



Instruction Manual

Hydraulic Bolt Tensioners

Model – DBS Series



Maximum Operating Pressure – 1,500 bar



This is a safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid injury or death

1.0 Product Information

DURAPAC – Hydraulic Bolt Tensioners are engineered to meet Industrial Standards for Performance and Safety. The DBS Series will ensure uniformed gasket compression. Compression is essential for the integrity of critical bolted flange connections. Unlike a torque wrench, the DBS Series Bolt Tensioners are capable of tightening more than one bolt at a time and can apply a consistent torque via direct axial stretching to any given number of bolts simultaneously. These tensioners have been designed to fit all standard ANSI & API flanges with quick release bridge incorporating hexagon socket for a fast change over. There are 9 load cells with a bolt size range from M20 to M115 or 3/4" to 4-1/2" 8UN and they are light and easily handled. All load cells are electroless nickel plated for extra protection and are easily maintained.

Special skill, knowledge and training may be required for a specific task and the product may not be suitable for all jobs. The user must ultimately make the decision regarding suitability of the product for any given task and assume the responsibility of safety for all in the work area. Contact a Durapac representative if you are unsure of your bolt tensioner's suitability for a particular application.

2.0 Receiving Instructions

It is recommended prior to use that an inspection be done by qualified personnel and that any missing or damaged parts, decals, warning/safety labels or signs are replaced with Durapac authorised replacement parts only. Any bolt tensioner that is damaged in any way, is worn, leaking or operates abnormally should be removed from service immediately until such time as repairs can be made. Any bolt tensioner that has been or suspected to have been subject to a shock load should be removed from service immediately until inspected by a Durapac authorised service centre. Owners and operators of this equipment should be aware that the use and subsequent repair of this equipment may require specialised training and knowledge.

3.0 Safety

Save these instructions. For your safety, read and understand the information contained within. The owner and operator should understand this product and safe operating procedures before attempting to use this product. Instructions and safety information should be conveyed in the operator's native language before use of this product is authorised. Make certain that the operator thoroughly understands the inherent dangers associated with the use and misuse of the product. If any doubt exists as to the safe and proper use of this product as outlined in this factory authorised manual, remove from service immediately.



DANGER:

- **Never** stand in-line with the bolt axis while tensioning or de-tensioning is in progress. If the bolt should fail, serious personal injury or death could result if loose or broken parts become projectiles. All personnel must always be aware of this potential hazard
- To avoid personal injury, keep hands and feet away from work area during operation
- **Do NOT** handle pressurised hoses. Escaping oil under pressure can penetrate the skin causing serious injury. If oil is injected under the skin, see a doctor immediately

**WARNING:**

- All hydraulic hoses and fittings used in the circuit must be rated at or above the maximum working pressure of the tensioner - 1500 bar [21,750 psi]. Install pressure gauges in the system to monitor operating pressure. It is your window to what is happening in the system
- Always wear appropriate personal protective equipment (PPE) when operating hydraulic equipment. The operator must take precaution against injury due to failure of the tool or work piece(s)
- **Do NOT** hold or stand directly in line with any hydraulic connections while pressurising
- **Do NOT** attempt to disconnect hydraulic connections under pressure. Release all line pressure before disconnecting hoses
- All personnel must be clear before pressurising or depressurising the system

**IMPORTANT:**

- If at any stage, the safety related decals become hard to read, these must be replaced
- Minimum age of the operator must be 18 years. The operator must have read and understood all instructions, safety issues, cautions and warnings before starting to operate the equipment. The operator is responsible for this activity towards other persons
- **Do NOT** lift hydraulic equipment by the hoses or couplers. Use the carrying handle or other means of safe transport
- Hydraulic equipment must only be serviced by a qualified hydraulic technician. For repair service, contact the Durapac authorised service centre in your area. To protect your warranty, use only high-quality hydraulic oil

**CAUTION:**

- **KEEP HYDRAULIC EQUIPMENT AWAY FROM FLAMES AND HEAT.** Hydraulic fluid can ignite and burn. Excessive heat will soften packings and seals, resulting in fluid leaks. Heat also weakens hose materials and packings. For optimum performance do not expose equipment to temperatures of 65°C (150°F) or higher. Protect all equipment from weld spatter
- No alteration should be made to this device

3.1 Bolt Tensioners

- **Ensure** no personnel are in-line with the bolt axis when system is under pressure, failure to do so could result in death or personal injury
- **Only** allow personnel to be near pressurised hydraulic tensioners when it is necessary and only when the pressure is steady. Keep an eye on the pump pressure gauge
- **Do NOT** exceed the rated capacity of the bolt tensioner or any equipment in the system. Burst hazard exists if connection pressure exceeds rated pressure
- **Do NOT** exceed the maximum extension for the equipment
- **Do** use a gauge or other load measuring instrument to verify load

- **Do NOT** leave the pressurised system unattended
- **Do NOT** operate the system with bent or damaged couplers or damaged threads
- **Use only** Durapac approved accessories and components
- **Do NOT** overload equipment. Overloading can cause equipment failure and possible personal injury

3.2 Hydraulic Hoses & Fluid Transmission Lines

- Avoid short runs of straight-line tubing. Straight line runs do not provide for expansion and contraction due to pressure and/or temperature changes
- Reduce stress in tube lines. Long tubing runs should be supported by brackets or clips. Before operating the pump, connections should be tightened securely and leak-free. Over tightening can cause premature thread failure or high-pressure fittings to burst
- Should a hydraulic hose ever rupture, burst or need to be disconnected, immediately shut off the pump and release all pressure. Never attempt to grasp a leaking pressurised hose with your hands. The force of escaping hydraulic fluid can inflict injury
- **Do NOT** subject the hose to potential hazard such as fire, sharp objects, extreme heat or cold or heavy impact
- **Do NOT** allow the hose to kink, twist, curl, crush, cut or bend so tightly that the fluid flow within the hose is blocked or reduced. Periodically inspect the hose for wear
- **Ensure** that the bend radius is not less than the manufacturer's specified minimum bend radius for the type of hose being used
- Hose material and coupler seals must be compatible with the hydraulic fluid used. Hoses also must not come in contact with corrosive materials such as battery acid, creosote-impregnated objects and wet paint. Never paint a coupler or hose

FAILURE TO HEED THESE WARNINGS MAY RESULT IN PERSONAL INJURY AS WELL AS PROPERTY DAMAGE.

4.0 Installation

- 4.1 Ensure that all personnel involved in this procedure are trained and understand bolt tightening procedures and the tensioning equipment being used. Ensure that all personnel read and understand the safety information contained within this document.
- 4.2 Familiarise yourself with the specifications and illustrations in this owner’s manual. Know your bolt tensioner, its limitations and how it operates before attempting to use. Refer to the specification chart below or if in doubt, contact a Durapac representative.

Model	DBS-0	DBS-1	DBS-2	DBS-3	DBS-4	DBS-5	DBS-6	DBS-7	DBS-8
Metric Bolt Dimensions (Ø * pitch)	M20x2.5	M24x3	M24x3	M33x3.5	M39x4	M52x5.5	M72x6	M90x6	M105x6
	M22x2.5	M27x3	M27x3	M36x4	M42x4.5	M56x5.5	M76x6	M96x6	M110x6
			M30x3.5	M39x4	M45x5	M60x5.5	M80x6	M100x6	M115x6
			M33x3.5	M42x4.5	M48x5	M64x6	M85x6		
			M36x4			M68x6	M90x6		
Imperial Threads (Ø in-)	3/4" 10UN	1" 8UN	1" 8UN	1 1/4" 8UN	1 1/2" 8UN	2" 8UN	2 3/4" 8UN	3 1/2" 8UN	4" 8UN
	7/8" 9UN	1 1/8" 8UN	1 1/8" 8UN	1 3/8" 8UN	1 5/8" 8UN	2 1/4" 8UN	3" 8UN	3 3/4" 8UN	4-1/4" 8UN
			1 1/4" 8UN	1 1/2" 8UN	1 3/4" 8UN	2 1/2" 8UN	3 1/4" 8UN	4" 8UN	4-1/2" 8UN
			1 3/8" 8UN	1 5/8" 8UN	1 7/8" 8UN	2 3/4" 8UN	3 1/2" 8UN		
					2" 8UN				
Maximum Pressure (bar)	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Effective Area (mm²)	1,067	1,867	3,003	4,400	6,669	10,002	16,670	21,336	27,336
Maximum Force (kN)	160	280	450	660	1,000	1,500	2,500	3,200	4,100
Maximum Piston Stroke (mm)	8	10	10	10	10	10	10	10	10
Retraction Type	Manual	Spring	Spring	Spring	Spring	Spring	Spring	Spring	Spring
Load Cell Weight (kg)	1.5	2.1	3.3	4.1	7.2	9.3	14.4	19.2	28.0
Approx. Thread Adaptor Kit (kg)	1.0	1.6	2.2	3.4	4.3	9.2	18.6	27.8	35.5
Approx. Total Weight (kg)	2.5	3.7	5.5	7.5	11.5	18.5	33.0	47.0	63.5

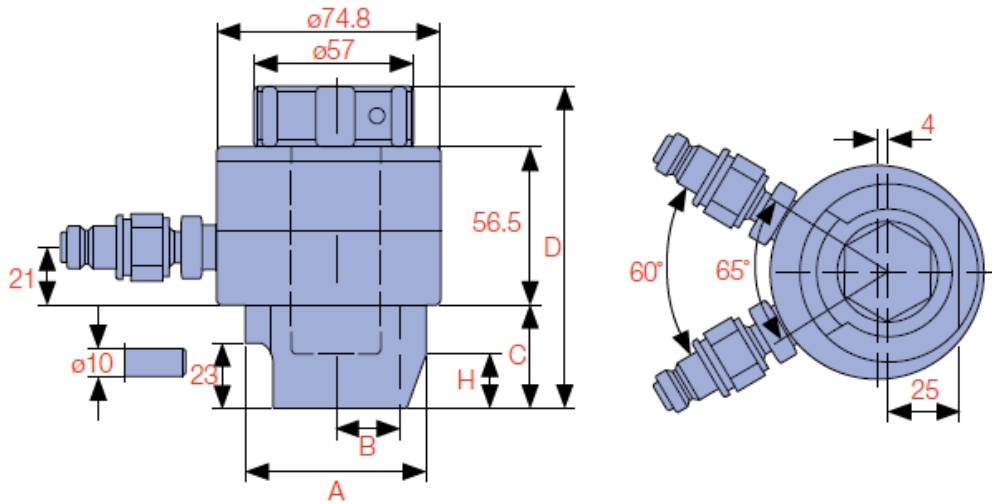


Figure 1 – DBS-0 Dimensions

Model	Thread Specification	Nut Size	A (mm)	B (mm)	C (mm)	D (mm)	G (mm)	H (mm)	L (mm)	M (mm)	V (mm)	W (mm)	X (mm)	Y ø (mm)	Z ø (mm)	Tommy Bar ø (mm)
DBS-0	M20x2.5	30	63.0	45.0	36.0	113.5	70.0	19.0	-	25.0	-	-	-	-	-	10.0
	M22x2.5	32	63.0	45.0	36.0	113.5	70.0	21.0	-	25.0	-	-	-	-	-	10.0
	3/4" 10UN	1-1/4"	63.0	45.0	36.0	113.5	70.0	22.0	-	25.0	-	-	-	-	-	10.0
	7/8" 9UN	1-7/16"	63.0	45.0	36.0	113.5	70.0	25.0	-	25.0	-	-	-	-	-	10.0

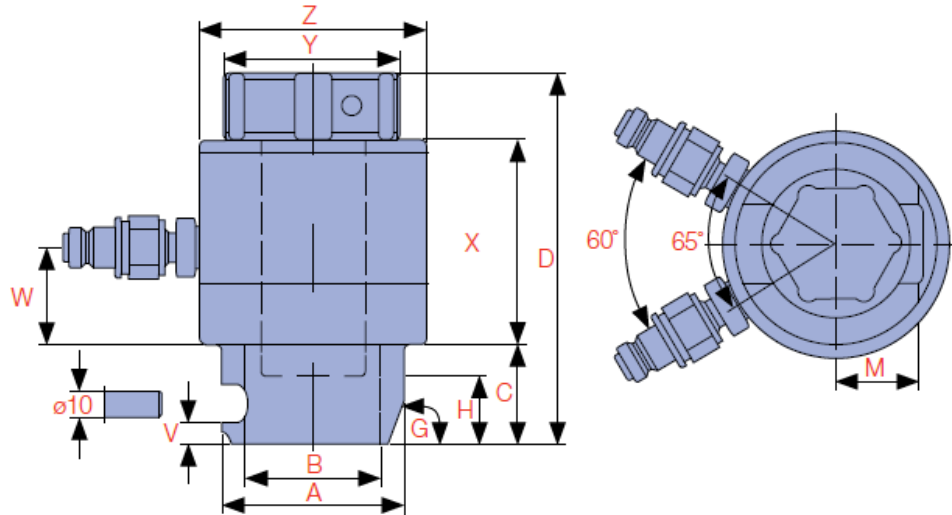


Figure 2 – DBS-1 ~ DBS-4 Dimensions

Model	Thread Specification	Nut Size	A (mm)	B (mm)	C (mm)	D (mm)	G (mm)	H (mm)	L (mm)	M (mm)	V (mm)	W (mm)	X (mm)	Y \varnothing (mm)	Z \varnothing (mm)	Tommy Bar \varnothing (mm)
DBS-1	M24x3	36	68.0	50.5	38.0	141.5	70.0	23.0	-	31.0	8.8	37.5	78.5	67.0	85.0	10.0
	M27x3	41	68.0	50.5	38.0	141.5	70.0	26.0	-	31.0	8.8	37.5	78.5	67.0	85.0	10.0
	1" 8UN	1-5/8"	68.0	50.5	38.0	141.5	70.0	30.0	-	31.0	8.8	37.5	78.5	67.0	85.0	10.0
	1-1/8" 8UN	1-13/16"	76.0	50.5	41.0	144.5	70.0	33.0	-	31.0	8.8	37.5	78.5	67.0	85.0	10.0
DBS-2	M24x3	36	75.0	50.5	38.0	141.5	60.0	23.0	-	30.0	11.8	37.5	78.5	82.0	103.0	10.0
	M27x3	41	75.0	50.5	38.0	141.5	60.0	26.0	-	30.0	11.8	37.5	78.5	82.0	103.0	10.0
	M30x3.5	46	80.0	50.5	41.0	144.5	60.0	28.0	-	30.0	11.8	37.5	78.5	82.0	103.0	10.0
	M33x3.5	50	84.0	62.0	44.0	147.5	70.0	30.0	-	35.0	11.8	37.5	78.5	82.0	103.0	10.0
	M36x4	55	88.5	67.0	47.0	150.5	63.0	33.0	-	35.0	11.8	37.5	78.5	82.0	103.0	10.0
	1" 8UN	1-5/8"	75.0	50.5	38.0	141.5	60.0	30.0	-	30.0	11.8	37.5	78.5	82.0	103.0	10.0
	1-1/8" 8UN	1-13/16"	80.0	55.5	41.0	144.5	60.0	33.0	-	30.0	11.8	37.5	78.5	82.0	103.0	10.0
DBS-3	1-1/4" 8UN	2"	84.0	62.0	44.0	147.5	70.0	36.0	-	35.0	11.8	37.5	78.5	82.0	103.0	10.0
	1-3/8" 8UN	2-3/16"	88.5	67.5	47.0	150.5	63.0	39.0	-	38.0	11.8	37.5	78.5	82.0	103.0	10.0
	M33x3.5	50	92.0	62.0	44.0	149.5	65.0	30.0	-	35.0	12.75	37.5	78.5	96.0	118.0	10.0
	M36x4	55	96.0	67.5	47.0	152.5	63.0	33.0	-	38.0	12.75	37.5	78.5	96.0	118.0	10.0
	M39x4	60	105.0	73.5	50.5	156.0	68.0	35.5	-	42.0	12.75	37.5	78.5	96.0	118.0	10.0
	M42x4.5	65	104.5	79.0	53.5	159.0	59.0	38.0	-	41.0	12.75	37.5	78.5	96.0	118.0	10.0
	1-1/4" 8UN	2"	92.0	62.0	44.0	149.5	65.0	36.0	-	35.0	12.75	37.5	78.5	96.0	118.0	10.0
DBS-4	1-3/8" 8UN	2-3/16"	96.0	67.5	47.0	152.5	63.0	39.0	-	38.0	12.75	37.5	78.5	96.0	118.0	10.0
	1-1/2" 8UN	2-3/8"	105.0	73.5	50.5	156.0	68.0	42.5	-	42.0	12.75	37.5	78.5	96.0	118.0	10.0
	1-5/8" 8UN	2-9/16"	104.5	79.0	53.5	159.0	59.0	45.5	-	41.0	12.75	37.5	78.5	96.0	118.0	10.0
	M39x4	60	112.0	73.0	50.5	163.5	64.0	35.5	-	42.0	12.75	40.0	81.0	110.0	140.5	10.0
	M42x4.5	65	114.0	79.0	53.5	166.5	67.0	38.0	-	45.0	12.75	40.0	81.0	110.0	140.5	10.0
	M45x4.5	70	126.0	84.5	57.0	170.0	69.0	40.0	-	52.0	12.75	40.0	81.0	110.0	140.5	10.0
	M48x5	75	123.0	89.5	60.0	173.0	68.0	42.0	-	51.0	12.75	40.0	81.0	110.0	140.5	10.0
DBS-4	1-1/2" 8UN	2-3/8"	112.0	73.0	50.5	163.5	64.0	42.5	-	42.0	12.75	40.0	81.0	110.0	140.5	10.0
	1-5/8" 8UN	2-9/16"	114.0	79.0	53.5	166.5	67.0	45.5	-	45.0	12.75	40.0	81.0	110.0	140.5	10.0
	1-3/4" 8UN	2-3/4"	126.0	84.5	57.0	170.0	69.0	49.0	-	52.0	12.75	40.0	81.0	110.0	140.5	10.0
	1-7/8" 8UN	2-15/16"	123.0	89.5	60.0	173.0	68.0	52.0	-	51.0	12.75	40.0	81.0	110.0	140.5	10.0
	2" 8UN	3-1/8"	128.0	95.5	63.0	176.0	61.0	55.0	-	52.0	12.75	40.0	81.0	110.0	140.5	10.0

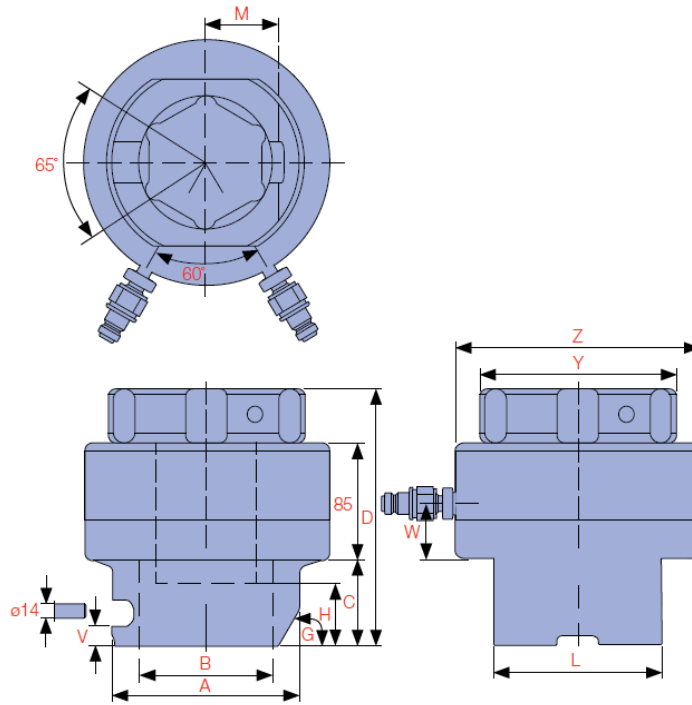


Figure 3 – DBS-5 ~ DBS-8 Dimensions

Model	Thread Specification	Nut Size	A (mm)	B (mm)	C (mm)	D (mm)	G	H (mm)	L (mm)	M (mm)	V (mm)	W (mm)	X (mm)	Y ø (mm)	Z ø (mm)	Tommy Bar ø (mm)
DBS-5	M52x6	80	134.0	95.5	63.0	187.0	61.0	46.0	120.0	52.0	14.5	41.0	85.0	140.0	175.5	14.0
	M56x5.5	85	148.0	106.5	69.5	193.5	60.0	49.0	138.0	58.0	14.5	41.0	85.0	140.0	175.5	14.0
	M60x5.5	90	148.0	106.5	69.5	193.5	60.0	52.0	138.0	58.0	14.5	41.0	85.0	140.0	175.5	14.0
	M64x6	95	153.0	118.0	76.0	200.0	60.0	55.0	138.0	63.0	14.5	41.0	85.0	140.0	175.5	14.0
	M68x6	100	153.0	118.0	76.0	200.0	60.0	58.0	138.0	63.0	14.5	41.0	85.0	140.0	175.5	14.0
	M70x6	102	153.0	118.0	76.0	200.0	60.0	58.0	138.0	63.0	14.5	41.0	85.0	140.0	175.5	14.0
	2" 8UN	3-1/8"	134.0	95.5	63.0	187.0	61.0	55.0	120.0	52.0	14.5	41.0	85.0	140.0	175.5	14.0
	2-1/4" 8UN	3-1/2"	148.0	106.5	69.5	193.5	60.0	61.5	138.0	58.0	14.5	41.0	85.0	140.0	175.5	14.0
	2-1/2" 8UN	3-7/8"	153.0	118.0	76.0	200.0	60.0	68.0	138.0	63.0	14.5	41.0	85.0	140.0	175.5	14.0
DBS-6	2-3/4" 8UN	4-1/4"	165.0	129.5	82.0	206.0	60.0	74.0	156.0	70.0	14.5	41.0	85.0	140.0	175.5	14.0
	M72x6	105	172.0	129.5	82.0	216.0	60.0	62.0	157.0	72.0	14.5	41.0	85.0	180.0	219.0	14.0
	M76x6	110	182.0	140.0	89.0	223.0	64.0	65.0	157.0	80.0	14.5	41.0	85.0	180.0	219.0	14.0
	M80x6	115	182.0	140.0	89.0	223.0	64.0	68.0	157.0	80.0	14.5	41.0	85.0	180.0	219.0	14.0
	M85x6	121	190.0	151.0	95.0	229.0	60.0	72.0	157.0	84.0	14.5	41.0	85.0	180.0	219.0	14.0
	M90x6	130	205.0	163.0	101.0	235.0	60.0	76.0	157.0	88.0	14.5	41.0	85.0	180.0	219.0	14.0
	2-3/4" 8UN	4-1/4"	172.0	129.5	82.0	216.0	60.0	74.0	157.0	72.0	14.5	41.0	85.0	180.0	219.0	14.0
	3" 8UN	4-5/8"	182.0	140.0	89.0	223.0	64.0	81.0	157.0	80.0	14.5	41.0	85.0	180.0	219.0	14.0
	3-1/4" 8UN	5"	190.0	151.0	95.0	229.0	60.0	87.0	157.0	84.0	14.5	41.0	85.0	180.0	219.0	14.0
DBS-7	3-1/2" 8UN	5-3/8"	205.0	163.0	101.0	235.0	60.0	93.0	157.0	88.0	14.5	41.0	85.0	180.0	219.0	14.0
	M90x6	130	230.0	163.0	101.0	241.0	60.0	76.0	200.0	88.0	45.0	41.0	85.0	200.0	252.0	14.0
	M95x6	135	230.0	163.0	101.0	241.0	60.0	80.0	200.0	88.0	45.0	41.0	85.0	200.0	252.0	14.0
	M100x6	146	235.0	174.0	107.0	247.0	60.0	84.0	200.0	94.0	45.0	41.0	85.0	200.0	252.0	14.0
	3-1/2" 8UN	5-3/8"	230.0	163.0	101.0	241.0	60.0	93.0	200.0	88.0	45.0	41.0	85.0	200.0	252.0	14.0
	3-3/4" 8UN	5-3/4"	235.0	174.0	107.0	247.0	60.0	99.0	200.0	94.0	45.0	41.0	85.0	200.0	252.0	14.0
DBS-8	4" 8UN	6-1/8"	242.0	185.0	114.0	254.0	60.0	106.0	210.0	114.0	45.0	41.0	85.0	200.0	252.0	14.0
	M105x6	150	255.0	185.0	114.0	264.0	60.0	88.0	210.0	114.0	45.0	41.0	85.0	218.0	283.0	14.0
	M110x6	155	255.0	185.0	114.0	264.0	60.0	92.0	210.0	114.0	45.0	41.0	85.0	218.0	283.0	14.0
	M115x6	165	260.0	197.0	120.0	270.0	60.0	96.0	224.0	114.0	45.0	41.0	85.0	218.0	283.0	14.0
	4" 8UN	6-1/8"	255.0	185.0	114.0	264.0	60.0	106.0	210.0	114.0	45.0	41.0	85.0	218.0	283.0	14.0
	4-1/4" 8UN	6-1/2"	260.0	197.0	120.0	270.0	60.0	112.0	224.0	114.0	45.0	41.0	85.0	218.0	283.0	14.0
4-1/2" 8UN	6-7/8"	270.0	207.0	127.0	277.0	60.0	119.0	232.0	117.0	45.0	41.0	85.0	218.0	283.0	14.0	

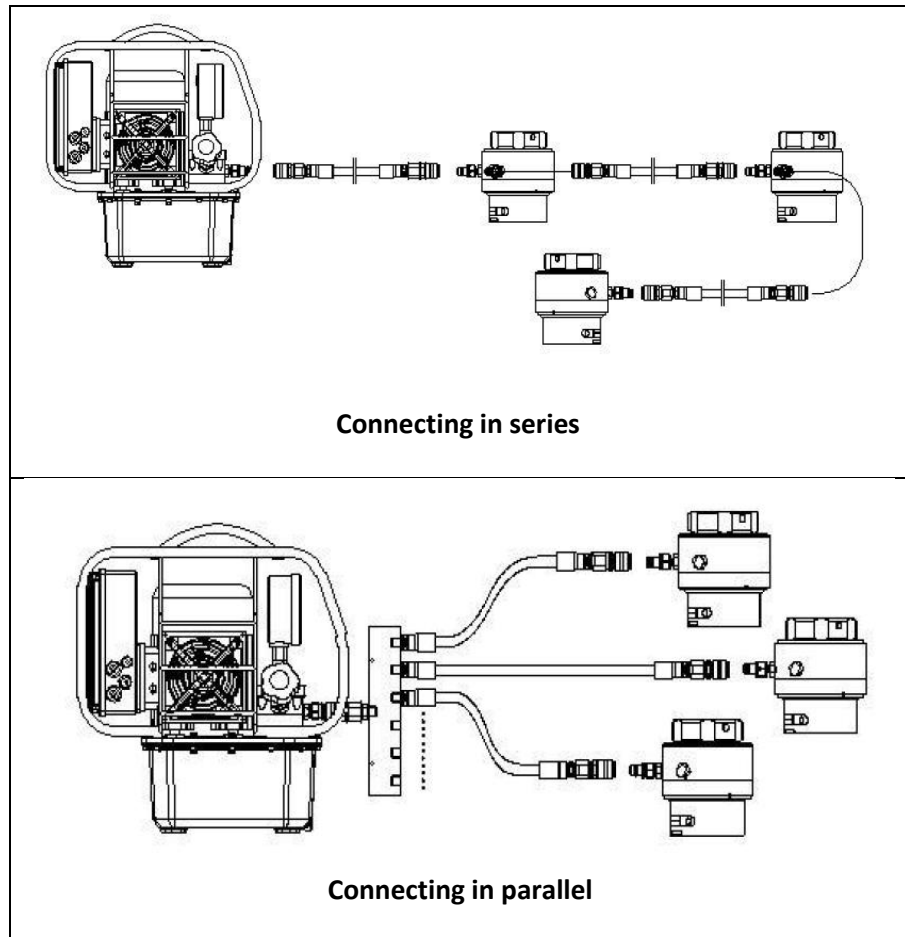
4.3 Check all system fittings and connections to be sure they are tight and leak free.

4.4 Check oil level in reservoir before operating pump.

5.0 Operation

5.1 Main Structure and Working Principle

5.1.1 The hydraulic tension device is mainly composed of a high-pressure oil pump and a tensioner. They are connected by a high-pressure hose to become a complete device. A set of tension device can be combined with a single or multiple tensioners from a high-pressure pump, as shown below:



Figures 4 & 5 – Tension Device Connection

5.1.2 The DBS bolt tensioner consists of a tension adaptor, a tension cylinder, a bridge and a tommy bar.

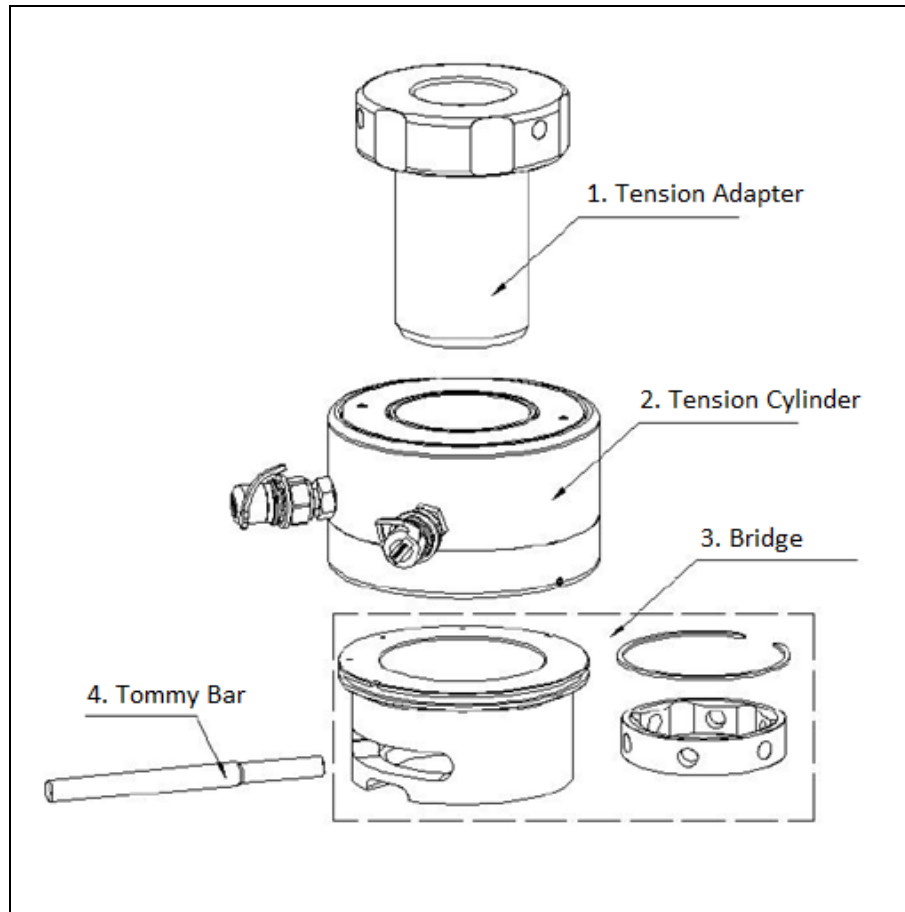


Figure 6 – Tension Device Components

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

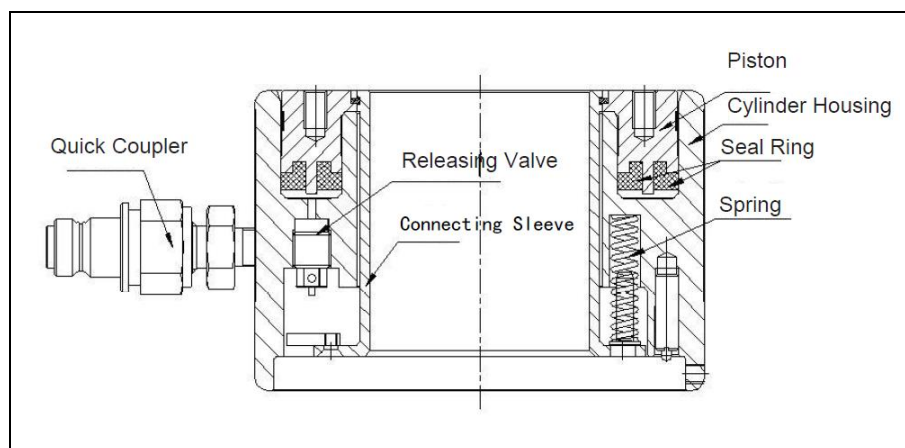
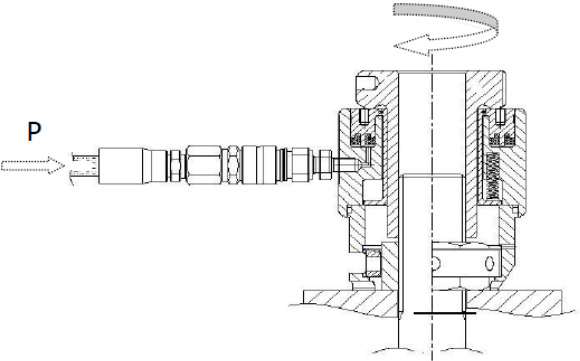
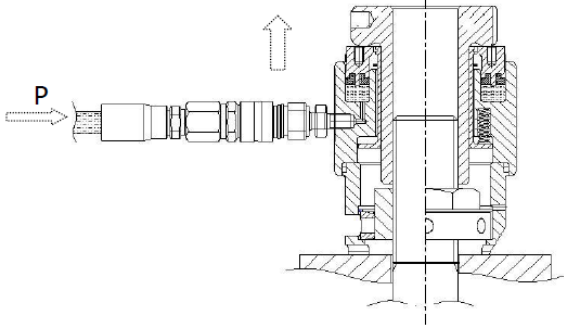
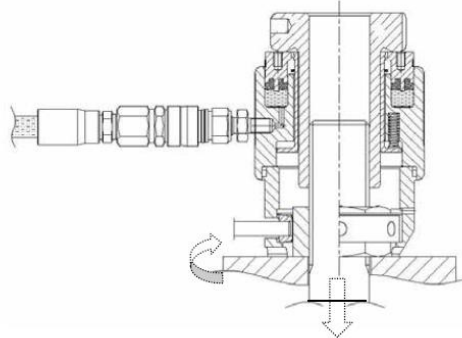
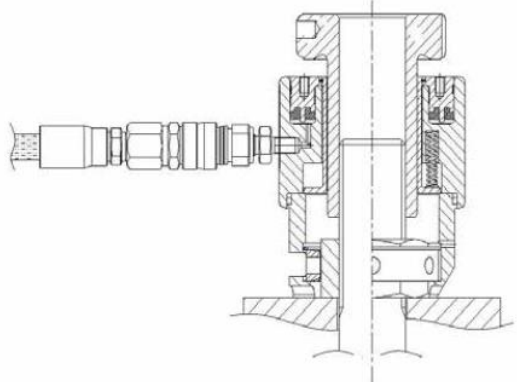


Figure 7 – Tension Cylinder Components

5.2 Work Process

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

<p>1. Filling Oil</p> <p>Screw the DBS bolt tensioner into the bolt, the pump will start to work. At low pressure, the large flow is filled with oil, the piston in the cylinder housing will start to rise. Push the tension adaptor upwards and start to tension the bolt.</p>	
<p>2. Rise Pressure</p> <p>The pump continues to pressurise and the axial tension force will lengthen the bolt. The nut will rise due to the elongation of the bolt and will be separated from the flange contact surface. When the required pre-tighten force is reached, the pressurisation is stopped.</p>	
<p>3. Operation</p> <p>After the required pre-tightening force is reached, the Tommy bar can be used to turn the sleeve through the window of the bridge, to lock or loosen the nut.</p>	
<p>4. Release Load</p> <p>After the work is completed, the Releasing valve is opened, and the oil comes back to the tank.</p>	

Figures 8 - 11 – Work Process

5.3 Operating Preparation



IMPORTANT:

- No pressure should be applied to the bolt tensioner until the tensioner is correctly placed on the bolt
 - Avoid severe bending and entanglement of hydraulic hose during operation
 - Using bent or entangled tubing will create excessive back pressure
 - Severe bending and entanglement will damage the inside of the hose
 - Prevent heavy objects from falling or pressing onto the hose
 - Severe impact may cause damage to the internal metal wire of the hose. The damaged hose may be broken during pressurisation; it is not possible to haul and lift other hydraulic components with a hydraulic hose
- 5.3.1 Carefully read the operating manuals of the High-Pressure Pump and the Bolt Tensioner before starting work. Pay special attention to the prevention points that may cause property damage and accidents.
- 5.3.2 Carefully check the appearance of the pump, hose and bolt tensioner for damage caused by improper transportation or storage. Contact your local Durapac authorised service centre for repairs.
- 5.3.3 Check the bolt tensioner operating data (pre-tighten force operation 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.
- 5.3.4 Do not exceed the maximum pressure/pre-tighten force marked on the Durapac DBS Tensioner.
- 5.3.5 Check the effective thread length of bolt protrusion above the nut to ensure enough thread length (see Fig. 12). Normally, the thread length of protrusion above the nut is (minimum) $1 \times M$ (M 100, H = min. 100 mm)

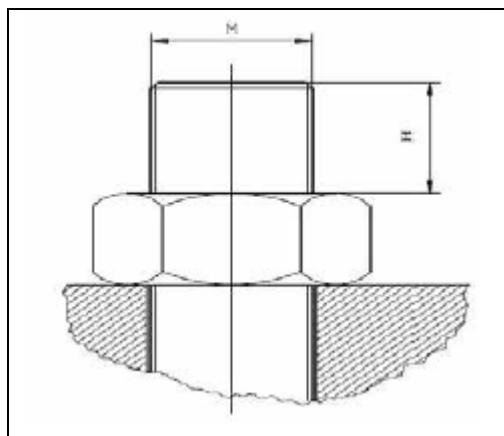


Figure 12 – Bolt Protrusion above Nut

- 5.3.6 Check the angle α of the bolt on the support surface and correct if necessary (see Fig. 13).

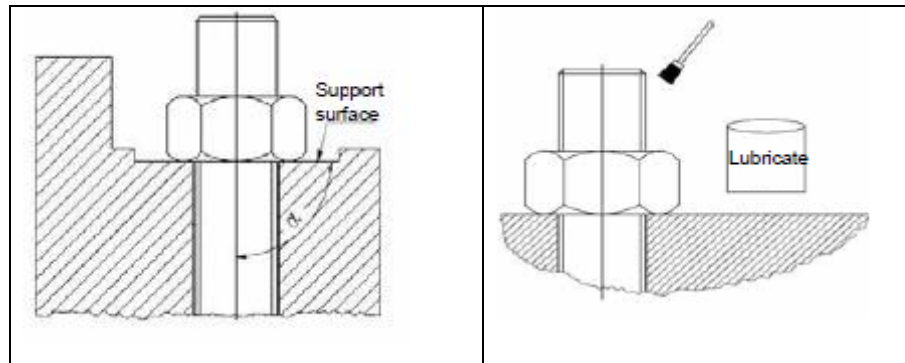
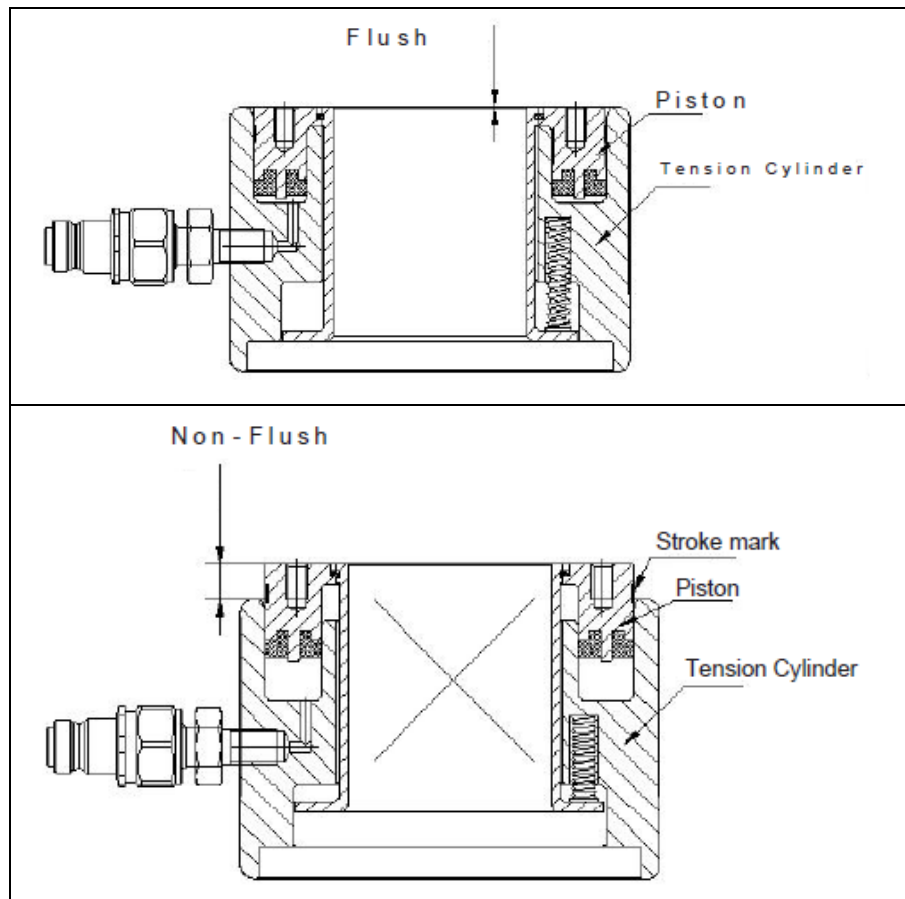


Figure 13 – Angle Accuracy

Figure 14 – Lubrication

- 5.3.7 Before using the DBS Bolt Tensioner, apply grease to the bolt threads. The grease type is user-defined (see Fig. 14).
- 5.3.8 Before using the DBS Bolt Tensioner, make sure the piston is at its end position, eg. the top of the piston is flush with the end face of the tension cylinder (see Fig. 15 & 16).



Figures 15 & 16 – Flush/Non-Flush Examples

- 5.3.9 During operation, pay attention to the distance between the tensioner and the pump. Always observe the position of the pressure gauge and the bolt.
- 5.3.10 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.

5.4 Connection and Operation



IMPORTANT:

- Ensure that the bolt material can take the initial load to be applied. DBS Series tensioners are powerful tools that are capable of yielding or breaking studs/bolts if bolt material properties are not sufficient to support the load being applied
- Ensure that all calculations (bolt load, hydraulic pressure, etc.) have been made prior to starting the tensioning process and that they have been reviewed and approved by a qualified engineer
- Check that the hydraulic harness is fully connected. There should be no loose ends and every male nipple should be connected to a corresponding female connector
- Check that each female connector is securely locked in position on the corresponding nipple by physically pulling the connection
- **ONLY** an unused female coupler or a blanking plug is to be used at the end of end of the tensioner circuit. A female coupler can remain disconnected (open ended) while under pressure. However, as a precaution, it is strongly recommended that a blanking plug be installed in the coupler before beginning pressurisation
- **Ensure** no personnel are in-line with the bolt axis when system is under pressure, failure to do so could result in death or personal injury
- Use only Durapac approved accessories and components
- 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
- To avoid personal injury, the maximum working pressure must not exceed 1,500 bar
- No-load pressure test is prohibited
- Over-stroke is prohibited, the maximum stroke must not exceed 10 mm
- The piston of the tensioner should be flush with the cylinder

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

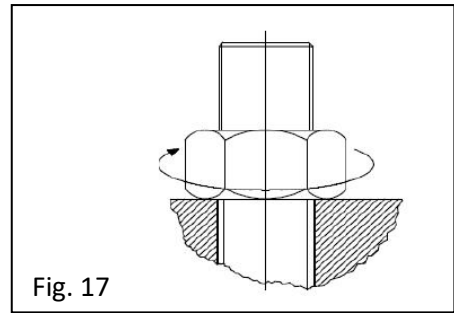


Fig. 17

5.4.2 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.

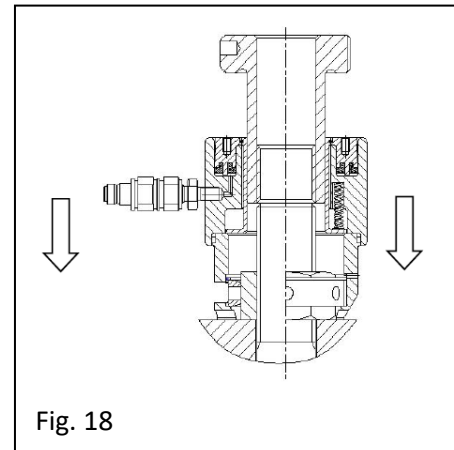


Fig. 18

5.4.3 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.

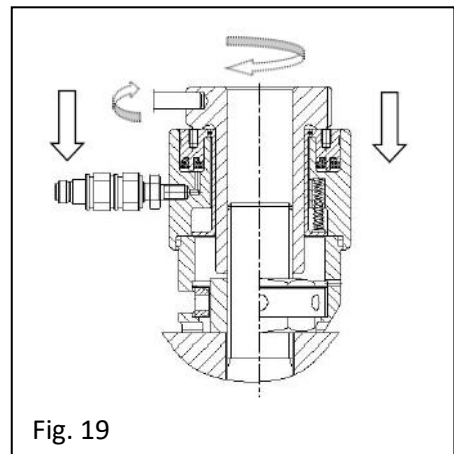


Fig. 19

5.4.4 Use a Tommy bar or manual reverse rotation of the tension nut. For bolts up to 1,000 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 1,000 mm or more, the clearance can be appropriately increased.

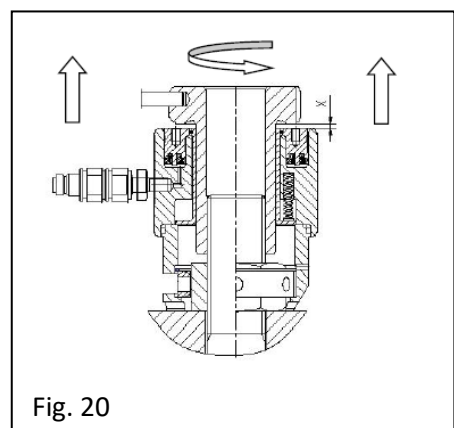


Fig. 20

5.4.5 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.

5.4.6 After the hydraulic connection, the tensioner piston is pressed and the axial tensile force will lengthen the bolt. The nut will rise 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 pressurisation is stopped.

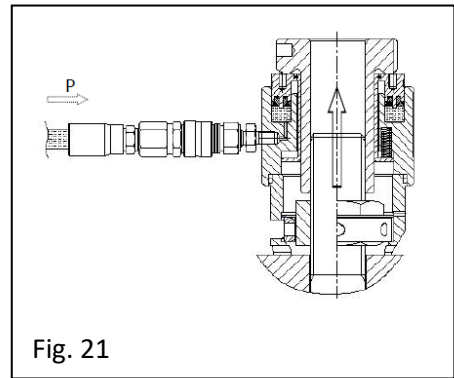


Fig. 21

5.4.7 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.

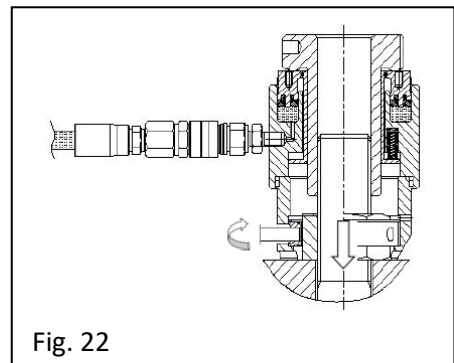


Fig. 22

5.4.8 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.

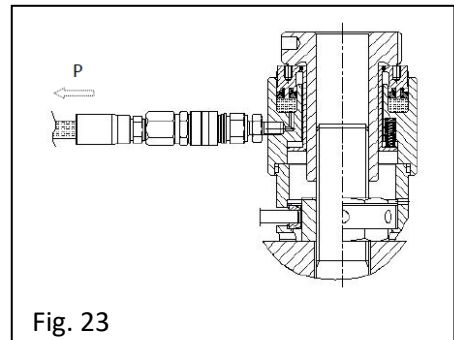


Fig. 23

5.4.9 When the piston returns to the initial position, remove the hose. Remove the bolt tensioner by Tommy bar or manually loosen the tension adaptor.

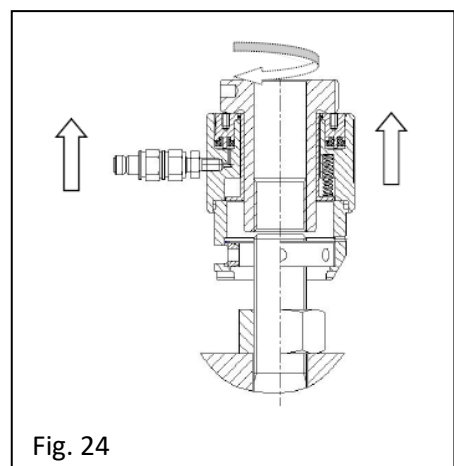


Fig. 24

Notes -:

- The bolt tensioner cannot exceed its maximum stroke. For the stroke parameters, see the DBS-Series Data Sheet shown in Section 8. 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

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

6.0 Maintenance



IMPORTANT:

- Check oil level regularly
- Use only good quality hydraulic fluid. **Do NOT** use brake fluid, transmission fluid, turbine oil, motor oil, alcohol, glycerine etc. Use of anything other than good quality hydraulic oil will void warranty and damage the pump, hose, and application. We recommend Durapac Hydraulic Oil or equivalent
- Equipment must only be serviced by a qualified hydraulic technician. For repair service, contact your local Durapac authorised service centre
- Damage to hydraulic hoses may not be detected during visual inspections. For this reason, Durapac recommends that hydraulic hoses be replaced on a regular basis
- Tighten connections as needed. Use non-hardening pipe thread compound when servicing connections
- When used, the bolt tensioner 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

6.1.1 **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.

6.1.2 Store the tool in a dry place after use.

7.0 Troubleshooting

Problem	Cause	Solution
Pump loses pressure	Leaking system components	<ul style="list-style-type: none"> • Repair or replace as necessary
Pump not delivering fluid	Low fluid level in reservoir	<ul style="list-style-type: none"> • Check fluid level
	Worn seats	<ul style="list-style-type: none"> • Repair seats • Replace pump body
Pump does not reach rated capacity	Low fluid level in reservoir	<ul style="list-style-type: none"> • Check fluid level
	Leaking system components	<ul style="list-style-type: none"> • Repair or replace as necessary
	Fluid leaking past inlet or outlet checks	<ul style="list-style-type: none"> • Repair inlet or outlet checks • Replace high pressure piston seal
Tensioner will not extend	Loose couplers	<ul style="list-style-type: none"> • Tighten couplers
	Low fluid level in pump reservoir	<ul style="list-style-type: none"> • Fill and bleed the system
	Leaking tensioner seals	<ul style="list-style-type: none"> • Replace worn seals • Look for excessive contamination or wear
Tensioner extends only partially	Low fluid level in pump reservoir	<ul style="list-style-type: none"> • Fill and bleed the system
	Load above capacity of system	<ul style="list-style-type: none"> • Use correct equipment
Tensioner extends slower than normal	Loose couplers	<ul style="list-style-type: none"> • Tighten couplers
	Restricted hydraulic line or fitting	<ul style="list-style-type: none"> • Clean and replace if damaged
	Pump not operating correctly	<ul style="list-style-type: none"> • Check pump’s operating instructions • Repair or replace as necessary
	Low fluid level in pump reservoir	<ul style="list-style-type: none"> • Fill and bleed the system
Tensioner does not hold pressure	Leaky connection	<ul style="list-style-type: none"> • Clean, reseal with thread sealant, and tighten connection
	Leaking tensioner seals	<ul style="list-style-type: none"> • Replace worn seals • Look for excessive contamination or wear • Replace contaminated fluid
	Pump or valve not operating correctly	<ul style="list-style-type: none"> • Repair or replace as necessary
Tensioner will not retract	Closed pump release valve	<ul style="list-style-type: none"> • Open pump release valve
	Loose couplers	<ul style="list-style-type: none"> • Tighten couplers
	Blocked hydraulic lines	<ul style="list-style-type: none"> • Clean and flush lines
	Pump reservoir too full	<ul style="list-style-type: none"> • Drain fluid to correct level

8.0 Data Sheet for DBS-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 Pressure – Tension Force table in the following Section (Section 9.0) or calculated by the following formula.

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

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

P = Bolt tensioner operating pressure (bar)
 F = Pre-tighten force (kN)
 A = Effective area of bolt tensioner (mm)

See Main Parameter table below

8.1 Main Parameter table

Model Number	Bolt Size		Effective Area mm ²	Max. Operating Pressure bar	Max. Force kN	Stroke mm	Weight kg
	Metric	Imperial					
DBS-0	M20x2.5	3/4"-10UN	1,067	1,500	160	8	2.5
	M22x2.5	7/8"-9UN					
DBS-1	M24x3	1"-8UN	1,867	1,500	280	10	3.7
	M27x3	1-1/8"-8UN					
DBS-2	M24x3	1"-8UN	3,003	1,500	450	10	5.5
	M27x3						
	M30x3.5	1-1/8"-8UN					
	M33x3.5	1-1/4"-8UN					
DBS-3	M36x4	1-3/8"-8UN	4,400	1,500	660	10	7.5
	M33x3.5	1-1/4"-8UN					
	M36x4	1-3/8"-8UN					
	M39x4	1-1/2"-8UN					
DBS-4	M42x4.5	1-5/8"-8UN	6,669	1,500	1,000	10	11.5
	M39x4	1-1/2"-8UN					
	M45x5	1-3/4"-8UN					
	M48x5	1-7/8"-8UN					
DBS-5		2"-8UN	10,002	1,500	1,500	10	18.5
	M52x5.5						
	M56x5.5	2-1/4"-8UN					
	M60x5.5						
	M64x6	2-1/2"-8UN					
	M68x6						
DBS-6		2-3/4"-8UN	16,670	1,500	2,500	10	33.0
	M72x6						
	M76x6	3"-8UN					
	M80x6						
	M85x6	3-1/4"-8UN					
	M90x6	3-1/2"-8UN					

8.2 Main Parameter table (cont.)

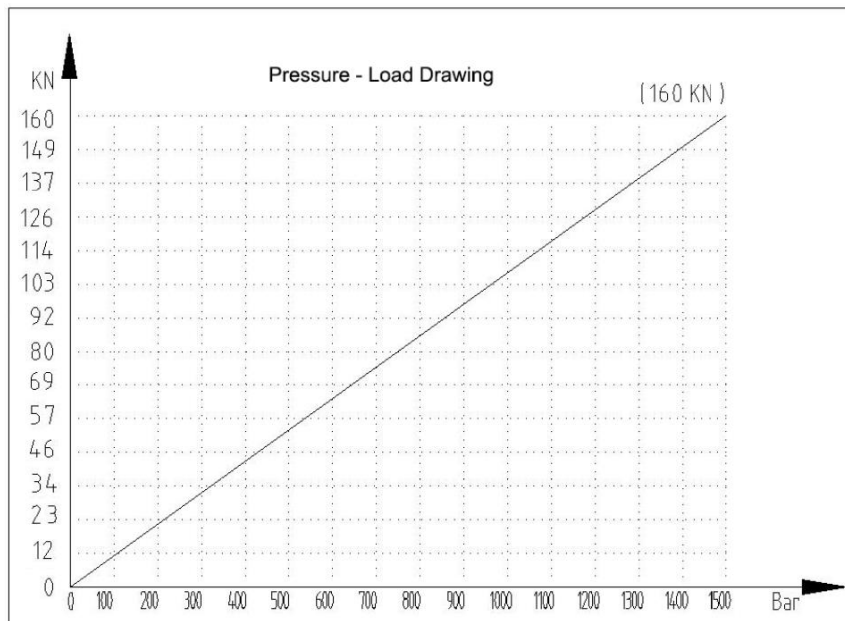
Model Number	Bolt Size		Effective Area	Max. Operating Pressure	Max. Force	Stroke	Weight
	Metric	Imperial	mm ²	bar	kN	mm	kg
DBS-7	M90x6	3-1/2"-8UN	21,336	1,500	3,200	10	47.0
	M95x6						
	M100x6	3-3/4"-8UN					
		4"-8UN					
DBS-8	M105x6	4"-8UN	27,336	1,500	4,100	10	63.5
	M110x6						
	M115x6	4-1/4"-8UN					
		4-1/2"-8UN					

Note - There is no tension adapter in the weight

9.0 Pressure-Force Table for DBS-Series Bolt Tensioner

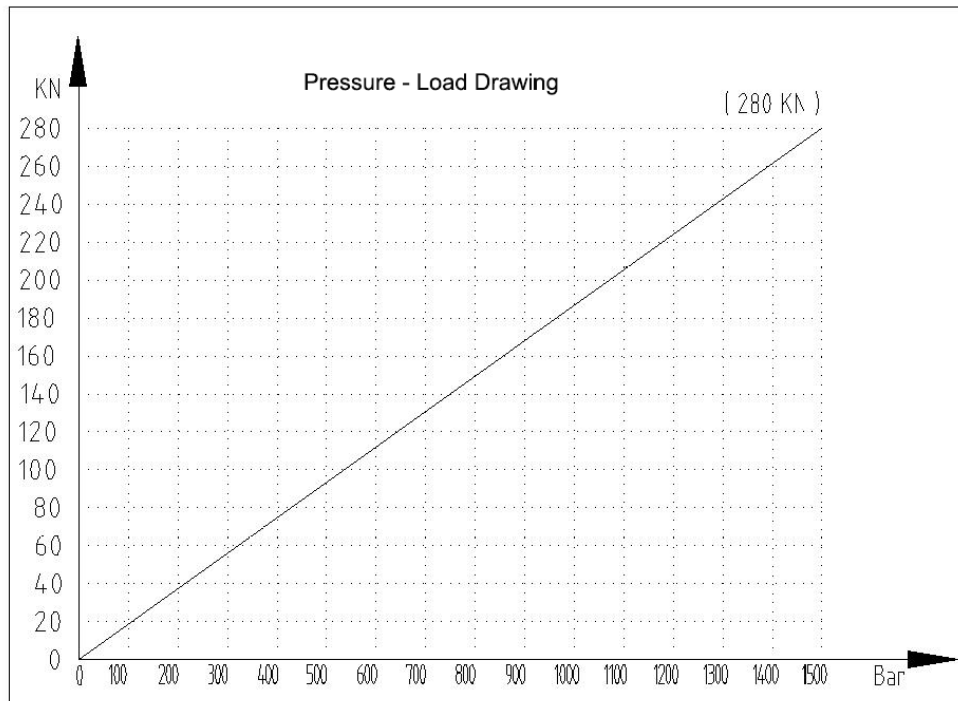
DBS-0								
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	2.1	0.2	520	55.5	5.7	1,020	108.8	11.1
40	4.3	0.4	540	57.6	5.9	1,040	110.9	11.3
60	6.4	0.7	560	59.7	6.1	1,060	113.1	11.5
80	8.5	0.9	580	61.9	6.3	1,080	115.2	11.8
100	10.7	1.1	600	64.0	6.5	1,100	117.3	12.0
120	12.8	1.3	620	66.1	6.7	1,120	119.5	12.2
140	14.9	1.5	640	68.3	7.0	1,140	121.6	12.4
160	17.1	1.7	660	70.4	7.2	1,160	123.7	12.6
180	19.2	2.0	680	72.5	7.4	1,180	125.9	12.8
200	21.3	2.2	700	74.7	7.6	1,200	128.0	13.1
220	23.5	2.4	720	76.8	7.8	1,220	130.1	13.3
240	25.6	2.6	740	78.9	8.1	1,240	132.3	13.5
260	27.7	2.8	760	81.1	8.3	1,260	134.4	13.7
280	29.9	3.0	780	83.2	8.5	1,280	136.5	13.9
300	32.0	3.3	800	85.3	8.7	1,300	138.7	14.1
320	34.1	3.5	820	87.5	8.9	1,320	140.8	14.4
340	36.3	3.7	840	89.6	9.1	1,340	142.9	14.6
360	38.4	3.9	860	91.7	9.4	1,360	145.1	14.8
380	40.5	4.1	880	93.9	9.6	1,380	147.2	15.0
400	42.7	4.4	900	96.0	9.8	1,400	149.3	15.2
420	44.8	4.6	920	98.1	10.0	1,420	151.5	15.5
440	46.9	4.8	940	100.3	10.2	1,440	153.6	15.7
460	49.1	5.0	960	102.4	10.4	1,460	155.7	15.9
480	51.2	5.2	980	104.5	10.7	1,480	157.9	16.1
500	53.3	5.4	1,000	106.7	10.9	1,500	160.0	16.3

Formula: Load (kN) = O.P. (bar)/1500x160 | Tension Force (ton) = Load (kN) / 9.8



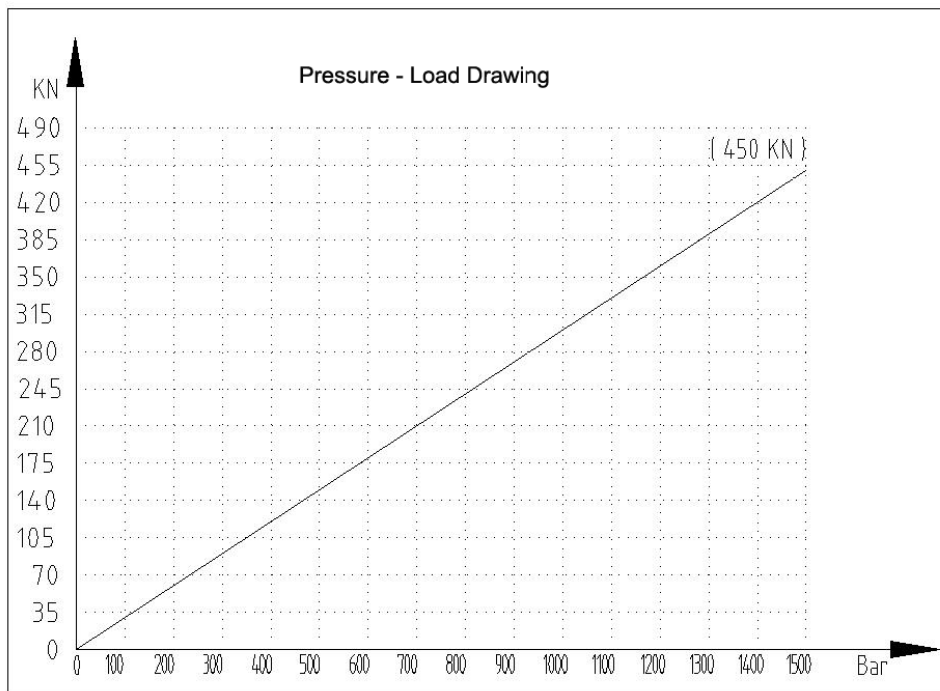
DBS-1								
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	3.7	0.4	520	97.1	9.9	1,020	190.4	19.4
40	7.5	0.8	540	100.8	10.3	1,040	194.1	19.8
60	11.2	1.1	560	104.5	10.7	1,060	197.9	20.2
80	14.9	1.5	580	108.3	11.0	1,080	201.6	20.6
100	18.7	1.9	600	112.0	11.4	1,100	205.3	21.0
120	22.4	2.3	620	115.7	11.8	1,120	209.1	21.3
140	26.1	2.7	640	119.5	12.2	1,140	212.8	21.7
160	29.9	3.0	660	123.2	12.6	1,160	216.5	22.1
180	33.6	3.4	680	126.9	13.0	1,180	220.3	22.5
200	37.3	3.8	700	130.7	13.3	1,200	224.0	22.9
220	41.1	4.2	720	134.4	13.7	1,220	227.7	23.2
240	44.8	4.6	740	138.1	14.1	1,240	231.5	23.6
260	48.5	5.0	760	141.9	14.5	1,260	235.2	24.0
280	52.3	5.3	780	145.6	14.9	1,280	238.9	24.4
300	56.0	5.7	800	149.3	15.2	1,300	242.7	24.8
320	59.7	6.1	820	153.1	15.6	1,320	246.4	25.1
340	63.5	6.5	840	156.8	16.0	1,340	250.1	25.5
360	67.2	6.9	860	160.5	16.4	1,360	253.9	25.9
380	70.9	7.2	880	164.3	16.8	1,380	257.6	26.3
400	74.7	7.6	900	168.0	17.1	1,400	261.3	26.7
420	78.4	8.0	920	171.7	17.5	1,420	265.1	27.0
440	82.1	8.4	940	175.5	17.9	1,440	268.8	27.4
460	85.9	8.8	960	179.2	18.3	1,460	272.5	27.4
480	89.6	9.1	980	182.9	18.7	1,480	276.3	28.2
500	93.3	9.5	1,000	186.7	19.0	1,500	280.0	28.6

Formula: Load (kN) = O.P. (bar)/1500x280 | Tension Force (ton) = Load (kN) / 9.8



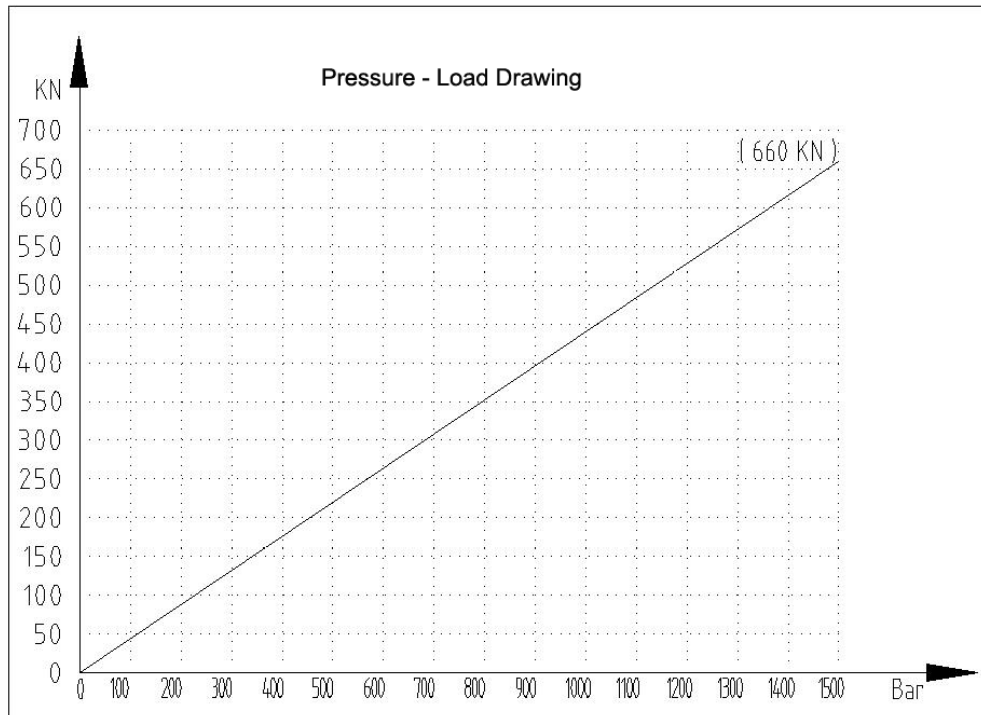
DBS-2								
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	6.0	0.6	520	156.0	15.9	1,020	306.0	31.2
40	12.0	1.2	540	162.0	16.5	1,040	312.0	31.8
60	18.0	1.8	560	168.0	17.1	1,060	318.0	32.4
80	24.0	2.4	580	174.0	17.8	1,080	324.0	33.1
100	30.0	3.1	600	180.0	18.4	1,100	330.0	33.7
120	36.0	3.7	620	186.0	19.0	1,120	336.0	34.3
140	42.0	4.3	640	192.0	19.6	1,140	342.0	34.9
160	48.0	4.9	660	198.0	20.2	1,160	354.0	36.1
180	54.0	5.5	680	204.0	20.8	1,180	354.0	36.1
200	60.0	6.1	700	210.0	21.4	1,200	360.0	36.7
220	66.0	6.7	720	216.0	22.0	1,220	366.0	37.3
240	72.0	7.3	740	222.0	22.7	1,240	372.0	38.0
260	78.0	8.0	760	228.0	23.3	1,260	378.0	38.0
280	84.0	8.6	780	234.0	23.9	1,280	384.0	39.2
300	90.0	9.2	800	240.0	24.5	1,300	390.0	39.8
320	96.0	9.8	820	246.0	25.1	1,320	396.0	40.4
340	102.0	10.4	840	252.0	25.7	1,340	402.0	41.0
360	108.0	11.0	860	258.0	26.3	1,360	408.0	41.6
380	114.0	11.6	880	264.0	26.9	1,380	414.0	42.2
400	120.0	12.2	900	270.0	27.6	1,400	420.0	42.9
420	126.0	12.9	920	276.0	28.2	1,420	426.0	43.5
440	132.0	13.5	940	282.0	28.8	1,440	432.0	44.1
460	138.0	14.1	960	288.0	29.4	1,460	438.0	44.7
480	144.0	14.7	980	294.0	30.0	1,480	444.0	45.3
500	150.0	15.3	1,000	300.0	30.6	1,500	450.0	45.9

Formula: Load (kN) = O.P. (bar)/1500x450 | Tension Force (ton) = Load (kN) / 9.8



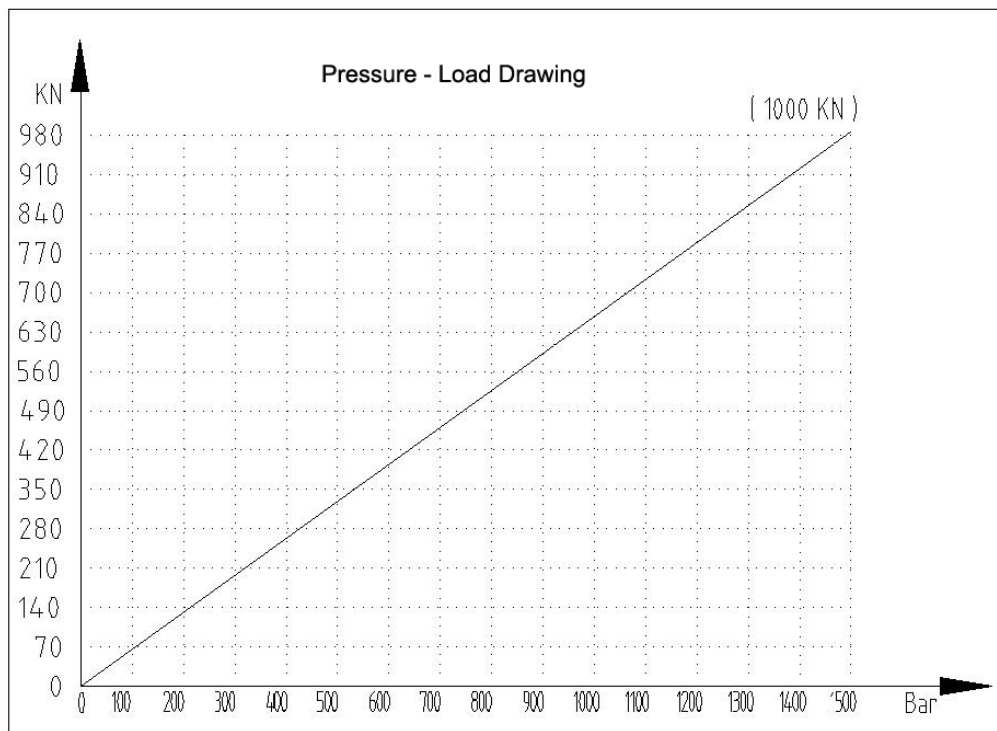
DBS-3								
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	8.8	0.9	520	228.8	23.3	1,020	448.8	45.8
40	17.6	1.8	540	237.6	24.2	1,040	457.6	46.7
60	26.4	2.7	560	246.4	25.1	1,060	466.4	47.6
80	35.2	3.6	580	255.2	26.0	1,080	475.2	48.5
100	44.0	4.5	600	264.0	26.9	1,100	484.0	49.4
120	52.8	5.4	620	272.8	27.8	1,120	492.8	50.3
140	61.6	6.3	640	281.6	28.7	1,140	501.6	51.2
160	70.4	7.2	660	290.4	29.6	1,160	510.4	52.1
180	79.2	8.1	680	299.2	29.6	1,180	519.2	53.0
200	88.0	9.0	700	308.0	31.4	1,200	528.0	53.9
220	96.8	9.9	720	316.8	32.3	1,220	536.8	54.8
240	105.6	10.8	740	325.6	33.2	1,240	545.6	55.7
260	114.4	11.7	760	334.4	34.1	1,260	554.4	56.6
280	123.2	12.6	780	343.2	35.0	1,280	563.2	56.6
300	132.0	13.5	800	352.0	35.0	1,300	572.0	58.4
320	140.8	14.4	820	360.8	36.8	1,320	580.8	59.3
340	149.6	15.3	840	369.6	37.7	1,340	589.6	60.2
360	158.4	16.2	860	378.4	38.6	1,360	598.4	61.1
380	167.2	17.1	880	387.2	39.5	1,380	607.2	62.0
400	176.0	18.0	900	396.0	40.4	1,400	616.0	62.9
420	184.8	18.9	920	404.8	41.3	1,420	624.8	63.8
440	193.6	19.8	940	413.6	42.2	1,440	633.6	64.7
460	202.4	20.7	960	422.4	43.1	1,460	642.4	65.6
480	211.2	21.6	980	431.2	44.0	1,480	651.2	66.4
500	220.0	22.4	1,000	440.0	44.9	1,500	660.0	67.3

Formula: Load (kN) = O.P. (bar)/1500x660 | Tension Force (ton) = Load (kN) / 9.8



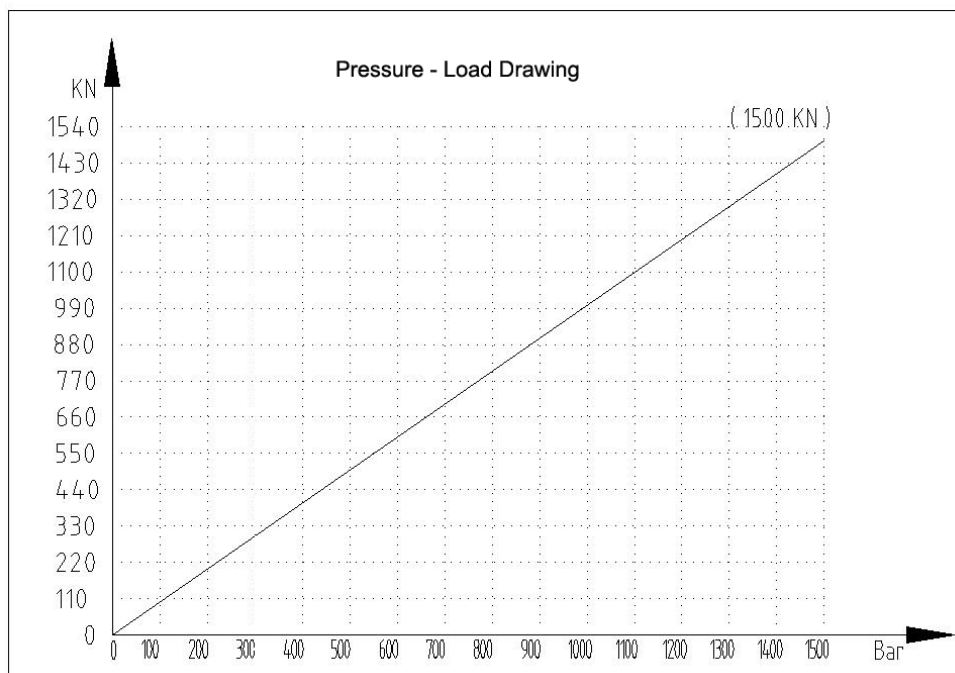
DBS-4			Operating Pressure (bar)			Operating Pressure (bar)			Operating Pressure (bar)		
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	13.3	1.4	520	346.7	35.4	1,020	680.0	69.4			
40	26.7	2.7	540	360.0	36.7	1,040	693.3	70.7			
60	40.0	4.1	560	373.3	38.1	1,060	706.7	72.1			
80	53.3	5.4	580	386.7	39.5	1,080	720.0	73.5			
100	66.7	6.8	600	400.0	40.8	1,100	733.3	74.8			
120	80.0	8.2	620	413.3	42.2	1,120	746.7	76.2			
140	93.3	9.5	640	426.7	43.5	1,140	760.0	77.6			
160	106.7	10.9	660	440.0	44.9	1,160	773.3	78.9			
180	120.0	12.2	680	453.3	46.3	1,180	786.7	80.3			
200	133.3	13.6	700	466.7	47.6	1,200	800.0	81.6			
220	146.7	15.0	720	480.0	49.0	1,220	813.3	83.0			
240	160.0	16.3	740	493.3	50.3	1,240	826.7	84.4			
260	173.3	17.7	760	506.7	51.7	1,260	840.0	85.7			
280	186.7	19.0	780	520.0	53.1	1,280	853.3	87.1			
300	200.0	20.4	800	533.3	54.4	1,300	866.7	88.4			
320	213.3	21.8	820	546.7	55.8	1,320	880.0	89.8			
340	226.7	23.1	840	560.0	57.1	1,340	893.3	91.2			
360	240.0	24.5	860	573.3	58.5	1,360	906.7	92.5			
380	253.3	25.9	880	586.7	59.9	1,380	920.0	93.9			
400	266.7	27.2	900	600.0	61.2	1,400	933.3	95.2			
420	280.0	28.6	920	613.3	62.6	1,420	946.7	96.6			
440	293.3	29.9	940	626.7	63.9	1,440	960.0	98.0			
460	306.7	31.3	960	640.0	65.3	1,460	973.3	99.3			
480	320.0	32.7	980	653.3	66.7	1,480	986.7	100.7			
500	333.3	34.0	1,000	666.7	68.0	1,500	1,000.0	102.0			

Formula: Load (kN) = O.P. (bar)/1500x1000 | Tension Force (ton) = Load (kN) / 9.8



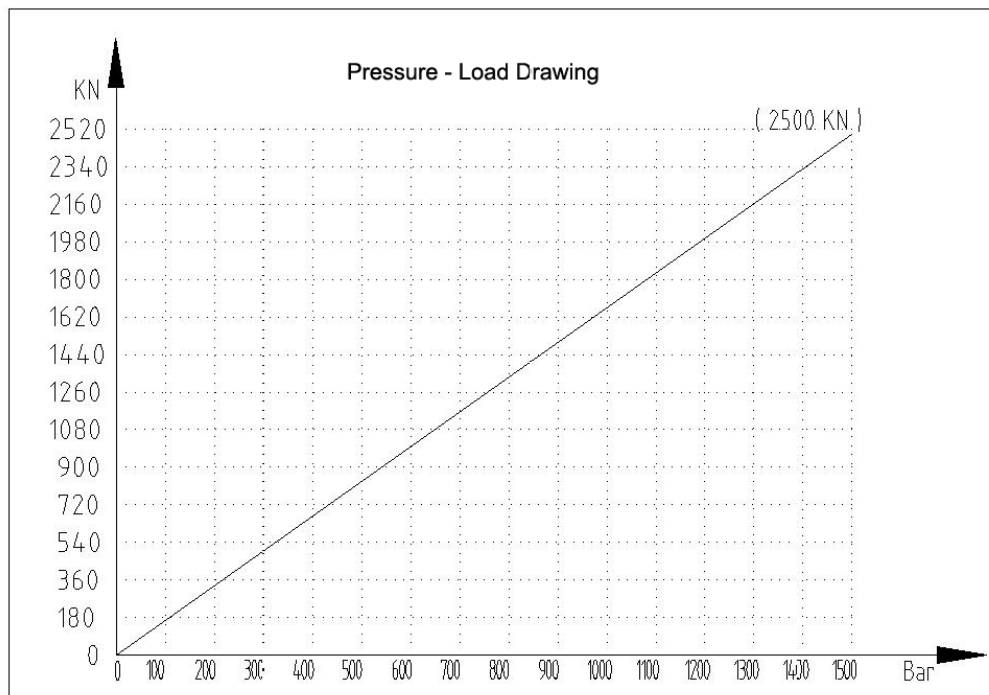
DBS-5								
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	20.0	2.0	520	520.0	53.1	1,020	1,020.0	104.1
40	40.0	4.1	540	540.0	55.1	1,040	1,040.0	106.1
60	60.0	6.1	560	560.0	57.1	1,060	1,060.0	108.2
80	80.0	8.2	580	580.0	59.2	1,080	1,080.0	110.2
100	100.0	10.2	600	600.0	61.2	1,100	1,100.0	112.2
120	120.0	12.2	620	620.0	63.3	1,120	1,120.0	114.3
140	140.0	14.3	640	640.0	65.3	1,140	1,140.0	116.3
160	160.0	16.3	660	660.0	67.3	1,160	1,160.0	118.4
180	180.0	18.4	680	680.0	69.4	1,180	1,180.0	120.4
200	200.0	20.4	700	700.0	71.4	1,200	1,200.0	122.4
220	220.0	22.4	720	720.0	73.5	1,220	1,220.0	124.5
240	240.0	24.5	740	740.0	75.5	1,240	1,240.0	126.5
260	260.0	26.5	760	760.0	77.6	1,260	1,260.0	128.6
280	280.0	28.6	780	780.0	79.6	1,280	1,280.0	130.6
300	300.0	30.6	800	800.0	81.6	1,300	1,300.0	132.7
320	320.0	32.7	820	820.0	83.7	1,320	1,320.0	134.7
340	340.0	34.7	840	840.0	85.7	1,340	1,340.0	136.7
360	360.0	36.7	860	860.0	87.8	1,360	1,360.0	138.8
380	380.0	38.8	880	880.0	89.8	1,380	1,380.0	140.8
400	400.0	40.8	900	900.0	91.8	1,400	1,400.0	142.9
420	420.0	42.9	920	920.0	93.9	1,420	1,420.0	144.9
440	440.0	44.9	940	940.0	95.9	1,440	1,440.0	146.9
460	460.0	46.9	960	960.0	98.0	1,460	1,460.0	149.0
480	480.0	49.0	980	980.0	100.0	1,480	1,480.0	151.0
500	500.0	51.0	1,000	1,000.0	102.0	1,500	1,500.0	153.1

Formula: Load (kN) = O.P. (bar)/1500x1500 | Tension Force (ton) = Load (kN) / 9.8



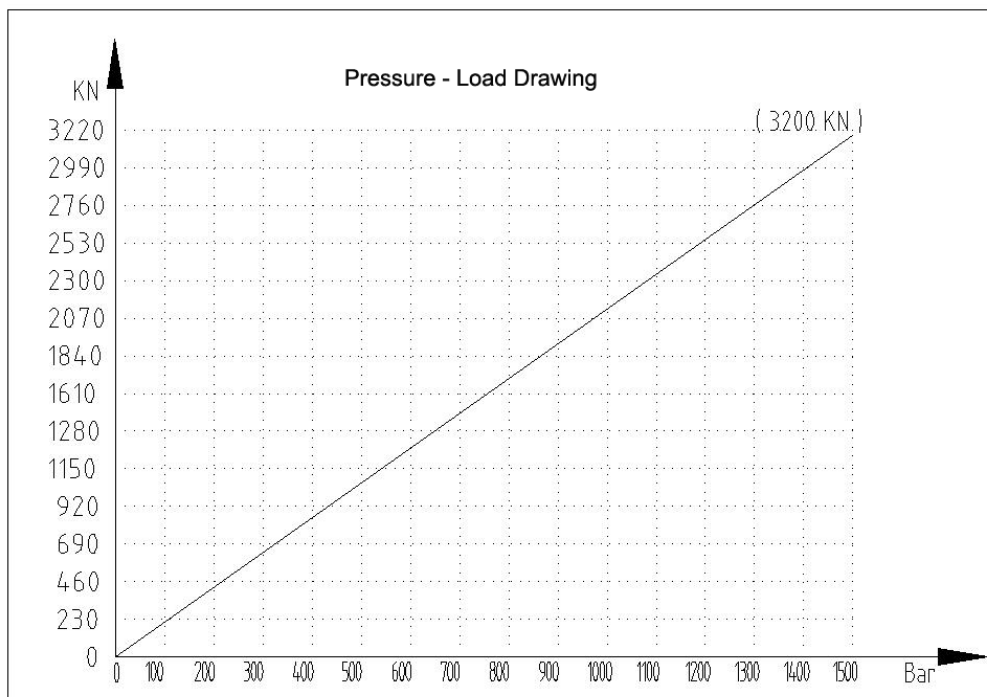
DBS-6								
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	33.3	3.4	520	866.7	88.4	1,020	1,700.0	173.5
40	66.7	6.8	540	900.0	91.8	1,040	1,733.3	176.9
60	100.0	10.2	560	933.3	95.2	1,060	1,766.7	180.3
80	133.3	13.6	580	966.7	98.6	1,080	1,800.0	183.7
100	166.7	17.0	600	1,000.0	102.0	1,100	1,833.3	187.1
120	200.0	20.4	620	1,033.3	105.4	1,120	1,866.7	190.5
140	233.3	23.8	640	1,066.7	108.8	1,140	1,900.0	193.9
160	266.7	27.2	660	1,100.0	112.2	1,160	1,933.3	197.3
180	300.0	30.6	680	1,133.3	115.6	1,180	1,966.7	200.7
200	333.3	34.0	700	1,166.7	119.0	1,200	2,000.0	204.1
220	366.7	37.4	720	1,200.0	122.4	1,220	2,033.3	207.5
240	400.0	40.8	740	1,233.3	125.9	1,240	2,066.7	210.9
260	433.3	44.2	760	1,266.7	129.3	1,260	2,100.0	214.3
280	466.7	47.6	780	1,300.0	132.7	1,280	2,133.3	217.7
300	500.0	51.0	800	1,333.3	136.1	1,300	2,166.7	221.1
320	533.3	54.4	820	1,366.7	139.5	1,320	2,200.0	224.5
340	566.7	57.8	840	1,400.0	142.9	1,340	2,233.3	227.9
360	600.0	61.2	860	1,433.3	146.3	1,360	2,266.7	231.3
380	633.3	64.6	880	1,466.7	149.7	1,380	2,300.0	234.7
400	666.7	68.0	900	1,500.0	153.1	1,400	2,333.3	238.1
420	700.0	71.4	920	1,533.3	156.5	1,420	2,366.7	241.5
440	733.3	74.8	940	1,566.7	159.9	1,440	2,400.0	244.9
460	766.7	78.2	960	1,600.0	163.3	1,460	2,433.3	248.3
480	800.0	81.6	980	1,633.3	166.7	1,480	2,466.7	251.7
500	833.3	85.0	1,000	1,666.7	170.1	1,500	2,500.0	255.1

Formula: Load (kN) = O.P. (bar)/1500x2500 | Tension Force (ton) = Load (kN) / 9.8



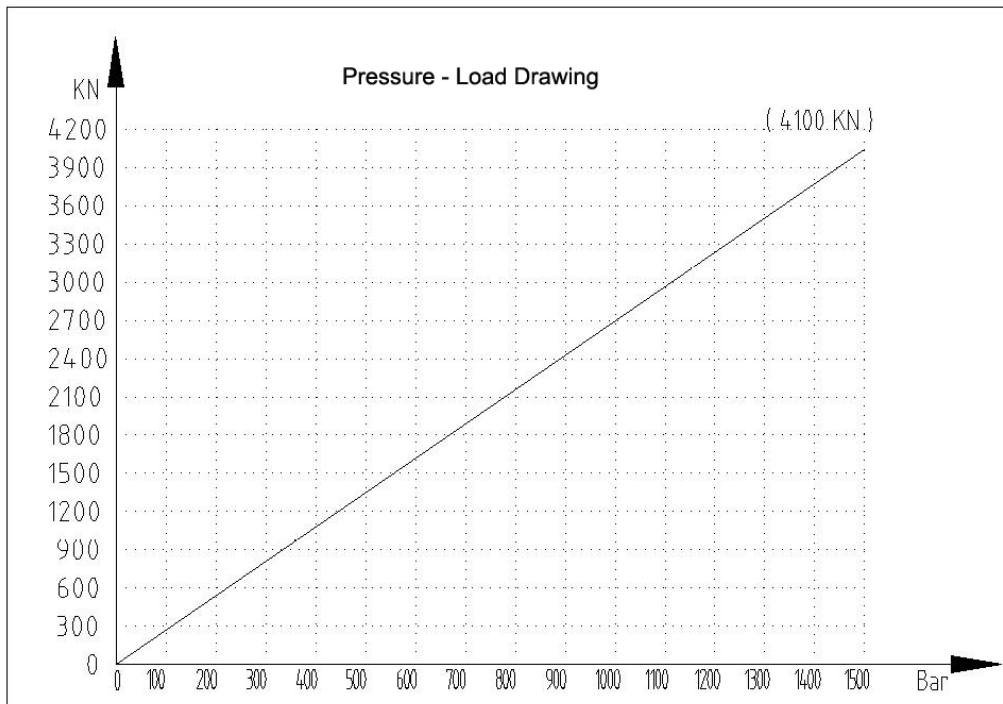
DBS-7								
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	42.7	4.4	520	1,109.3	113.2	1,020	2,176.0	222.0
40	85.3	8.7	540	1,152.0	117.6	1,040	2,218.7	226.4
60	128.0	13.1	560	1,194.7	121.9	1,060	2,261.3	230.7
80	170.7	17.4	580	1,237.3	126.3	1,080	2,304.0	235.1
100	213.3	21.8	600	1,280.0	130.6	1,100	2,346.7	239.5
120	256.0	26.1	620	1,322.7	135.0	1,120	2,389.3	243.8
140	298.7	30.5	640	1,365.3	139.3	1,140	2,432.0	248.2
160	341.3	34.8	660	1,408.0	143.7	1,160	2,474.7	252.5
180	384.0	39.2	680	1,450.7	148.0	1,180	2,517.3	256.9
200	426.7	43.5	700	1,493.3	152.4	1,200	2,560.0	261.2
220	469.3	47.9	720	1,536.0	156.7	1,220	2,602.7	265.6
240	512.0	52.2	740	1,578.7	161.1	1,240	2,645.3	269.9
260	554.7	56.6	760	1,621.3	165.4	1,260	2,688.0	274.3
280	597.3	61.0	780	1,664.0	169.8	1,280	2,730.7	278.6
300	640.0	65.3	800	1,706.7	174.1	1,300	2,773.3	283.0
320	682.7	69.7	820	1,749.3	178.5	1,320	2,816.0	287.3
340	725.3	74.0	840	1,792.0	182.9	1,340	2,858.7	291.7
360	768.0	78.4	860	1,834.7	187.2	1,360	2,901.3	296.1
380	810.7	82.7	880	1,877.3	191.6	1,380	2,944.0	300.4
400	853.3	87.1	900	1,920.0	195.9	1,400	2,986.7	304.8
420	896.0	91.4	920	1,962.7	200.3	1,420	3,029.3	309.1
440	938.7	95.8	940	2,005.3	204.6	1,440	3,072.0	313.5
460	981.3	100.1	960	2,048.0	209.0	1,460	3,114.7	317.8
480	1,024.0	104.5	980	2,090.7	213.3	1,480	3,157.3	322.2
500	1,066.7	108.8	1,000	2,133.3	217.7	1,500	3,200.0	326.5

Formula: Load (kN) = O.P. (bar)/1500x3200 | Tension Force (ton) = Load (kN) / 9.8



DBS-8								
Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)	Operating Pressure (bar)	Load (kN)	Tension Force (ton)
20	54.7	5.6	520	1,421.3	145.0	1,020	2,788.0	284.5
40	109.3	11.2	540	1,476.0	150.6	1,040	2,842.7	290.1
60	164.0	16.7	560	1,530.7	156.2	1,060	2,897.3	295.6
80	218.7	22.3	580	1,585.3	161.8	1,080	2,952.0	301.2
100	273.3	27.9	600	1,640.0	167.3	1,100	3,006.7	306.8
120	328.0	33.5	620	1,694.7	172.9	1,120	3,061.3	312.4
140	382.7	39.0	640	1,749.3	178.5	1,140	3,116.0	318.0
160	437.3	44.6	660	1,804.0	184.1	1,160	3,170.7	323.5
180	492.0	50.2	680	1,858.7	189.7	1,180	3,225.3	329.1
200	546.7	55.8	700	1,913.3	195.2	1,200	3,280.0	334.7
220	601.3	61.4	720	1,968.0	200.8	1,220	3,334.7	340.3
240	656.0	66.9	740	2,022.7	206.4	1,240	3,389.3	345.9
260	710.7	72.5	760	2,077.3	212.0	1,260	3,444.0	351.4
280	765.3	78.1	780	2,132.0	217.6	1,280	3,498.7	357.0
300	820.0	83.7	800	2,186.7	223.1	1,300	3,553.3	362.6
320	874.7	89.3	820	2,241.3	228.7	1,320	3,608.0	368.2
340	929.3	94.8	840	2,296.0	234.3	1,340	3,662.7	373.7
360	984.0	100.4	860	2,350.7	239.9	1,360	3,717.3	379.3
380	1,038.7	106.0	880	2,405.3	245.4	1,380	3,772.0	384.9
400	1,093.3	111.6	900	2,460.0	251.0	1,400	3,826.7	390.5
420	1,148.0	117.1	920	2,514.7	256.6	1,420	3,881.3	396.1
440	1,202.7	122.7	940	2,569.3	262.2	1,440	3,990.7	401.6
460	1,257.3	128.3	960	2,624.0	267.8	1,460	3,990.7	407.2
480	1,312.0	133.9	980	2,678.7	273.3	1,480	4,045.3	412.8
500	1,366.7	139.5	1,000	2,733.3	278.9	1,500	4,100.0	418.4

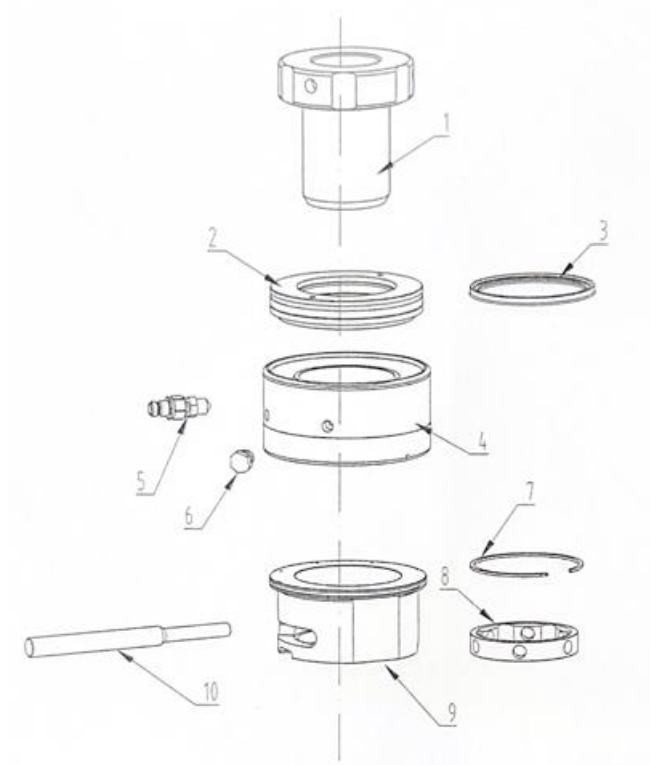
Formula: Load (kN) = O.P. (bar)/1500x4100 | Tension Force (ton) = Load (kN) / 9.8



10.0 DBS-Series Parts Breakdown and Lists

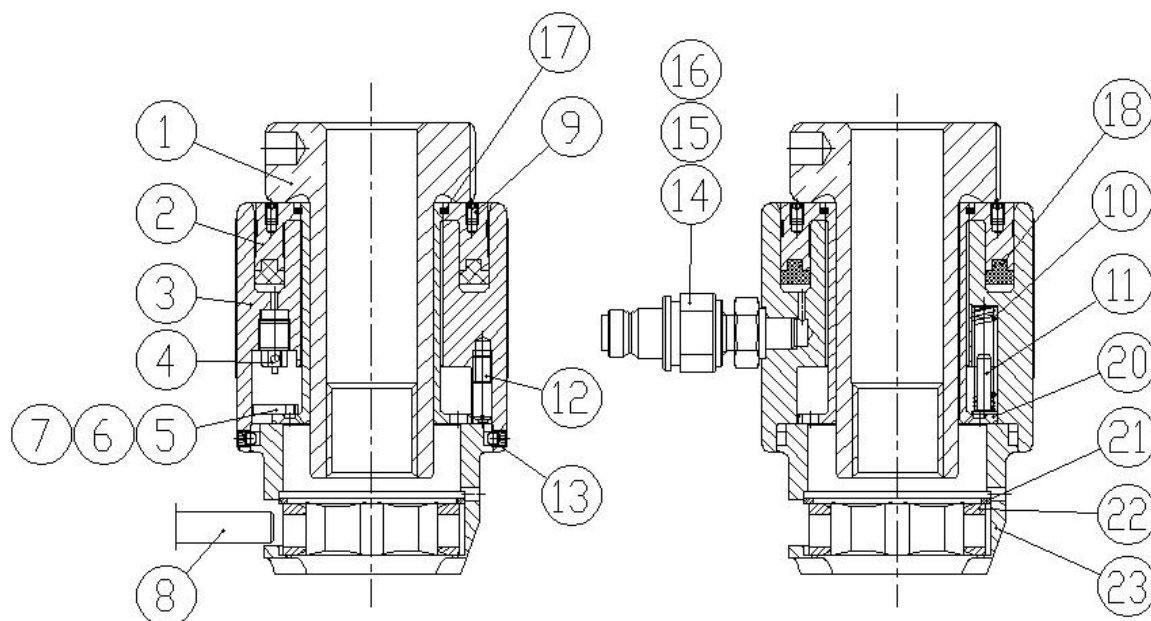
Serial number and model need to be quoted when ordering parts.

10.1 DBS-0 Parts Breakdown and List



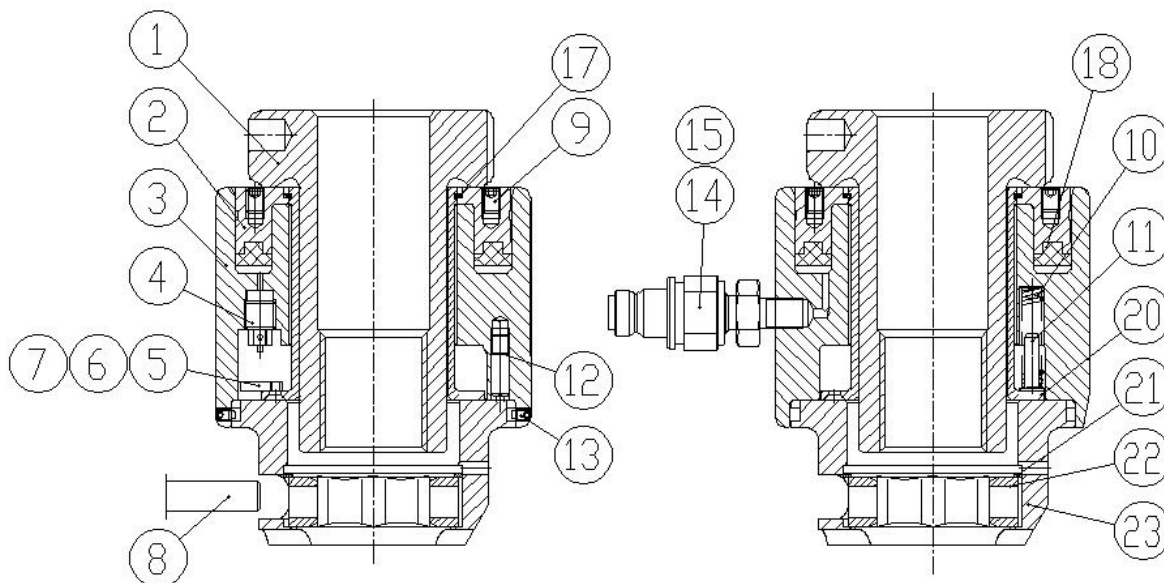
Item	Description	Qty
1	Tension adaptor	1
2	Piston	1
3	Seal	1
4	Tension cylinder	1
5	Quick coupler	1
6	Plug	1
7	Circlip	1
8	Nut sleeve	1
9	Bridge	1
10	Tommy bar	1

10.2 DBS-1 Parts Breakdown and List



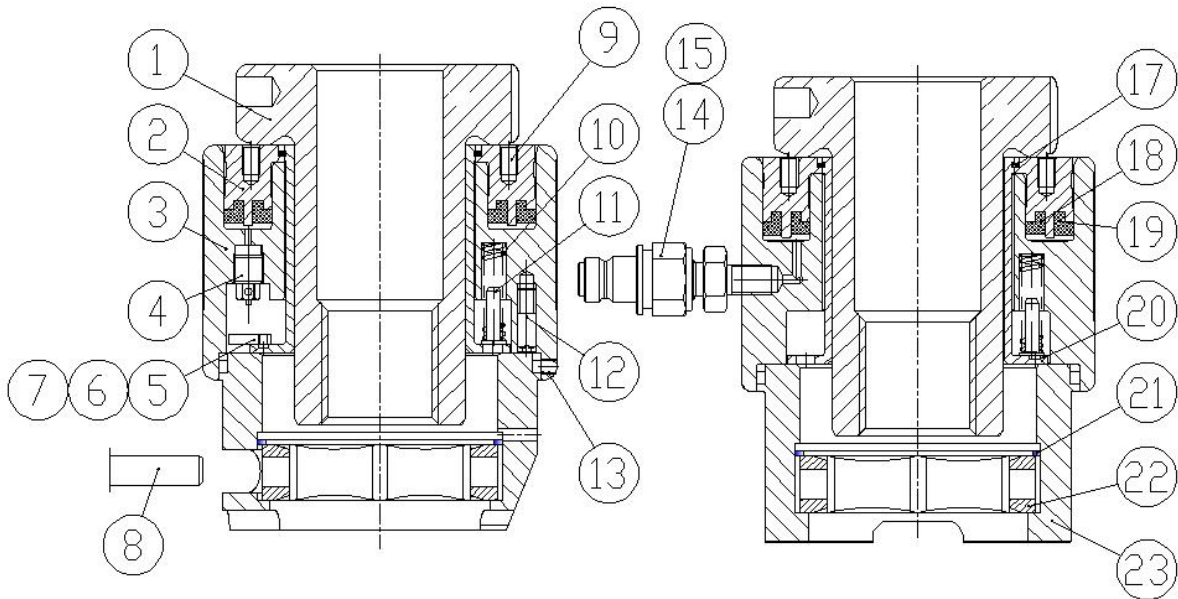
Item	Description	Qty	Item	Description	Qty
1	Tension adaptor	1	12	Threaded lock pin	1
2	Piston rod	1	13	Screw pin	2
3	Tension cylinder	1	14	Fitting	2
4	Releasing valve	1	15	Quick coupler	2
5	Retaining plate	1	16	Gasket	2
6	Screw	1	17	Connecting clip	1
7	Pin	1	18	Seal ring	1
8	Tommy bar	1	20	Connecting sleeve	1
9	Nylon plug	2	21	Bridge clip	1
10	Spring	4	22	Nut sleeve	1
11	Spring seat	4	23	Bridge	1

10.3 DBS-2 Parts Breakdown and List



Item	Description	Qty	Item	Description	Qty
1	Tension adaptor	1	12	Threaded lock pin	1
2	Piston rod	1	13	Screw pin	2
3	Tension cylinder	1	14	Fitting	2
4	Releasing valve	1	15	Quick coupler	2
5	Retaining plate	1	17	Connecting clip	1
6	Screw	3	18	Seal ring	1
7	Pin	1	20	Connecting sleeve	1
8	Tommy bar	1	21	Bridge clip	1
9	Nylon plug	2	22	Nut sleeve	1
10	Spring	6	23	Bridge	1
11	Spring seat	6			

10.4 DBS-3 – DBS-8 Parts Breakdown and Lists



DBS-3 - DBS-5					
Item	Description	Qty	Item	Description	Qty
1	Tension adaptor	1	12	Threaded lock pin	1
2	Piston rod	1	13	Screw pin	2
3	Tension cylinder	1	14	Fitting	2
4	Releasing valve	1	15	Quick coupler	2
5	Retaining plate	1	17	Connecting clip	1
6	Screw	1	18	Seal ring	1
7	Pin	1	19	Seal ring	1
8	Tommy bar	1	20	Connecting sleeve	1
9	Nylon plug	2	21	Bridge clip	1
10	Spring	8	22	Nut sleeve	1
11	Spring seat	8	23	Bridge	1

DBS-6					
Item	Description	Qty	Item	Description	Qty
1	Tension adaptor	1	12	Threaded lock pin	1
2	Piston rod	1	13	Screw pin	2
3	Tension cylinder	1	14	Fitting	2
4	Releasing valve	1	15	Quick coupler	2
5	Retaining plate	1	17	Connecting clip	1
6	Screw	1	18	Seal ring	1
7	Pin	1	19	Seal ring	1
8	Tommy bar	1	20	Connecting sleeve	1
9	Nylon plug	2	21	Bridge clip	1
10	Spring	18	22	Nut sleeve	1
11	Spring seat	18	23	Bridge	1

DBS-7					
Item	Description	Qty	Item	Description	Qty
1	Tension adaptor	1	12	Threaded lock pin	1
2	Piston rod	1	13	Screw pin	2
3	Tension cylinder	1	14	Fitting	2
4	Releasing valve	1	15	Quick coupler	2
5	Retaining plate	1	17	Connecting clip	1
6	Screw	1	18	Seal ring	1
7	Pin	1	19	Seal ring	1
8	Tommy bar	1	20	Connecting sleeve	1
9	Nylon plug	2	21	Bridge clip	1
10	Spring	25	22	Nut sleeve	1
11	Spring seat	25	23	Bridge	1

DBS-8					
Item	Description	Qty	Item	Description	Qty
1	Tension adaptor	1	12	Threaded lock pin	1
2	Piston rod	1	13	Screw pin	2
3	Tension cylinder	1	14	Fitting	2
4	Releasing valve	1	15	Quick coupler	2
5	Retaining plate	1	17	Connecting clip	1
6	Screw	1	18	Seal ring	1
7	Pin	1	19	Seal ring	1
8	Tommy bar	1	20	Connecting sleeve	1
9	Nylon plug	2	21	Bridge clip	1
10	Spring	32	22	Nut sleeve	1
11	Spring seat	32	23	Bridge	1

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

A1 - 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.

A2 - The allowable axial force FA listed in Table A1 calculated the fatigue strength of the bolted joint.

A3 - The conditions for using this appendix are:

- a. The thread conforms to GB 196;
- b. The axial force is transmitted along the centre of the bolt;
- c. Ambient temperature -50 - 300°C;
- d. Lubricate the bearing surfaces of the threads, bolt heads and nuts during pre-tightening.

A4 - For fasteners with soft materials (such as A3, etc.), to avoid excessive loss of pre-tightening force, special washers for high-strength bolts should be installed under the bolt head or nut.

A5 - 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: $F_v(5.6) = 0.47 \times F_v(8.8)$
 $MA(5.6) = 0.47 \times MA(8.8)$
 Class 10.9: $F_v(10.9) = 1.41 \times F_v(8.8)$
 $MA(10.9) = 1.41 \times MA(8.8)$
 Class 12.9: $F_v(12.9) = 1.69 \times F_v(8.8)$
 $MA(12.96) = 1.69 \times MA(8.8)$

Table A1

Thread Size		Stress Area Ac (mm)	Allowable Axial Force (kN)					Pretighten Force (Fv) (kN)	Pretighten Torque (Ma) (N.m)
Diam. (mm)	Pitch Size		HC/d						
			2	3	4	6	>6		
M6	1.00	20.1	3	3	3	3	3	6.8	7
M8	1.25	36.6	7	7	7	7	7	12.5	18
M10	1.50	58.0	11	11	11	11	11	19.9	35
M12	1.75	84.3	16	17	17	16	16	29.1	61
M14	2.00	115.4	20	23	24	23	23	39.8	96
M16	2.00	157.0	27	32	33	32	32	55.3	149
M18	2.50	192.0	31	36	38	37	36	67.5	205
M20	2.50	245.0	36	42	49	51	50	86.3	290
M24	3.00	353.0	52	61	71	73	72	124.4	500
M30	3.50	561.0	85	100	115	118	116	199.1	1,004
M36	4.00	817.0	124	146	168	173	170	291.4	1,749
M42	4.50	1,121.0	175	206	237	239	235	401.2	2,806
M48	5.00	1,473.0	231	273	314	315	310	528.6	4,236
M56	5.50	2,030.0	299	354	408	440	432	732.2	6,791
M64	6.00	2,676.0	384	454	583	586	574	958.9	10,147
M72	6.00	3,463.0	486	575	663	768	752	1,265.0	14,689
M80	6.00	4,344.0	608	716	907	934	920	1,563.0	19,626
M90	6.00	5,590.0	782	922	1,168	1,202	1,185	2,012.0	28,584
M100	6.00	7,000.0	980	1,155	1,463	1,505	1,484	2,520.0	39,960
M110	6.00	8,560.0	1,198	1,412	1,789	1,840	1,815	3,081.0	53,939
M120	6.00	10,300.0	1,442	1,700	2,152	2,215	2,183	3,708.0	71,034
M125	6.00	11,200.0	1,568	1,848	2,340	2,408	2,374	4,032.0	80,567
M140	6.00	14,200.0	1,988	2,343	2,968	3,053	3,010	5,112.0	114,800
M160	6.00	18,700.0	2,618	3,085	3,098	4,020	3,964	6,732.0	173,400