TRITORC
PIPELINE SOLUTIONS

Operation Manual

Bolt Tensioner

MODEL: SLT

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Operating Manual

- Please read carefully following instructions, warnings, cautions. Please observe the safety prescriptions so that it can avoid personal to injury and equipment's damage when you operate the Bolt Tensioner.

  Any information without mentions in operating manual, please direct to contact TRITORC or local distributors/partners.

  TRITORC is not responsible for any damage and injury from operation.

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1. Attention of Receiving

Carefully inspect the hydraulic bolt tensioner upon arrival. If any shipping damage is found, please notify carrier at once. Shipping damage is not covered by warranty. The carrier is responsible for all repair or replacement cost resulting from damage in shipment.

Caution:

▲ This is dangerous sign, if you ignore this sign, it may have serious risk and cause person's injury.

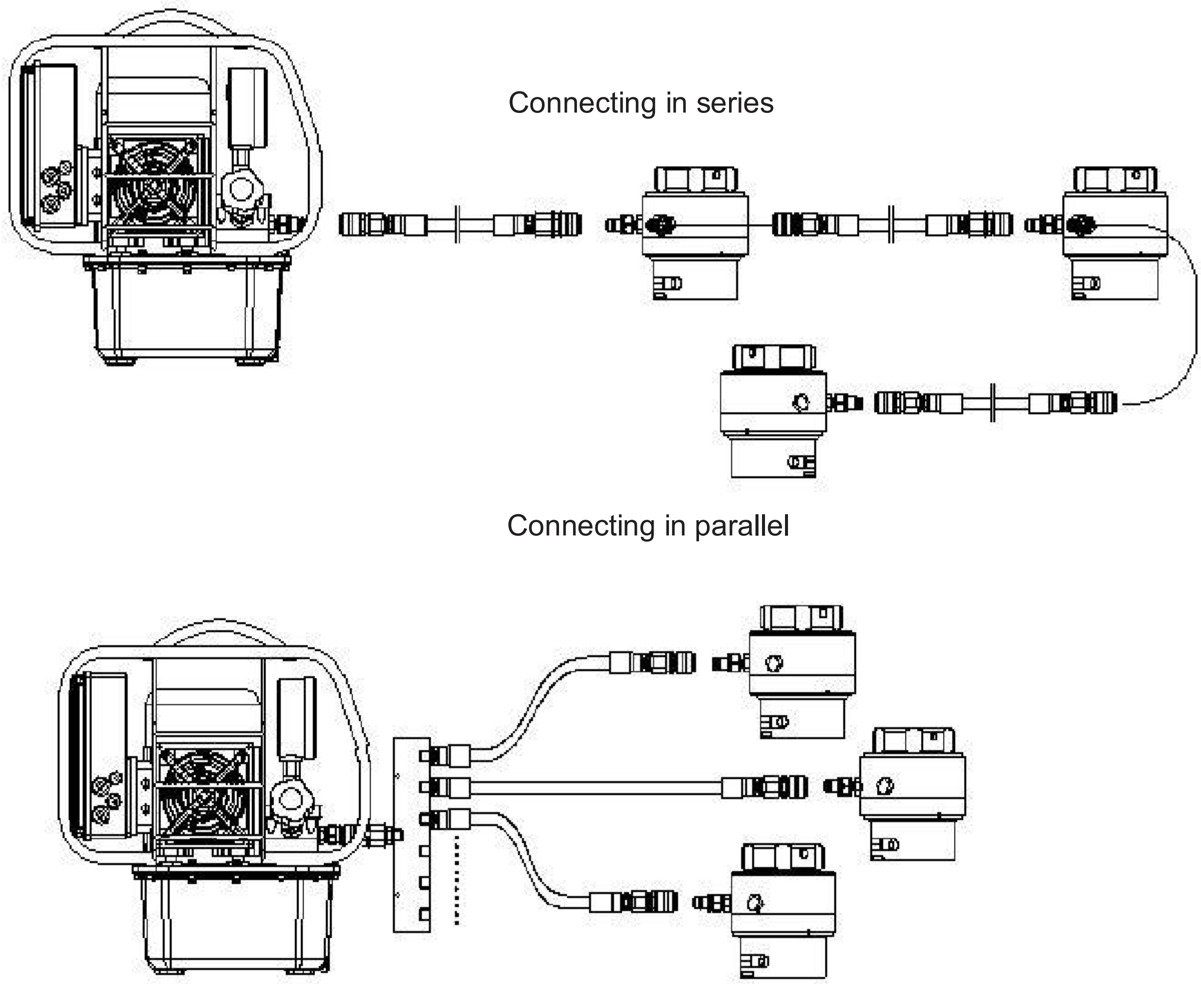
2.Summarize

Bolt tensioner (hydraulic bolt tensioner), which has the function of bolt fastening and disassembly, and can be widely applied to metallurgical mines, Oil-gas industry, shipbuilding industry, engineering truck, wind power and other industries. It uses the power provided by the high-pressure pump to stretch and deform the bolt within the allowable elastic deformation to achieve the purpose of tightening and loosening the bolt. When the bolt tensioner works, it can accurately control the pre-tightening force, does not damage the thread, is easy to operate, reduces the labor intensity, shortens the production maintenance period, effectively increases the reliability of the joint and the fatigue strength of the bolt, and improves the assembly precision and safety factor. The hydraulic tension device consists of a bolt tensioner and a high pressure pump (manual, electric or air operated).

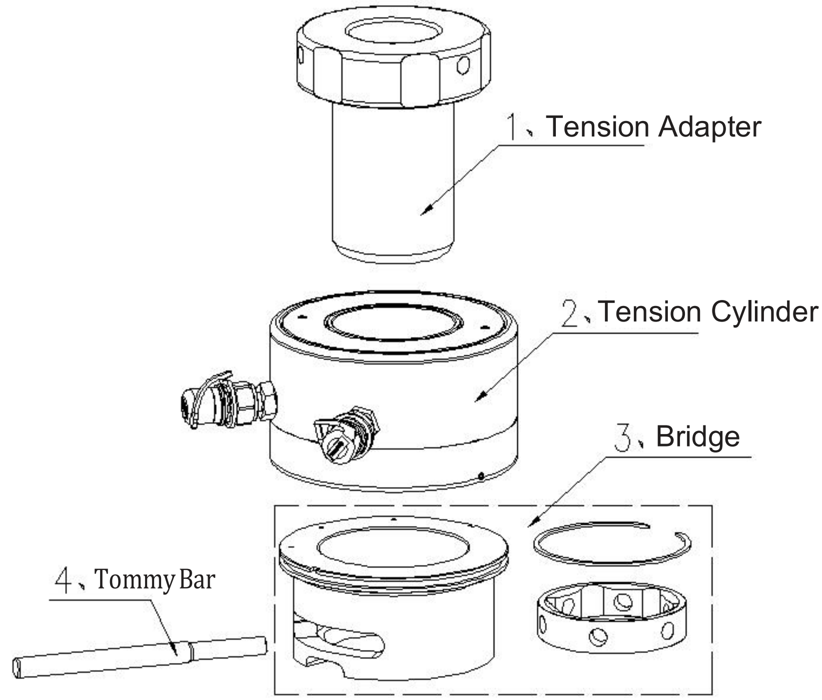
3. Main structure and working principle

The hydraulic tension device is mainly composed of a high-pressure oil pump and a tensioner, and is connected by a high-pressure hose to become a complete device. A set of tension device can be combined with a single or multiple tensioner from a high-pressure pump. As showed below.

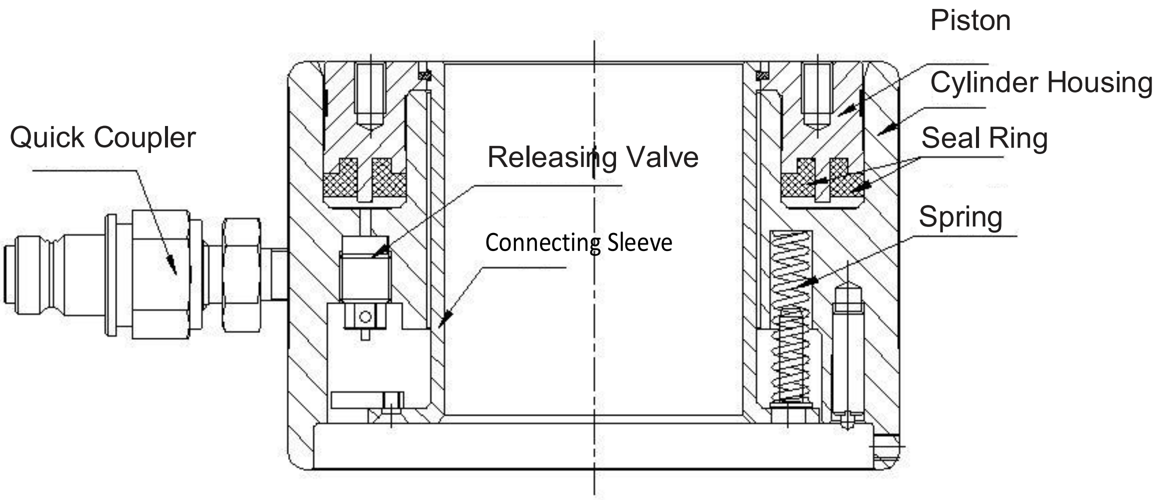
Connecting drawing for tension device



The SLT bolt tensioner consists of a tension cylinder, a tension adapter and a bridge



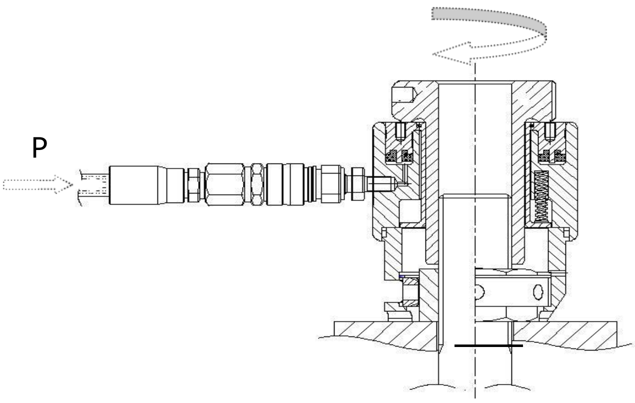
The tension cylinder includes piston, cylinder housing, connecting sleeve, sealing rings, releasing valves, automatic retraction mechanisms, quick couplings and other spare parts.



Remind：

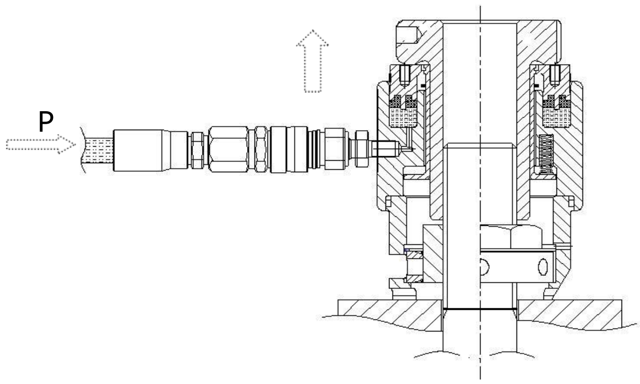
1. There are differences in the appearance parameters of the products. The above figure is for reference only, and the actual ones shall prevail.
2. If the product has improvements, it will be compiled into the new manual without prior notice.

The bolt tensioner is used in conjunction with the high-pressure pump, and the work process is divided into four steps:



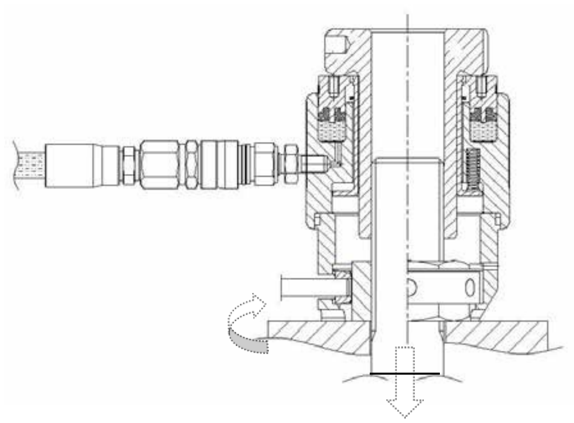
Filling oil :

Screw the SLT bolt tensioner into the bolt, the pump starts to work, the low pressure, the large flow is filled with oil, the piston in the cylinder housing starts to rise, push the tension adapter upwards, and start to tension the bolt.



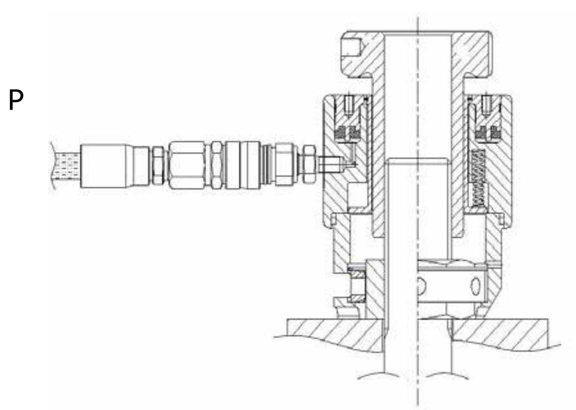
Rise Pressure :

The pump continues to pressurize, and the axial tension force will lengthen the bolt. At this time, the nut rises due to the elongation of the bolt and is separated from the flange contact surface. When the required pretighten force is reached, the pressurization is stopped.



Operation:

After the required pre-tightening force is reached, the Tommy bar can be used to turn sleeve through the window of the bridge, to lock or loosen the nut.



Release Load:

After the work is completed, the Releasing valve is opened and the oil comes back to the tank.

4. Operating Method

4.1. Operating Preparation

4.1.1.Carefully read the operating manual of High-Pressure Pump" and Bolt Tensioner before starting work, and pay attention to the prevention points that may cause property damage and accidents.

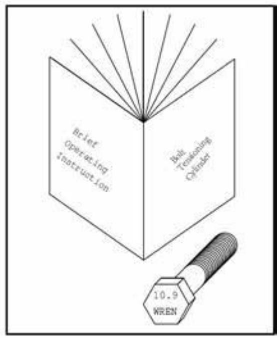


Figure 1: Operating instruction

4.1.2.Carefully check the appearance of the pump, hose, and bolt tensioner for damage caused by improper transportation or storage. If it is damaged, please use it after confirmation from TRITORC.

4.1.3. Check the bolt tensioner operating data (pre-tighten force, operating pressure) and bolts (grade, thread length on the nut). It is the responsibility of the user to confirm the characteristics, pre-tighten and connection of the bolts used.

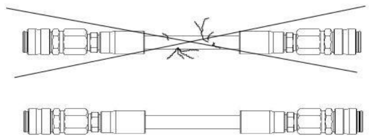


Figure 2: Hose is damaged, do not use please

Max pressure, pre-tighten force: marked on TRITORC Tensioner.

Please check that the effective thread length of bolt protrusion above nut to ensure enough thread length。 (Figure 3)

Normally, the thread length of protrusion above nut is (minimum)

1×M (M 100, H = min. 100 mm)

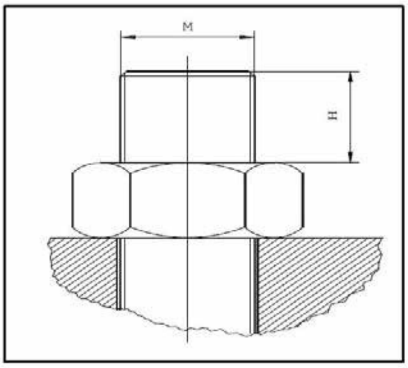


Figure 3:
Bolt protrusion above nut

Consult with TRITORC Professional Engineers if needed， TEL：0571-85855333。

4.1.4.Cleaning and drying: The inner and outer surfaces of the bolt tensioner and the high pressure pump, especially the exposed movable surface, must be kept clean. It should be cleaned with a special cleaning material and then wiped clean with a clean towel.

4.1.5.Determine if the oil is used correctly and enough.

The pump is filled with 32 # anti-wear hydraulic oil before leaving the factory. After use, when the oil level is insufficient, it needs to be replenished in time.

4.1.6.Check the angle α of the bolt on the support surface and correct if necessary. (Figure 4) 4.1.7. Before using the bolt tensioner, apply grease to the bolt threads. The grease type is user- defined. (Figure 5)

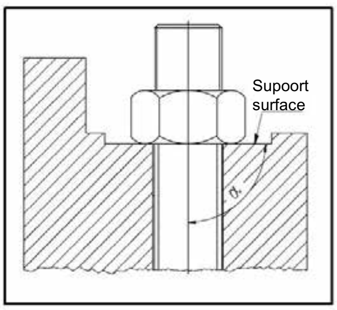


Figure 4: Angle accuracy

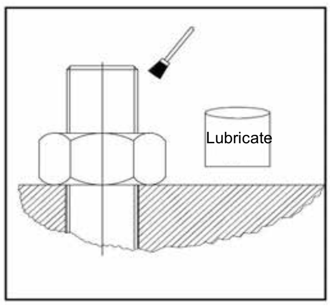
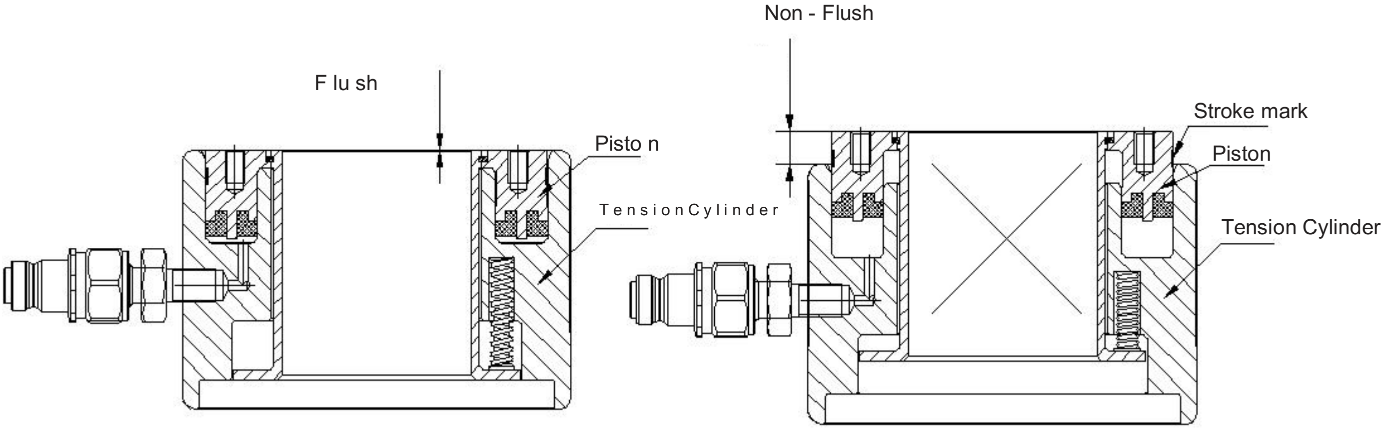


Figure 5: Lubricate

4.1.8. Before using the tensioner, make sure the piston is at its end position (for example, if the top of the piston is flush with the end face of the tension cylinder).

Consult with TRITORC Professional Engineers if needed， TEL ：0571-85855 333



4.1.9. In operation, please pay attention to the distance between the tensioner and the pump, and always observe the position of the pressure gauge and the bolt.

4.1.10. After cleaning the outlet joint of the high-pressure pump, the inlet of the bolt tensioner and the joints of the high-pressure hose, plug them in and tighten them to enter the working state. (The bending radius of the high-pressure hose should be ≥ 200 mm.)

▲Warning ：No pressure should be applied to the bolt tensioner until it is correctly placed Tensioner on the bolt.

▲Caution ：Avoid severe bending and entanglement of hydraulic hose during operation.

(A) Using a bent or entangled tubing will create excessive back pressure ;

(B) Severe bending and entanglement damage the inside of the hose and prematurely scrapped;

(C) Prevent heavy objects from falling or pressing onto the hose ;

(D) Severe impact may cause damage to the internal metal wire of the hose. The damaged hose may be broken during pressurization; it is not possible to haul and lift other hydraulic components with hydraulic hose;

4.2. Connection and operation

▲ Note: Use TRITORC original high-performance hydraulic components.

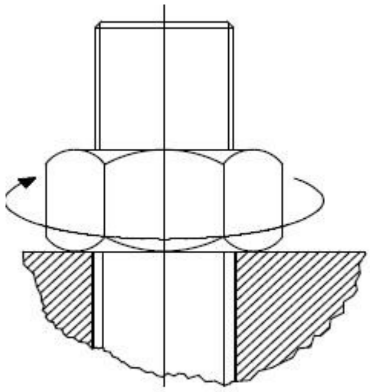
▲Note: The pressure value of the bolt tensioner is read by the pressure gauge on the pump. Note: This pressure gauge can be selected according to the user's needs for accuracy and calibration requirements.

▲Warning: To avoid personal injury, the maximum working pressure must not exceed 1500 bar.

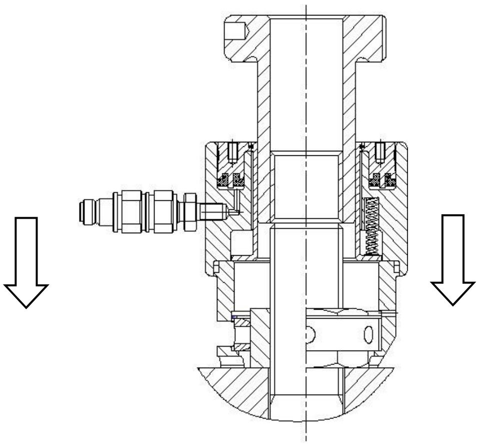
▲Warning: No-load pressure test is prohibited.

▲ Warning: Over-stroke is prohibited; the maximum stroke must not exceed 10mm.

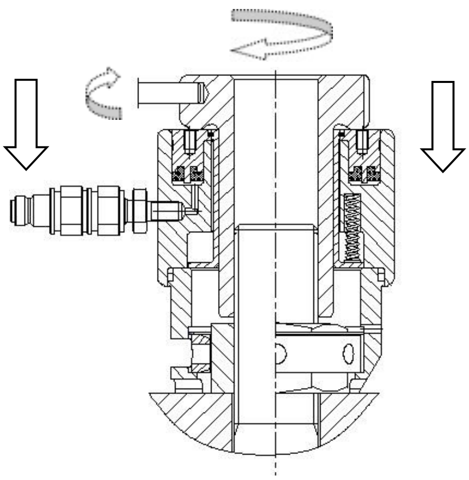
▲ WARNING: The piston of the tensioner should be flush with the cylinder.



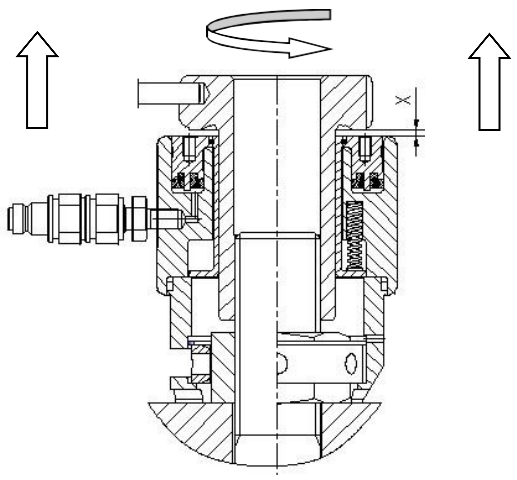
Step 1 :
Once the bolt protrusion above nut is confirmed, turn the nut onto the support surface and tighten. This is to prevent the bolt from rotating inward when the bolt tensioner is rotated to the set position.



Step 2:
Place the hydraulic bolt tensioner over the outer ring of the nut and place the tension nut on the bolt that you want to tension. For rigid flat contact sealing bolts, single operation is possible; for gasketed sealing bolts, multiple joint operations are recommended.

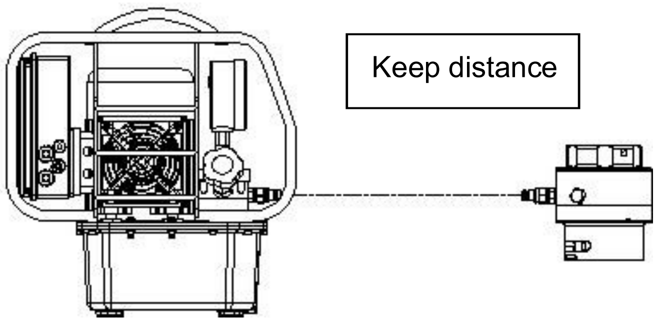


St ep 3:
Rotate the bolt tensioner through the Tommy bar or manually onto the bolt to be tensioned and continue to rotate until the tension nut contacts the support surface of the Tension Cylinder.



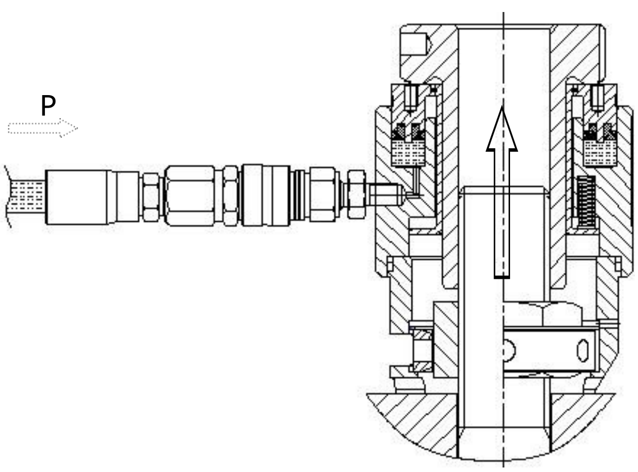
Step 4:

Use a Tommy bar or manual reverse rotation of the tension nut. For bolts up to 1000 mm in length, reserve a clearance of 2 - 3 mm between the support surface of the tension cylinder and the tension nut. For bolts with a length of 1000 mm or more, the clearance can be appropriately increased.



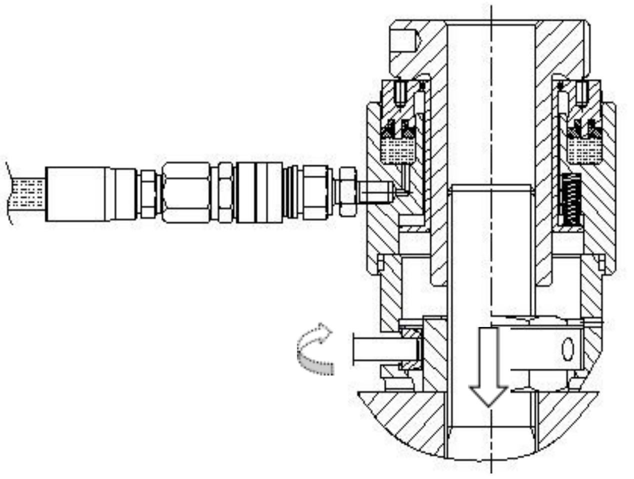
Step 5:

The bolt tensioner is connected to the pump with a high-pressure hose. Keep the distance between the tensioner and pump during pressure rise so that the position of the gauge and bolt can always be observed.



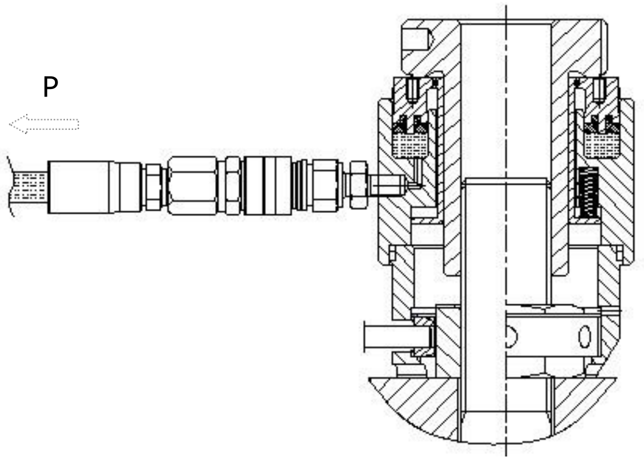
Step 6:

After the hydraulic connection, the tensioner piston is pressed, and the axial tensile force will lengthen the bolt. At this time, the nut rises due to the elongation of the bolt and is separated from the flange contact surface. According to the principle of force and reaction, the same reverse force will compress the flange. When the required tension force is reached, the pressurization is stopped.



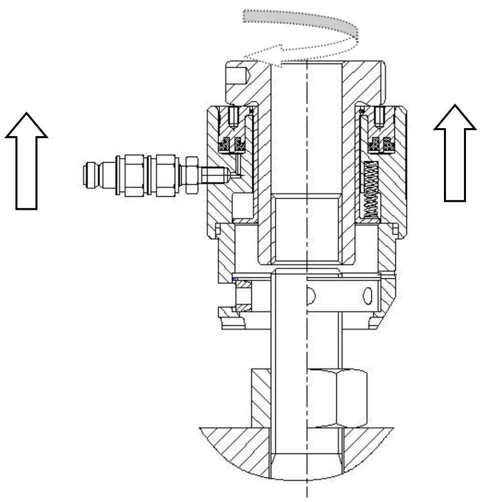
Step 7:

After the required tension force is reached, under the pressure holding status, the tommy bar can be used to pass through the window of the bridge, and the dial nut sleeve is pushed to tighten or loosen the nut on the support surface.



Step 8:

Tighten or loosen the nut to complete the work and unload the pump.
Release the pressure, the tensioner automatically returns to the position, and the hydraulic oil flows back to the oil tank.



Step 9:

When the piston returns to the initial position, remove the hose.
Remove the bolt tensioner by tommy bar or manually loosen the tension adapter. Prepare for the next job

▲ WARNING: Before removing the tensioner, make the stroke of the tensioner "0" before tension again.

▲ Note: After the device is used, it should be wiped clean and sealed after rust prevention. After the hose is coiled, insert the handle of the pump to avoid shaking.

Note: 1. Users should not disassemble the hydraulic tension device to avoid damage.

2. The bolt tensioner cannot exceed its maximum stroke. For the stroke parameters, see the main data sheet of the SLT series bolt tensioner. A mark that can be seen on the piston when the maximum stroke is reached. If the tensioner operates beyond its maximum stroke, it will automatically unload and relieve pressure and will not function at all.

3. This product is constantly undergoing technological innovation. If the contents of this manual are updated, we will not notify individually. Please understand.

5. Safety and Caution

5.1. Make sure the high-pressure hose is not broken or kinked before using the bolt tensioner. Do not use damaged or unqualified high-pressure hose. Do not use kinking hose. The bending radius of the high-pressure hose should be ≥ 200 mm.

5.2. After the hydraulic tension device is finished, the pump pressure should be reduced to zero, otherwise the hydraulic oil will be sprayed out, polluting the clothes, and may cause harm to the human body.

6. Maintenance

6.1. When uses, it should be handled lightly. The mating surface of the bolt tensioner is very precise. It should be protected during installation and disassembly, and the relevant mating surface should not be damaged.

6.2. When installs and replaces the seal ring, clean the surface of the seal ring and the matching surface of the tension cylinder and piston with a special cleanser.

6.3. Store the tool in a dry place after use.

6.4. The high-pressure pump can be found in the instruction manual.

7. Trouble Shooting

The bolt tensioner itself generally does not malfunction. During work, the hydraulic oil leaks out at the joint between the hole and the shaft of the tension cylinder. It may be that the seal is poorly sealed. It should be disassembled to check whether the seal is installed correctly and the shape is complete. If the shape of the seal is deformed or broken, the seal must be replaced.

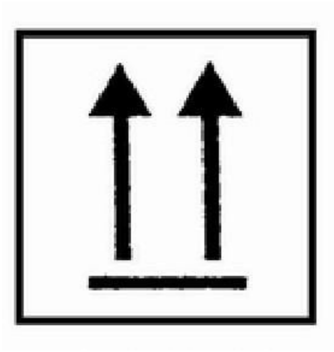
Trouble shooting of the pump, see its manual.

8.Noise and transportation of Bolt Tensioner

8.1. Hydraulic tensioner noise / vibration statement

Hydraulic tensioner using noise value: ≤ 70 db

8.2. Hydraulic tensioner transport information

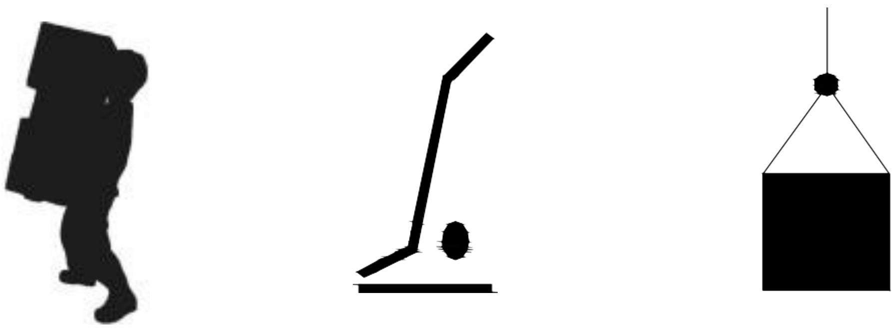


（Figure 9）

8.2.1. Pay attention to handle when moves tools.

8.2.2. The product should be lifted upright as shown in Figure 9.

8.2.3. Product handling is generally carried by hand or trolley to move, hoist and move, as shown in Figure 10.



（Figure 10）

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9. Data sheet for SLT3 series bolt tensioner

The bolt tensioner tensile force (F) is directly related to the pressure (P). The pressure unit, indicated by the pressure gauge on the pump, is determined using the table of (9.4) or calculated by the following formula.

$$P(bar) = 10000 \times \frac{F\ (kN)}{A(mm^2)}$$

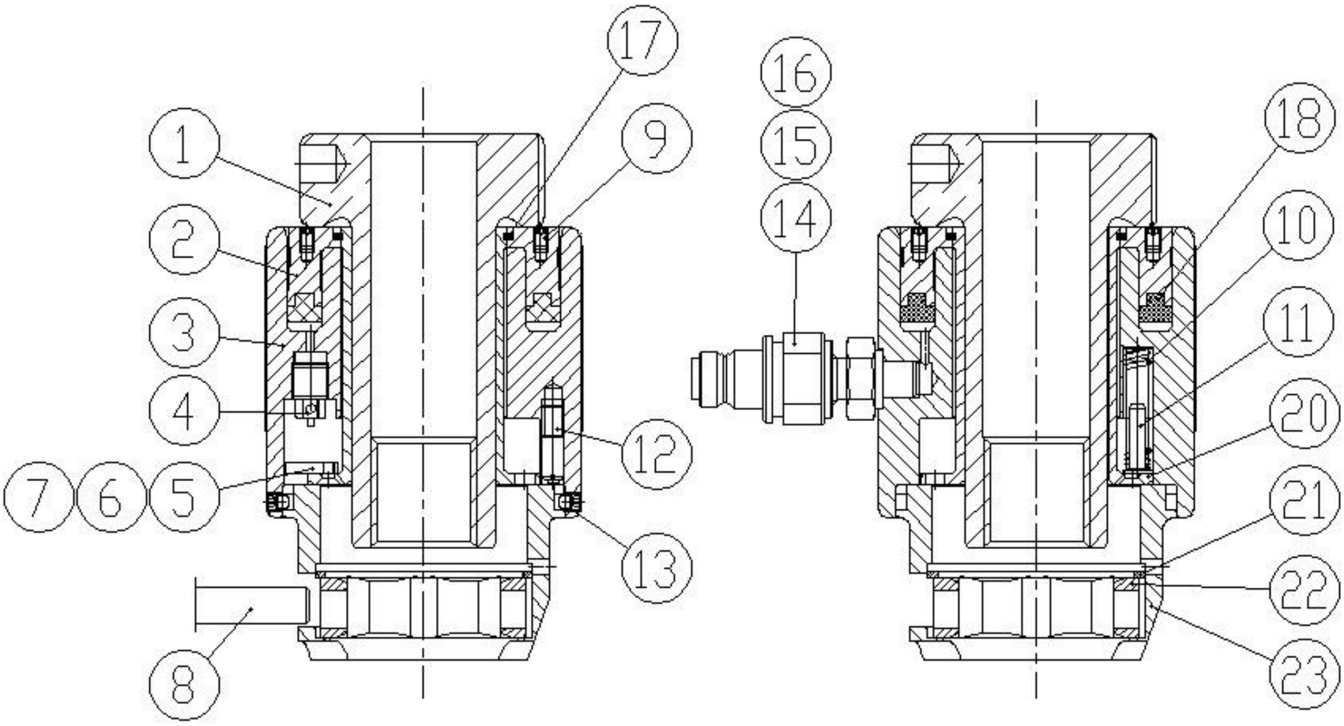
$$F\ (kN) = \frac{P(bar) \times A(mm^2)}{10000}$$

P = Bolt tensioner operating pressure C bar 3
F = Pre-tighten force C k N 3
A = Effective area of bolt tensioner

C mm 3 C See 9.1 data sheet 3

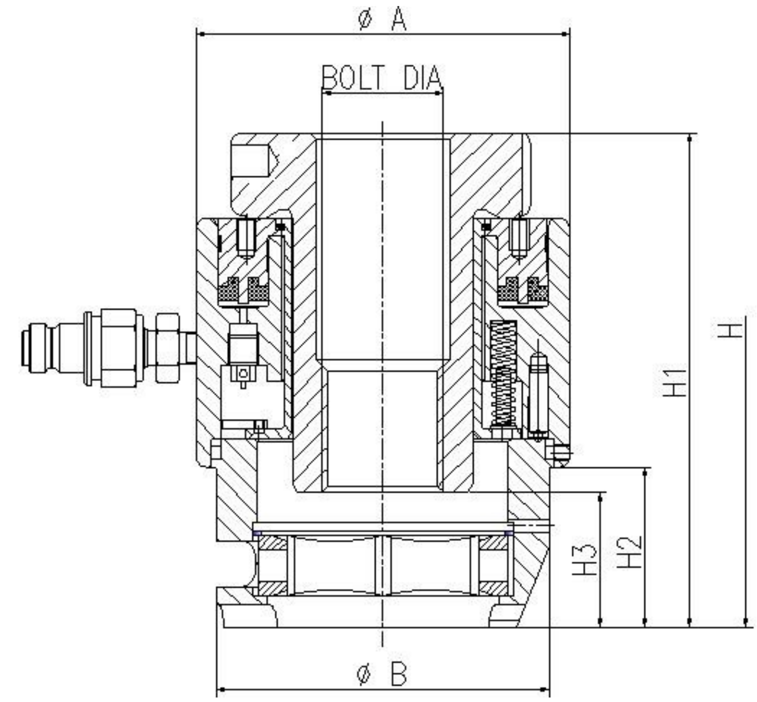
9.1 Part List

SLT



Part List for SLT Bolt Tensioner									
Item	Name	Part Number	QTY	Remark	Item	Name	Part Number	QTY	Remark
1	Tension Adapter		1		12	Threaded Lock Pin		1	
2	Piston	HSR1-01	1		13	Screw Pin		2	
3	Tension Cylinder	HSR1-02	1		14	Fitting	J02-115	2	
4	Releasing Valve	HSR. 01	1		15	Quick Coupler		2	
5	Retaining Plate	HSR2-06	1		16	Gasket		2	
6	Screw		1		17	Connecting Clip	HSR1-05	1	
7	Pin		1		18	Seal Ring	HSR1-03	1	
8	Tommy Bar	TY1710	1		20	Connecting Sleeve	HSR1-04	1	
9	Nylon Plug		2		21	Clip for bridge		1	
10	Spring I	HSR-01	4		22	Nut Sleeve		1	
11	Spring Seat	HSR-02	4		23	Bridge		1	

9.2 Dimension drawing



Dimension table for SLT series Bolt Tensioner - Imperial

SLT	Threads	Nut Size	A		B		H1		H2		H3		H	
	mm	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1	M24×3	36	3.3	85	2.7	68	5.6	141.5	1.5	38	0.9	23	6.9	175
	M27×3	41			2.7	68	5.6	141.5	1.5	38	1.0	26	7.0	178
2	M24×3	36	4.1	103	3.0	75	5.6	141.5	1.5	38	0.9	23	6.9	175
	M27×3	41			3.0	75	5.6	141.5	1.5	38	1.0	26	7.0	178
	M30×3.5	46			3.1	80	5.7	144.5	1.6	41	1.1	28	7.2	184
	M33×3.5	50			3.3	84	5.8	147.5	1.7	44	1.2	30	7.5	190
	M36×4	55			3.5	88.5	5.9	150.5	1.9	47	1.3	33	7.7	196
3	M33×3.5	50	4.6	118	3.6	92	5.9	149.5	1.7	44	1.2	30	7.6	192
	M36×4	55			3.8	96	6.0	152.5	1.9	47	1.3	33	7.8	198
	M39×4	60			4.1	105	6.1	156	2.0	50.5	1.4	35.5	8.0	204
	M42×4.5	65			4.1	104.5	6.3	159	2.1	53.5	1.5	38	8.3	211
4	M39×4	60	5.5	140.5	4.4	112	6.4	163.5	2.0	50.5	1.4	35.5	8.3	212
	M42×4.5	65			4.5	114	6.6	166.5	2.1	53.5	1.5	38	8.6	218
	M45×4.5	70			5.0	126	6.7	170	2.2	57	1.6	40	8.9	225
	M48×5	75			4.8	123	6.8	173	2.4	60	1.7	42	9.1	231
5	M52×5	80	6.9	175.5	5.3	134	7.4	187	2.5	63	1.8	46	9.8	249
	M56×5.5	85			5.8	148	7.6	193.5	2.7	69.5	1.9	49	10.2	260
	M60×5.5	90			5.8	148	7.6	193.5	2.7	69.5	2.0	52	10.4	264
	M64×6	95			6.0	153	7.9	200	3.0	76	2.2	55	10.8	274
	M68×6	100			6.0	153	7.9	200	3.0	76	2.3	58	11.0	279
	M70×6	102			6.0	153	7.9	200	3.0	76	2.3	58	11.0	280
6	M72×6	105	8.6	219	6.8	172	8.5	216	3.2	82	2.4	62	11.7	297
	M76×6	110			7.2	182	8.8	223	3.5	89	2.6	65	12.1	308
	M80×6	115			7.2	182	8.8	223	3.5	89	2.7	68	12.3	312
	M85×6	120			7.5	190	9.0	229	3.7	95	2.8	72	12.7	323
	M90×6	130			8.1	205	9.3	235	4.0	101	3.0	76	13.1	334
7	M90×6	130	9.9	252	9.1	230	9.5	241	4.0	101	3.0	76	13.4	341
	M95×6	135			9.1	230	9.5	241	4.0	101	3.1	80	13.6	346
	M100×6	145			9.3	235	9.7	247	4.2	107	3.3	84	14.1	357
8	M105×6	15	11.1	283	10.0	255	9.5	241	4.0	101	3.5	88	14.9	378
	M110×6	155			10.0	255	9.5	241	4.0	101	3.6	92	15.1	383
	M115×6	165			10.2	260	9.7	247	4.2	107	3.8	96	15.5	394

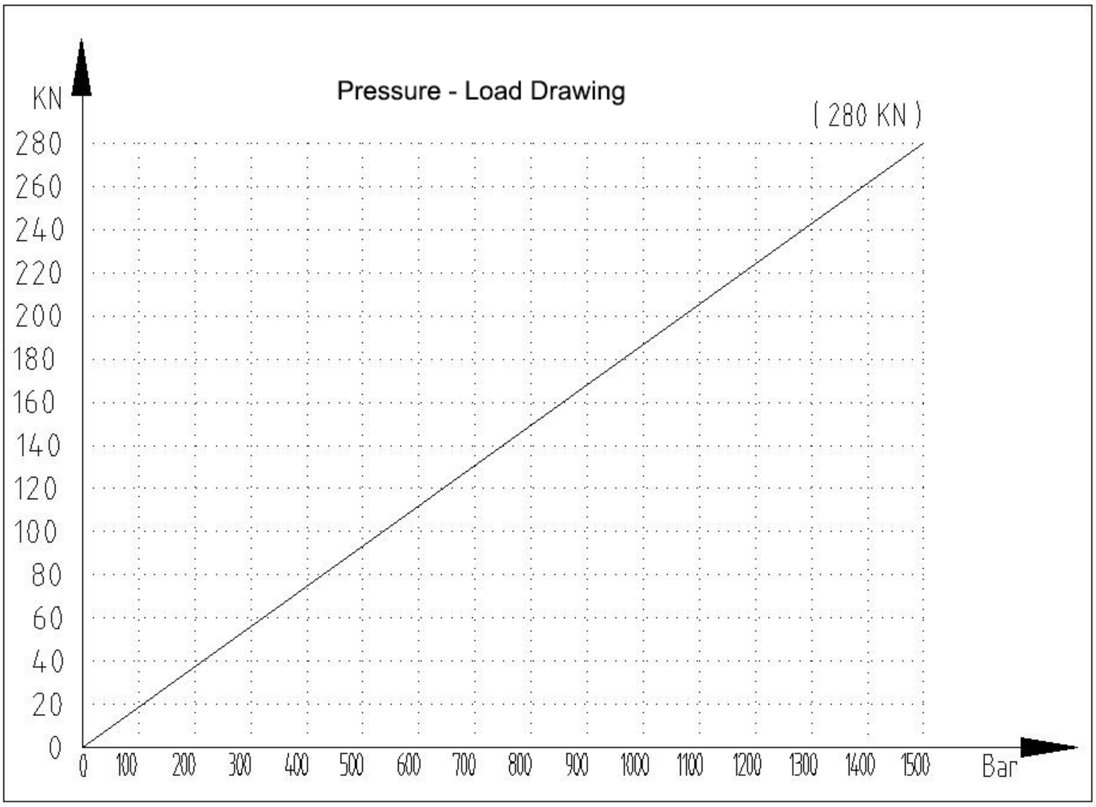
Dimension table for SLT series Bolt Tensioner - Imperial

SLT	Threads	Nut Size	A		B		H1		H2		H3		H	
			in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1	1"-8UN	1 5/8″	3.3	85	2.7	68	5.6	141.5	1.5	38	1.2	30	7.0	177
	1 1/8"-8UN	1 13/16″			3.0	76	5.7	144.5	1.6	41	1.3	33	7.2	183
2	1″-8UN	1 5/8″	4.1	103	3.0	75	5.6	141.5	1.5	38	1.2	30	6.9	175
	1 1/8″-8UN	1 13/16″			3.1	80	5.7	144.5	1.6	41	1.3	33	7.1	181
	1 1/4″-8UN	2″			3.3	84	5.8	147.5	1.7	44	1.4	36	7.4	188
	1 3/8″-8UN	2 3/16″			3.5	88.5	5.9	150.5	1.9	47	1.5	39	7.5	191
3	1 1/4″-8UN	2″	4.6	118	3.6	92	5.9	149.5	1.7	44	1.4	36	7.5	190
	1 3/8″-8UN	2 3/16″			3.8	96	6.0	152.5	1.9	47	1.5	39	7.8	197
	1 1/2″-8UN	2 3/8″			4.1	105	6.1	156	2.0	50.5	1.7	42.5	8.0	203
	1 5/8″-8UN	2 9/16″			4.1	104.5	6.3	159	2.1	53.5	1.8	45.5	8.2	209
4	1 1/2″-8UN	2 3/8″	5.5	140.5	4.4	112	6.4	163.5	2.0	50.5	1.7	42.5	8.3	211
	1 5/8″-8UN	2 9/16″			4.5	114	6.6	166.5	2.1	53.5	1.8	45.5	8.5	217
	1 3/4″-8UN	2 3/4″			5.0	126	6.7	170	2.2	57	1.9	49	8.9	225
	1 7/8″-8UN	2 15/16″			4.8	123	6.8	173	2.4	60	2.0	52	9.1	230
	2″-8UN	3 1/8″			5.0	128	6.9	176	2.5	63	2.2	55	9.3	236
5	2″-8UN	3 1/8″	6.9	175.5	5.3	134	7.4	187	2.5	63	2.2	55	9.8	248
	2 1/4″-8UN	3 1/2″			5.8	148	7.6	193.5	2.7	69.5	2.4	61.5	10.3	261
	2 1/2″-8UN	3 7/8″			6.0	153	7.9	200	3.0	76	2.7	68	10.8	274
	2 3/4″-8UN	4 1/4″			6.5	165	8.1	206	3.2	82	2.9	74	11.3	286
6	2 3/4″-8UN	4 1/4″	8.6	219	6.8	172	8.5	216	3.2	82	2.9	74	11.6	294
	3″-8UN	4 5/8″			7.2	182	8.8	223	3.5	89	3.2	81	12.1	307
	3 1/4″-8UN	5″			7.5	190	9.0	229	3.7	95	3.4	87	12.6	320
	3 1/2″-8UN	5 3/8″			8.1	205	9.3	235	4.0	101	3.7	93	13.1	332
7	3 1/2″-8UN	5 3/8″	9.9	252	9.1	230	9.5	241	4.0	101	3.7	93	13.3	339
	3 3/4″-8UN	5 3/4″			9.3	235	9.7	247	4.2	107	3.9	99	13.9	352
	4″-8UN	6 1/8″			9.5	242	10.0	254	4.5	114	4.2	106	14.4	366
8	4″-8UN	6 1/8″	11.1	283	10.0	255	10.4	264	4.5	114	4.2	106	14.7	374
	4 1/4″-8UN	6 1/2″			10.2	260	10.6	270	4.7	120	4.4	112	15.2	387
	4 1/2″-8UN	6 7/8″			10.6	270	10.9	277	5.0	127	4.7	119	15.7	400

9.3 Pressure - Tension Force table

SLT 1 Bolt Tensioner: Pressure. Load. Tension Force Chart

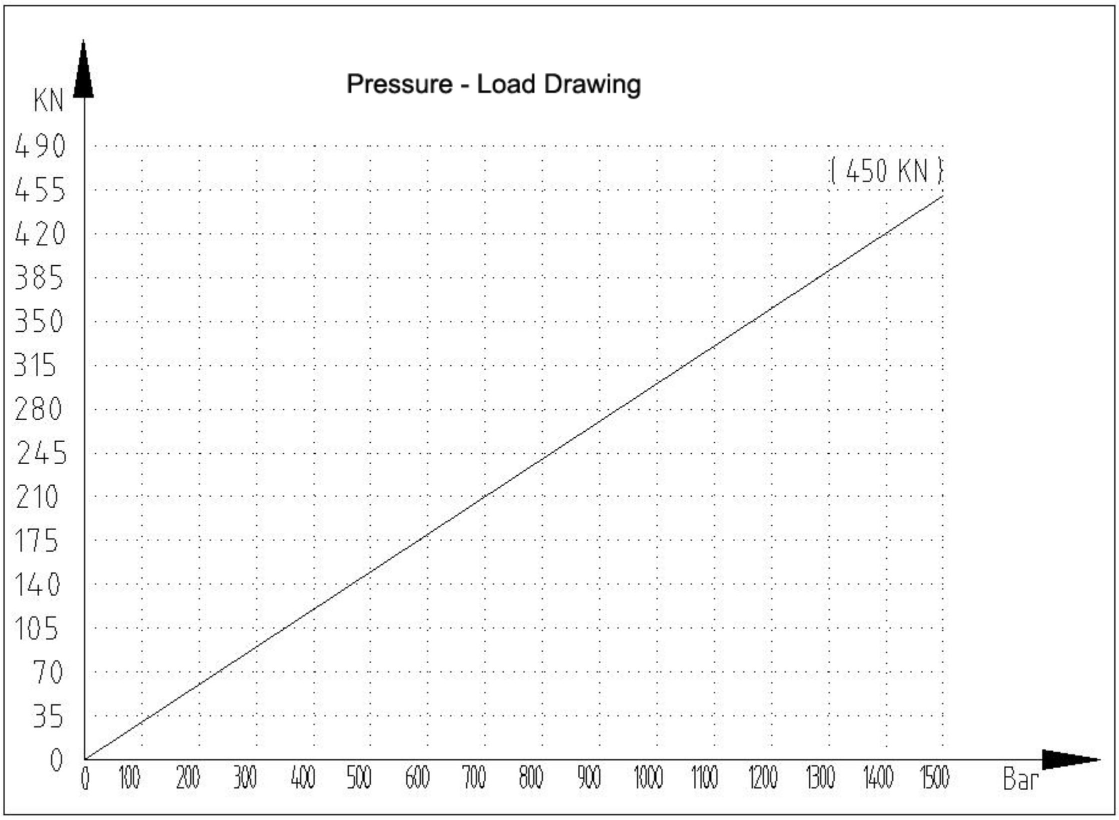
Operating Pressure (Mpa)	Load (KN)	Tension Force (t)	Operating Pressure (Mpa)	Load (KN)	Tension Force (t)	Operating Pressure (Mpa)	Load (KN)	Tension Force (t)
2	3.7	0.4	52	97.1	9.9	102	190.4	19.4
4	7.5	0.8	54	100.8	10.3	104	194.1	19.8
6	11.2	1.1	56	104.5	10.7	106	197.9	20.2
8	14.9	1.5	58	108.3	11.0	108	201.6	20.6
10	18.7	1.9	60	112.0	11.4	110	205.3	21.0
12	22.4	2.3	62	115.7	11.8	112	209.1	21.3
14	26.1	2.7	64	119.5	12.2	114	212.8	21.7
16	29.9	3.0	66	123.2	12.6	116	216.5	22.1
18	33.6	3.4	68	126.9	13.0	118	220.3	22.5
20	37.3	3.8	70	130.7	13.3	120	224.0	22.9
22	41.1	4.2	72	134.4	13.7	122	227.7	23.2
24	44.8	4.6	74	138.1	14.1	124	231.5	23.6
26	48.5	5.0	76	141.9	14.5	126	235.2	24.0
28	52.3	5.3	78	145.6	14.9	128	238.9	24.4
30	56.0	5.7	80	149.3	15.2	130	242.7	24.8
32	59.7	6.1	82	153.1	15.6	132	246.4	25.1
34	63.5	6.5	84	156.8	16.0	134	250.1	25.5
36	67.2	6.9	86	160.5	16.4	136	253.9	25.9
38	70.9	7.2	88	164.3	16.8	138	257.6	26.3
40	74.7	7.6	90	168.0	17.1	140	261.3	26.7
42	78.4	8.0	92	171.7	17.5	142	265.1	27.0
44	82.1	8.4	94	175.5	17.9	144	268.8	27.4
46	85.9	8.8	96	179.2	18.3	146	272.5	27.8
48	89.6	9.1	98	182.9	18.7	148	276.3	28.2
50	93.3	9.5	100	186.7	19.0	150	280.0	28.6
Formula:		Load(KN) =Operating Pressure(Mpa)/150x280				Tension Force(t)= Load (KN)/9.8		



SLT 2 Bolt Tensioner: Pressure. Load. Tension Force Chart

Operating Pressure	Load	Tension Force		Operating Pressure	Load	Tension Force		Operating Pressure	Load	Tension Force
(Mpa)	(KN)	(t)		(Mpa)	(KN)	(t)		(Mpa)	(KN)	(t)
2	6	0.6		52	156.0	15.9		102	306.0	31.2
4	12.0	1.2		54	162.0	16.5		104	312.0	31.8
6	18.0	1.8		56	168.0	17.1		106	318.0	32.4
8	24.0	2.4		58	174.0	17.8		108	324.0	33.1
10	30.0	3.1		60	180.0	18.4		110	330.0	33.7
12	36.0	3.7		62	186.0	19.0		112	336.0	34.3
14	42.0	4.3		64	192.0	19.6		114	342.0	34.9
16	48.0	4.9		66	198.0	20.2		116	348.0	35.5
18	54.0	5.5		68	204.0	20.8		118	354.0	36.1
20	60.0	6.1		70	210.0	21.4		120	360.0	36.7
22	66.0	6.7		72	216.0	22.0		122	366.0	37.3
24	72.0	7.3		74	222.0	22.7		124	372.0	38.0
26	78.0	8.0		76	228.0	23.3		126	378.0	38.6
28	84.0	8.6		78	234.0	23.9		128	384.0	39.2
30	90.0	9.2		80	240.0	24.5		130	390.0	39.8
32	96.0	9.8		82	246.0	25.1		132	396.0	40.4
34	102.0	10.4		84	252.0	25.7		134	402.0	41.0
36	108.0	11.0		86	258.0	26.3		136	408.0	41.6
38	114.0	11.6		88	264.0	26.9		138	414.0	42.2
40	120.0	12.2		90	270.0	27.6		140	420.0	42.9
42	126.0	12.9		92	276.0	28.2		142	426.0	43.5
44	132.0	13.5		94	282.0	28.8		144	432.0	44.1
46	138.0	14.1		96	288.0	29.4		146	438.0	44.7
48	144.0	14.7		98	294.0	30.0		148	444.0	45.3
50	150.0	15.3		100	300.0	30.6		150	450.0	45.9

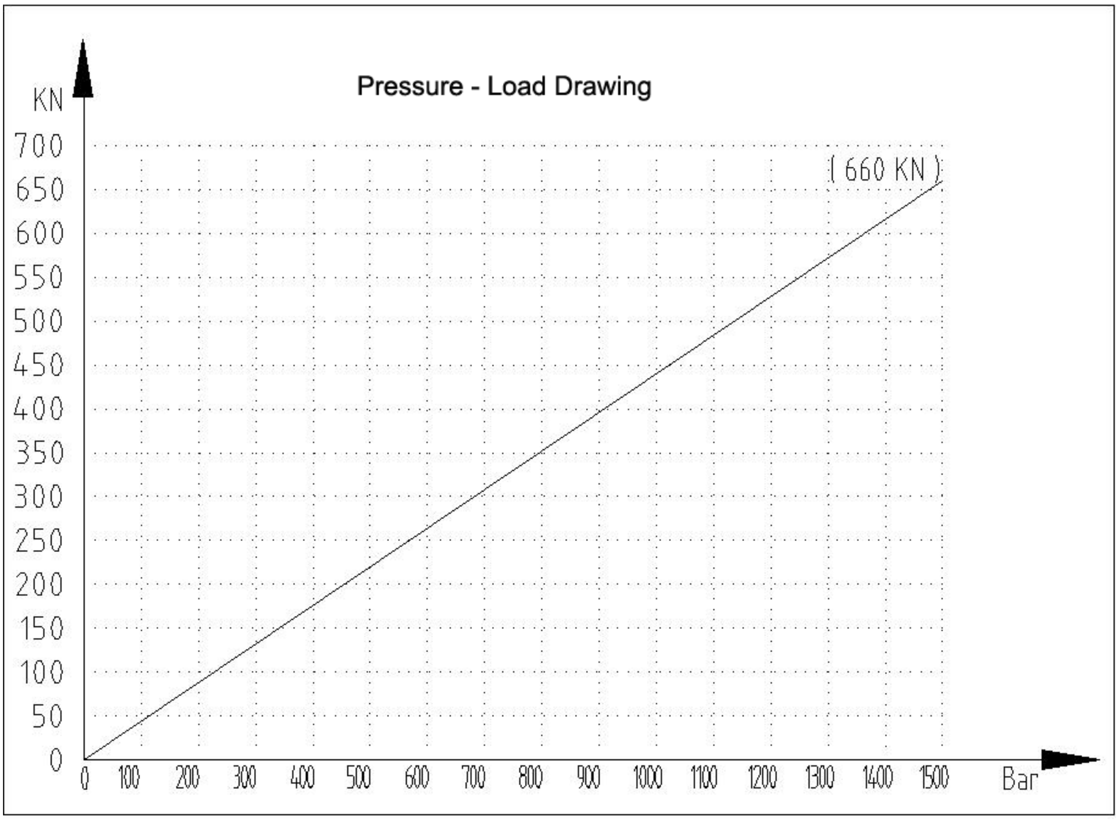
Formula: Load(KN) =Operating Pressure(Mpa)/150x450 Tension Force(t)= Load (KN)/9.8



SLT 3 Bolt Tensioner: Pressure. Load. Tension Force Chart

Operating Pressure	Load	Tension Force	Operating Pressure	Load	Tension Force	Operating Pressure	Load	Tension Force
(Mpa)	(KN)	(t)	(Mpa)	(KN)	(t)	(Mpa)	(KN)	(t)
2	8.8	0.9	52	228.8	23.3	102	448.8	45.8
4	17.6	1.8	54	237.6	24.2	104	457.6	46.7
6	26.4	2.7	56	246.4	25.1	106	466.4	47.6
8	35.2	3.6	58	255.2	26.0	108	475.2	48.5
10	44.0	4.5	60	264.0	26.9	110	484.0	49.4
12	52.8	5.4	62	272.8	27.8	112	492.8	50.3
14	61.6	6.3	64	281.6	28.7	114	501.6	51.2
16	70.4	7.2	66	290.4	29.6	116	510.4	52.1
18	79.2	8.1	68	299.2	30.5	118	519.2	53.0
20	88.0	9.0	70	308.0	31.4	120	528.0	53.9
22	96.8	9.9	72	316.8	32.3	122	536.8	54.8
24	105.6	10.8	74	325.6	33.2	124	545.6	55.7
26	114.4	11.7	76	334.4	34.1	126	554.4	56.6
28	123.2	12.6	78	343.2	35.0	128	563.2	57.5
30	132.0	13.5	80	352.0	35.9	130	572.0	58.4
32	140.8	14.4	82	360.8	36.8	132	580.8	59.3
34	149.6	15.3	84	369.6	37.7	134	589.6	60.2
36	158.4	16.2	86	378.4	38.6	136	598.4	61.1
38	167.2	17.1	88	387.2	39.5	138	607.2	62.0
40	176.0	18.0	90	396.0	40.4	140	616.0	62.9
42	184.8	18.9	92	404.8	41.3	142	624.8	63.8
44	193.6	19.8	94	413.6	42.2	144	633.6	64.7
46	202.4	20.7	96	422.4	43.1	146	642.4	65.6
48	211.2	21.6	98	431.2	44.0	148	651.2	66.4
50	220.0	22.4	100	440.0	44.9	150	660.0	67.3

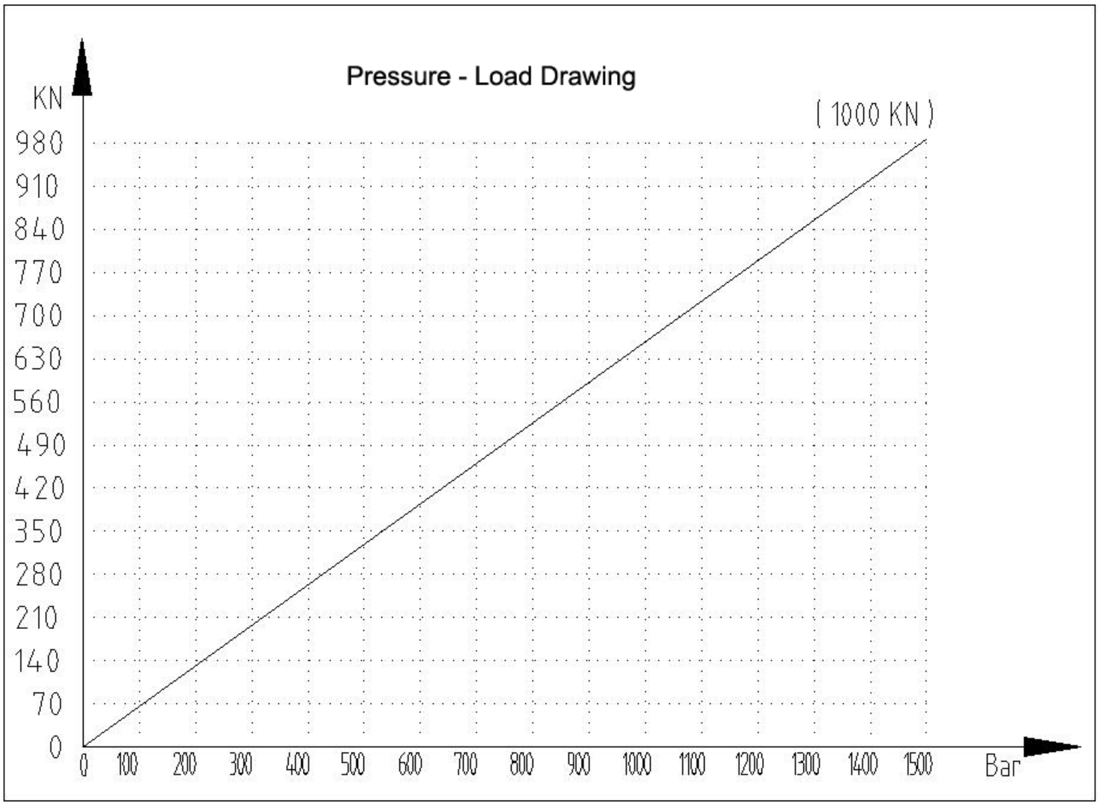
Formula: Load(KN) =Operating Pressure(Mpa)/150x660 Tension Force(t)= Load (KN)/9.8



SLT 4 Bolt Tensioner: Pressure. Load. Tension Force Chart

Operating Pressure (Mpa)	Load (KN)	Tension Force (t)	Operating Pressure (Mpa)	Load (KN)	Tension Force (t)	Operating Pressure (Mpa)	Load (KN)	Tension Force (t)
2	13.3	1.4	52	346.7	35.4	102	680.0	69.4
4	26.7	2.7	54	360.0	36.7	104	693.3	70.7
6	40.0	4.1	56	373.3	38.1	106	706.7	72.1
8	53.3	5.4	58	386.7	39.5	108	720.0	73.5
10	66.7	6.8	60	400.0	40.8	110	733.3	74.8
12	80.0	8.2	62	413.3	42.2	112	746.7	76.2
14	93.3	9.5	64	426.7	43.5	114	760.0	77.6
16	106.7	10.9	66	440.0	44.9	116	773.3	78.9
18	120.0	12.2	68	453.3	46.3	118	786.7	80.3
20	133.3	13.6	70	466.7	47.6	120	800.0	81.6
22	146.7	15.0	72	480.0	49.0	122	813.3	83.0
24	160.0	16.3	74	493.3	50.3	124	826.7	84.4
26	173.3	17.7	76	506.7	51.7	126	840.0	85.7
28	186.7	19.0	78	520.0	53.1	128	853.3	87.1
30	200.0	20.4	80	533.3	54.4	130	866.7	88.4
32	213.3	21.8	82	546.7	55.8	132	880.0	89.8
34	226.7	23.1	84	560.0	57.1	134	893.3	91.2
36	240.0	24.5	86	573.3	58.5	136	906.7	92.5
38	253.3	25.9	88	586.7	59.9	138	920.0	93.9
40	266.7	27.2	90	600.0	61.2	140	933.3	95.2
42	280.0	28.6	92	613.3	62.6	142	946.7	96.6
44	293.3	29.9	94	626.7	63.9	144	960.0	98.0
46	306.7	31.3	96	640.0	65.3	146	973.3	99.3
48	320.0	32.7	98	653.3	66.7	148	986.7	100.7
50	333.3	34.0	100	666.7	68.0	150	1000.0	102.0

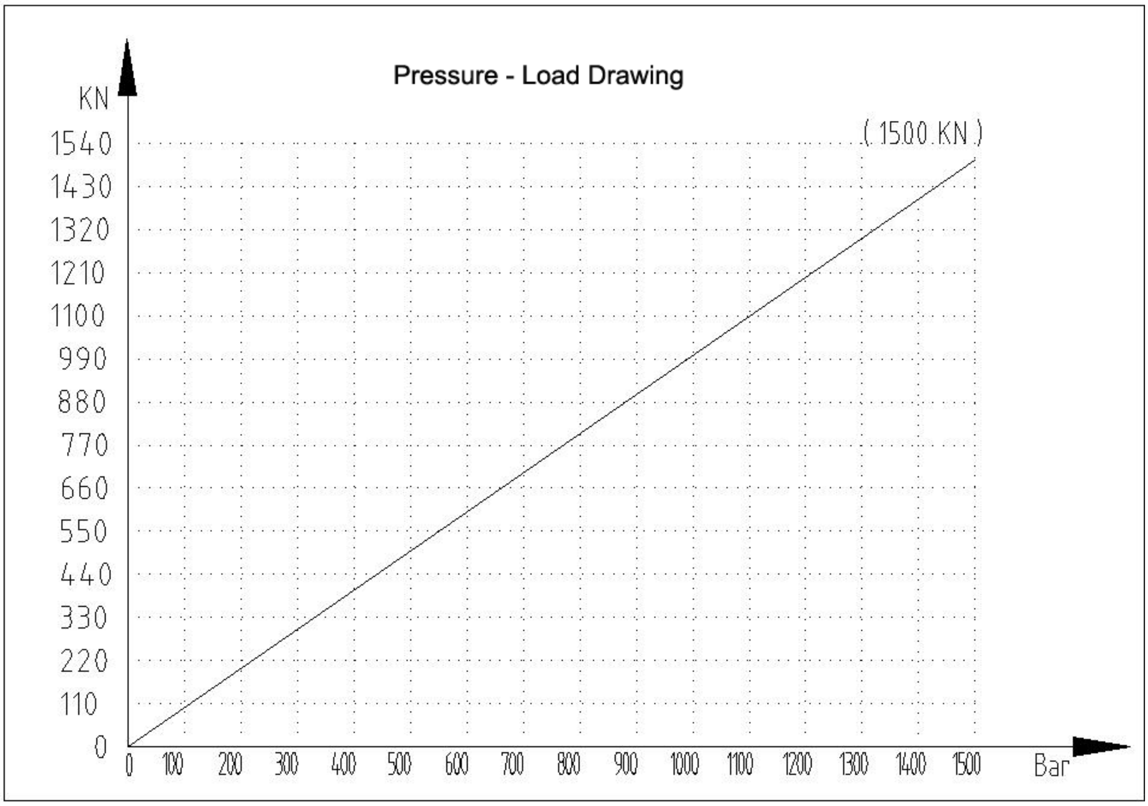
Formula: Load(KN) =Operating Pressure(Mpa)/150x1000 Tension Force(t)= Load (KN)/9.8



SLT 5 Bolt Tensioner: Pressure. Load. Tension Force Chart

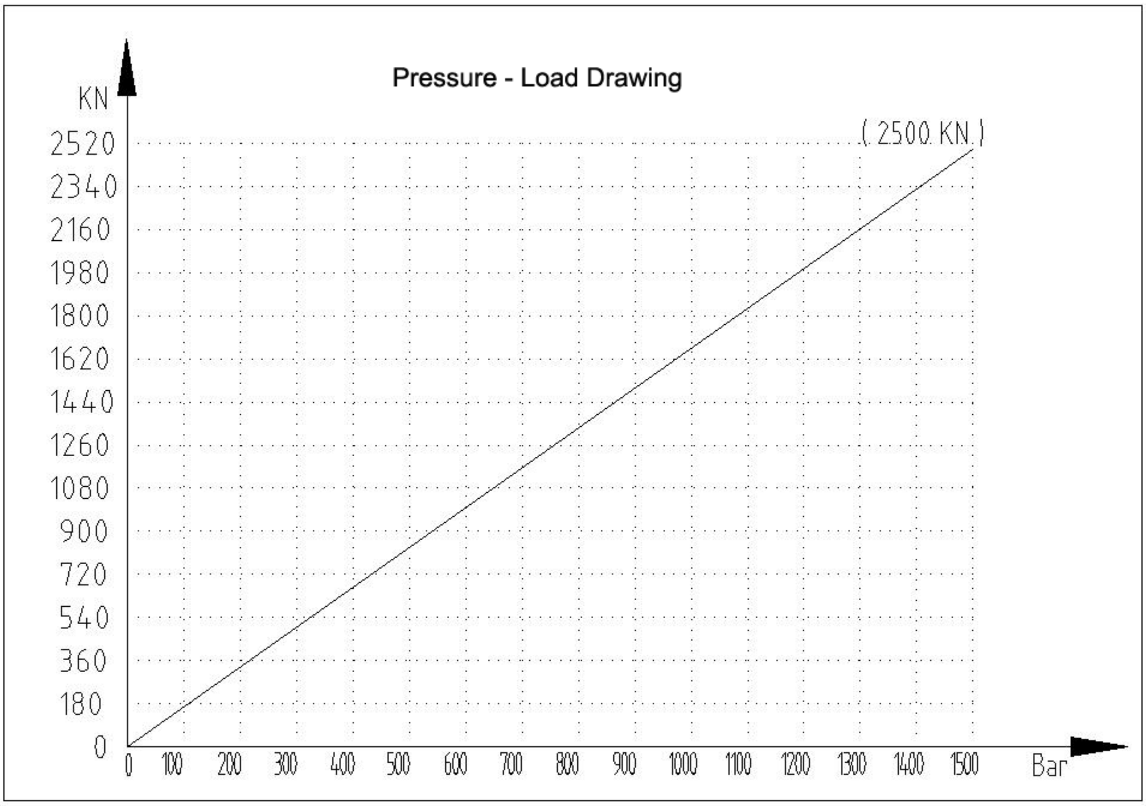
Operating Pressure	Load	Tension Force	Operating Pressure	Load	Tension Force	Operating Pressure	Load	Tension Force
(Mpa)	(KN)	(t)	(Mpa)	(KN)	(t)	(Mpa)	(KN)	(t)
2	20	2.0	52	520.0	53.1	102	1020.0	104.1
4	40.0	4.1	54	540.0	55.1	104	1040.0	106.1
6	60.0	6.1	56	560.0	57.1	106	1060.0	108.2
8	80.0	8.2	58	580.0	59.2	108	1080.0	110.2
10	100.0	10.2	60	600.0	61.2	110	1100.0	112.2
12	120.0	12.2	62	620.0	63.3	112	1120.0	114.3
14	140.0	14.3	64	640.0	65.3	114	1140.0	116.3
16	160.0	16.3	66	660.0	67.3	116	1160.0	118.4
18	180.0	18.4	68	680.0	69.4	118	1180.0	120.4
20	200.0	20.4	70	700.0	71.4	120	1200.0	122.4
22	220.0	22.4	72	720.0	73.5	122	1220.0	124.5
24	240.0	24.5	74	740.0	75.5	124	1240.0	126.5
26	260.0	26.5	76	760.0	77.6	126	1260.0	128.6
28	280.0	28.6	78	780.0	79.6	128	1280.0	130.6
30	300.0	30.6	80	800.0	81.6	130	1300.0	132.7
32	320.0	32.7	82	820.0	83.7	132	1320.0	134.7
34	340.0	34.7	84	840.0	85.7	134	1340.0	136.7
36	360.0	36.7	86	860.0	87.8	136	1360.0	138.8
38	380.0	38.8	88	880.0	89.8	138	1380.0	140.8
40	400.0	40.8	90	900.0	91.8	140	1400.0	142.9
42	420.0	42.9	92	920.0	93.9	142	1420.0	144.9
44	440.0	44.9	94	940.0	95.9	144	1440.0	146.9
46	460.0	46.9	96	960.0	98.0	146	1460.0	149.0
48	480.0	49.0	98	980.0	100.0	148	1480.0	151.0
50	500.0	51.0	100	1000.0	102.0	150	1500.0	153.1

Formula: Load(KN) =Operating Pressure(Mpa)/150x1500 | Tension Force(t)= Load (KN)/9.8



SLT 6 Bolt Tensioner: Pressure. Load. Tension Force Chart

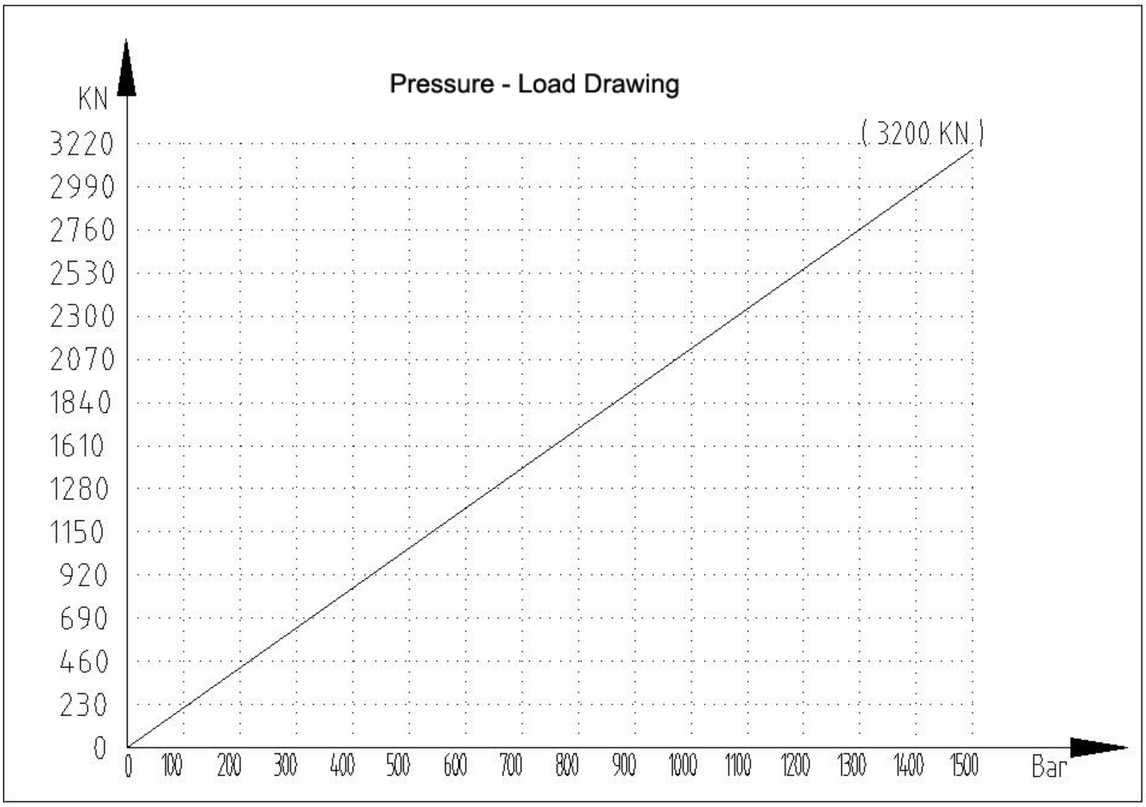
Operating Pressure (Mpa)	Load (KN)	Tension Force (t)	Operating Pressure (Mpa)	Load (KN)	Tension Force (t)	Operating Pressure (Mpa)	Load (KN)	Tension Force (t)
2	33.3	3.4	52	866.7	88.4	102	1700.0	173.5
4	66.7	6.8	54	900.0	91.8	104	1733.3	176.9
6	100.0	10.2	56	933.3	95.2	106	1766.7	180.3
8	133.3	13.6	58	966.7	98.6	108	1800.0	183.7
10	166.7	17.0	60	1000.0	102.0	110	1833.3	187.1
12	200.0	20.4	62	1033.3	105.4	112	1866.7	190.5
14	233.3	23.8	64	1066.7	108.8	114	1900.0	193.9
16	266.7	27.2	66	1100.0	112.2	116	1933.3	197.3
18	300.0	30.6	68	1133.3	115.6	118	1966.7	200.7
20	333.3	34.0	70	1166.7	119.0	120	2000.0	204.1
22	366.7	37.4	72	1200.0	122.4	122	2033.3	207.5
24	400.0	40.8	74	1233.3	125.9	124	2066.7	210.9
26	433.3	44.2	76	1266.7	129.3	126	2100.0	214.3
28	466.7	47.6	78	1300.0	132.7	128	2133.3	217.7
30	500.0	51.0	80	1333.3	136.1	130	2166.7	221.1
32	533.3	54.4	82	1366.7	139.5	132	2200.0	224.5
34	566.7	57.8	84	1400.0	142.9	134	2233.3	227.9
36	600.0	61.2	86	1433.3	146.3	136	2266.7	231.3
38	633.3	64.6	88	1466.7	149.7	138	2300.0	234.7
40	666.7	68.0	90	1500.0	153.1	140	2333.3	238.1
42	700.0	71.4	92	1533.3	156.5	142	2366.7	241.5
44	733.3	74.8	94	1566.7	159.9	144	2400.0	244.9
46	766.7	78.2	96	1600.0	163.3	146	2433.3	248.3
48	800.0	81.6	98	1633.3	166.7	148	2466.7	251.7
50	833.3	85.0	100	1666.7	170.1	150	2500.0	255.1
Formula:	Load(KN) =Operating Pressure(Mpa)/150x2500					Tension Force(t)= Load (KN)/9.8		



SLT 7 Bolt Tensioner: Pressure. Load. Tension Force Chart

Operating Pressure (Mpa)	Load (KN)	Tension Force (t)	Operating Pressure (Mpa)	Load (KN)	Tension Force (t)	Operating Pressure (Mpa)	Load (KN)	Tension Force (t)
2	42.7	4.4	52	1109.3	113.2	102	2176.0	222.0
4	85.3	8.7	54	1152.0	117.6	104	2218.7	226.4
6	128.0	13.1	56	1194.7	121.9	106	2261.3	230.7
8	170.7	17.4	58	1237.3	126.3	108	2304.0	235.1
10	213.3	21.8	60	1280.0	130.6	110	2346.7	239.5
12	256.0	26.1	62	1322.7	135.0	112	2389.3	243.8
14	298.7	30.5	64	1365.3	139.3	114	2432.0	248.2
16	341.3	34.8	66	1408.0	143.7	116	2474.7	252.5
18	384.0	39.2	68	1450.7	148.0	118	2517.3	256.9
20	426.7	43.5	70	1493.3	152.4	120	2560.0	261.2
22	469.3	47.9	72	1536.0	156.7	122	2602.7	265.6
24	512.0	52.2	74	1578.7	161.1	124	2645.3	269.9
26	554.7	56.6	76	1621.3	165.4	126	2688.0	274.3
28	597.3	61.0	78	1664.0	169.8	128	2730.7	278.6
30	640.0	65.3	80	1706.7	174.1	130	2773.3	283.0
32	682.7	69.7	82	1749.3	178.5	132	2816.0	287.3
34	725.3	74.0	84	1792.0	182.9	134	2858.7	291.7
36	768.0	78.4	86	1834.7	187.2	136	2901.3	296.1
38	810.7	82.7	88	1877.3	191.6	138	2944.0	300.4
40	853.3	87.1	90	1920.0	195.9	140	2986.7	304.8
42	896.0	91.4	92	1962.7	200.3	142	3029.3	309.1
44	938.7	95.8	94	2005.3	204.6	144	3072.0	313.5
46	981.3	100.1	96	2048.0	209.0	146	3114.7	317.8
48	1024.0	104.5	98	2090.7	213.3	148	3157.3	322.2
50	1066.7	108.8	100	2133.3	217.7	150	3200.0	326.5

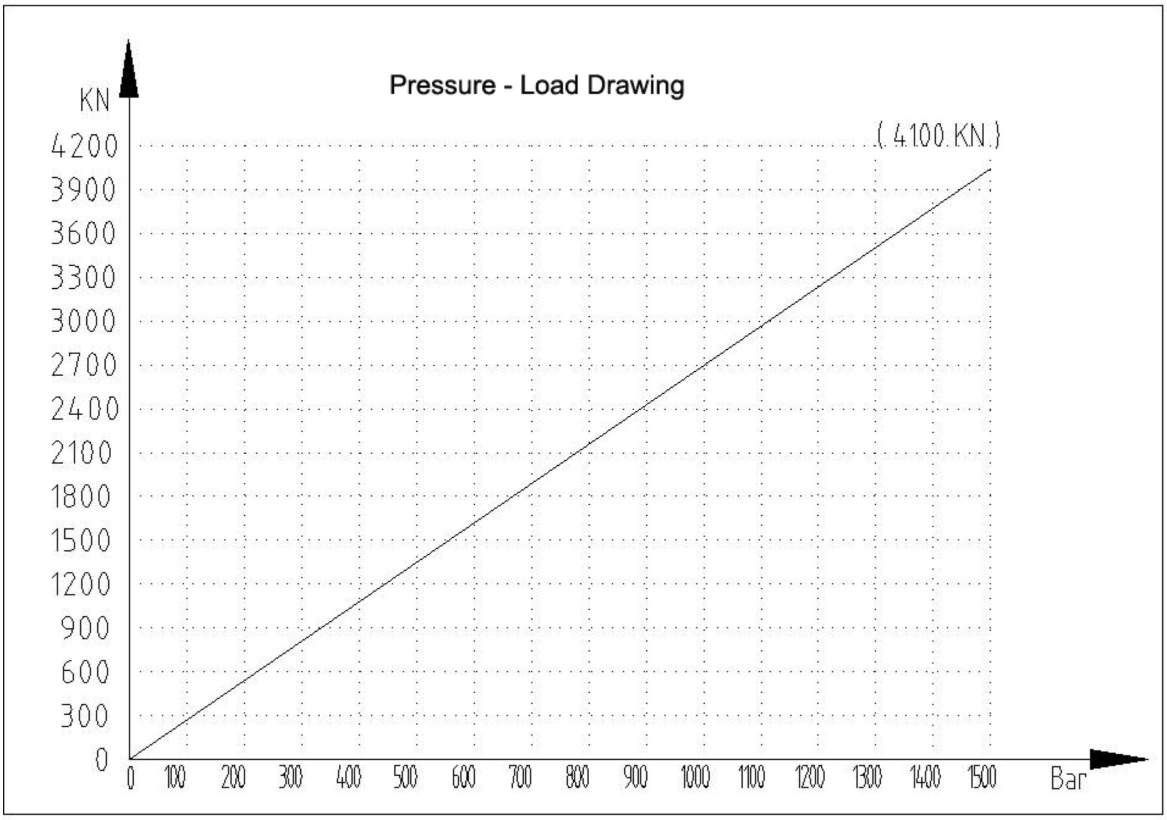
Formula: Load(KN) =Operating Pressure(Mpa)/150x3200 | Tension Force(t)= Load (KN)/9.8



SLT 8 Bolt Tensionner : Pressure. Load. Tension Force Chart

Operating Pressure	Load	Tension Force	Operating Pressure	Load	Tension Force	Operating Pressure	Load	Tension Force
(Mpa)	(KN)	(t)	(Mpa)	(KN)	(t)	(Mpa)	(KN)	(t)
2	54.7	5.6	52	1421.3	145.0	102	2788.0	284.5
4	109.3	11.2	54	1476.0	150.6	104	2842.7	290.1
6	164.0	16.7	56	1530.7	156.2	106	2897.3	295.6
8	218.7	22.3	58	1585.3	161.8	108	2952.0	301.2
10	273.3	27.9	60	1640.0	167.3	110	3006.7	306.8
12	328.0	33.5	62	1694.7	172.9	112	3061.3	312.4
14	382.7	39.0	64	1749.3	178.5	114	3116.0	318.0
16	437.3	44.6	66	1804.0	184.1	116	3170.7	323.5
18	492.0	50.2	68	1858.7	189.7	118	3225.3	329.1
20	546.7	55.8	70	1913.3	195.2	120	3280.0	334.7
22	601.3	61.4	72	1968.0	200.8	122	3334.7	340.3
24	656.0	66.9	74	2022.7	206.4	124	3389.3	345.9
26	710.7	72.5	76	2077.3	212.0	126	3444.0	351.4
28	765.3	78.1	78	2132.0	217.6	128	3498.7	357.0
30	820.0	83.7	80	2186.7	223.1	130	3553.3	362.6
32	874.7	89.3	82	2241.3	228.7	132	3608.0	368.2
34	929.3	94.8	84	2296.0	234.3	134	3662.7	373.7
36	984.0	100.4	86	2350.7	239.9	136	3717.3	379.3
38	1038.7	106.0	88	2405.3	245.4	138	3772.0	384.9
40	1093.3	111.6	90	2460.0	251.0	140	3826.7	390.5
42	1148.0	117.1	92	2514.7	256.6	142	3881.3	396.1
44	1202.7	122.7	94	2569.3	262.2	144	3936.0	401.6
46	1257.3	128.3	96	2624.0	267.8	146	3990.7	407.2
48	1312.0	133.9	98	2678.7	273.3	148	4045.3	412.8
50	1366.7	139.5	100	2733.3	278.9	150	4100.0	418.4

Formula: Load(KN) =Operating Pressure(Mpa)/150x4100 | Tension Force(t)= Load (KN)/9.8



Appendix

A (Normative appendix)

8.8 Class of bolts allow axial force, pre-tightening force and pre-tightening torque

A 1 : Refer to this appendix to easily determine the pre-tightening force of the performance class 8.8 bolt and the corresponding pre-tightening torque. This appendix does not apply to bolts and expansion bolts with fine thread.

A 2 : The allowable axial force FA listed in Table A1 calculated the fatigue strength of the bolted joint.

A 3 : The conditions for using this appendix are:

a. The thread conforms to GB 196;

b. The axial force is transmitted along the center of the bolt;

c. Ambient temperature -50-300 ℃

d. Lubricate the bearing surfaces of the threads, bolt heads and nuts during pre-tightening.

A 4 : For fasteners with soft materials (such as A3, etc.), in order to avoid excessive loss of pre-tightening force, special washers for high-strength bolts should be installed under the bolt head or nut.

A 5 : If the other performance grade bolts, pre-tightening force and pre-tightening torque can be used, the following factors can be converted:

Class 5. 6 : Fv(5.6) = 0.47 × Fv(8.8)
MA(5.6) = 0.47 × MA(8.8)

Class 10. 9 : Fv(10.9) = 1.41 × Fv(8.8)
MA(10.9) = 1.41 × MA(8.8)

Class 12. 9 : Fv(12 9)=1.69 × Fv(8 8)
MA(12.96) = 1.69 × MA(8.8)

Table A 1

Remark: HC Tightening thickness

Threads Size		Stress area Ac(mm)	Allowable axial force KN					Pretighten Force (Fv)	Pretighten Torque (Ma)
			Hc/d						
Diameter d(mm)	Pitch size(mm)		2	3	4	6	>6	KN	N.m
M6	1	20.1	3	3	3	3	3	6.8	7
M8	1.25	36.6	7	7	7	7	7	12.5	18
M10	1.5	58	11	11	11	11	11	19.9	35
M12	1.75	84.3	16	17	17	16	16	29.1	61
M14	2	115.4	20	23	24	23	23	39.8	96
M16	2	157	27	32	33	32	32	55.3	149
M18	2.5	192	31	36	38	37	36	67.5	205
M20	2.5	245	36	42	49	51	50	86.3	290
M24	3	353	52	61	71	73	72	124.4	500
M30	3.5	561	85	100	115	118	116	199.1	1004
M36	4	817	124	146	168	173	170	291.4	1749
M42	4.5	1121	175	206	237	239	235	401.2	2806
M48	5	1473	231	273	314	315	310	528.6	4236
M56	5.5	2030	299	354	408	440	432	732.2	6791
M64	6	2676	384	454	583	586	574	958.9	10147
M72	6	3463	486	575	663	768	752	1265	14689
M80	6	4344	608	716	907	934	920	1563	19626
M90	6	5590	782	922	1168	1202	1185	2012	28584
M100	6	7000	980	1155	1463	1505	1484	2520	39960
M110	6	8560	1198	1412	1789	1840	1815	3081	53939
M120	6	10300	1442	1700	2152	2215	2183	3708	71034
M125	6	11200	1568	1848	2340	2408	2374	4032	80567
M140	6	14200	1988	2343	2968	3053	3010	5112	114800
M160	6	18700	2618	3085	3098	4020	3964	6732	173400

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