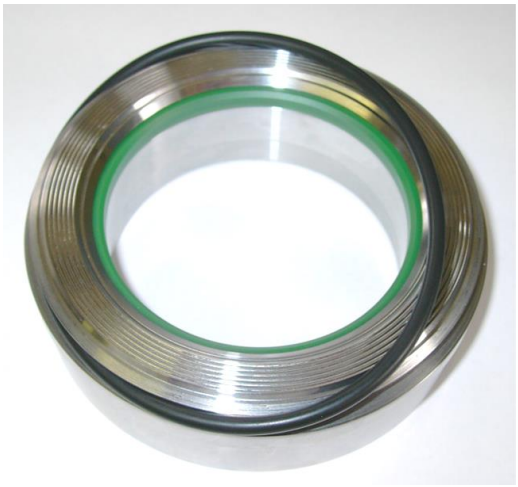
Wipe away any excess grease.

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Maintenance – Changing the Outer Piston Seal

The old seal set must be removed by cutting through the seal with a knife. The “O” ring can be removed by cutting or by levering it out. Both items should be discarded.

Lubricate the “O” ring with grease. Ensure the seal groove is clean.



Place the Piston on a clean surface. Insert the rubber “O” ring into the seal groove.



Stretch the “O” ring until it snaps into the seal groove.

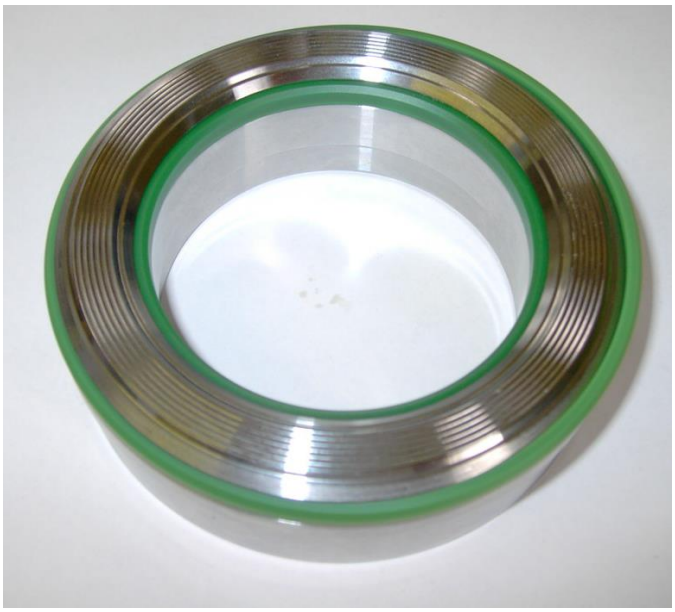


Pack the “O” ring with grease.

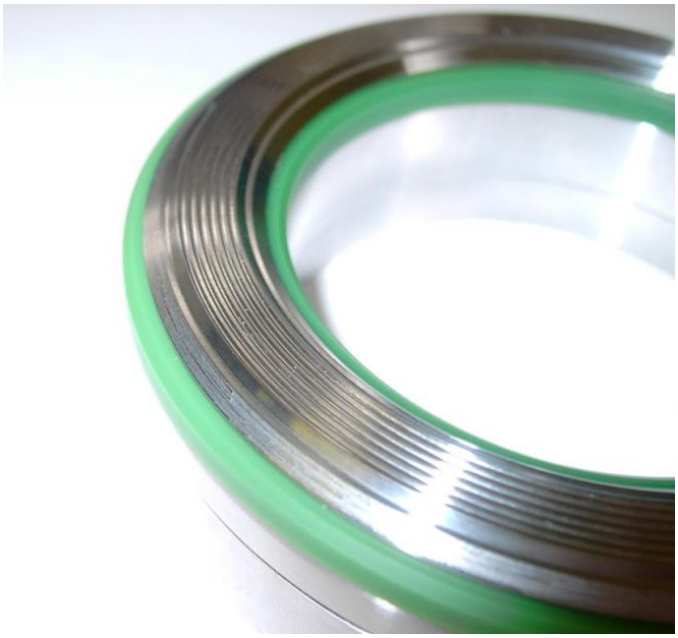
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Insert the green plastic seal into the seal groove. Make sure the chamfer is at the top.



Stretch the seal over the outer lip of the piston by working around both sides of the piston simultaneously.



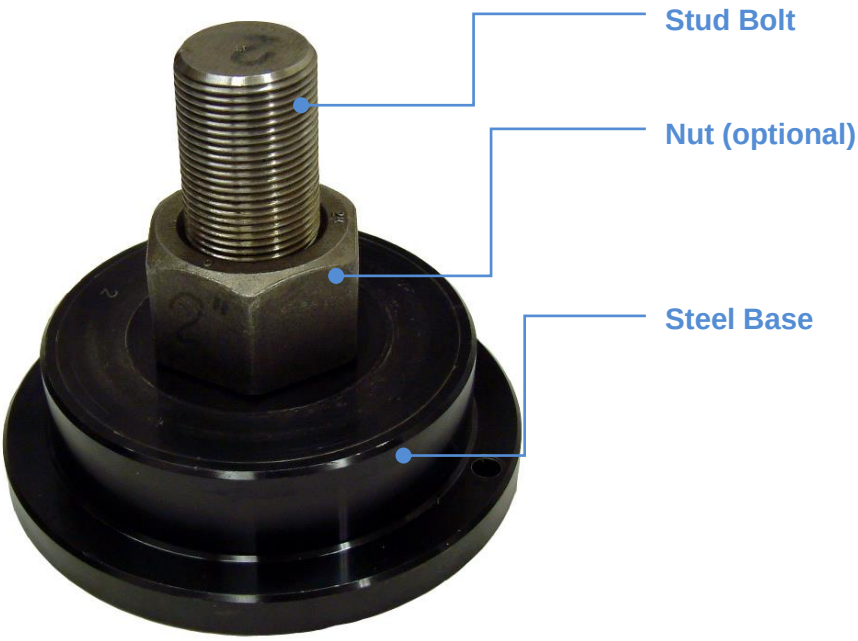
Work the seal into the groove using hand force only.

Wipe away any excess grease.

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Fitting the Piston

BOLTIGHT recommends that the easiest and safest method of fitting a piston into any of our standard tools is by using a test block such as the one shown below. This can be easily manufactured with a steel base threaded through the centre to accept the correct stud bolt for the tool in question. Assuming that the test block has been manufactured from the appropriate grade of steel, it can also be used to pressure test the tools once the pistons are fitted.



Alternatively the piston could be fitted using an application bolt on a flange that is to be tensioned. The principal remains the same.

To fit the piston, proceed as follows:-



Firstly make sure the cylinder and piston are clean and free from foreign objects and dirt. Lubricate the cylinder walls and the seals of the piston with hydraulic oil.

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Assemble the tool onto the bolt as normal; Bridge followed by Cylinder.



Ensure that you fit an open quick connect coupling to the hydraulic connection to enable air to be expelled from the Cylinder as the Piston is pushed in.



Place the Piston over the Cylinder. Ensure that the Piston is correctly aligned with the Cylinder.

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Now wind the puller down onto the bolt until it is in contact with the Piston. Once again, check that the Piston is aligned correctly with the Cylinder.



Using a tommy bar, gently wind the Puller down the bolt, easing the Piston into the Cylinder. This should not require much force. The seals can be easily damaged if the Piston is not aligned correctly with the Cylinder.



Once the Puller is fully down, the Piston is fitted. Remove the open quick connect coupling. The seals can now be energised and the tool tested as it stands. (See section 3.5)



The Cylinder with a correctly fitted Piston.

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Energising the Seals

After fitting new seals and before the Bolt Tensioning Tool can be used, the new seals must be energised.

Observing the safety instructions give in Section 1 and Section 2 of this manual proceed as follows :-

Make sure the Piston is fully returned into the Cylinder body.

Using a test bolt, or an actual bolt to be tensioned, lower the bolt tensioning tool onto the bolt.

Screw the Puller onto the bolt. Centralise the tool if necessary, to allow the Puller to fit into the centre of the tool. Turn the Puller by hand until it comes into contact with the top of the Puller.

Wind back the Puller ONE FULL TURN.

Connect the tool to the pump.

Run the pump quickly and pump oil into the tool. Air and oil may escape from the seals during this operation and the pressure gauge may indicate rising and falling pressure at each stroke of the pump.

If the seals have been properly fitted the seals will quickly energise. Any leakage from the seals will stop and pressure will start to be generated in the tool.

Stop the pump when the pressure reaches 1000 bar.

The pressure should be steady and not fall, to show the seals are working.

When satisfied the seals are functioning, release the oil pressure.

The seals are now energised and the tool is ready for use.

If the seals will not energise, the tool must be taken apart again because the seals have not been correctly fitted. The seals may not energise if the pump is unable to deliver oil quickly enough.

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Fitting a Quick Connector (without Bonded Seal)

Fitting either the quick connect nipple or coupling, can be achieved by following the simple steps shown below.



Check the internal and external threads are clean and free from damage.



Screw the adaptor into the hydraulic Cylinder. The adaptor is identical at each end so it does not matter which end is inserted into the Cylinder.



Screw the Nipple or Coupling onto the adaptor.

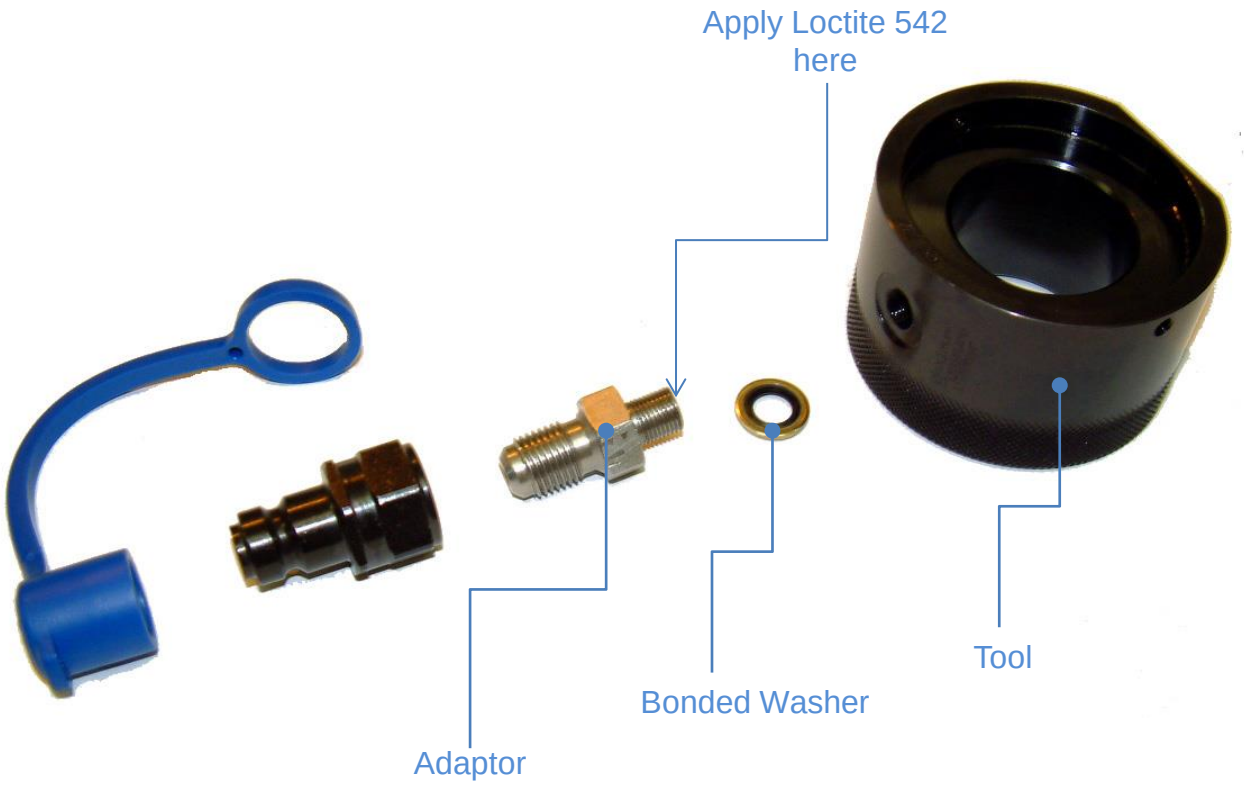


Using a spanner, firmly tighten then the nipple or coupling onto the adaptor.

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Fitting a Quick Connector (with bonded seal)

To fit a quick connector that requires a bonded seal the steps are the same as mentioned previously. However the user must ensure that a bonded seal is located between then tool and the adaptor and that loctite 542 is applied to the adaptor.



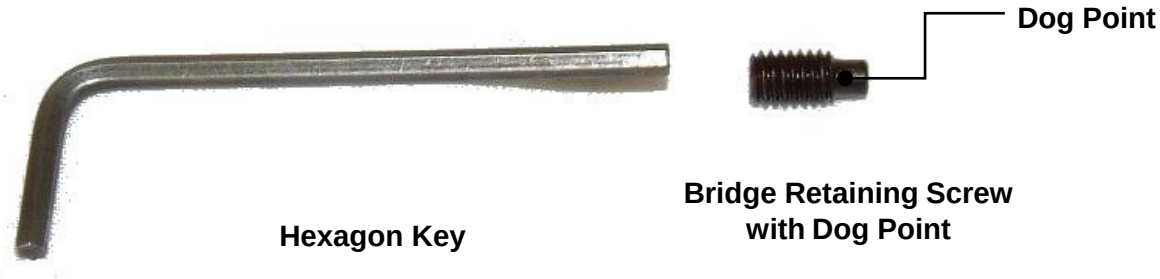
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Removing and Fitting the Bridge

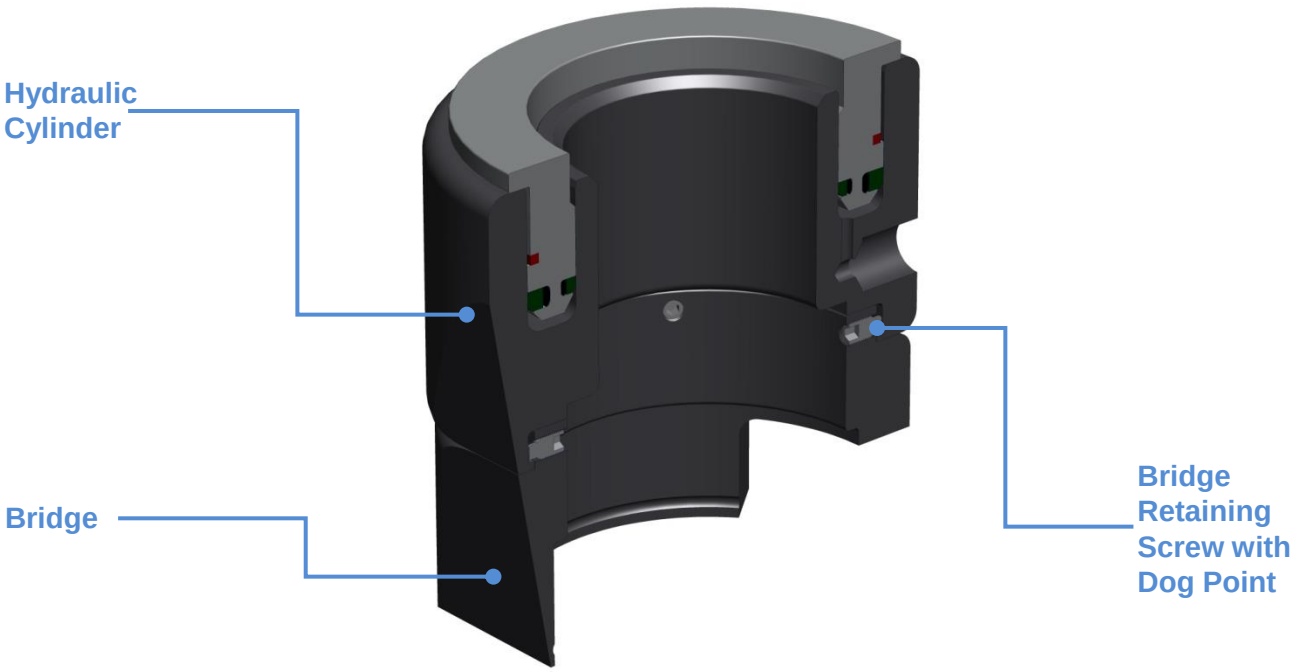
The Bridge and the Hydraulic Cylinder can be held together as one piece.

When using the tools it is sometimes advantageous to work with three separate parts, however when it is better for the Hydraulic Cylinder and the Bridge to be joined, Bridge Retaining Screws are used.

Depending on the tool, two or three Bridge Retaining Screws may be used. The screws are Socket Head Screws with Dog Points. They are located in radial drilled and tapped holes near the top of the Bridge.

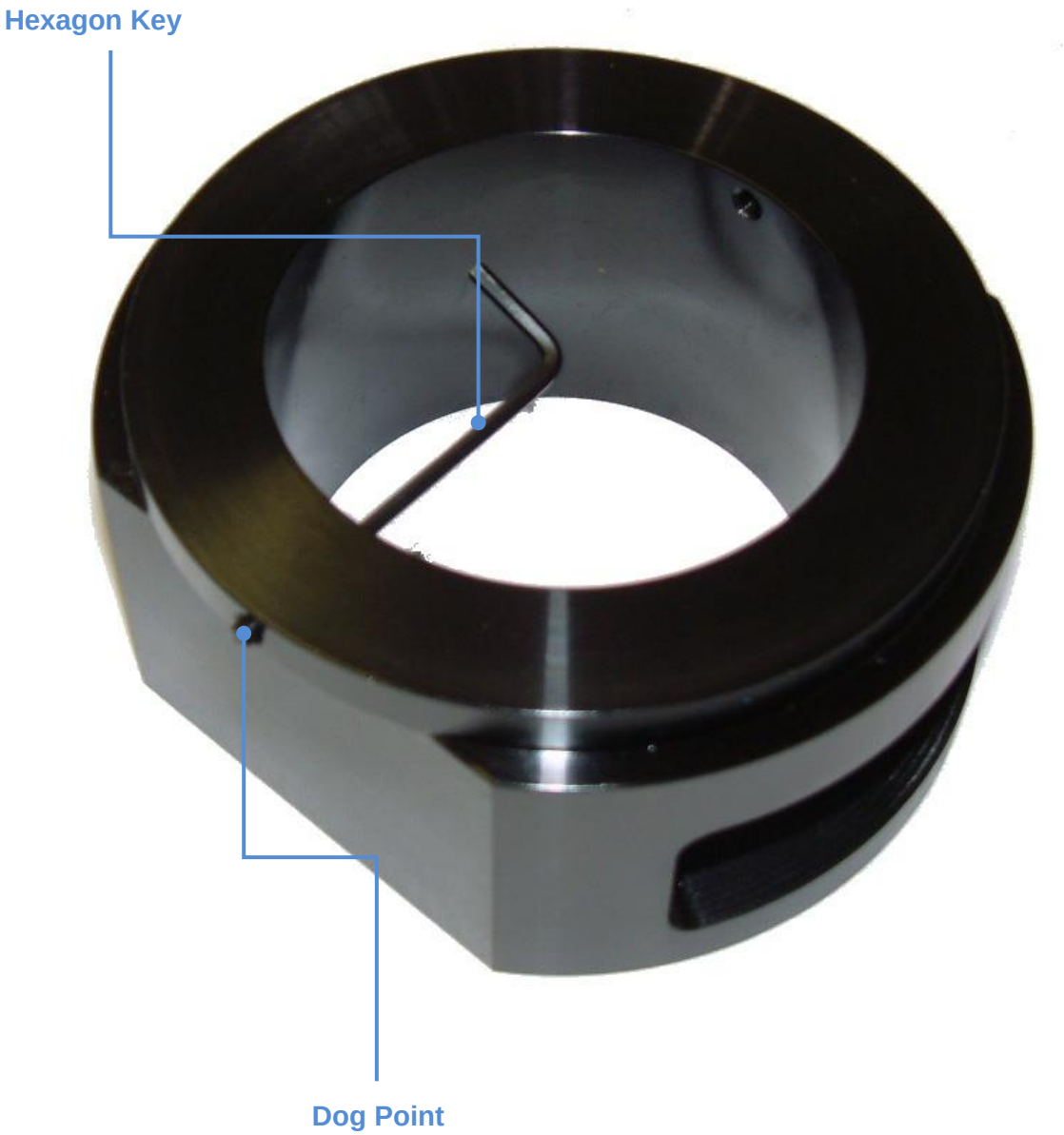


The screws remain in the Bridge but the Dog Point can be advanced into the groove machined in the recess, in the base of the Hydraulic Cylinder. A hexagon key is used to advance or withdraw the Bridge Retaining Screws working from the inside of the Bridge. It is not necessary to remove the screws for the Bridge and Cylinder to be separated. The screws need only be withdrawn into the Bridge wall by 2 to 3 mm to disengage the dog point from the groove.



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When refitting the Bridge, the Retaining Screws need only be advanced enough for the dog points to locate into the groove in the Hydraulic Cylinder. If they are fully advanced and tightened, the Bridge will be locked into the Hydraulic Cylinder which is not recommended. If the screws are advanced but not tightened, the Bridge and the Cylinder will be permanently joined but the two components will rotate relative to each other. This can be useful as the Hydraulic Cylinder can be rotated until the quick connectors are in the best position for the flexible hoses to be connected whilst the window in the Bridge is in the best position for access to the nuts with a tommy bar.



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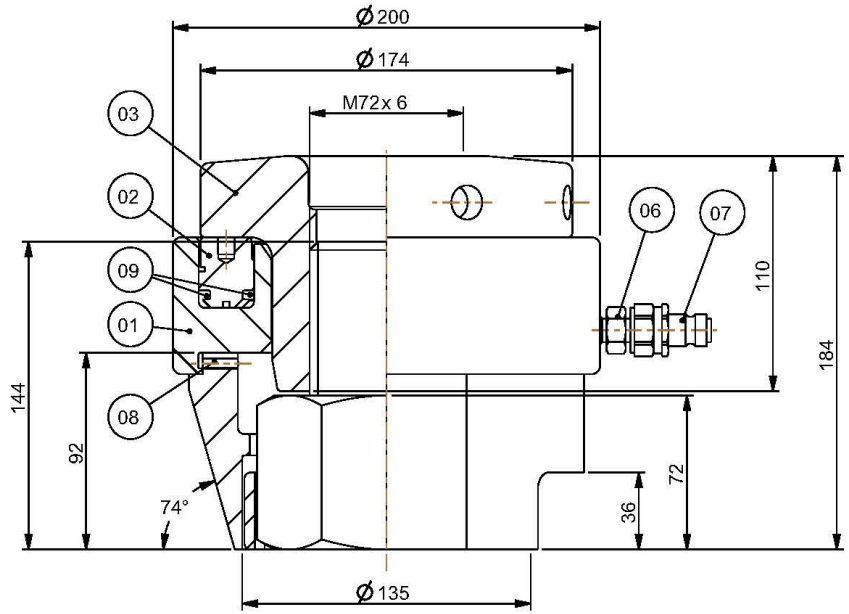
Section 4

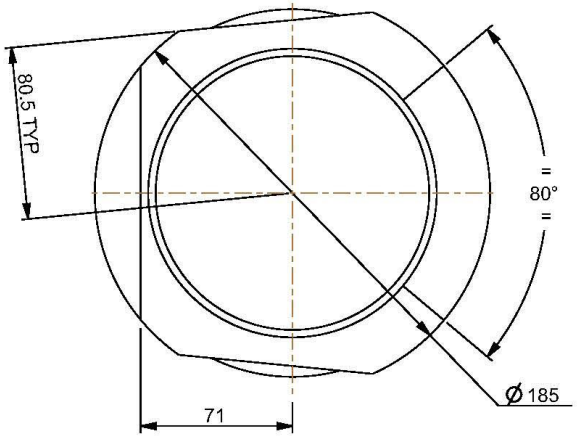
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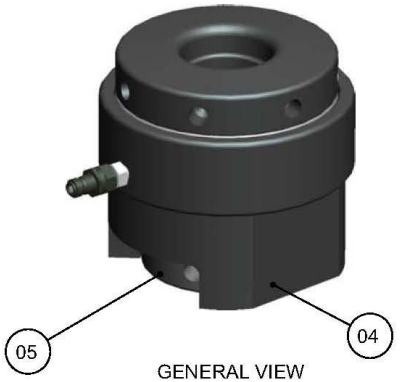
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ALL DIMS MM U.S.O.

DO NOT SCALE







GENERAL VIEW
SCALE 0.300

PARTS LIST			
NO	DESCRIPTION	PART NO	QTY
01	BODY	BT-CB1-T25	1
02	PISTON	BT-PT-T25	1
03	PULLER	BT-M072-P25	1
04	BRIDGE	BT-2750-B25	1
05	SOCKET	BT-M072-S25	1
06	ADAPTOR	BT-1503	1
07	NIPPLE	BT-1502	1
08	SET SCREWS	SSS-M006-008-DP	3
09	SEAL KIT	BT-SK-T25	1

SPECIFICATION				
MAXIMUM PRESSURE	1500	bar	21750	psi
HYDRAULIC PRESSURE AREA	12197	mm2	18.91	in2
MAXIMUM LOAD	1830	kN	411.29	klbf
MAXIMUM STROKE	15	mm	0.59	in
FOOTPRINT AREA	6552	mm2	10.16	in2
MAXIMUM FOOTPRINT STRESS	279	MPa	40481	psi

MATERIAL						
FINISH						
SURFACE FINISH						
LIMITS U.S.O.	±0.25 ± 0.25 °					
SIZE A3	SCALE 0.500	A	-	UL		
		REV	CNN	DRAWN	CHECKED	DATE

BOLTIGHT

TITLE: TOOL NO 25 FOR M72

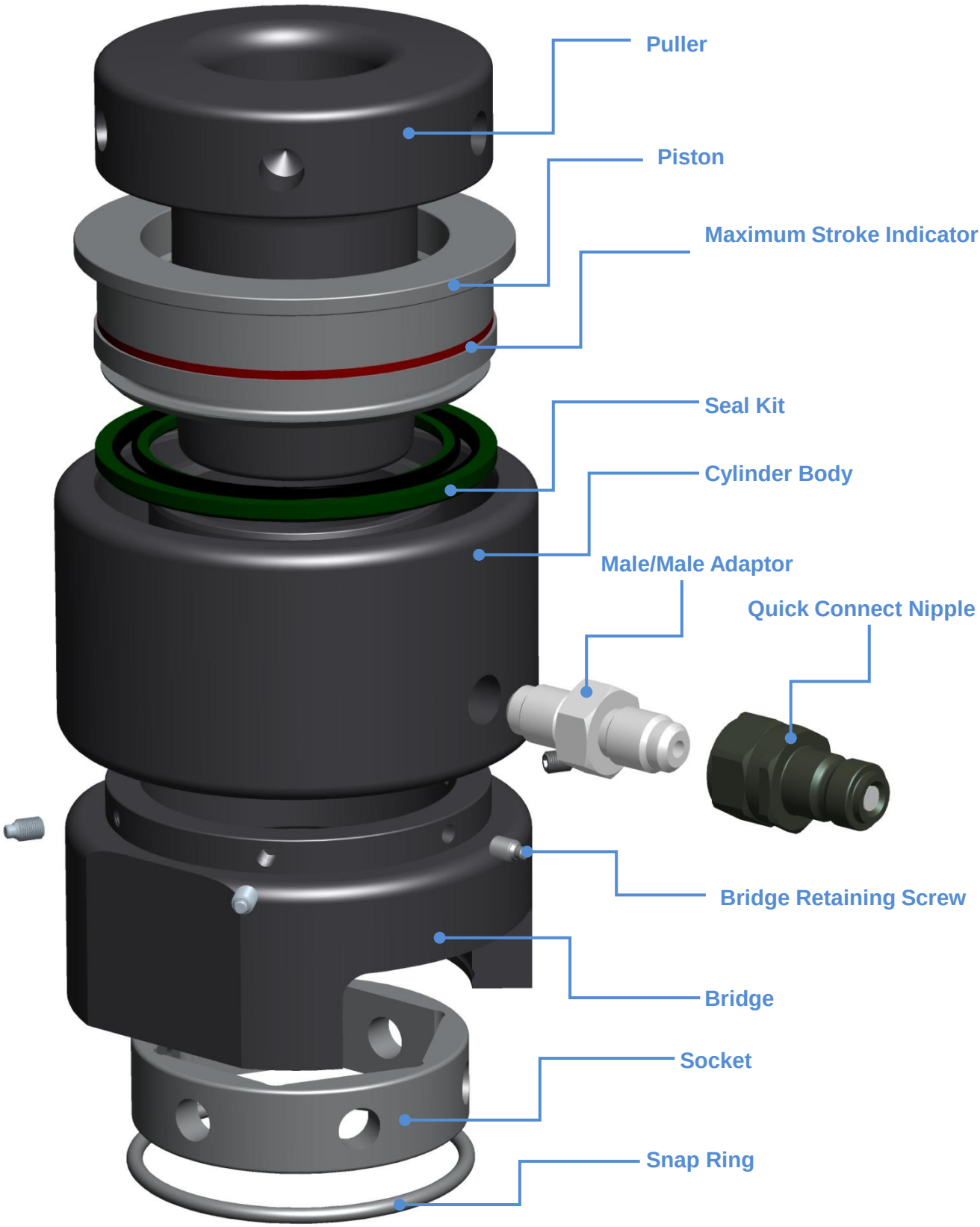
DRAWING NO. BT-M072-T25

ISSUE A

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Typical Parts



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Oil Pressure Calculations

The formula used to calculate the Oil Pressure to be used with a bolt tensioning tool are 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 Loss Allowance

The ratio of ***Tensioning Force*** to ***Bolt Load***

$$Load\ Loss\ Allowance = \frac{Tensioning\ Force}{Bolt\ Load} = 1.01 + \left(\frac{Bolt\ Diameter}{Grip\ Length}\right)$$

If the ***Load Loss Allowance*** calculates to less than 1.10 then use 1.10.

$$\boldsymbol{Tensioning\ Force} = Bolt\ Load \times Load\ Loss\ Allowance$$



Always check that the tensioning force will not exceed 90% of the yield strength of the bolt material. If it does, the grip length of the bolt must be increased. Contact BOLTIGHT for advice on this.

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

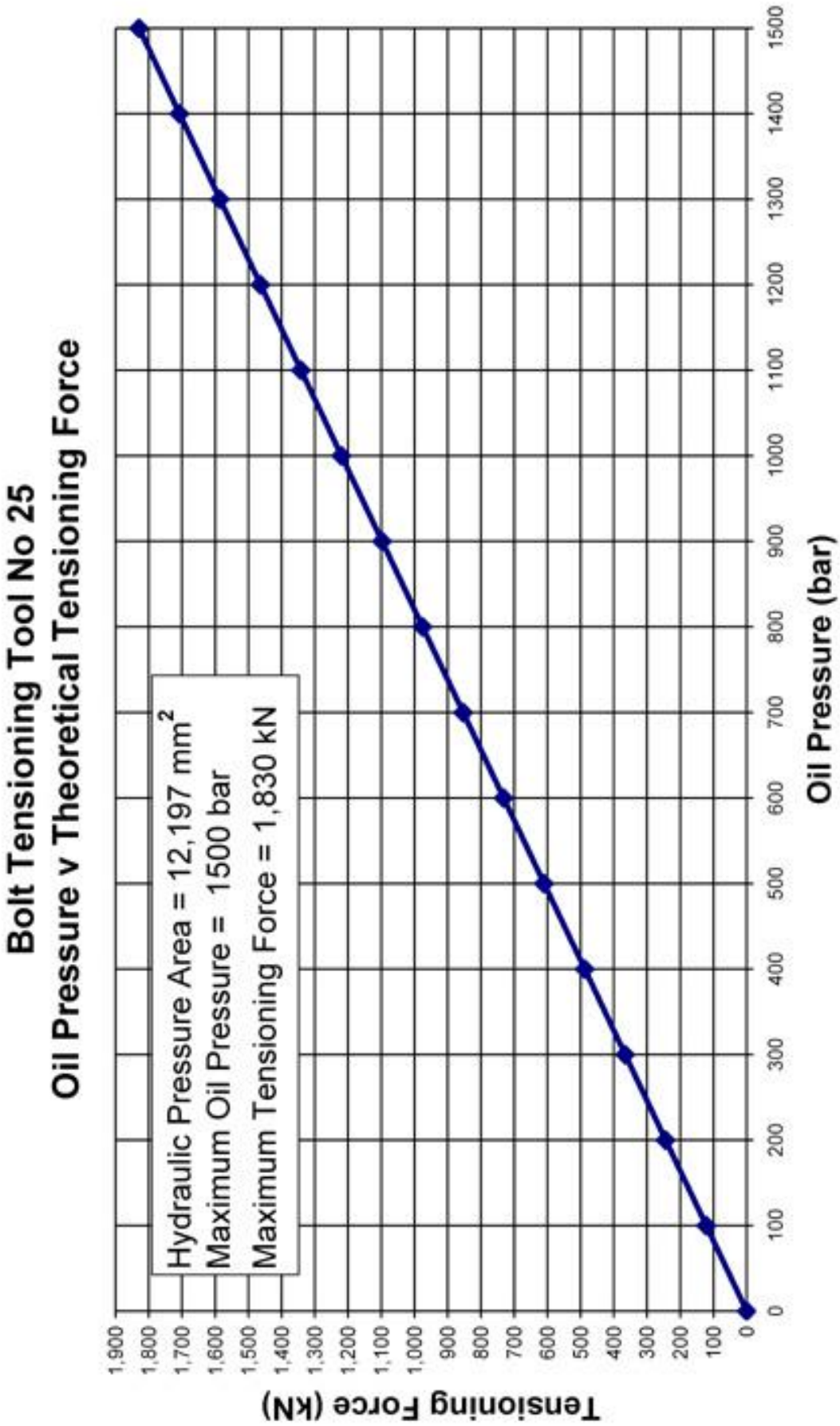
Oil pressure graphs are provided for each bolt size.

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

The next graphs show the initial bolt stress developed by the tool against the oil pressure applied for each bolt size. This graph is provided to assist with the 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.

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