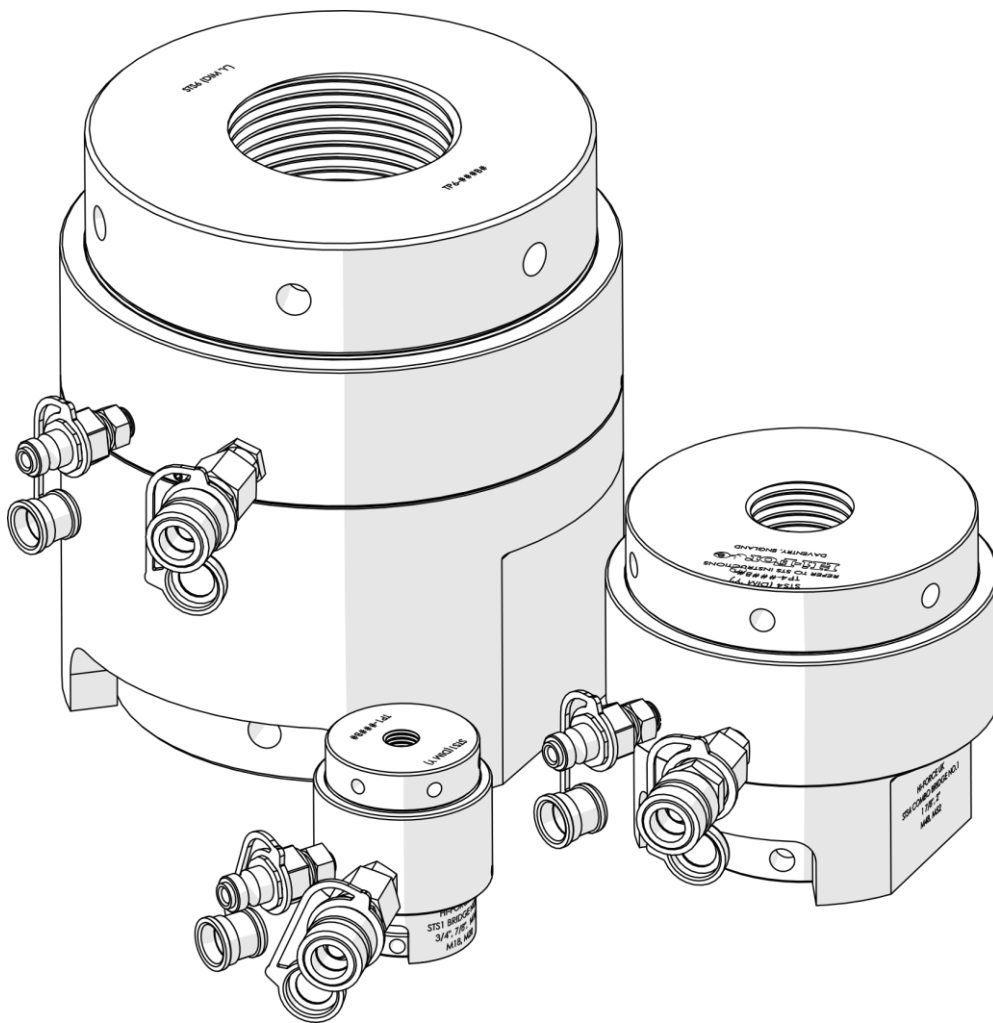


This 'Original instructions' document assumes that the operator carrying out any operation with this product is trained and competent to do so. This manual does not attempt to cover all details or variations in the equipment. Nor does this manual claim to provide for every possible contingency met in connection with the installation, operation, or maintenance thereof. Should further information be desired, or should a particular problem arise which is not covered in sufficient detail, the matter should be referred to Hi-Force.

## **OPERATING INSTRUCTION MANUAL**

### **STS SERIES | TOPSIDE BOLT TENSIONERS**



This manual applies to the Hi-Force STS range of Bolt Tensioners. It contains the latest product information available at the time of publication and approval. Information pertaining to the servicing of the torque pump is contained in the servicing instructions which are available on the Hi-Force website. The right is reserved to make changes at any time without notice.

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**NOTE:** Images contained within this document are for illustrative purposes **ONLY**.

## 1.0 Inspection upon Receipt

Upon receipt of the product, visually inspect the item for any evidence of shipping damage. Please note: the warranty does not cover shipping damage. Notify the courier immediately if shipping damage is found and refrain from putting the product into service. The carrier is responsible for repair and replacement costs resulting from damage that occurred in transit.

## 2.0 Safety Precautions

### 2.1 Introduction



Read and follow all the instructions and safety warnings carefully before handling, installation, or use of any hydraulic equipment. Failure to do so could lead to equipment damage, equipment failure, personal injury or even death. Hi-Force will not be held responsible for any damage to the equipment, injury or death resulting from the unsafe use of, lack of maintenance to, or incorrect operation of the product. If in doubt on the correct use of any Hi-Force equipment, contact your nearest Hi-Force office or distributor. Only qualified personnel should be allowed to operate hydraulic equipment. If an operator has not been trained on high-pressure hydraulic equipment and its safe usage, consult your local Hi-Force sales office or distributor who can offer training courses for operators.

### 2.2 General Hydraulic System Safety Precautions



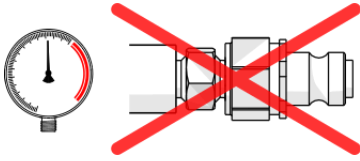
**WARNING!** Failure to observe and obey the following safety precautions could result in property damage, significant personal injury or death.



- When operating any hydraulic equipment, all operators should ensure that all necessary personal protective equipment (PPE) is worn, as specified by their employer. Steel toe-cap safety shoes, safety glasses/visor, and protective gloves should be always worn. All relevant risk assessments should be completed before the use of the equipment.
- Keep hydraulic equipment away from open flames and direct heat.
- **NEVER** use a coupler as a tool handle, especially when the system is pressurised.
- **NEVER** handle a pressurised hydraulic hose. Hydraulic oil escaping under pressure from a ruptured hose can penetrate the skin and lead to a significant medical emergency, and in some cases, death. Should this incident occur, seek out medical attention immediately.
- Seek medical attention immediately if a hydraulic injection injury (no matter how minor) occurs.
- The system operating pressure **MUST NOT** exceed the pressure rating of the lowest-rated component in the system.

**Good Practice:** Use a pressure gauge to monitor the entire system.

- Only use hydraulic tools/cylinders in a complete and tested, coupled system. **NEVER** attempt to use a tool/cylinder that is not correctly coupled to its operational pump.



- **NEVER** pressurise an unconnected male coupler/s.

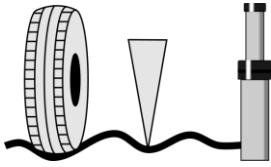
- **NEVER** attempt to disconnect a hose from a hydraulic system until the system's pressure has been completely released. Doing so can result in that pressure becoming trapped within the system and relieving trapped pressure can be dangerous.
- **NEVER** try to relieve trapped hydraulic pressure in the system by loosening or attempting to remove the coupler. Trapped hydraulic pressure can cause a loosened coupler to dislodge unexpectedly with great force. This action could result in serious personal injury or death.
- Loosening a coupler under pressure can result in the escape of hydraulic oil at high pressure, which can penetrate the skin and cause significant injury or death.
- **NEVER** use a hammer and punch to unseat a coupler check valve that is under pressure. Doing so could result in the sudden, uncontrolled release of hydraulic oil at high pressure, which could cause significant injury or death.
- **NEVER** attempt to solve or clean up leaks in the system while the system is pressurised.
- Immediately replace any worn or damaged parts using genuine Hi-Force parts only.
- **DO NOT** remove any labels from the product. Replace any damaged or unreadable labels immediately.
- **DO NOT** use any hydraulic equipment if you are under the influence of alcohol, drugs or medication. Lack of attention whilst operating high-pressure hydraulic tools can result in personal injury or death.



## CAUTION!

Failure to observe and obey the following safety precautions could result in property damage, equipment damage or minor/moderate personal injury.

- **NEVER** lift, carry, or move any hydraulic components by the hose or hoses connected to them.
- Avoid damaging hydraulic hoses. **ALWAYS** route hoses to ensure that they are free from sharp bends and kinks. Using a sharply bent or kinked hose will result in severe backpressure, which can lead to hose failure.
- **NEVER** use a coupler/s to lift, carry or position a tool.
- Servicing of hydraulic equipment **MUST** only be undertaken by a qualified technician.



- **DO NOT** drop or place heavy objects on a hydraulic hose, as this may cause internal damage, which could result in rupture of the pressurised hose. A ruptured hose could cause significant damage to components and possible severe injury to personal operating nearby.

- **DO NOT** let familiarity gained with any hydraulic tools allow you to become complacent. Complacency with any tooling can result in a lack of discipline toward working guidelines and safety principles.
- Avoid loose clothing and jewellery that could get caught in moving parts, tie back long hair.

## 2.3 Hydraulic Tensioner Specific Safety Precautions



**WARNING!** Failure to observe and obey the following safety precautions could result in property damage, serious personal injury or death.

- **IMPORTANT:** Proper, safe tensioning and de-tensioning of studs/bolts or joints is a precise operation which varies based on the details of the application and the equipment available and is therefore beyond the scope of this manual. A comprehensive bolting sequence and tensioning / de-tensioning procedure should be prepared and overseen by a trained professional with bolting experience.

Hi-Force recommends that the entire tensioning / de-tensioning process be read and fully understood prior to tensioning.

- **DO NOT** mix high-pressure and low-pressure components. All equipment **MUST** be rated for the same operating pressure. I.e. 1500 bar (21,750 psi)
- **NEVER** exceed the maximum rated capacity of any hydraulic bolt tensioner. Hi-Force manufactures its STS bolt tensioners to operate at a maximum working pressure of 1500 bar (21,750 psi). Overloading hydraulic tensioners can result in component failure and possible serious personal injury.

**NOTE:** The maximum safe working pressure specified for the tensioner does not necessarily represent the maximum safe load that may be induced in the stud/bolt. Make sure the stud/bolt material can take the load/force to be applied.

- **NEVER** exceed the maximum stroke length specified for the tensioner. (See sections 6.2 & 8.2)
- **DO NOT** weld any items to the tensioner or modify it in any way from its delivered condition. Your warranty may be invalidated, and it could lead to serious personal injury.
- When tensioning bolts/studs, the work area should be cordoned-off, and any persons not involved in the process should be kept clear of the working area. Ensure all persons are aware of the operation taking place.
- **NEVER** stand or place any body part in line with the bolt/stud axis or over the tensioner while it is pressurised. All personnel **MUST** be always aware of this.

- Keep hands and feet away from the tensioner during operation.
- **NEVER** leave a pressurised system unattended. If you must leave the area, release the pressure and ensure the hydraulic release valve on the pump unit is fully open.
- **ALWAYS** maintain a safe distance from the tensioner/s while the system pressure is being increased. **ONLY** approach pressurised bolt tensioners when you are certain that the pressure is holding, and only for as long as is necessary to tighten/release the nut rotating sockets (8).
- Release the oil pressure immediately if any unauthorised person/s moves into the stud/bolt tensioning area.



## CAUTION!

Failure to observe and obey the following safety precautions could result in property damage, equipment damage or minor/moderate personal injury.

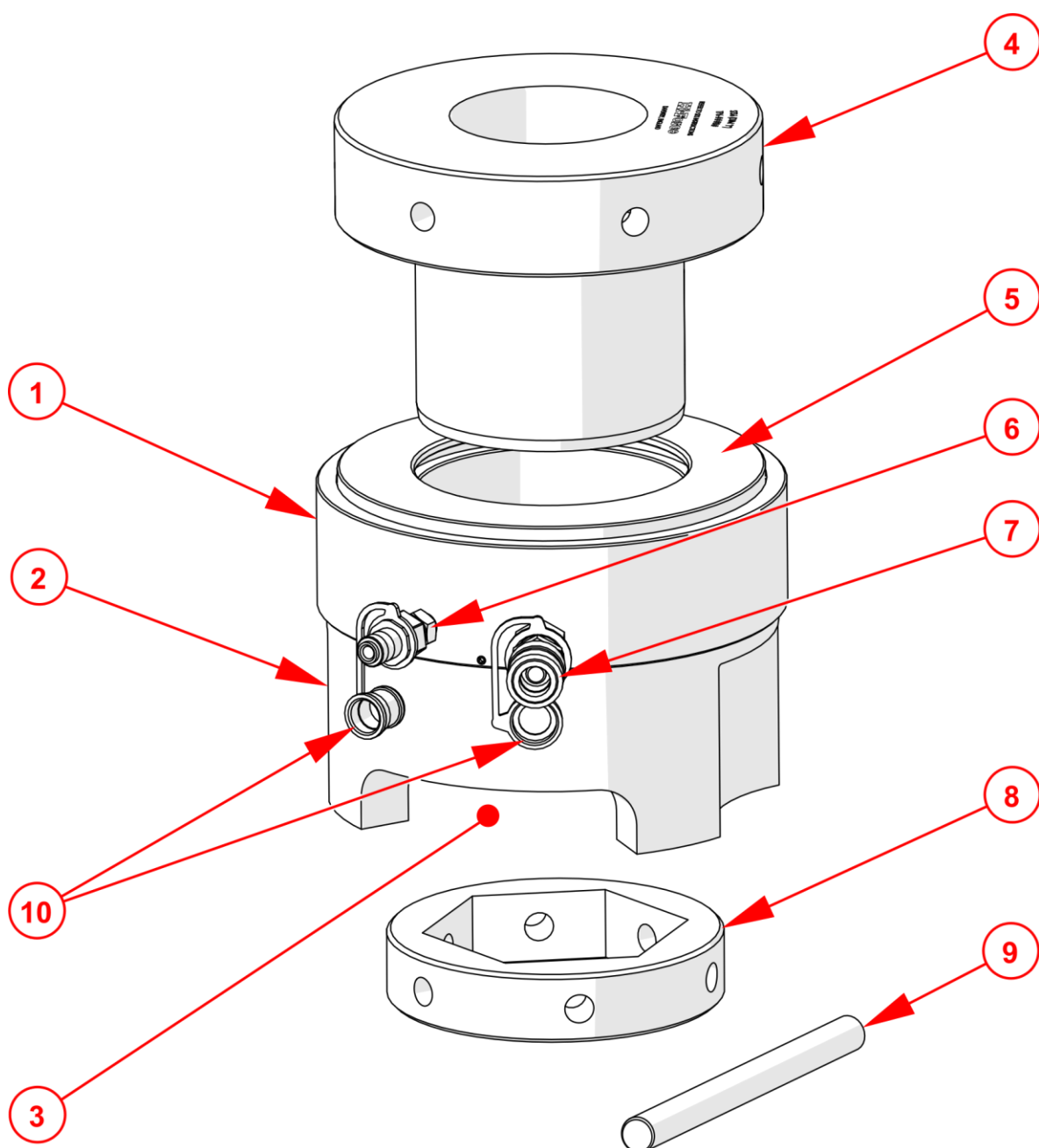
- To protect your warranty, only use the hydraulic oil grade specified in the Hi-Force pump's operating instruction manual. (See section 8.1)

### 3.0 Declaration of Incorporation / Conformity

Hi-Force declares that this product has been tested and complies with the standards set out in the relevant EU directives. The EU Declaration of Incorporation / Conformity is included as Annex A to this instruction document and is supplied with all shipments of this product.

## 4.0 Component Identification

1	Load Cell	6	Male Coupler
2	Bridge	7	Female Coupler
3	Bridge Window	8	Nut Rotating Socket (Optional)
4	Threaded Puller	9	Tommy Bar (Optional)
5	Piston	10	Dust Caps



*Figure 4.1: Component Identification*

## 5.0 Installation/Setup

### 5.1 Preparation

- Before installing each tensioner, make sure studs are clean and that there is sufficient stud protrusion from the top of the nut. A minimum of 1 x Stud diameter is essential. E.g. For an M30 bolt, the minimum required stud protrusion is 30mm. (See figure 5.1)
- Make sure the surface the tensioners' bridge contacts is smooth, flat and free from rust and other debris. Ideally, this surface would be machined, or spot faced to ensure that the tensioner is fully supported and that it sits square to the bolts loading axis.
- Make sure the studs can take the load to be applied, during tensioning.
- Make sure the joint is correctly aligned.
- Determine the tensioning pressure/s required for the application.

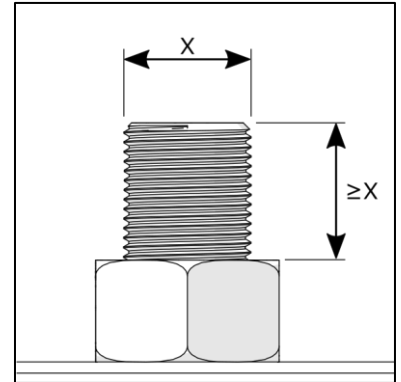


Figure 5.1: Minimum Stud Protrusion

**IMPORTANT:** Tensioning pressures **MUST** be calculated by a qualified engineer, with bolting experience.

### 5.2 Hydraulic Connections

**ALWAYS** use Hi-Force XHC hoses to make connections.

Connection to the hydraulic pump must **ALWAYS** be made to the male coupler on the tensioner.

Hi-Force STS tensioners are fitted with dual quick-connect couplers.

Connections between couplers (see figure 5.2) are made by [1] pulling back the spring collar on the female coupler. [2] Inserting the male coupler into the female coupler and then releasing the female spring collar. [3] Lock the connection by (1) pushing forward on the locking-collar and then (2) twisting it clockwise and releasing. A gentle tug on the hose should be enough to make sure the hose is correctly connected.

Disconnections are the reverse of the above process.

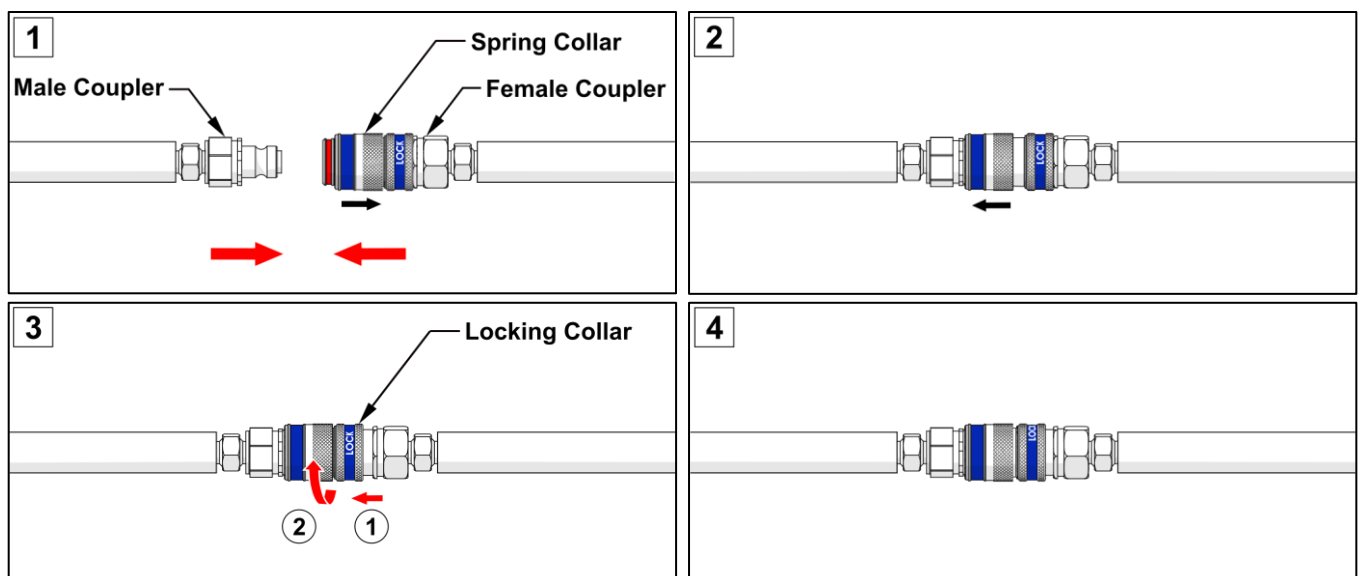


Figure 5.2 Hydraulic Connections



## **5.3 Tensioning Sequence**

In order to apply an evenly distributed load to a bolted joint, the sequence in which hydraulic tensioners are applied to the joint is important.

The exact detail of this sequence is dependent upon the number of bolt tensioners available. A **minimum** of 4 diametrically opposed tensioners can be used to tension a joint. **REMEMBER:** The lower the stud/tensioner ratio, the longer it will take to tension the joint.

The most common configuration for topside tensioning is the 50% coverage arrangement, covered below (See figure 5.4). For further advice about bolting sequences not covered in the manual, contact your nearest Hi-Force office or distributor.

## **5.4 Installing the Tensioners (50% Coverage)**

Install the tensioners as detailed in steps 1-5 below. (Steps illustrated in *Figure 5.3. For clarity only 1 stud and tensioner are shown*)

1. If holes are not drilled in the faces of the hexagonal nuts, place a nut rotating socket (8) over every nut on every alternate bolt/stud to be simultaneously tensioned.


Tighten down every bolt on the flange using the tommy bar (9) purchased with the tensioning equipment. Ensure the two halves of the joint are pulled firmly together.

2. Assemble the load cell and bridge over the first 50% of the bolts to be tensioned (every alternate bolt) (See figure 5.4). Position the bridge window (3) so that access to either the nut rotating socket, (8) or hexagon nut, is comfortably achieved. It is normal for the bridge window to face radially out from the centre of a circular flanged joint.

Examine around the circumference of the bridge base to ensure it is sitting flat against the tensioning surface. The bridge can be adjusted in relation to the load cell by means of 3 set screws, positioned around the base of the load cell.

3. Ensure the threaded pullers (4) are threaded to the same diameter, thread form and pitch as the bolts to be tensioned.
  - a) Insert a threaded puller into each bolt tensioner.
  - b) Screw down onto the threads protruding above the nut. Using the Tommy bar, fully screw down the inserts, until contact is made with the top face of the load cells.
4. Remove the dust caps from all male and female quick-connect couplers. Connect a link-hose from the female coupler of the 1<sup>st</sup> tensioner to the male coupler of the next tensioner. Repeat this step, connecting the 2<sup>nd</sup> tensioner to the 3<sup>rd</sup> and so on, until all tensioners are connected. (See figure 5.4)
5. Connect a mainline hose from the pump unit to the male coupler on the first tensioner. (See section 5.2)

**NOTE:** The last tensioner in the system will have an unconnected female coupler. This is correct, and it can be left unconnected. Alternatively, this last coupler can be removed, and a suitable high-pressure blanking plug fitted. (Contact your local Hi-Force office or distributor for further details).

 **WARNING!** NEVER pressurise an unconnected male coupler/s.

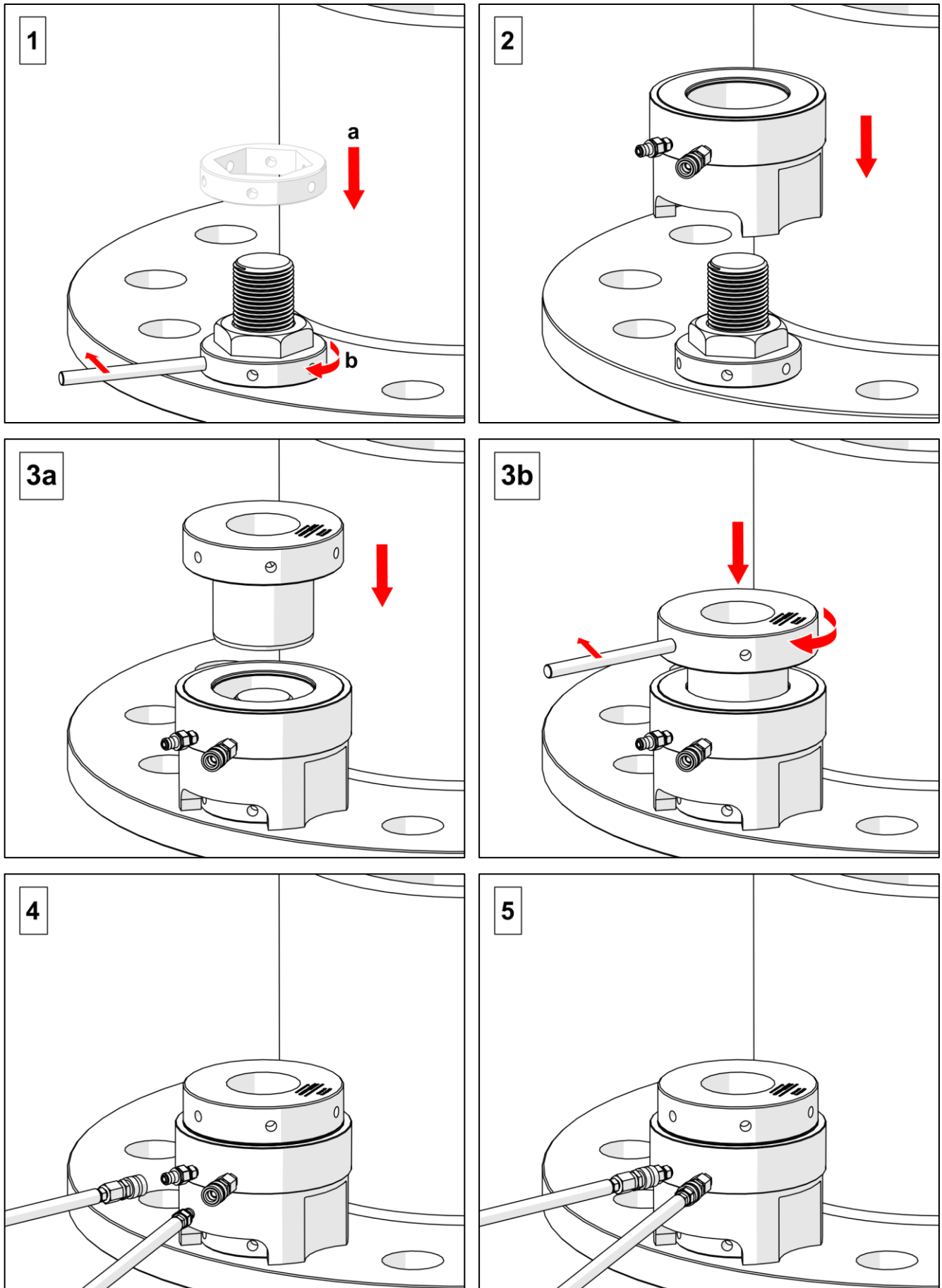
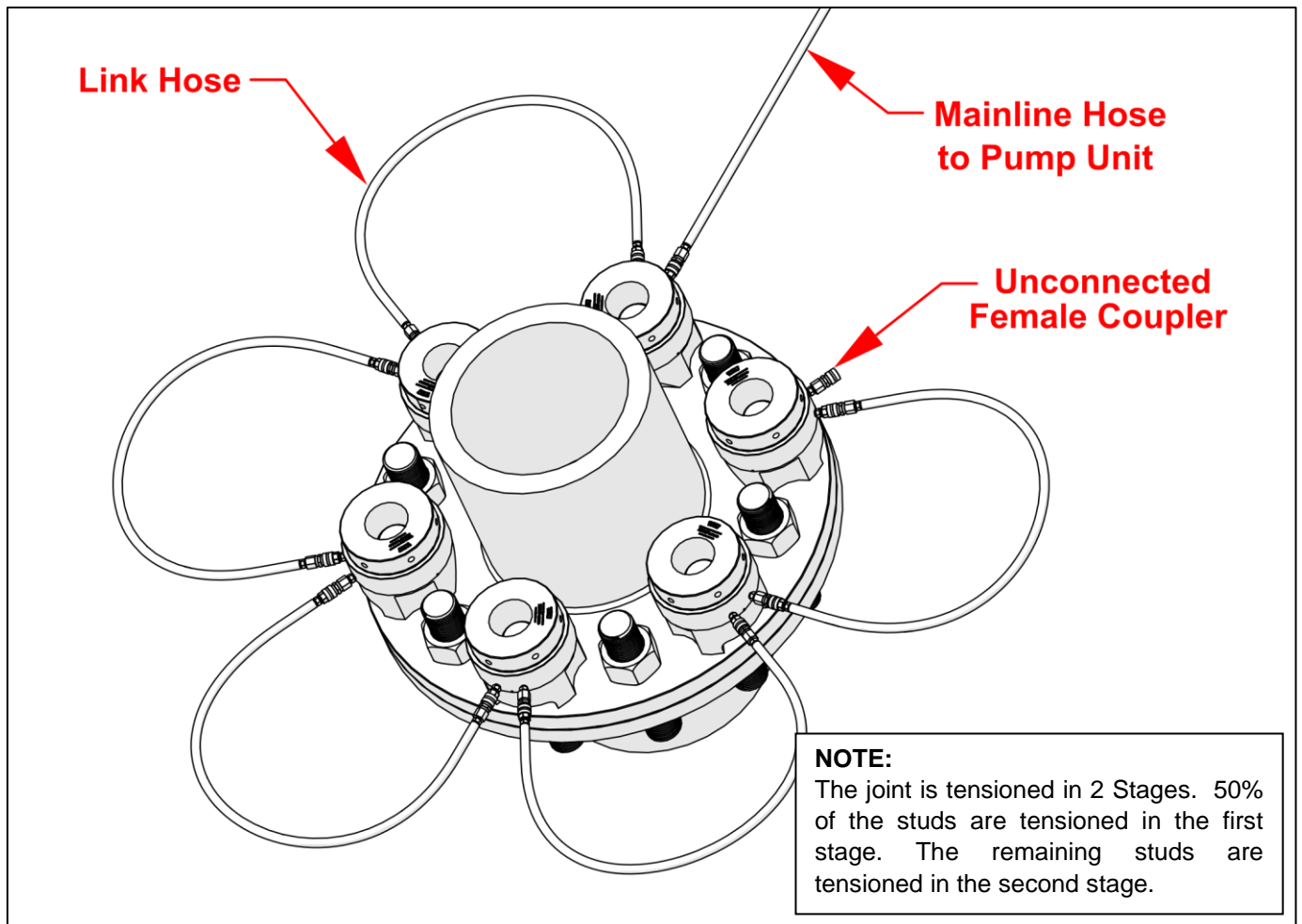


Figure 5.3: Bolt Tensioner Installation



*Figure 5.4: Bolt Tensioner Sequence (50% Coverage)*

**SAFETY NOTE:** Link hose – maximum working pressure = 1500 bar (21,750 psi)

## 6.0 Operation

Hi-Force STS bolt tensioners are operated by means of a suitable hydraulic pump. Make sure you read this manual in conjunction with the pumps operating instruction manual to ensure correct and safe operation of the hydraulic system.

**NOTE:** It is strongly recommended that a Hi-Force AHP-BTU or HPX-BTU series pump unit be used to pressurise STS tensioners. Refer to the pumps user manual for detailed instructions on its use.

Before applying pressure to the system make sure you observe the following points

- You are aware of the correct operation of the pump unit.
- You are aware of the maximum working pressure of the tensioner/s.
- You are aware of the maximum piston movement of the tensioner/s.
- You are aware of the required working pressure/s that must be applied to the tensioner/s.
- You have read and fully understood the tensioning / de-tensioning procedure.
- You have performed the relevant risk assessment/s and have a method statement (safe system of work) for all operators to follow.

### 6.1 Tensioning and De-Tensioning Studs/Bolts & Joints

**IMPORTANT:** Read through all Safety Instructions as detailed in section 2 and below before starting any tensioning or de-tensioning operation. Make sure they are followed by all persons, always.

Proper, safe tensioning and de-tensioning of bolts/studs or joints is a precise operation which varies based on the details of the application, and the equipment available, and is therefore beyond the scope of this manual. A comprehensive bolting sequence and tensioning / de-tensioning procedure should be prepared and overseen by a trained professional with bolting experience.

Hi-Force recommends that the entire tensioning / de-tensioning process be read and fully understood prior to tensioning.

**IMPORTANT:** Tensioning pressures **MUST** be calculated by a qualified engineer, with bolting experience. (See Section 9)

**NOTE:** If you require assistance with calculating correct tensioning pressures, preparing a bolting sequence or you would like further information on one of Hi-Forces training courses. Contact your nearest Hi-Force office or distributor.

**IMPORTANT:** Setup and operate the pump at a safe distance from the tensioner/s, allowing personnel to approach only for as long as it takes to tighten or release the nut rotating socket/s (8). Keep the tensioner/s under pressure for the minimum time necessary to complete the job.

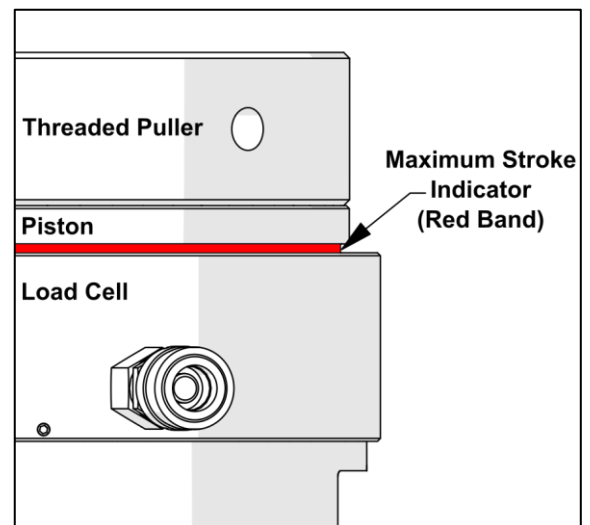
**⚠ CAUTION!** During the pressurisation procedure, continually monitor both piston stroke and system pressure. **NEVER** exceed either. (See sections 6.2 & 8.2)

**⚠ WARNING!** When de-tensioning bolts/studs or joints, pressurise the tensioners to the expected, approximate break-loose pressure, before approaching to see if the nut/s can be released. Further increases in system pressure, should be done incrementally, with all persons a safe distance from the tensioning area. Only approach tensioners when pressurisation has stopped, and the system pressure has been determined to be stable. **DO NOT** remain by the tensioner, to continually test the nut while the pressure is being increased.

## **6.2 Maximum Stroke Indicator** (Figure 6.1)

Hi-Force STS tensioners like similar equipment have no physical, built-in device to prevent the piston from being pumped right out of the cylinder. This allows the tensioner to be kept compact, for use in confined spaces. Hi-Force STS tensioners have a maximum stroke indicator in the form of a red band on the piston. When this band becomes visible, the piston is at its maximum stroke, and the pump should be stopped immediately.

In the event of over-stroking: Tensioners are designed so that escaping oil is directed inward, towards the centre of the tensioner, rather than outward, towards the operator (see warning below). Seal damage is very likely if pistons are over-stroked in this manner. Tensioners with damaged seals will need the seal/s replaced by a qualified technician (Refer to Service Manual).



*Figure 6.1 - Maximum Stroke Indicator*

**⚠ WARNING!** Side-loading of the tensioner can result in high-pressure hydraulic oil escaping at high force, if over-stroked, resulting in equipment damage and possible serious personal injury.

## **6.3 System Leak Check**

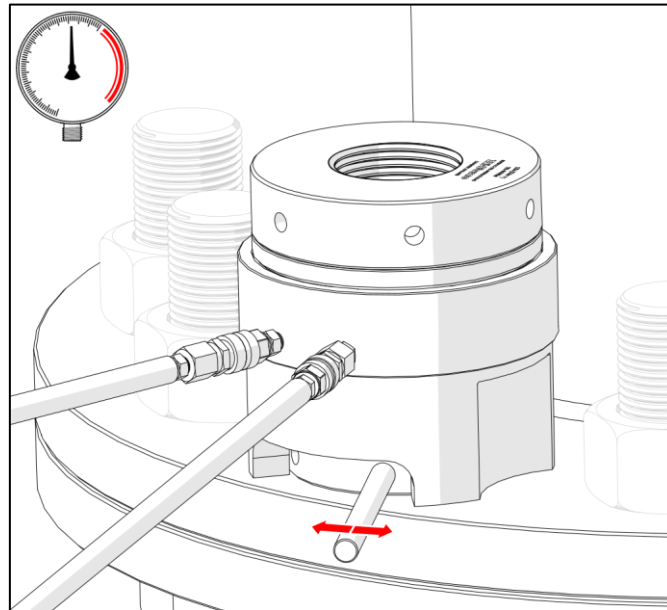
Before operating the system to full tensioning pressure, pressurise the tensioners up to approximately 100 bar (1,450 psi). With the pressure held, visually check the entire system for oil leaks.

If leaks are found, depressurise the system completely, before attempting to resolve the leak/s.

## **6.4 Setting / Releasing the Nut/s.** (Figure 6.2)

Once the studs/bolts have been tensioned, and the system pressure is holding stable. Approach the tensioner/s and with a tommy bar, (through the bridge access window) (3) fully tighten the nut/s against the workpiece surface or loosen the nut/s by rotating them a maximum of 4-flats. I.e. 240° or 4/6 of a full rotation for standard hex nuts.

**NOTE:** A rubber mallet can be used on the tommy bar to firmly seat the nut/s against the joint/mounting surface.



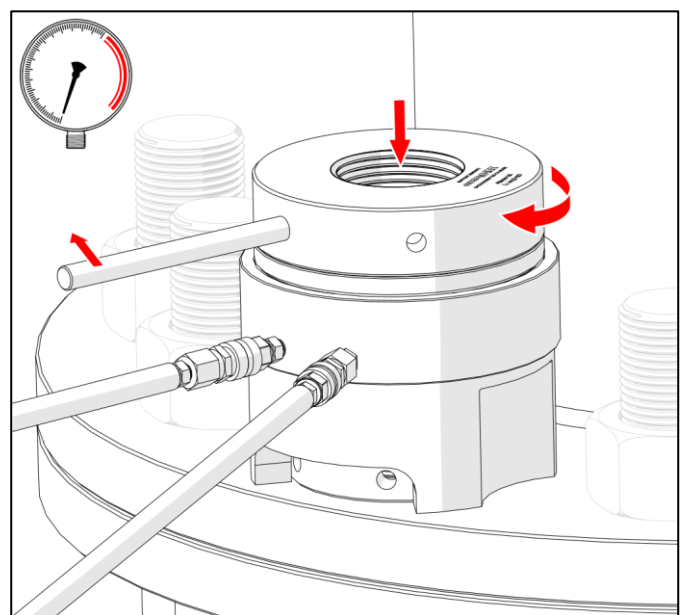
**Figure 6.2 - Setting / Releasing the Nut**

## **6.5 Retracting the Piston/s.** (Figure 6.3)

STS tensioners are load-return and after operation pistons need to be manually retracted.

Use a tommy bar to turn down the threaded puller onto the stud and return the pistons to their fully closed position.

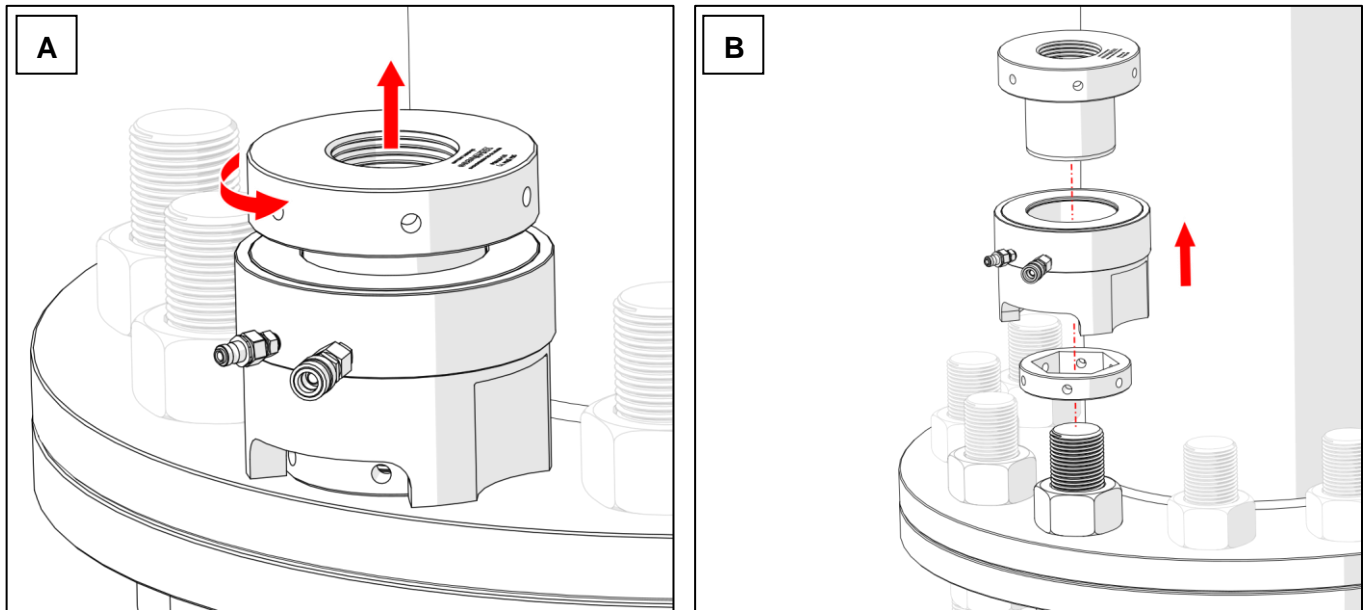
Fully retract all pistons before disconnections are made.



**Figure 6.3 - Retracting the Piston**

## **6.6 Removing the tensioner/s.** (Figure 6.4)

1. Disconnect all hoses and fit dust caps (not shown) to the couplers.
2. Turn the threaded puller anti-clockwise until it disengages from the threads of the stud [A].
3. Lift the threaded puller, load cell and nut rotating socket from the tensioned stud [B].
4. Clean tensioners before placing them into storage.



**Figure 6.4 - Removing the Tensioner**



## 7.0 Maintenance and Storage

- Routinely inspect hydraulic connections and threads for signs of damage.
- **ALWAYS** fully retract tensioners when not in use.
- Store tensioners upright in a clean and dry environment.
- Fit dust caps to couplers when not in use.
- When storing tensioners, apply a light coating of rust inhibitor to exposed surfaces and to the threads of the threaded puller.

## 8.0 Specifications

### 8.1 Oil Specifications

Hi-Force cylinders/tools will use 1 of 2 grades of oil, dependant on the pump used. The tools are designed to operate at temperatures between -20°C and 80°C. Details of the oil used can be found in the pumps operating instruction manual, in the section: **FILLING OF PUMP WITH OIL.**

Hi-Force Model Number	ISO Hydraulic Oil Grade	Temperature Range: Degrees Celcius (°C)	
		From:	To:
HFO15	ISO15	-23	44
HFO46	ISO46	-2	73



## 8.2 STS Specifications

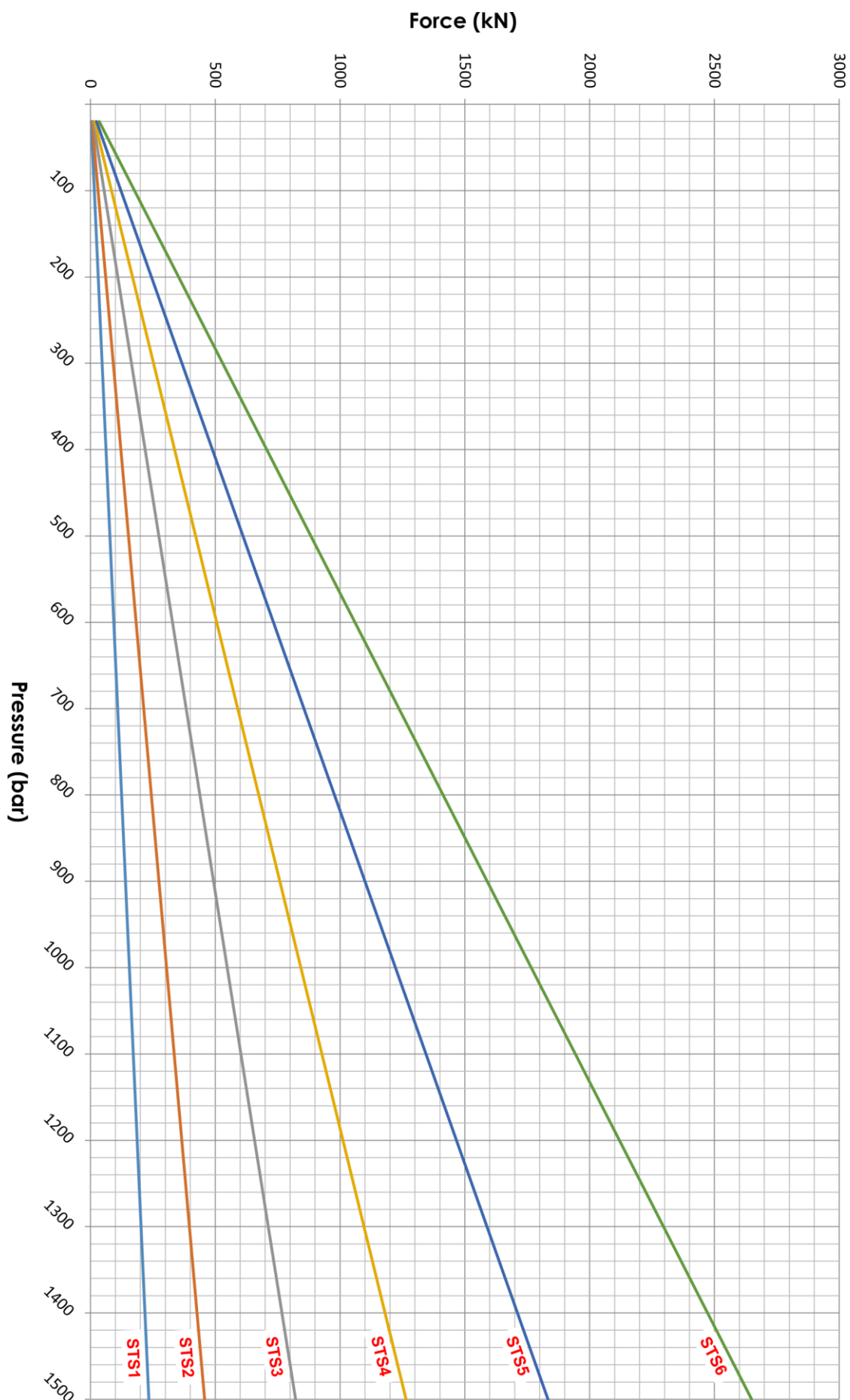
Refer to the engraved detail on the tensioner for model identification.

STS - TOPSIDE BOLT TENSIONERS (METRIC)						
Model Number	Bolt Thread Size	Thread Pitch (mm)	Capacity		Effective Area (cm <sup>2</sup> )	Stroke (mm)
			(kN)	(tonnes)		
STS1-M16B1	M16	2	234	23.9	15.6	10
STS1-M18B1	M18	2.5	234	23.9	15.6	10
STS1-M20B1	M20	2.5	234	23.9	15.6	10
STS1-M22B2	M22	2.5	234	23.9	15.6	10
STS1-M24B2	M24	3	234	23.9	15.6	10
STS1-M27B2	M27	3	234	23.9	15.6	10
STS2-M30B1	M30	3.5	457	46.6	30.5	15
STS2-M33B1	M33	3.5	457	46.6	30.5	15
STS2-M36B1	M36	4	457	46.6	30.5	15
STS2-M39B1	M39	4	457	46.6	30.5	15
STS3-M42B1	M42	4.5	822	83.8	54.8	15
STS3-M45B1	M45	4.5	822	83.8	54.8	15
STS3-M45B2	M45	4.5	822	83.8	54.8	15
STS3-M48B1	M48	5	822	83.8	54.8	15
STS3-M48B2	M48	5	822	83.8	54.8	15
STS3-M52B2	M52	5	822	83.8	54.8	15
STS4-M48B1	M48	5	1264	128.9	84.3	15
STS4-M52B1	M52	5	1264	128.9	84.3	15
STS4-M52B2	M52	5	1264	128.9	84.3	15
STS4-M56B2	M56	5.5	1264	128.9	84.3	15
STS4-M60B2	M60	5.5	1264	128.9	84.3	15
STS4-M64B2	M64	6	1264	128.9	84.3	15
STS5-M64B1	M64	6	1833	186.9	122.2	15
STS5-M68B1	M68	6	1833	186.9	122.2	15
STS5-M72B1	M72	6	1833	186.9	122.2	15
STS5-M76B1	M76	6	1833	186.9	122.2	15
STS6-M76B1	M76	6	2649	270	176.6	15
STS6-M80B1	M80	6	2649	270	176.6	15
STS6-M85B1	M85	6	2649	270	176.6	15
STS6-M90B1	M90	6	2649	270	176.6	15
STS6-M95B3	M95	6	2649	270	176.6	15
STS6-M100B3	M100	6	2649	270	176.6	15

## STS - TOPSIDE BOLT TENSIONERS (IMPERIAL)

Model Number	Bolt Thread Size	Threads per Inch	Capacity		Effective Area	Stroke
			(kN)	(tonnes)	(cm²)	(mm)
STS1-075B1	¾"	10	234	23.9	15.6	10
STS1-087B1	⅞"	9	234	23.9	15.6	10
STS1-100B2	1"	8	234	23.9	15.6	10
STS1-112B2	1 ⅛"	8	234	23.9	15.6	10
STS2-125B1	1 ¼"	8	457	46.6	30.5	15
STS2-137B1	1 ⅜"	8	457	46.6	30.5	15
STS2-150B1	1 ½"	8	457	46.6	30.5	15
STS3-162B1	1 ⅝"	8	822	83.8	54.8	15
STS3-175B1	1 ¾"	8	822	83.8	54.8	15
STS3-175B2	1 ¾"	8	822	83.8	54.8	15
STS3-187B1	1 ⅞"	8	822	83.8	54.8	15
STS3-187B2	1 ⅞"	8	822	83.8	54.8	15
STS3-200B2	2"	8	822	83.8	54.8	15
STS4-187B1	1 ⅞"	8	1264	128.9	84.3	15
STS4-200B1	2"	8	1264	128.9	84.3	15
STS4-200B2	2"	8	1264	128.9	84.3	15
STS4-225B2	2 ¼"	8	1264	128.9	84.3	15
STS4-250B2	2 ½"	8	1264	128.9	84.3	15
STS5-250B1	2 ½"	8	1833	186.9	122.2	15
STS5-275B1	2 ¾"	8	1833	186.9	122.2	15
STS5-300B1	3"	8	1833	186.9	122.2	15
STS6-300B1	3"	8	2649	270	176.6	15
STS6-325B1	3 ¼"	8	2649	270	176.6	15
STS6-350B1	3 ½"	8	2649	270	176.6	15
STS6-375B3	3 ¾"	8	2649	270	176.6	15
STS6-400B3	4"	8	2649	270	176.6	15

**MAXIMUM OPERATING PRESSURE: 1500 bar / 21,750 psi**



## 9.1 Pressure to Force Conversion Chart (STS)

### 9.0 Conversion Charts & Tables

**NOTE:** More detailed charts and tables available on the Hi-Force website.

9.2 Pressure to Force Conversion Table (STS)

Pressure		STS1		STS2		STS3		STS4		STS5		STS6	
(bar)	(psi)	Force (kN)	Force (tonne)	Force (kN)	Force (tonne)	Force (kN)	Force (tonne)	Force (kN)	Force (tonne)	Force (kN)	Force (tonne)	Force (kN)	Force (tonne)
50	725	8	0.8	15	1.6	27	2.8	42	4.3	61	6.2	88	9.0
100	1450	16	1.6	31	3.1	55	5.6	84	8.6	122	12.5	177	18.0
150	2175	23	2.4	46	4.7	82	8.4	126	12.9	183	18.7	265	27.0
200	2901	31	3.2	61	6.2	110	11.2	169	17.2	244	24.9	353	36.0
250	3626	39	4.0	76	7.8	137	14.0	211	21.5	306	31.1	442	45.0
300	4351	47	4.8	92	9.3	164	16.8	253	25.8	367	37.4	530	54.0
350	5076	55	5.6	107	10.9	192	19.6	295	30.1	428	43.6	618	63.0
400	5801	62	6.4	122	12.4	219	22.3	337	34.4	489	49.8	706	72.0
450	6526	70	7.2	137	14.0	247	25.1	379	38.7	550	56.1	795	81.0
500	7252	78	8.0	153	15.5	274	27.9	422	43.0	611	62.3	883	90.0
550	7977	86	8.7	168	17.1	301	30.7	464	47.3	672	68.5	971	99.0
600	8702	94	9.5	183	18.7	329	33.5	506	51.6	733	74.7	1060	108.0
650	9427	101	10.3	198	20.2	356	36.3	548	55.9	794	81.0	1148	117.0
700	10152	109	11.1	214	21.8	384	39.1	590	60.2	855	87.2	1236	126.0
750	10877	117	11.9	229	23.3	411	41.9	632	64.4	917	93.4	1325	135.0
800	11602	125	12.7	244	24.9	438	44.7	674	68.7	978	99.7	1413	144.0
850	12328	133	13.5	259	26.4	466	47.5	717	73.0	1039	105.9	1501	153.0
900	13053	140	14.3	275	28.0	493	50.3	759	77.3	1100	112.1	1589	162.0
950	13778	148	15.1	290	29.5	521	53.1	801	81.6	1161	118.3	1678	171.0
1000	14503	156	15.9	305	31.1	548	55.9	843	85.9	1222	124.6	1766	180.0
1050	15228	164	16.7	320	32.6	575	58.7	885	90.2	1283	130.8	1854	189.0
1100	15953	172	17.5	336	34.2	603	61.4	927	94.5	1344	137.0	1943	198.0
1150	16678	179	18.3	351	35.8	630	64.2	969	98.8	1405	143.3	2031	207.0
1200	17404	187	19.1	366	37.3	658	67.0	1012	103.1	1466	149.5	2119	216.0
1250	18129	195	19.9	381	38.9	685	69.8	1054	107.4	1528	155.7	2208	225.0
1300	18854	203	20.7	397	40.4	712	72.6	1096	111.7	1589	161.9	2296	234.0
1350	19579	211	21.5	412	42.0	740	75.4	1138	116.0	1650	168.2	2384	243.0
1400	20304	218	22.3	427	43.5	767	78.2	1180	120.3	1711	174.4	2472	252.0
1450	21029	226	23.1	442	45.1	795	81.0	1222	124.6	1772	180.6	2561	261.0
1500	21755	234	23.9	457	46.6	822	83.8	1264	128.9	1833	186.9	2649	270.0

## **10.0 System Components / Accessories**

*(Refer to the Hi-Force website or latest Hi-Force catalogue for further details)*

- Tommy Bars for Tensioner Series STS1 - STS6
- Optional Bridges for Load Cells STS1, STS3, STS4 & STS6
- Optional Threaded Pullers for Tensioner Series STS1 - STS6
- Optional Rotating Sockets for Tensioner Series STS1 - STS6
- Complete conversion Kits for Tensioner Series STS1 - STS6
- Optional Blank Threaded Pullers for Tensioner Series STS1 – STS6 - (1)
- 1500 bar Mainline and Link Hoses
- XHR1 Hose Reel for Mainline Hoses up to 300m
- Selection of High Pressure (1500 bar / 21,750 psi) Hydraulic Couplers and Fittings.

### Notes:

(1). Blank threaded pullers supplied solid and without thread. Threading and further modification are at customer risk and liability.

## 11.0 Troubleshooting

Hi-Force STS topside bolt tensioners should be serviced and repaired only by authorised Hi-Force repair centres. The following table gives possible causes and solutions for common problems.

TROUBLESHOOTING GUIDE		
Problem	Possible Cause	Solution
1. Piston/s will not advance.	a. Pump release valve open.	Close pump release valve.
	b. Coupler not fully engaged.	Check coupler engagement. (See section 5.2)
	c. Oil level in pump is low.	Add oil to pump reservoir. (See pump manual)
	d. Pump malfunctioning.	Contact your local Hi-Force office/distributor.
	e. Tensioner seals leaking.	Contact your local Hi-Force office/distributor.
2. Piston/s advances part way.	a. Oil level in pump is low.	Add oil to pump reservoir. (See pump manual)
	b. Tensioner piston binding.	Contact your local Hi-Force office/distributor.
	c. Pump pressure incorrectly set.	Set pump pressure to correct value. (See pump manual).
3. Piston/s advances in spurts.	a. Tensioner piston binding.	Contact your local Hi-Force office/distributor.
	b. Air in the system due to low oil.	Add oil to pump reservoir. (See pump manual)
4. Piston/s advances slower than normal.	a. Leaking connection.	Replace faulty component.
	b. Pump malfunctioning.	Contact your local Hi-Force office/distributor.
5. Piston/s advance but will not hold tension.	a. Pump malfunctioning.	Contact your local Hi-Force office/distributor.
	b. Leaking connection.	Replace faulty component.
	c. Incorrect system setup.	Check system setup.
	d. Tensioner seals leaking.	Repair or replace tensioner.
6. Tensioner leaks oil.	a. Worn or damaged seals.	Contact your local Hi-Force office/distributor.
	b. Tensioner damaged internally.	Contact your local Hi-Force office/distributor.
	c. Loose connection.	Tighten or repair connection.
7. Tensioner will not retract or retracts slower than normal.	a. Pump release valve is closed.	Open pump release valve.
	b. Coupler not fully engaged.	Check coupler engagement. (See section 5.2)
	c. Pump reservoir over-filled.	Drain excess oil from pump reservoir.
	d. Tensioner damaged internally.	Contact your local Hi-Force office/distributor.
8. When de-tensioning the joint, the nut becomes locked onto the stud.	a. Corrosion or thread damage above the nut.	Screw the nut down and clean up the thread above the nut.
	b. Nut rotating socket turned up more than 4 flats, causing tensioner to jam when depressurised.	Re-tension stud and set the tensioner correctly.

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