

# TL-PST SERIES TOPSIDE BOLT TENSIONERS



TL-PST SERIES Bolt Tensioners are one of the most light, compact and versatile line of tensioners available. Designed for operation in a variety of Applications including pipeline flanges, heat feed pumps, anchor bolts and many others.

The TL-PST Tensioner is very simple to use and consists of four parts-Threaded Puller, Load Cell, Bridge and Nut Driver (Nut Rotating Socket).



THREADED PULLER



LOAD CELL



BRIDGE



NUT DRIVER/  
NUT ROTATING SOCKET

## VERSATILE DESIGN

The TL-PST Series standard variable tensioners are designed to provide a wide range of flexibility, covering stud sizes from 3/4" to 5.3/4" (M-16 to M-150). Different stud sizes are accommodated by the same load cell by simply changing the adaptor kit consisting of Threaded Puller, Bridge, and Nut Driver.

## ANTI ROLL SEALS

All TL-PST Series Tensioners are fitted with Anti Roll, Composite Material Seals for longer life and high reliability. The seals used have a low coefficient of friction so that the piston can be returned to a closed position with minimal effort. TL-PST Series tensioners can be provided with machined PU (poly urethane) seats if requested.

## STROKE INDICATOR

The TL-PST tensioners have an exceptional stroke of 15 mm. The Integral Stroke Indicator allows the piston stroke to be viewed while tensioning is in progress. A Red line on piston indicates an over stroke ensuring safe operation.

## SAFE DESIGN

The TL-PST series tensioners are designed so that in the event of an over-stroke the high pressure fluid will be released from the inner side of the load cell, thus saving the operator from any potential exposure.

## MULTI TENSIONING QUALITY STEEL

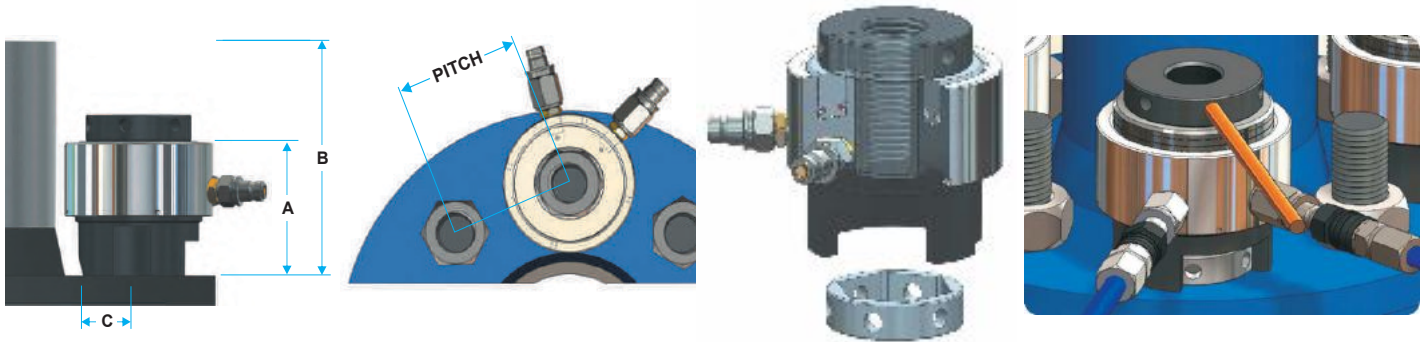
The TL-PST Series load cell is provisioned with two connections and this acts as a manifold for multi-tensioning applications. By using high pressure link hoses, any number of bolt tensioners can be connected and used simultaneously. This ensures equal tightening of all bolts on the flange and reduces work time.

The TL-PST Series tensioners operate at a maximum pressure of 1500 Bar and are manufactured from high strength aircraft quality AISI 4340 alloy steel parts for long lasting trouble free performance.

## FLOATING PISTON

The unique piston design allows 2° tilt without any loss of load, preventing piston seizure or damage to piston bore.

# TL-PST SERIES TOPSIDE BOLT TENSIONERS



Model No.		Bolt Size		Max Load		Hyd Area		O.D.	Min Pitch	Relief C	Height A	Clearance B	Weight
Load Cell	Adaptor Kit	Inch	mm	M Ton	kN	in <sup>2</sup>	mm <sup>2</sup>	mm	mm	mm	mm	mm	kg.
TL-PST-01	TL-A1-0.12	3/4		34.5	339	3.5	2257	84	46	30	86	160	3.5*
	TL-A1-M20		20						47	30	86	160	1.3
	TL-A1-0.14	7/8							53	32	94	168	1.4
	TL-A1-M24		24						54	32	94	168	1.4
	TL-A1-1.00	1							55	32	94	168	1.4
TL-PST-02	TL-A2-M27		27	40.6	397	4.11	2649	98	56	34	96	170	4.5*
	TL-A2-1.02	1.1/8							59	37	98	172	1.8
	TL-A2-M30		30						62	37	97	173	1.9
	TL-A2-1.04	1.1/4							67	40	99	180	2.0
	TL-A2-M33		33						68	40	99	181	2.1
	TL-A2-1.06	1.3/8							72	43	101	186	2.3
	TL-A2-M36		36						73	43	101	187	2.3
TL-PST-03	TL-A3-1.04	1.1/4		65.2	639	6.6	4259	115	69	40	99	185	5.9*
	TL-A3-M33		33						70	40	99	174	2.4
	TL-A3-1.06	1.3/8							74	43	101	177	2.9
	TL-A3-M36		36						75	43	101	178	2.9
	TL-A3-1.08	1.1/2							80	45	105	187	3.0
	TL-A3-M39		39						80	43	105	186	3.0
TL-PST-04	TL-A4-1.06	1.3/8		73.6	721	7.45	4808	128	75	43	101	183	7.7*
	TL-A4-M36		36						76	43	101	183	3.4
	TL-A4-1.08	1.1/2							81	45	105	183	3.6
	TL-A4-M39		39						81	45	105	183	3.6
	TL-A4-1.10	1.5/8							86	48	107	187	3.9
	TL-A4-M42		42						86	48	107	188	3.9
	TL-A4-1.12	1.3/4							91	51	108	192	4.0
TL-PST-05	TL-A5-1.10	1.5/8		96.1	942	9.73	6280	145	87	48	113	198	11.4
	TL-A5-M42		4						87	48	113	200	5.2
	TL-A5-1.12	1.3/4							92	51	117	205	5.4
	TL-A5-M45		45						93	51	117	206	5.4
	TL-A5-1.14	1.7/8							98	54	120	212	5.6
	TL-A5-M48		48						98	54	120	212	5.6
	TL-A5-2.00	2							104	57	120	217	6.3
	TL-A5-M52		52						105	57	120	217	5.9
TL-PST-06	TL-A6-1.14	1.7/8		138.2	1354	13.99	9028	165	99	54	120	209	14.8*
	TL-A6-M48		48						99	54	120	210	7.1
	TL-A6-2.00	2							105	57	123	215	7.6
	TL-A6-M52		52						106	57	123	215	7.6
	TL-A6-M56		56						113	62	126	223	7.8
	TL-A6-2.04	2.1/4							114	62	126	224	7.8

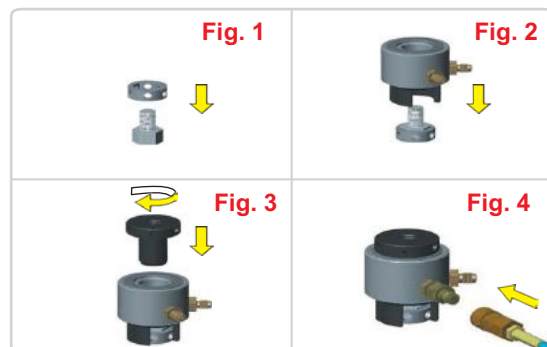
\* Indicates weight of Load Cell + Adaptor Kit of particular size.

# TL-PST SERIES TOPSIDE BOLT TENSIONERS

Model No.		Bolt Size		Max Load		Hyd Area		O.D.	Min Pitch	Relief C	Height A	Clearance B	Weight
Load Cell	Adaptor Kit	Inch	mm	M Ton	kN	in <sup>2</sup>	mm <sup>2</sup>	mm	mm	mm	mm	mm	kg.
TL-PST-07	TL-A07-M56		56	168.5	1651	17.06	11006	180	112	62	129	222	18.1*
	TL-A7-2.04	2.1/4							112	62	129	224	9.3
	TL-A07-M60		60						117	62	132	229	9.4
	TL-A7-2.08	2.1/2							125	68	135	236	9.7
	TL-A07-M64		64						125	68	135	236	9.7
	TL-A07-M68		68						129	68	140	238	10.0
TL-PST-08	TL-A8-2.08	2.1/2		201.8	1978	20.44	13188	198	129	70	137	242	23.4*
	TL-A08-M64		64						129	70	138	242	12.1
	TL-A08-M68		68						132	69	143	249	12.3
	TL-A8-2.12	2.3/4							139	75	146	254	12.5
	TL-A08-M72		72						141	75	146	256	12.5
TL-PST-09	TL-A9-2.12	2.3/4		230.3	2257	23.3	15045	215	139	75	146	261	29.3*
	TL-A09-M72		72						141	75	146	261	15.6
	TL-A09-M76		76						150	80	150	263	17.2
	TL-A9-3.00	3							150	80	151	264	17.2
TL-PST-10	TL-A10-M80		80	310.9	3047	31.48	20312	244	160	87	158	275	40.3*
	TL-A10-3.04	3.1/4							162	87	158	278	24.0
	TL-A10-M85		85						164	87	160	278	24.5
	TL-A10-3.08	3.1/2							174	93	164	280	22.6
	TL-A10-M90		90						175	93	164	279	22.6
	TL-A10-M95		95						179	93	170	281	22.8
	TL-A10-3.12	3.3/4							191	105	170	281	22.9
	TL-A10-M100		100						195	105	177	304	22.1
TL-PST-11	TL-A10-4.00	4							197	105	177	304	22.1
	TL-A11-3.12	3.3/4		384.5	3769	38.94	25120	280	192	106	172	299	52.7*
	TL-A11-M100		100						196	106	179	306	31.4
	TL-A11-4.00	4							198	106	179	299	31.4
	TL-A11-4.04	4.1/4							209	111	183	312	36.4
	TL-A11-M110		110						210	111	186	312	36.4
	TL-A11-4.08	4.1/2							222	118	191	324	39.7
	TL-A11-M120		120						226	118	198	330	41.4
	TL-A11-4.12	4.3/4							229	121	202	342	42.3
	TL-A11-M125		125						233	121	20	348	43.3
	TL-A12-M125		125						236	124	204	354	89.6*
TL-PST-12	TL-A12-5.00	5		485.1	4754	49.13	31694	325	243	129	204	359	60.3
	TL-A12-M130		130						243	126	207	361	63.1
	TL-A12-5.04	5.1/4							254	135	210	367	63.1
	TL-A12-5.08	5.1/2							266	141	217	380	70.4
	TL-A12-M140		140						260	135	217	380	70.6
	TL-A12-5.3/4	5.3/4							276	145	218	389	70.8
	TL-A12-M150		150						275	141	221	396	73.3

\*Weight of Load Cell + Adaptor K \* it of particular size. Please refer to catalog sheet - 'Application' page for Bolt Tensioners application and tool pressure calculation.

The nut-driver is placed over the nut (fig.1). The bridge and load cell is then placed over the bolt (fig.2). The Puller is then screwed over the stud protruding above the nut face (fig.3) making sure that at least 1 x diameter of bolt is engaged with the Threaded Puller. Desired hydraulic pressure is now applied to load cell, which stretches the bolt. (fig.4). The nut is turned down using the nut-driver and tommy bar. The Pressure is then released leaving the stud loaded to the desired value.



# TL-TSS SERIES SUB SEA BOLT TENSIONERS



TL-TSS Series Bolt Tensioners are specially designed for subsea applications. These Tensioners are suitable for higher pressure rating flanges also. It's ergonomic design makes it very easy to handle and use by divers under the harsh sea conditions. These tensioners are designed to provide a wide range of flexibility, covering stud sizes 3/4" to 3.1/2" (M-18 to M-85).

The tool consists of two basic parts-Tensioning Unit and Puller Nut as shown.

**QUALITY  
STEEL**

The Complete tool is made from high strength stainless steel for use in corrosive sea environment and to minimize maintenance. Optional alloy steel construction also available.

**VERSATILE  
DESIGN**

Designed to provide a wide range of flexibility, covering stud sizes 3/4" to 3.1/2" (M-18 to M-85) using just 8 load cells.

**HIGH LOAD  
GENERATION**

Generates higher load making it suitable for high pressure rating flanges (API 170 - 10K).

**STROKE  
INDICATOR  
SAFE  
DESIGN**

All tensioners have a 25mm long stroke with piston marked with fluorescent rings for indication of stroke and over stroke limit.

Designed to release high pressure hydraulic oil inward in the event of over-stroke thus saving the operator from any potential exposure.

Fluorescent band provided on load cell body for easy tool identification in poor visibility conditions.

Provisioned with detachable hooks and straps for easy handling under water.

**MULTI  
TENSIONING**

The tensioning unit cell is provisioned with two connections that act as a manifold for multi tensioning applications.

**ANTI ROLL  
SEALS**

Fitted with Anti Roll, Composite Material seals for longer life and high reliability. The seals used have a low coefficient of friction so that the piston can be returned to a closed position with minimal effort. Sub Sea tensioners can be provided with machined PU (poly urethane) seals if requested.

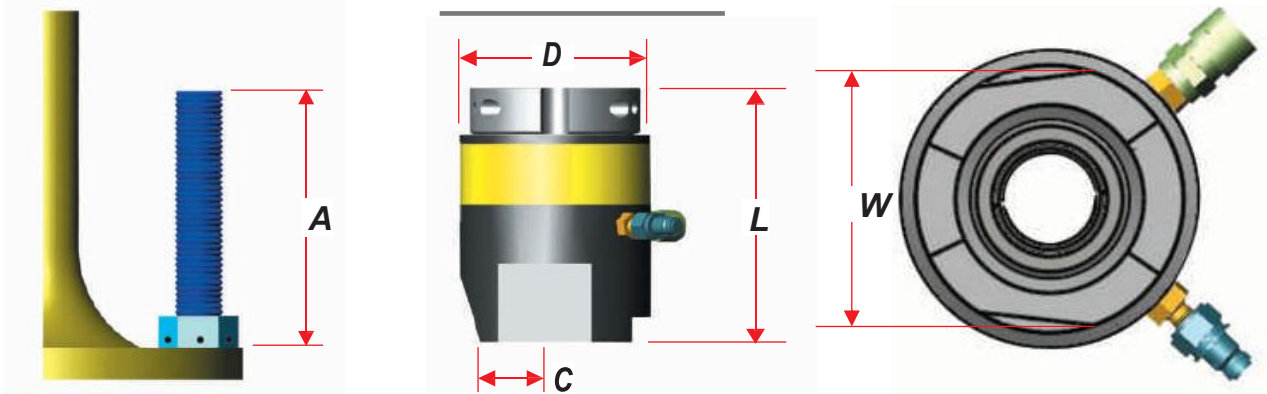
**OPTIONAL SPLIT  
NUT**

Optional Split Nut available for fast and easy fitment which ensures most efficient use of expensive dive time.

**EASY TO  
HANDLE**

Knurled and formed surface allows easy handling.

# TL-TSS SUB SEA BOLT TENSIONERS



Model No.		Bolt Size		Max Load		Hyd Area		D	C	W	L	A	Weight
Load Cell	Puller Nut	inch	mm	Ton	kN	in <sup>2</sup>	mm <sup>2</sup>	mm	mm	mm	mm	mm	Kg.
TL-TSS-03	TL-PT03-0.12	3/4"	M20	21.2	188	1.95	1256	65	30	46	100	122	2.0*
	TL-PT03-M20												0.3
	TL-PT03-0.14	7/8"											0.3
TL-TSS-04	TL-PT04-M24			34.7	309	3.19	2061	86	30	64	123	153	4.0*
	TL-PT04-1.00	1"											0.1
	TL-PT04-M27		M27										0.7
	TL-PT04-1.02	1.1/8"											0.7
	TL-PT04-M30		M30										0.7
TL-TSS-05	TL-PT05-1.04	1.1/4"		54.2	482	4.98	3215	98	30	78	138	171	5.5*
	TL-PT05-M33		M33									171	0.7
	TL-PT05-1.06	1.3/8"										174	0.7
	TL-PT05-M36		M36									174	0.7
TL-TSS-07	TL-PT07-1.08	1.1/2"		79.4	706	7.3	4710	117	30	93	147	186	7.4
	PT-PT07-M39		M39									186	0.8
	TL-PT07-1.10	1.5/8"										189	0.8
	TL-PT07-M42		M42									189	0.8
TL-TSS-11	TL-PT11-1.12	1.3/4"		119.1	1060	10.95	7065	138	60	113	152	197	13.5
	TL-PT11-M45		M45									197	3.5
	TL-PT11-1.14	1.7/8"										200	3.5
	TL-PT11-M48		M48									203	3.5
	TL-PT11-2.00	2"										206	3.8
	TL-PT11-M52		M52									209	3.8
TL-TSS-15	TL-PT15-M56		M56	174.7	1554	16.06	10362	164	60	141	171	229	20.7
	TL-PT15-2.04	2.1/4"										229	5.0
	TL-PT15-M60		M60									229	5.0
	TL-PT15-2.08	2.1/2"										233	5.2
	TL-PT15-M64		M64									233	5.2
TL-TSS-20	TL-PT20-2.12	2.3/4"		219.4	1952	20.17	13011	190	60	166	194	266	23.5
	TL-PT20-M72		M72									266	5.2
	TL-PT20-M76		M76									269	5.2
	TL-PT20-3.00	3"										269	5.2
TL-TSS-27	TL-PT20-M80		M80	268.7	2390	24.7	15935	214	60	191	208	288	31.5
	TL-PT27-3.04	3.1/4"										288	6.5
	TL-PT27-M85		M85									293	6.5
	TL-PT27-3.08	3.1/2"										293	6.5

\* Weight of Load Cell + Puller Nut.

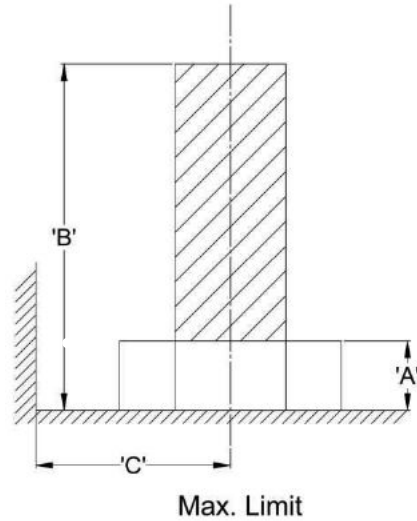


# TL-MSBT WIND-MILL

BOLT  
TENSIONERS



These 1500 bar working pressure tensioners are specially developed from our Compact series to meet auto retract and ease of operation requirement of wind-mill application.



**COMPACT**  
DESIGN

The tensioners are designed with smaller dia. for ease of tool fitment.

**HIGHER**  
WORKING PRESSURE

1500 bar working pressure to generate higher load with smaller hydraulic area of tensioner.

**GEARED** NUT  
DRIVE

Geared Nut Driver to move the nut faster and with ease using standard 1/2" Square Drive Wrench.

**LONGER STROKE**  
**QUALITY**  
STEEL

Tool is available with standard and long stroke as per application.

**CUSTOM**  
ADAPTOR KITS

CAT series tensioners are available with both standard and customized adaptor kit.

**OPTIONAL**  
SPRING RETURN

Standard tensioners are available with optional auto spring retraction for fast and easy retraction of piston.

Model No.	Stud Dia.		Outer Dia	Load	Stroke	OAL	A	B	C	Weight
	mm	inch								
TL-MSBT-30	30	1.1/8	73	452	6	203	28	65	36.5	6.0
TL-MSBT-33	33	1.1/4	78	516	6	229	32	73	39	8.0
TL-MSBT-36	36	1.3/8	85	664	8	230	35	79	42.5	10
TL-MSBT-39	39	1.1/2	94	862	8	252.50	37.50	81.50	48.50	12
TL-MSBT-42	42	1.5/8	98	930	8	282	42	107	48.5	13
TL-MSBT-45	45	1.3/4	108	1062	8	288	45	110	54	16
TL-MSBT-48	48	1.7/8	114	1235	8	310	45	101	57	17

# SPECIFIC APPLICATION BOLT TENSIONERS



## Dedicated Tensioners:

Dedicated Tensioners are used for Specific Thread Size Application, in these tensioners the threaded piston acts as a puller too. These tensioners are specific designed for applications having space restrictions, around the stud bolt.

**COMPACT  
DESIGN**  
**CUSTOMISED  
STROKE**  
**QUALITY  
STEEL**

The tensioners are designed with smaller dia. for ease of tool fitment. The dedicated tensioner has a very compact dia for required load and size with nominal requirement of operational height.

Tool is available with standard 15mm and customized stroke as per application.

All parts are made from High Strength Alloy Steel for better strength and compact design.

## Customized Tensioners:

These tensioners are designed for application where standard tensioners can't be accommodated due to space and load requirements. Working pressure may be 1500 to 2500 as per application.

All parts of these tensioners are made of Special High Strength Alloy Steel for better design and safety requirements.



# TL-PM-EH-1500 ELECTRIC PUMP BOLT TENSIONERS



The TL-PM-EH-1500 Electric motor with gear pump are designed to provide optimal service with bolt tensioner or hydraulic tools single-acting. Equipped with remote control with 5 m. cable for an easy use, 5 Ltr. tank, electromagnetic level and protective framework it is the ideal tool under all job conditions.

Other Models with higher maximum operating pressures, digital pressure gauges and larger hydraulic reservoir capacities are available as per customer requirements.

**HEAVY DUTY  
FRAME**  
**CALIBRATED  
PRESSURE GAUGE**  
**HIGH FLOW  
RATE**  
**ERGONOMICAL  
LAYOUT**  
**HIGH  
QUALITY**  
**REMOTE  
CONTROL**

Unit is enclosed in a heavy-duty frame for protection during handling usage and transportation.

Calibrated 100mm (4"). Liquid filled, 2000 bar rating pressure gauge with dual reading of bar and psi.

Provides high initial flow rate to ensure faster operation.

Logical layout of equipment and controls ensure easy operation and maintenance.

Heavy duty cycle comforts for reliability and durability of the unit.

Hand held remote control for easy and safe operation.

Model		TL-PM-EH-1500
Maximum pressure 1st stage	bar	150
	psi	2,145
Maximum pressure 2nd stage	bar	1,500
	psi	21,450
Hydraulic flow 1st stage	Lt./min	3
Hydraulic flow 2nd stage	Lt./min	0.7
Power rating and Voltage	kW/V	0.7/230 V-50Hz/single-phase
Speed	rpm	1400
Sound level	dB(A)	80
Intensification factor		13:01
Electric pump weight	Kg	42 (with 5 Lt. Reservoir, frame and remote control)
	Lbs.	92.6 (with 5 Lt. Reservoir, frame and remote control)



# TL-PU-AH-1500 AIR/ HYDRAULIC PUMP BOLT TENSIONERS



The TL-PU-AH-1500 air operated pumps are designed and manufactured to meet the highest technical and safety requirements of high-pressure equipment.

Other Models with higher maximum operating pressures, digital pressure gauges and larger hydraulic reservoir capacities are available as per customer requirements.

**HEAVY DUTY  
FRAME**

The hydraulic unit is installed in a weather-proof stainless-steel protection frame.

**LOGICAL CONTROL**

Logical layout design engraved for easy operation.

**PANEL CALIBRATED  
PRESSURE GAUGE**

Calibrated 150mm (6"), liquid filled, SS Frame, 2500 bar rating pressure gauge with dual reading of bar & psi.

**COMPLETE AIR  
SYSTEM**

Systems includes FRL Unit, air pressure gauge and control knob for safety air control and supply.

**HIGH  
OPERATING PRESSURE  
LIGHT WEIGHT**

Pump has max working pressure of 1500 bar to cover all bolt tensioning applications.

Unit weighs only 22 Kg and measures 380mm X 80mm x 410mm.

**QUICK CONNECT OUTLET**

Higher pressure ratio of 1:250 ensures less input air pressure for operation. Pump comes fitted with quick connect outlet for easy connection of hydraulic hoses.

Model No		TL-PU-AH-1500
Pressure Ratio		1 : 350
Displacement Volume	Cm3	1.3
Operating Pressure , Max. (at 5.1 bar Pre Limited (PL) Air Pressure)	bar	1,800
<b>Compressed air supply (air drive)</b>		
System Operating Air Pressure, Max.	bar	5.1
Safety Valve Set Pressure	bar	5.5
<b>Stainless Steel Tank Capacity</b>		
Oil Tank capacity	litre	5

# TL-PU-HP-1500 HAND PUMP BOLT TENSIONERS

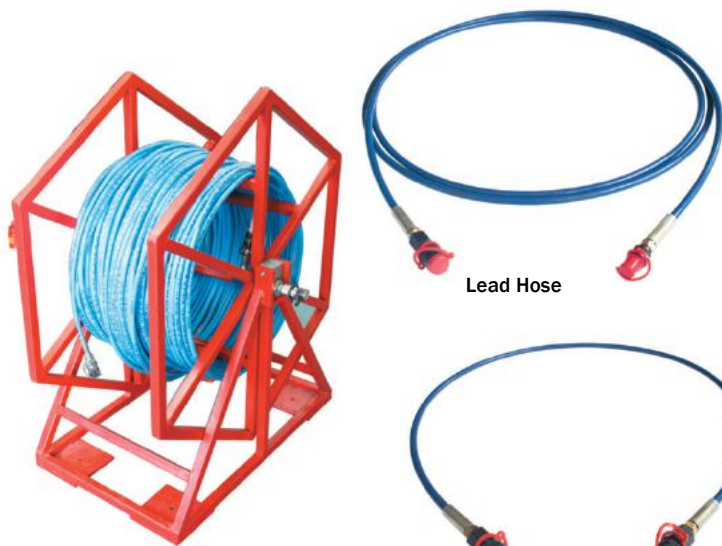


**Hand Pump:**

This hand pump is specially designed for bolt tensioner applications. The pump is compact and light in weight with longer handle needing very little effort to generate max working load. All pumps are supplied with suitable fittings and stainless steel 70mm dia pressure gauge.

Model No.	Description	Usable Oil Capacity (Liters)	Outlet Coupler	Dimensions								Net Weight	
				Length		Width		Height					
				mm	Inches	mm	Inches	mm	Inches	Kg.	Lbs.		
TL-PU-HP-1500	1500 bar Hand Pump c/w 200 bar gauge	3	HCS-150-F	615	24.22	200	7.88	190	7.48	12	26.46		

# TENSIONER HOSES BOLT TENSIONERS



Hose Reel

Lead Hose

Connecting Hose

Torq/Lite's High Pressure Tensioner Hoses for various tensioning applications are available in different lengths and end-fittings.

## Features :

- 4- Ply construction
- Available in 1.5m, 3m and 5m standard lengths. Other custom built lengths also available
- Max. Working Pressure: 1800 Bar
- Burst Pressure: 4500 Bar
- Min. Bend Radius: 150mm
- All hoses fitted with quick connect Coupling at both ends
- Working Temperature Range: -30 to 80 Deg C
- Tensioner Hose Reel of up to 500m single hose for sub-sea applications available with required end fittings

Part No.	OAL Mtr.	QRC
TL-PU-HG-0150	1.5	F x F
TL-PU-HG-0300	3	F x F
TL-PU-HQ-0300-L	3	F x M
TL-PU-HQ-0500	5	F x F

# MANIFOLD, FITTINGS & COUPLINGS BOLT TENSIONERS



Couplings



Fittings



Manifolds

Torq/Lite's Manifolds, Fittings, and Couplings for various configurations are are for all tensioning applications.

## Features :

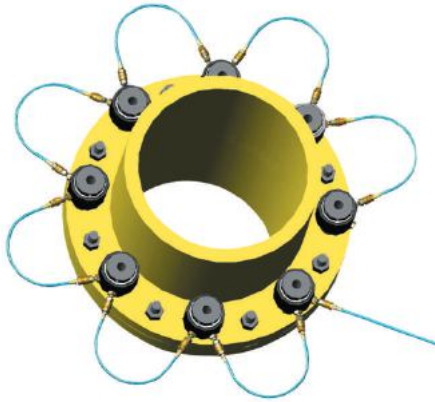
- Manifold/Blocks for 1500 working pressure
- T-Fittings for 1500 Bar working pressure
- Male/ Female Coupling for 1500 and 2500 bar working pressure
- High Pressure Fitting and Adaptors

Part No.	Description
TL-HCS-150-F	Coupling, 150 Mpa
TL-HCS-150-M	Nipple, 150 Mpa
TL-HCS-250-F	Coupling, 250 Mpa
TL-HCS-250-F	Nipple, 250 Mpa
TL-HF-G4-G4	Fitting, G 1/4 CS
TL-HF-G4-GM16	Fitting, G 1/4 x M16

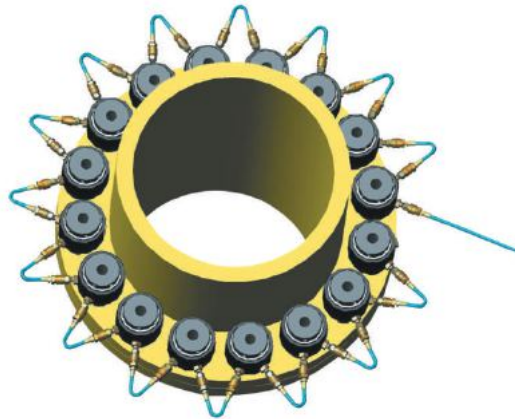
# APPLICATION BOLT TENSIONERS

## IMPORTANT FORMULA

- (A) Residual Bolt Load = Bolt Stress x Bolt Tensile Stress Area  
= (Bolt Stretch x Modulus of Elasticity x Bolt Tensile Stress area) ÷ Effective Length.
- (B) Bolt Tensile Stress Area =  $(3.14 \times D \times D) / 4$  (D is smallest Stress Dia of Bolt)
- (C) % of Yield Strength = (Bolt Stress Required / Yield Strength of bolt) x 100
- (D) Hydraulic Pressure = (Residual Bolt Load x Load Relaxation Factor) / Hydraulic Area of Load Cell
- (E) Load Relaxation Factor =  $1.01 + (\text{Bolt Size (Dia.)} / \text{Effective Length})$  or 1.1 which-ever is greater.



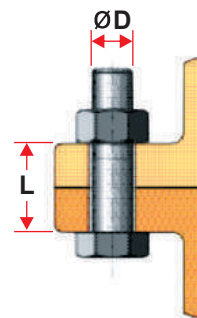
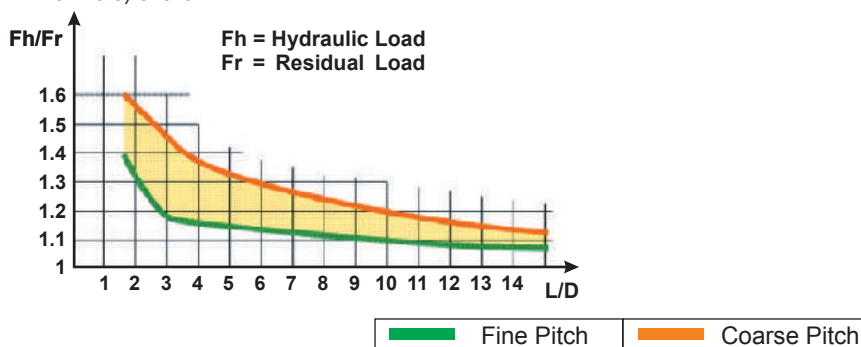
50% Tool Coverage



100% Tool Coverage

## BASIC CALCULATION & WORKING

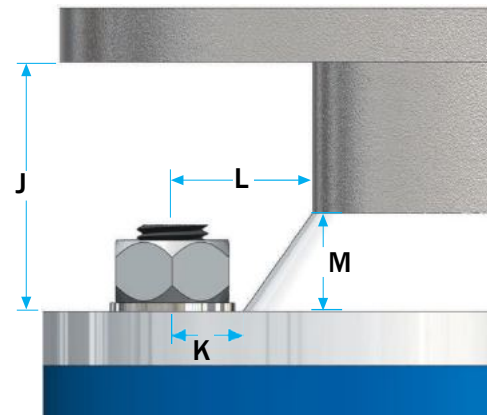
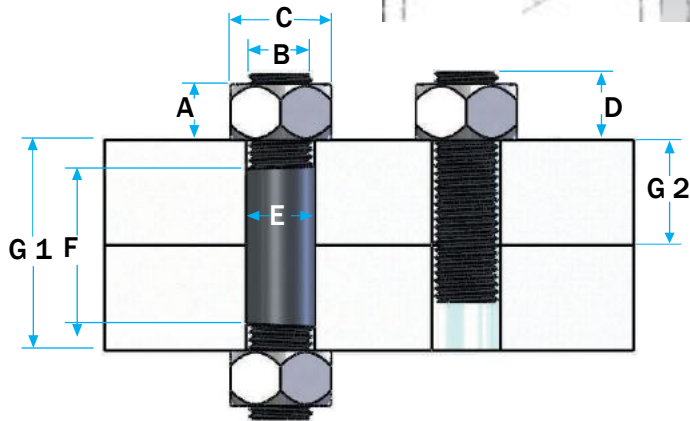
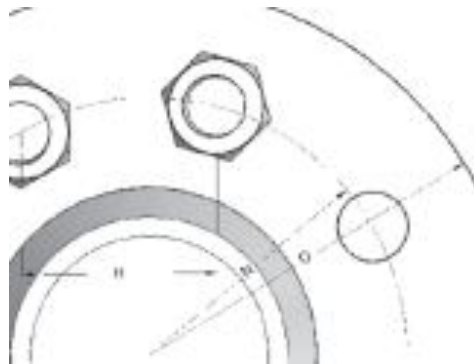
- a. Calculate Bolt Residual Load: Residual Load can be calculated from known stress or bolt stretch requirement.
- b. Calculate Load Relaxation factor using Bolt Dia and Effective Length. It can be calculated from below formula/chart:



- c. Calculate application hydraulic load.
- d. Calculate hydraulic pressure for required hydraulic load.
- e. Select Tensioning Procedure. (25%, 50%, 100%...ect.)
- f. Calculate pass load as applicable. (Max applied load should never exceed 95% bolt yield strength.)

# APPLICATION CHECKLIST BOLT TENSIONERS

A) \_\_\_\_\_ H) \_\_\_\_\_  
 B) \_\_\_\_\_ I) \_\_\_\_\_  
 C) \_\_\_\_\_ J) \_\_\_\_\_  
 D) \_\_\_\_\_ K) \_\_\_\_\_  
 E) \_\_\_\_\_ L) \_\_\_\_\_  
 F) \_\_\_\_\_ M) \_\_\_\_\_  
 G) \_\_\_\_\_ N) \_\_\_\_\_  
 H) \_\_\_\_\_ O) \_\_\_\_\_



Thread Pitch / TPI. \_\_\_\_\_ Stud material. \_\_\_\_\_  
 Stud strength. \_\_\_\_\_ Desired retained stress in stud. \_\_\_\_\_  
 Depth if nut fits in a counterbore (or spot face depth). \_\_\_\_\_  
 Service temperature. \_\_\_\_\_ Desired stroke or amount of flange compression. \_\_\_\_\_  
 Will studs be loaded individually or several at a time? \_\_\_\_\_