TRISTAR

Bolting Solutions

Torqueing & Tensioning Solutions

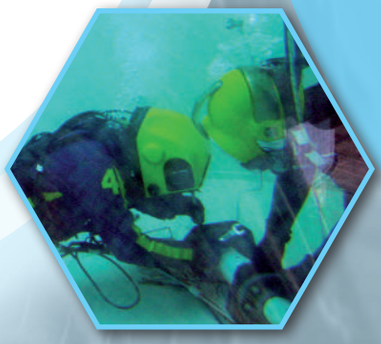
- Topside
- Subsea
- Structural

Innovations
based on
EXPERIENCE

Tri-Star has been in the oil & gas and power generation industry since 1983.

Tri-Star's Bolting Solutions Division supplies and rents a full range of bolt tightening tools and provides service (with engineers) around the world.

The Tri-Star experience results in unsurpassed knowledge in the design, manufacture and on-site commissioning of fasteners and bolting solutions, cable management and corrosion protection.



QUALITY AND SERVICE

Design with Experience

Customers benefit from our single most important asset, extensive application knowledge in a wide range of industries and bolting applications. This supported with for example, up-to-date Design Modelling techniques, Finite Element analysis and Strain Gauge Testing which enables us to provide the very best standard and bespoke bolting product design solutions available today.

Quality Accreditation and Manufacture

With the increasingly shorter and stringent time schedules in today's industrial work, product delivery is essential in maintaining and improving plant productivity. Managed by our accredited ISO 9001 quality system our modern in-house manufacturing and inspection facilities provide efficient and effective delivery of our products to meet your requirements.

Bolted Joint Integrity

Joint integrity, the ability of a bolted joint to maintain a safe and, in the case of flanged joints, leak free service over a prolonged period of time is a key requirement for safe and effective operation of plants. Clients have access to highly qualified and experienced engineers in a variety of industrial bolted joint applications. Combined with access to our Joint integrity software clients can attain fast solutions to bolted joint problems.

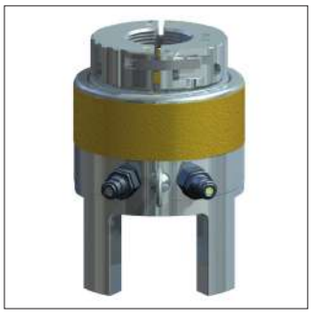
Onsite Solutions

TRI-STAR's onsite service and commissioning teams are trained in the use and application of our products and procedures over a wide variety of applications, bringing you onsite joint integrity 24 hours per day, 365 days per year. Our knowledge base is constantly being upgraded through our learning and thinking organization to meet the ever-changing needs of the market place.

CERT. NO 93-2-0163
SS ISO 9001 : 2000

001

MS ISO 9001/QS-9000 REG. NO. AR 0176



SM Sub-Marine Tool

FOR SUBSEA APPLICATIONS

Revolutionary 'QUICK' SNAP CLOSED Reaction Nut provides the most RIGID, RELIABLE and LIGHT WEIGHT diver's operated tools available today.

- STAINLESS STEEL
- Piston mis-alignment compensation
- Long Piston Stroke (up to 30mm)

Flange Pulling System

PULL and ALIGN FLANGES TOPSIDE AND SUBSEA

For use on connections where speed, relability and simple operation are essential. The Flange Pulling System is a hydraulically operated tool being connected to a pump unit via a hydraulic harness assembly and downline.

MPR Topside Tool

FOR SERVICE INDUSTRY

For companies frequently working on a variety of bolt tensioning projects, this tool offers LOAD and SIZE ideally suited to ANSI and API flange applications. INTEGRAL HEX INSERT and QUICK FIT BRIDGE provide efficient bolt size change over. No hex wrenches required and no lost hex inserts.

- ONLY 4 primary tools cover 1" to 3-1/2" (M24 – M90)
- ONLY 6 Primary tools cover 5/8" to 4" (M16 – M100)
- Additional Secondary tools add range flexibility

EV Topside Tool

FOR COMPLETE FLEXIBILITY

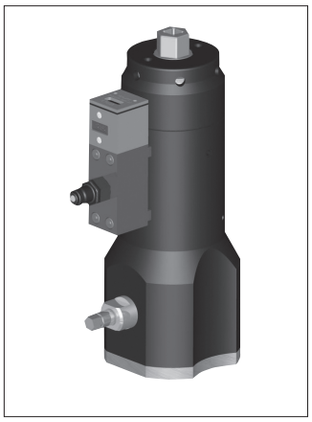
Suited to a wide range of industrial applications, whether for a SINGLE OR MULITIPLE BOLT SIZE PROJECTS the EV range enable users to select the most ECONOMICAL and VERSATILE range to meet their particular requirements.

- Dual Bridge increases ECONOMY
- 13 Tools provide flexible range 3/4” to 4 “ (M20 – M100)
- Select only 4 tools TO COVER 1” TO 3-1/2”

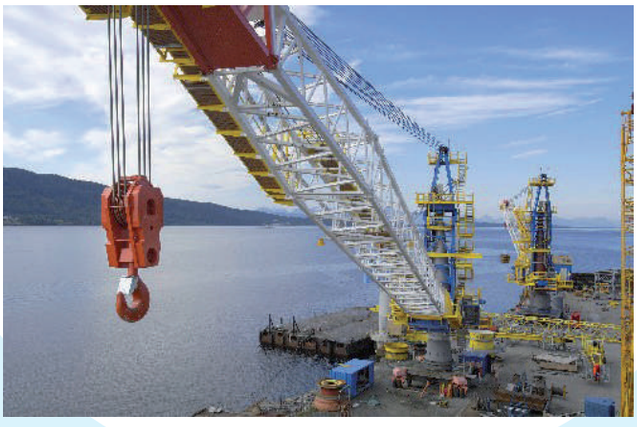
Dual Piston Tensioner

FOR STRUCTURAL BOLTS AND CRANE SERVICES

Dual Piston design provides small diameter compact tools
- suited to crane slewing bolts
- 30mm to 60mm 10.9 bolts
- Time saving
- Counter to ensure tool’s monitored operation



APPLICATIONS IN DIFFERENT INDUSTRIES



Puller Bar Bolt Tensioning Tools

Many applications such as crane slew rings require bolt tensioning tools that provide high loads but with small diameter. TRISTAR Puller Bar Bolt Tensioning Tools provide solutions to such applications.

Single, dual or triple piston designs are available which utilises a puller bar that connects to the extended stud to be tightened. These pistons act on the puller bar to provide bolt extension during the bolt tightening operation.

TRISTAR Puller Bar Bolt Tensioning Tools may include additional features such as spring assisted spring return. Hydraulic connections can either be top or side entry to suit the intended application.

Threaded Piston Bolt Tensioning Tools

TRISTAR Threaded Piston Bolt Tensioning Tools provide solutions for applications with space restrictions where standard puller sleeve type tools will not fit. They can also be designed for applications which require higher bolt loads or smaller tools.

Conventional bolt tensioning tools utilise a separate threaded puller sleeve where as the Tri-Star Threaded Bolt Tensioning Tools has a threaded piston that engages with the stud bolt to be tightened. A top hydraulic connection also allows easy fitting of the Threaded Piston Bolt Tensioning Tool on to the application to be tightened. If there exist any height restrictions, a swivel connection is provided.

Hydraulic Nuts

TRISTAR Hydraulic Nuts replace conventional hex nuts.

The use of TRISTAR Hydraulic Nuts significantly reduces down time on applications that require frequent maintenance involving joint breakout and re-assembly. Other than the supply of a hydraulic pump unit and hoses, no other equipment is needed.

To use, simply screw the TRISTAR Hydraulic Nuts onto the stud bolts to be tightened. Apply a predetermined hydraulic pressure via a pump and hoses and turn down the threaded collar. Release the hydraulic pressure, disconnect pump and hoses and the application is complete. Break out is simply the reverse procedure.

Depending upon the application, top collar or bottom collar designs are available in a range of loads to suit many industrial applications.

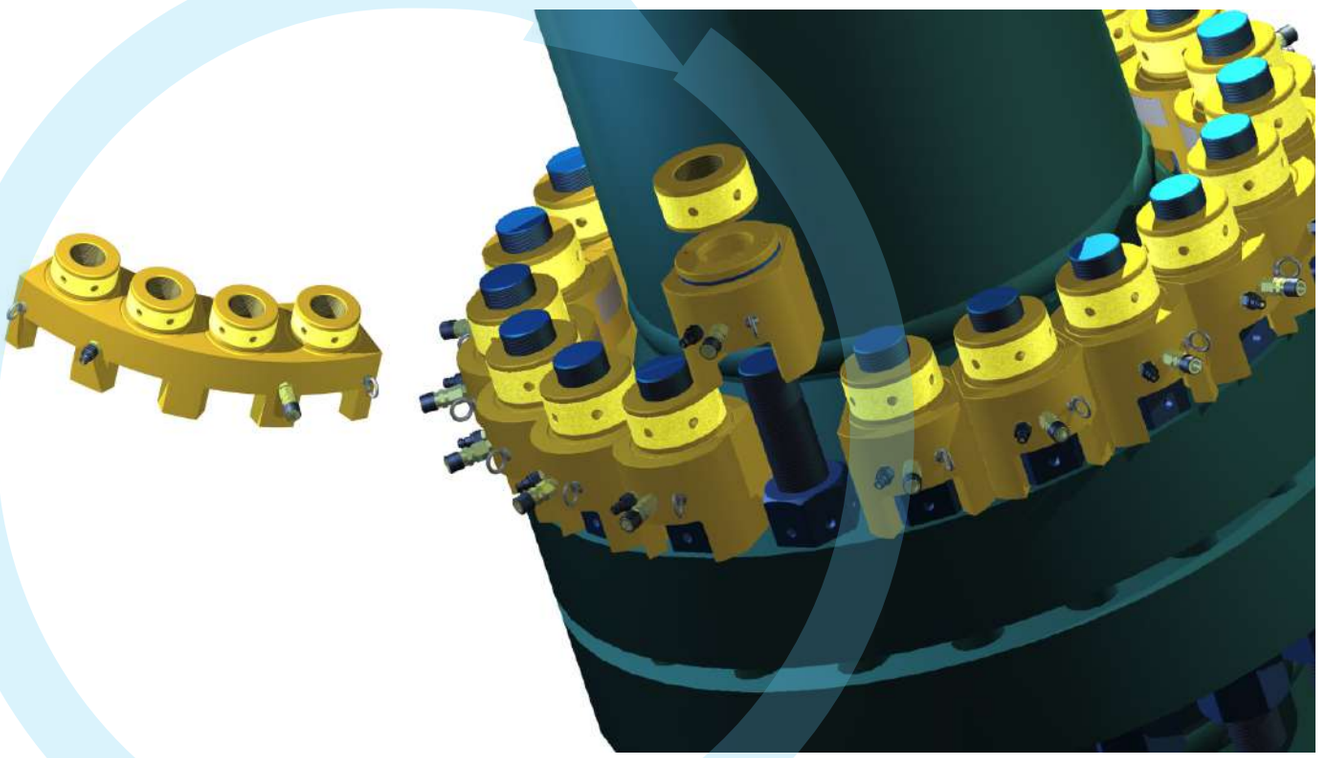
Segmented Bolt Tensioning Tools

When applications require all bolts to be tightened simultaneously, access to both sides of the joint is usually required so that half the quantity of bolts are tightened from one side and the remaining from the other side.

However, some applications have access restrictions, allowing bolt tensioning tools to be fitted to only one side of the joint to be tightened. TRISTAR Single Stud and Multi-Stud Segmented Bolt Tensioning Tools enable all bolts on a flanged joint to be tightened simultaneously from one side of the joint.

TRISTAR Multi-Stud Bolt Tensioning Tools provide fast assembly with minimum hose connections. These tools have multiple pistons fitted to a single segment, each segment provides tightening of a number of stud bolts usually ranging from 2 to 5 being tightened simultaneously.

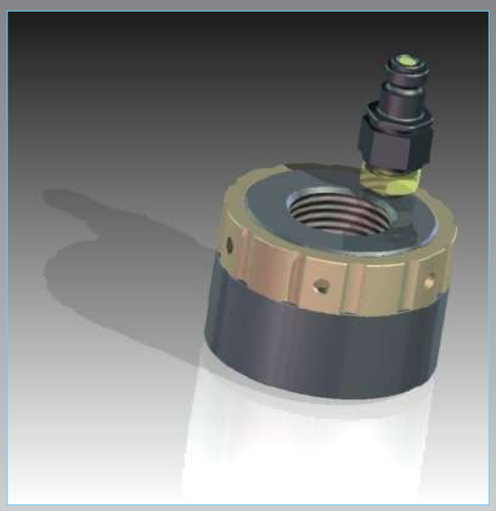
For smaller diameter joint with up to 12 bolts, a TRISTAR Single Segment Bolt Tensioning Tool can be used to tighten all stud bolts simultaneously. These tools also provide the ideal solution when tool weight and handleability are significant considerations. Although they require more hose connections, they are much easier to handle in difficult to access situations or in challenging environments such as subsea applications.

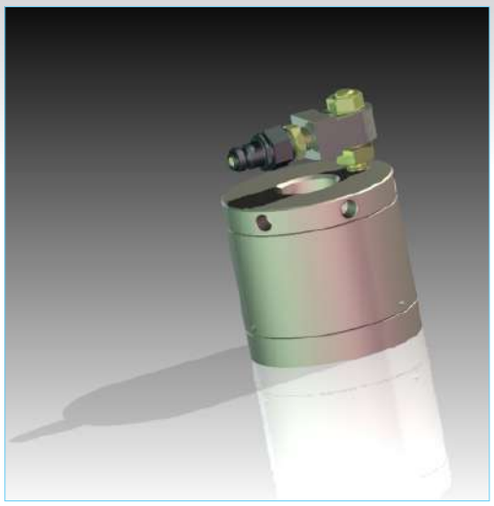


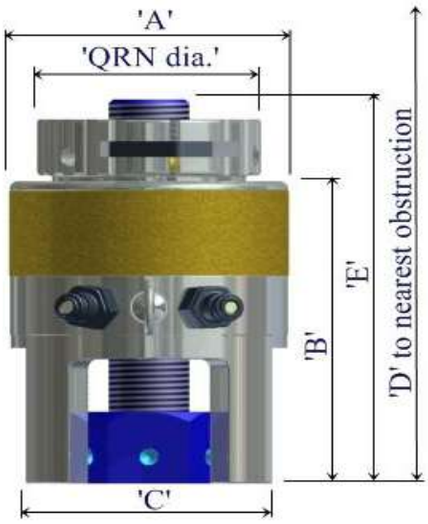
BOLT TENSIONING SYSTEM

Bolt Tensioning is a simple and reliable method of applying a preload to a fastener assembly. Bolt Tensioning applies a force directly to the bolt and stretches it axially, eliminating most of the factors which provide control problems using other tightening methods such as torque tightening.

The Bolt Tensioner is placed over each stud bolt on the joint to be tightened. They are then interconnected via a harness assembly to a single pump unit. This allows each bolt tensioning tool to be pressurised simultaneously providing even loading around the joint. Extension is applied directly to the stud bolt, which is then retained by the stud bolts and nuts. This in turn provides the clamping force necessary to maintain the joint.







Submarine Bolt Tensioner

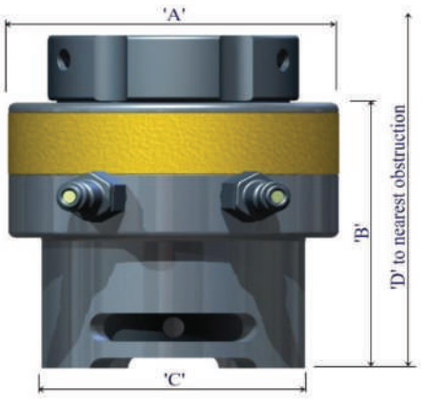
Compact design covers ANSI and API Flange

- 5/8” to 4” Imperial Bolting, M16 to M100 Metric Bolting
- Only 5 ‘PRIMARY’ tools cover 3/4” to 3-1/2” bolt sizes (SM1, SM2, SM3, SM4, SM5)
- Stainless Steel - No Corrosion
- Option Carbon Steel Electro-less Nickel Plated
- Improved on-site durability
- Piston mis-alignment compensation
- Hinged quick reaction nut - improved operation
- Long piston stroke
- Piston over-stroke safety feature
- Max working pressure 1500 Bar (21750psi).

Tool Ref	Bolt Size ins	Bolt Size mm(3)	Piston Stroke mm	Hydraulic Area sq mm	Tool Load kN	QRN Dia. mm	A mm	B mm	C(1) mm	D mm	E(2) mm	Wt(2) kg
SMC	5/8 3/4 7/8	16 20 22	20	1081	162	62	65	103	52	146	206	1.7
SM0	5/8 3/4 7/8 1	16 20 22 24	25	1667	250	72	80	117.5	66	146	221	2.2
SM1	3/4 7/8 1 1-1/8 1-1/4	20 22 24 27 33	30	2413	362	82	93	134	74	170	255	4.1
SM2	1-3/8 1-1/2 1-5/8	36 39 42	30	3417	513	87	110	145	93	186	276	5.8
SM3	1-3/4 1-7/8 2	45 48 52	30	5342	801	106	132	160.5	108	203	303	8.7
SM4	2-1/4 2-1/2 2-3/4	56 64 72	30	10409	1561	135	177	180	140	230	350	15.6
SM5	3 3-1/4 3-1/2	76 85 90	30	17173	2576	150	220	202	180	264	399	30.0
SM6	3-1/2 3-3/4 4	90 95 100	30	24017	3602	182	262	240	214	304	464	40.0

Notes:
1) Dimension ‘C’ for guidance only. For detailed foot print details request a General Arrangement Drawing.
2) Dimension ‘E’ for guidance only. For tool removal add 2 x piston stroke used.
3) Weight excludes Quick Reaction Nut.
4) Specifications may change without prior notice. For updated information request a General Arrangement Drawing.

Topside Bolt Tensioner



Compact design covers ANSI and API Flange

- 5/8" to 4" Imperial Bolting, M16 to M100 Metric Bolting.
- COST SAVING : Only 4 'PRIMARY' tools (suffix 'P') needed to cover 1" to 3-1/2" (M27 to M90) bolt sizes.
- Only 6 'PRIMARY' tools cover 5/8" to 4" bolt sizes.
- 3 'SECONDARY' tools (suffix 'S') add range flexibility.
- Bayonet fitting Bridge with integral Nut Rotating Disc.
- Built in automatic piston mis-alignment compensation combats flange rotation.
- Maximum Piston Stroke Indicator helps prevent piston over stroking.
- Optional tool finishes available to suit budget and technical requirements, including Stainless Steel.
- Twin Port arrangement eliminated expensive 'Tee' Block hose assemblies.
- Maximum operating pressure 1500 bar.
- Improved Reliability - High cycle self energising seal arrangement.

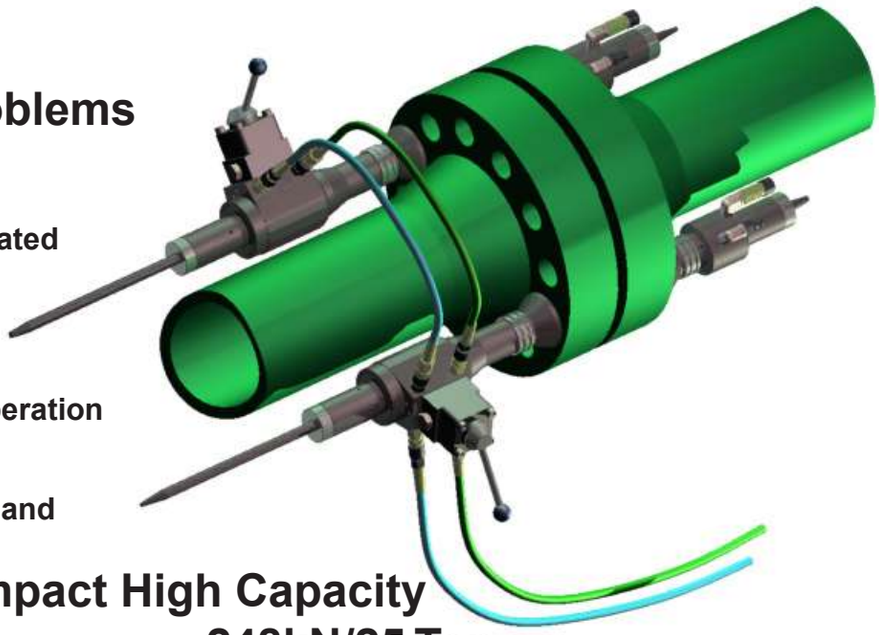
Tool Ref	Bolt Size		Piston Stroke	Hydraulic Area	Tool Load	A	B	C	D(1)	Wt(2)
	ins	mm(3)	mm	sq mm	kN	mm	mm	mm	mm	kg
MPR0-P	5/8	16	10	1188	178	72	88.5	49.6	132.5	1.9
	3/4	20					91.5	51.6	135.5	
	7/8	22					91.0	64.0	135.0	
MPR1-S	7/8	22	10	2000	300	87	97.5	63.5	143.5	2.8
		24					97.5	63.5	143.5	
	1	27					100.5	70.00	150.0	
	1-1/8	30					103.5	75.5	156.0	
MPR2-P	1	27	15	3033	455	105	108.5	75.0	160.0	3.7
	1-1/8	30					111.5	80.0	166.0	
	1-1/4	33					114.5	84.0	172.0	
	1-3/8	36					118.0	88.5	179.0	
MPR3-S	1-1/4	33	15	4533	680	117	115.0	87.0	173.5	5.3
	1-3/8	36					118.0	92.0	180.0	
	1-1/2	39					121.0	95.0	186.0	
	1-5/8	42					123.5	95.0	192.5	
MPR3.5-S	1-3/8	36	15	5000	798	131	121	110.0	182.0	7.9
	1-1/2	39					121	112.0	188.0	
	1-5/8	42					124.5	114.0	195.0	
	1-3/4	45					127.5	117.0	201.0	
MPR4-P	1-1/2	39	15	6933	1040	145.6	121.0	112.0	192.0	8.7
	1-5/8	42					124.5	109.0	198.5	
	1-3/4	45					127.5	110.0	205.0	
	1-7/8	48					130.5	110.0	211.0	
	2	52					134.0	119.0	217.5	
MPR5-P	2	52	15	12400	1860	182	134.0	119.0	220.5	12.9
	2-1/4	56					140.5	132.0	233.0	
		60					140.5	132.0	233.0	
	2-1/2	64					146.5	144.5	246.0	
		68					146.5	144.5	246.0	
	2-3/4	72					152.5	159.2	258.5	
MPR6-P	2-3/4	72	20	18805	2820	234.5	178.0	166.5	298.5	29.5
	3	76					184.0	168.5	311.5	
		80					184.0	168.5	311.5	
	3-1/4	85					191.0	188.5	324.0	
	3-1/2	90					197.0	187.5	337.0	
MPR7-P	3-1/2	90	20	24873	3730	265	197.0	193.0	337.0	47
	3-3/4	95					203.5	225.0	349.5	
	4	100					209.0	228.0	362.0	

Notes:

1) Dimension 'D' for guidance and applies to imperial bolt sizes assuming stud protrusion above the nut=1 bolt diameter. As a general rule, for tool removal after bolt tensioning add 2 x piston stroke used.
2) Weight excludes puller sleeve and varies dependent upon Cylinder/Bridge combination.
3) For metric sizes, the imperial bridge indicated is used.
4) Specifications may change without prior notice. For updated information request a General Arrangement drawing.

Flange Pullers

High Tensile Cable
No ‘Bird Nesting’ Problems



High Tensile Cable eliminates ‘Bird Nesting’ problems associated with products using wire rope.

Multiple configuration modes:
- **Single or multiple operation**
- **Individual or simultaneous operation**
- **Integral or Remote valve**

Reaction Clamp - Rapid set-up and decommissioning

Compact High Capacity
248kN/25 Ton

Introduction

The TRI-STAR Flange Pulling system has been developed for use on subsea flanged connections where speed, reliability and simple operation are essential. They are hydraulically operated tools being connected to a pump unit via a hydraulic harness assembly and downline.

The system comprises a hydraulic puller cylinder, hydraulic reaction clamp and length of high tensile cable. The high tensile cable is placed through corresponding bolt holes on each of the flanges. The clamp cylinder is located on the cable at the back of one of the flanges and acts as a reaction point for the system. The clamp cylinder ‘grips’ the cable via an integral hydraulically activated and de-activated collet system. The pulling cylinder is located at the opposite end of the high tensile cable (at the rear of the opposite flange). Collets located at the front and rear of the puller cylinder alternatively ‘grip’ the cable as the piston in the puller cylinder extends and retracts. As the piston extends the rear collet grips the cable and the puller moves forward bringing the flanges together. The piston is then retracted and front collets grip the cable holding the puller in position. This operation is repeated until the flanges are brought together.

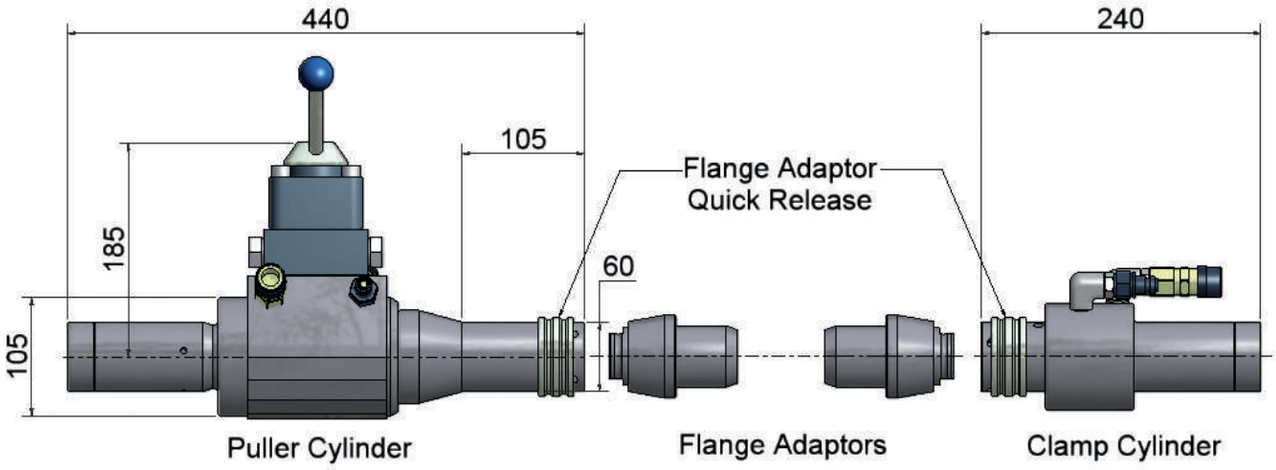
To bring the flanges together evenly and in alignment, 2 puller cylinders and associated clamp cylinders are normally used. Alternative arrangements are readily set-up for individual or simultaneous operation from either integral valves or remote valves. Once the flanges are brought together the clamps can be hydraulically de-activated and removed from the cable, this then allows the puller units and the cables to be removed and recovered to the surface.

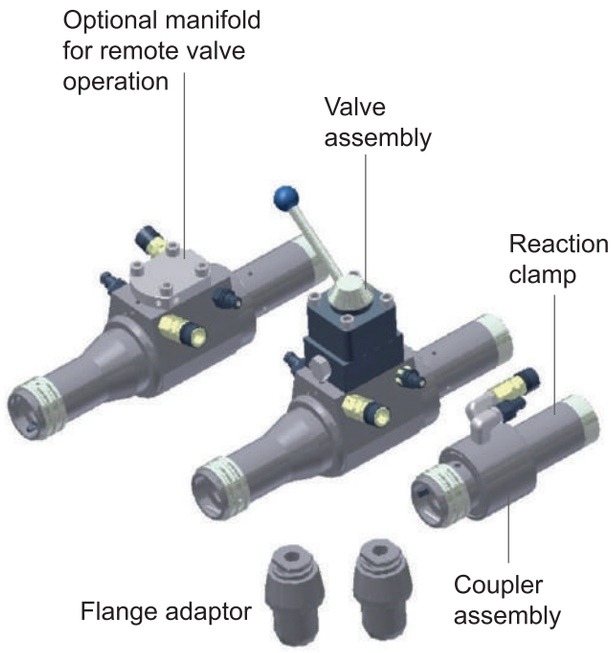
Tool Ref.	Maximum Working Pressure		Maximum Load			Piston Stroke		Cable DIA.
	Bar	PSI	Tonf. Long	Tonf. Short	kN	ins	mm	mm
Puller Cylinder	700	10,000	25.0	28.0	248.0	3.0	76	18
Reaction Clamp						-	-	

FLANGE PULLING SYSTEM

• Integral Operating Valve • Optional Manifold for Remote Valve Operation

• Pre-Stress Cables provide Increased Rigidity as Joints are closed





Flange Adaptors
Unique Quick-connect/Dis-connect flange adaptors are used to assist in the alignment of flanges during the pulling operation.
Sizes available for all imperial & metric bolt holes.

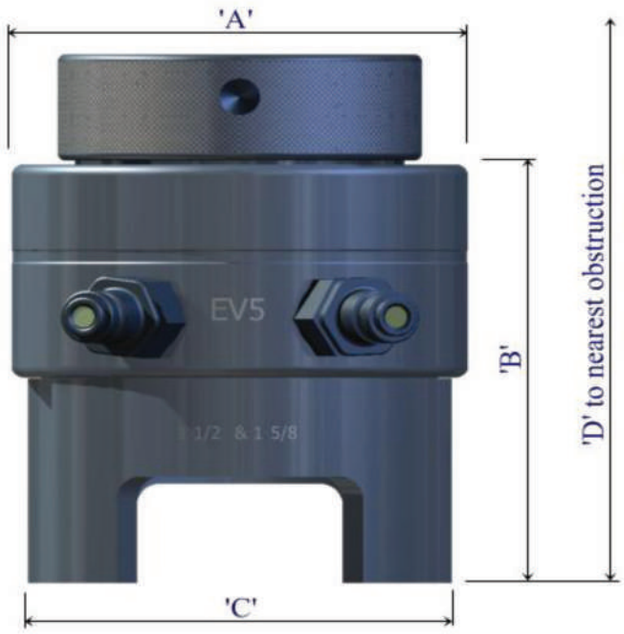
Valve Assembly
Valve design incorporates a centre 'hold' position, allowing the hydraulic supply/down line to be disconnected and the puller units to stay in position. This will ensure there is no separation of the joint during periods of weather downtime or bell changeovers.
Valve design also permits the pullers to be operated simultaneously or individually, allowing the operator to control the alignment of the flanges during the pulling operation.

Reaction Clamps
Hydraulically activated and released reaction clamps eliminate collect lock-on and allow fast application and removal of the tool.

Coupler Assembly
Simple 'quick disconnect' coupler system offers quick connection and removal of the harness assembly.

High Tensile Cable
18mm High Tensile Cable is used, the structure of the wire eliminates the possibility of the strands falling under load preventing 'bird nesting' from taking place. The cable is flexible over longer distances (2-3m) but becomes almost rigid over short lengths (around 12"), this aids in the alignment of flanges as they are drawn together.

EV Bolt Tensioners



FOR COMPLETE FLEXIBILITY

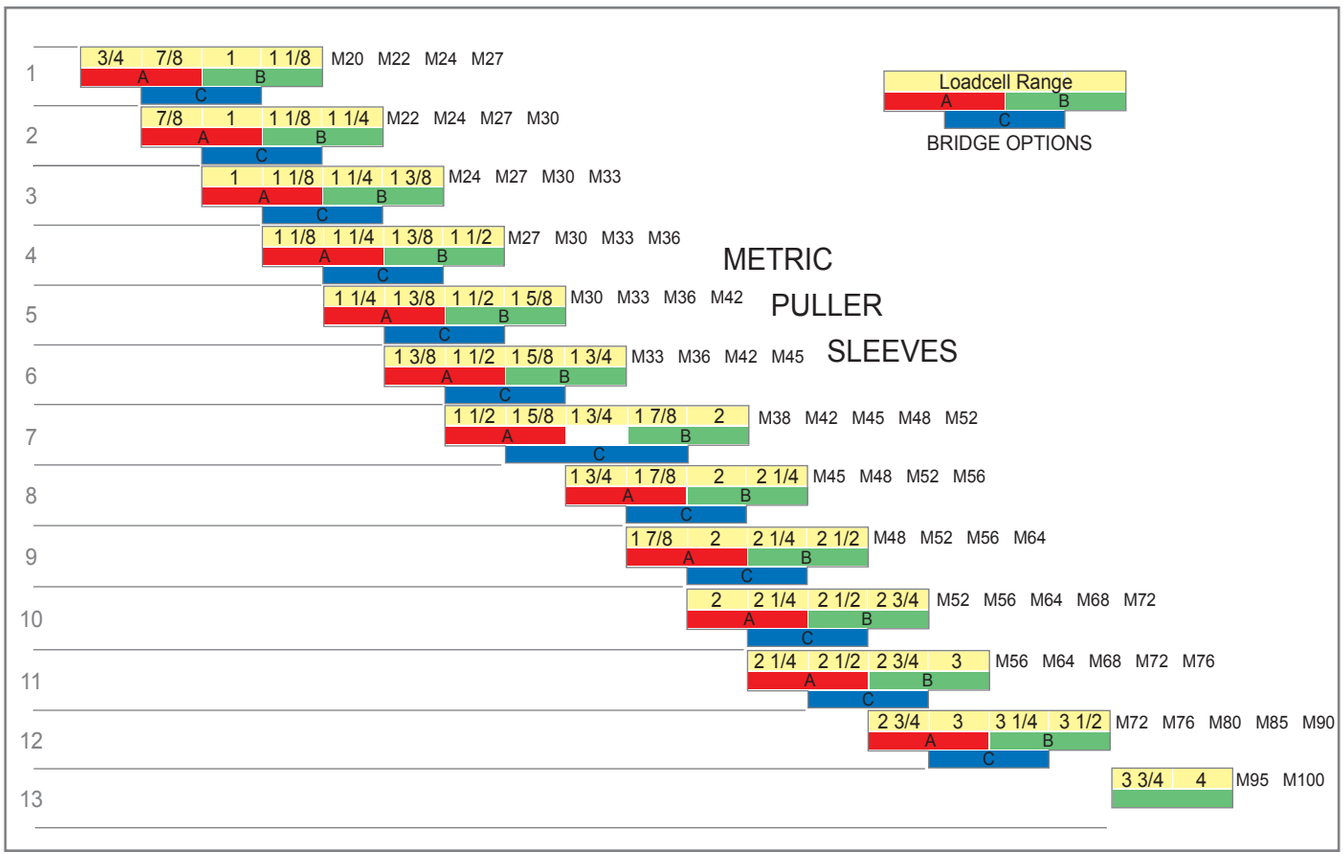
Suited to a wide range of industrial application. Whether for SINGLE OR MULTIPLE BOLT SIZE PROJECTS, the EV range enable users to select the most economical and versatile range to meet their particular requirement.

- Dual Bridge
  increase ECONOMY
- 13 Tools provide flexible range
  3/4” to 4” (M20 - M100)
- Select only 4 tools
  TO COVER 1” to 3-1/2”

Tool Ref	Piston Stroke mm	Hydraulic Area sq mm	Tool Load kN	A mm	B mm	C(3) mm	D(1) mm	Wt (2) kg
EV1	15	1510	226	82.4	104.5	80	176	1.9
EV2	15	1990	297	90.6	111.0	85	180	3.3
EV3	15	2540	381	99.6	114.0	96	185	4.7
EV4	15	3130	469	107.6	121.0	104	196	5.7
EV5	15	3810	571	115.9	120.0	110	199	6.1
EV6	15	4581	687	124.4	125.0	118	214	8.6
EV7	15	6207	931	142.5	131.0	140	220	10.0
EV8	15	7130	1069	150.6	137.0	150	248	11.7
EV9	15	9201	1380	167.7	143.0	162	255	14.1
EV10	15	11416	1712	185.0	150.0	176	266	16.8
EV11	15	14125	2118	201.0	179.0	194	326	20.7
EV12	15	20065	3010	235.2	192.0	230	347	24.7
EV13	15	26866	4030	267.6	205.0	250	377	33.6

Notes:
1) Dimension ‘C’ for guidance and varies considerably dependent upon bolt size and thread protrusion above the nut. For more detailed information ask for General Arrangement drawing.
2) Weight excludes puller sleeve and varies dependent upon Cylinder/Bridge combination.
3) Varies with bolt size, worse case shown. For detailed information ask for General Arrangement drawing.
4) Specifications may change without prior notice. For updated information request a General Arrangement Drawing.

EV Range Table



For maximum economy, select the Puller Sleeve and Bridge combinations that best suit your current and future requirements.

Some examples shown here.

Four Puller Sleeve Sizes with Two Bridges

Two Smaller Puller Sleeve Sizes with One Bridge

Two intermediate Puller Sleeve Sizes with One Bridge

Two larger Puller Sleeve Sizes with One Bridge

Dual Piston Bolt Tensioner

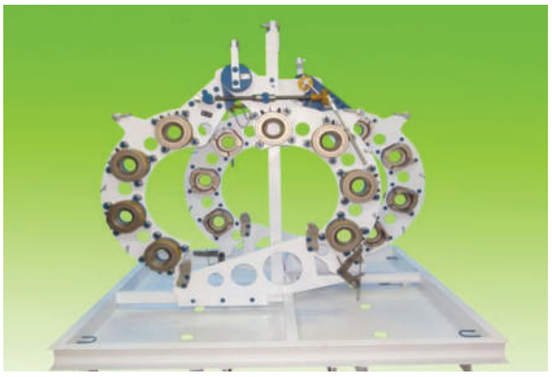
- Dual Piston design providing small diameter compact tool operating at 1500 Bar
- Ideally suited to crane slewing and foundation bolt applications
- Time saving Rapid Piston Reset suitable for multiple bolt high frequency use
- Standard tools provided for grade 10.9 structural bolting and below
- Tools for higher strength typically grade 12.9/14.9 structural bolting can be provided
- Optional bridge designs for hex and round nut applications
- Joint quality - Optional geared bridge improves bolt residual load and consistency between bolts
- Stroke counter helps monitor tool life and service intervals to ensure reliable usage.

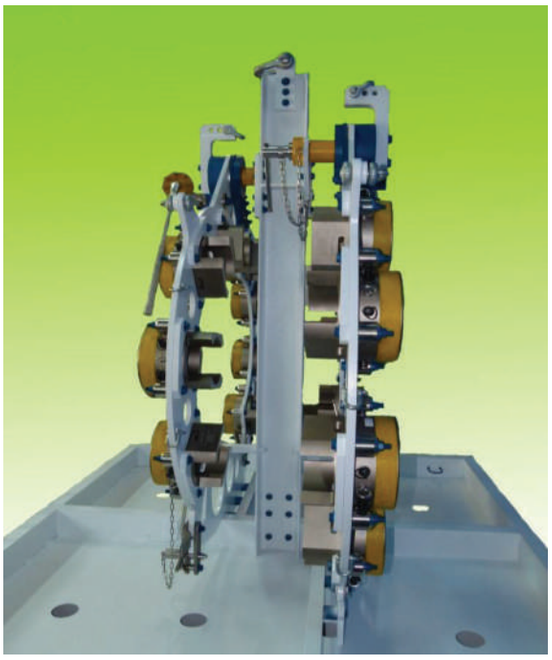
Tool Ref	Bolt Size mm	Piston Stroke mm	Hydraulic Area sq mm	Tool Load kN	A (1) mm	B(2) mm
DPS30	30	8	3228	465.60	75	230
DPS33	33	8	3840	576.00	79	237
DPS36	36	8	4562	678.52	84	244
DPS39	39	8	5401	810.08	94	291
DPS42	42	8	6197	929.60	100	301
DPS45	45	8	7249	1087.30	106	304
DPS48	48	8	8134	1220.10	113	319
DPS52	52	10	9739	1460.80	124	365
DPS56	56	10	11233	1684.90	133	364
DPS60	60	10	13060	1959.00	143	375

Notes:

1) Final dimensions depend upon your specific application and bridge detail
2) Typical value, Tool Height depends upon your specific application and bridge used
3) Specifications may change without prior notice. For updated information request a General Arrangement Drawing.

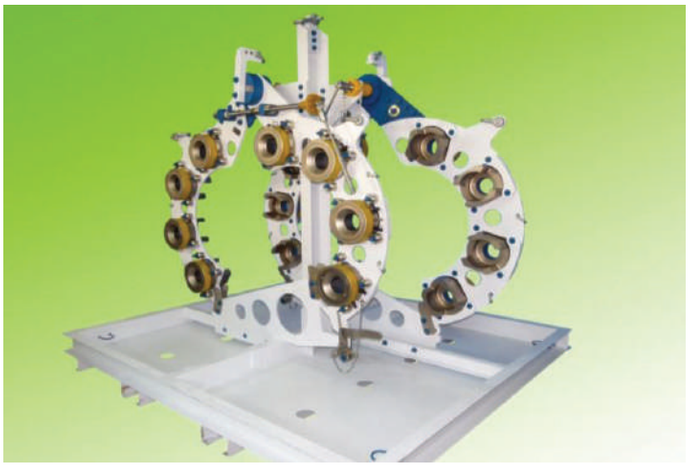
SUBSEA TENSIONER TOOL PLATES





SPEED Plate

- Easy handling and mobilities (Diver's friendly)
- Faster and economical completion of joints
- Design to fit
- Can accommodate large size tensioners
- Skid mounted for easy tranportation to site
- Maintenance free



Bolt Tensioning SPEED Plates - The ULTIMATE Bolt Tensioning Fixture

TRI-STAR Industries is capable of designing and producing bolt tensioning SPEED plates for bolt tensioning applications.

SPEED plates significantly reduce set-up and operation time especially for the subsea environment where tight schedule always persist. With the introduction of our SPEED plate, divers no longer need to 'lock-in' tensioners, one at a time on each stud bolts. This time consuming task is made easier for all bolt sizes including large sized bolt tensioner e.g. 3.0" to 4.0" bolt sizes. Simply makeover the SPEED plate into position and adjust the jacking screw to allow tensioners to slide into studs. Large SPEED plates may be securely mounted on a skid base, designed to be lowered to the sea bed. Subsequently, air lifting bags are used to lift them off the skid to be aligned onto each flange for tensioning.

Concurrent 50% tightening will need only 1 set of SPEED plate, whereas concurrent 100% tightening will need 2 sets of SPEED plates, saving diving time and costs!

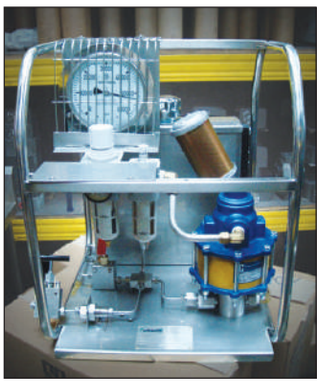
PUMPS AND ACCESSORIES

AIR DRIVEN TORQUE WRENCH PUMP

Max Air Inlet Pressure : 100psi / 6.9 Bar / 50 cfm
Max Working Pressure : 10,000psi / 680 Bar
Dimension : 16.55” x 9.5” x 19.8”
Approx Wt : 65 lbs

SINGLE/TWIN HOSE REEL & DOWNLINE

Standard hose downline of 210metres for Subsea applications.
Longer downline can be provided according to client’s requirement.
Reels are constructed from Stainless Steel or Coated Steel Structure.

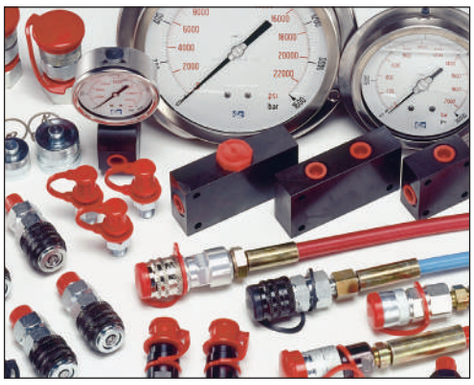


AIR DRIVEN TENSIONER PUMP

Max Air Inlet Pressure : 100psi / 6.9 Bar / 56 cfm
Max Working Pressure : 22,500psi / 1550 Bar
Dimension : 18” x 15” x 18.25”
Approx Wt : 40 lbs

AIR DRIVEN FLANGE PULLER PUMP

Max Air Inlet Pressure : 100psi / 6.9 Bar / 56 cfm
Max Working Pressure : 13,500psi / 930 Bar
Dimension : 18” x 15” x 18.25”
Approx Wt : 40 lbs



HIGH PRESSURE FITTINGS; COUPLING; GAUGES

Lead hose; inter-connecting hoses and torque wrench hoses are approved manufacturer supplied with universal threads to suit connection’s requirements. High pressure above 1500 bars hoses and fittings are also available.

OPTION • Removable handle to increase ease of handling (LP8 and LP15)

Swift-Torque LP Series

CONSTRUCTION •
Lightweight Aluminium

DESIGN •
Strong, durable, reliable

HIGH-FLOW MANIFOLD •
Delivers rapid cycling of the torque wrench

TILT AND SWIVEL MANIFOLD •
Hose connections gives 360 and 180 degrees positioning

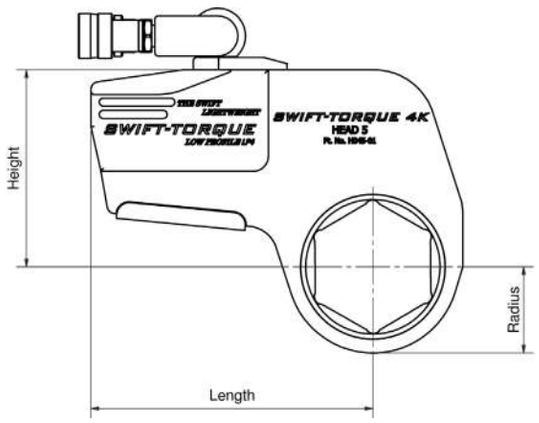
RATCHET ASSEMBLY •
Provides large nut rotation of 32 degrees

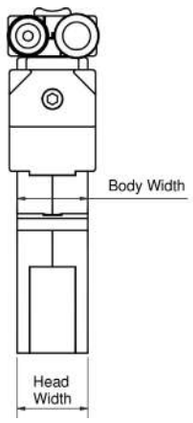
ACCURACY •
High Torque output +/- 2%

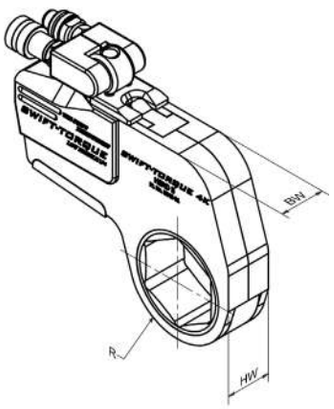
ASSEMBLY •
Does not require specialised tools or pins to locate cassette to hydraulic cylinder

HEX HEAD •
Can be changed quickly, easily and safely

Simple to use • Lightweight • Compact • Durable • Fast Acting • Efficient

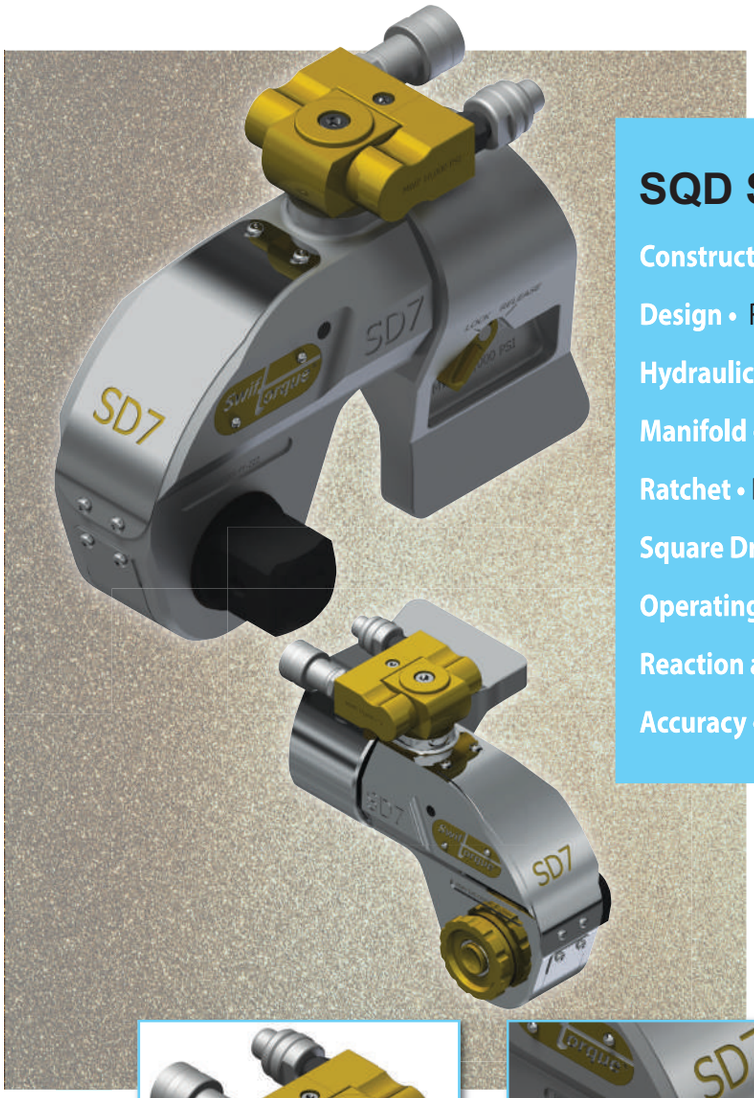






LP Series	Max. Ft.lbs (N.m) @ 10000psi	Length (mm)	Height (mm)	Body Width (mm)	Head Width (mm)	Radius (mm)	AF Range (Inches)	Weight with Head (kg)
LP2K	2,000 (2,711)	150	102	43	33.7	32.5 to 45.5	1-7/16" to 2-3/8"	2.2
LP4K	4,000 (5,422)	186.5	128	59	49	45 to 59	2-3/16" to 3-1/8"	4.4
LP8K	8,000 (10,844)	247.5	163	75	63	59.5 to 75	2-15/16" to 3-15/16"	9.1
LP15K	15,000 (20,337)	264.5	181	84	73	65.5 to 87	3-1/8" to 4-5/8"	13.3

SQUARE DRIVE TORQUE WRENCH



SQD Series Torque Wrench

Construction • Stainless Steel

Design • Robust, durable, reliable,

Hydraulics • High flow allowing for fast cycle rates

Manifold • Tilt and swivel – 180, 360 Degrees

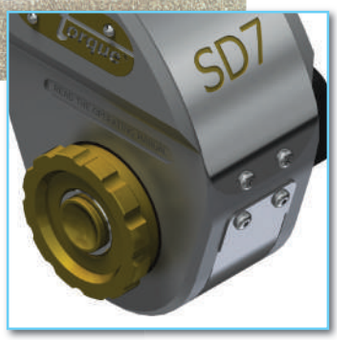
Ratchet • Nut rotation 33 Degrees

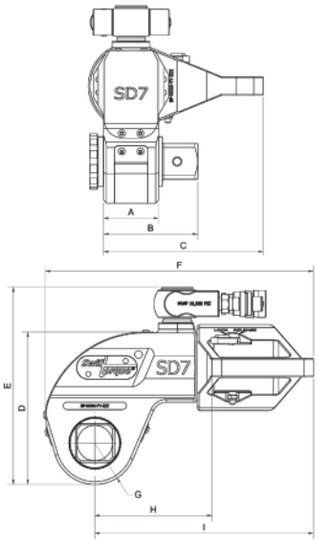
Square Drive • Push button square drive 3/4", 1", 1 ½", 2 1/2"

Operating pressure • 10,000psi

Reaction arm • 360 rotation with quick release lever

Accuracy • +/-3%





MODEL	A		B		C		D		E		F		G		H		I		WEIGHT	TORQUE OUTPUT		SQUARE DRIVE
	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(inch)	(kg)	(Nm)	(Ft.lbs)	(inch)
SQD1	42	1.654	67	2.618	88	3.465	103	4.055	151	5.952	190	7.482	27	1.063	99	3.898	158	6.222	3	1356	1000	3/4
SQD3	51	2.008	81	3.189	115	4.524	132	5.207	180	7.104	242	9.532	38	1.476	122	4.791	198	7.778	5	4067	3000	1
SQD7	59	2.323	101	3.976	172	6.752	164	6.437	212	8.335	288	11.324	45	1.752	126	4.961	235	9.247	9	9491	7000	1-1/2
SQD11	67	2.638	109	4.291	150	5.906	190	7.478	238	9.375	371	14.606	54	2.106	174	6.850	306	12.061	15	14914	11000	1-1/2
SQD18	80	3.150	161	6.339	180	7.087	224	8.799	272	10.696	376	14.793	63	2.480	176	6.929	302	11.892	24	24405	18000	2-1/2
SQD25	94	3.701	175	6.890	224	8.819	254	9.980	302	11.878	434	17.082	71	2.795	193	7.579	351	13.814	31	33895	25000	2-1/2

FSH / FSM Hydraulic & Mechanical Flange Spreader

- Unique interlocking wedge design - eliminates the risk of the wedge slipping out the joint
- Stepped spreader arm - each step can spread under full load
- Requires a very small access gap of only 6mm
- Up to 12 Ton spreading force
- Light weight, portable and easy to operate
- Single acting spring return piston for fast operation
- Safety block prevent the joint from springing closed

FSH / FSM
Hydraulic Spreader /
Mechanical Spreader

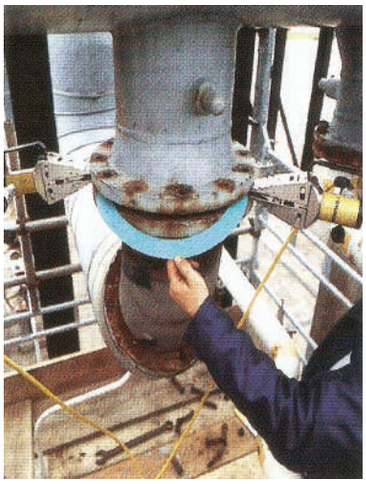
Tip Clearance / Maximum Spread
6mm / 81mm*

Maximum Spreading Force
8 - 12 Ton

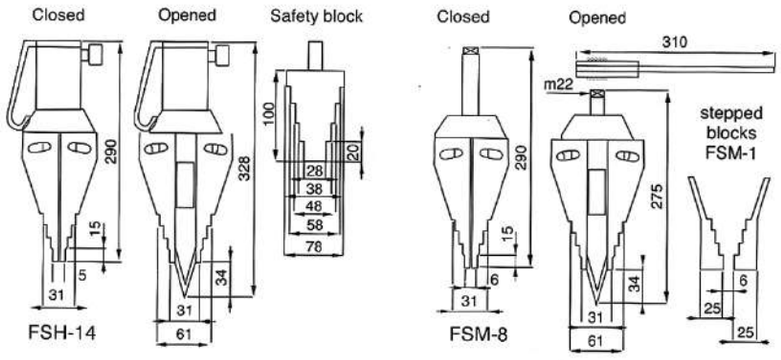
Step Blocks FSB-1
Step blocks increase spreader opening to 81mm.
Fits both FSH-14 and FSM-8 spreaders.

Spreader Kits
FSH hydraulic spreaders can be made up as a MAXI KIT.

The kit includes a hand pump, hoses and manifold which allows the individual operation of two spreaders from a single pump unit



Hydraulic Flange Spreaders easily separate an ANSI flange set during maintenance operations on a gas plant



Max Lifting Force kN	(Ton)	Model	Tip Clearance (mm)	Max Spread* (mm)	Type	Weight (kg)
125	12.5	FSH-14	6	81	Hydraulic	7.1
72	7	FSM-8	6	81	Manual	6.5

** Using stepped blocks FSB-1*

HYDRAULIC NUT SPLITTERS

ENERPAC

Hydraulic Nut Splitters

- Compact and ergonomic design
- Lightweight and easily handled
- Angled head permits nut splitting on large flat surfaces
- Heavy duty blades can be re-ground
- Single acting piston for fast operation
- Seven tools cover the main standard nut sizes

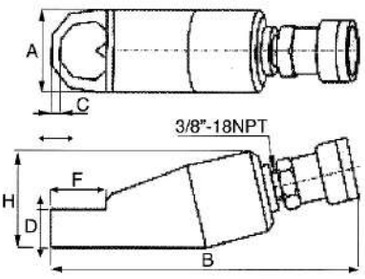
Pump Units
Hand, Air, Electric or Battery powered pump unit options are available for the operation of Enerpac Nut Splitters.

NC
Nut Splitter Range

Capacity:
5 - 90 Ton

Bolt Size / Nut A/F Range:
M6 - M48 / 10 - 75MM

Caution !
Do not use on square nuts. Maximum allowable nut hardness to split is HRc-44



Easy removal of corroded nuts on rail-track maintenance is just one of many application examples for the Enerpac Nut Splitters.

Bolt Range	Nut A/F (mm)	Model No.	Capacity (Ton)	A (mm)	B (mm)	C (mm)	D (mm)	F (mm)	H (mm)	Weight (kg)
M6-M12	10-19	NC-1319	5	40	170	7	19	28	48	1.2
M12-M16	19-24	NC-1924	10	54	191	10	26	40	62	2
M16-M22	24-32	NC-2432	15	64	222	13	29	51	72	3
M22-M27	32-41	NC-3241	20	75	244	17	36	66	88	4.4
M27-M33	41-50	NC-4150	35	94	288	21	45	74	105	8.2
M33-M39	50-60	NC-5060	50	106	318	23	54	90	128	11.8
M39-M48	60-75	NC-6075	90	156	393	26	72	110	181	34.1

PROJECT REFERENCES

TRI-STAR INDUSTRIES has been awarded a global Enterprise Framework Agreement with Shell.

This Agreement enables Shell's MRO and Project teams worldwide to access Tri-Star's expertise in studbolts and fasteners heavily used in upstream exploration and production facilities.

HIAP SENG ENGINEERING LTD

CERTIFICATE OF COMPLETION

PROJECT : SINGAPORE LNG PROJECT
ORDER NO : 12000137
DESCRIPTION : HYDRAULIC BOLT TORQUEING AND TENSIONING
SUB-CONTRACTOR : TRI-STAR INDUSTRIES PTE LTD
DURATION : OCT'12 ~ DEC'13

SUBJECT : CERTIFICATE OF COMPLETION

I hereby certify that the sub-contractor has satisfactorily completed the described works on above mentioned project safely and on time. The sub-contractor has delivered all the relevant documents for the described works.

HIAP SENG ENGINEERING LIMITED

Kwek Boon Hiong
Senior Project Manager

SINGLE BUOY MOORINGS INC.

TO WHOM IT MAY CONCERNED

CAMERON

Certificate of Appreciation

This certificate is to acknowledge that
SBN INDUSTRIES SDN BHD
has been a Critical Supplier to Cameron International Malaysia Systems (CIMS) and has met the stringent Quality & Delivery requirements for 2011.

OCEAN WORKS ASIA PTE LTD.

15 October 2015

Letter of Commitment

Yours sincerely

MS

MUN SIONG ENGINEERING PTE LTD
SHELL HOUDINI ECC PROJECT PROCESS AREA 3

This award is presented to

TRI-STAR INDUSTRIES PTE LTD
in recognition of your participation and effort
in achieving
2,000,000 Manhours
without Lost Time Injury
on 31 January 2010

Chris Lim Choon Wah
Project Manager

Vincent Quek Chiau Liong
Managing Director

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Serving the Oil & Gas, Infrastructure & Building Industries Worldwide

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★ Tri-Star representatives worldwide

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April 2022