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液壓螺栓拉伸器 操作說明

SBT



中文 : C1~C15

中文
English
Ver.16

1. 安全預防措施



不遵守以下的注意事項和警告將引起設備損失及人員傷害。



重要事項：未滿18歲人員不得擅自操作。操作SUN RUN油壓設備前請先仔細閱讀並了解相關操作手冊、安全事項和警告事項。操作人員負有油壓設備週邊之人員及環境之安全責任。



警告事項：為確保避免人員傷害和設備作業損失，請確認所有油壓設備及週邊配件，使用最大壓力為 1520 bar(22,000psi)。



警告事項：操作人員於使用期間為避免傷害，需全程配戴安全防護措施。



危險事項：為避免人員傷害，請於操作過程中手、腳遠離液(油)油壓缸和液壓設備。



危險事項：不要用手對油管施加壓力(包括拉或舉高) 高壓下洩漏的液壓油會穿透皮膚造成嚴重傷害。當液壓油侵入皮膚請立即就診。



警告事項：系統操作壓力絕不可超過最低壓力元件之值最低值。系統中應加裝壓力錶藉以監測系統中的壓力並了解使用狀態。



警告事項：當零件出現裂痕或損壞時，應立即以**SUN RUN** 零件更換。正確標準的零件可防止人員或設備損傷。**SUN RUN**零件經特別設計可完全適用並適用產品標稱的額定荷載或壓力。

重要事項：液壓設備必需由合格的液壓技工進行維修。需要修理時，請連繫就近的**SUN RUN**服務據點並使用**SUN RUN** 液壓油保固方為有效。



警告事項：避免損壞油壓管。捲收油管時，避免油管強烈彎曲或打結。使用彎曲或打結油管易引起背壓。強烈彎曲或打結的油管亦易引起內部損壞或提早油管老化。



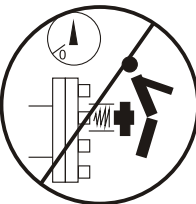
千萬不要重壓油管。劇烈的撞擊會造成油管內鋼絲網損壞。使用受損的油管可能導致油管破裂。



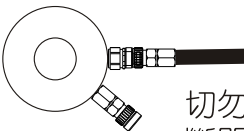
重要事項：千萬不要利用油管來提攜其他油壓設備(例如:小型油壓缸、泵浦..等)。



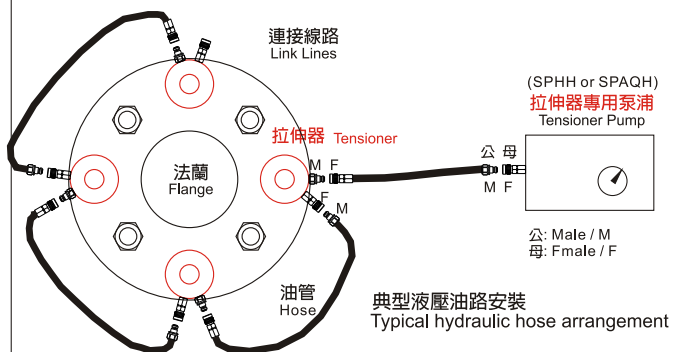
危險事項：液(油)壓設備應遠離火或熱源 高溫會軟化包裝和密封材料，導致液壓油洩漏；高溫同時也會造成油管材質與包裝變質。為確保最好狀態，不要將液(油)壓設備暴露於 65°C(150°F)高溫。在電焊場所時亦應注意防止電焊火花噴到油管。



切勿在拉伸或拆卸過程中站立於螺栓同軸位置。如果螺栓出現問題、鬆脫或損壞的零件可能會射出，如此可能會導致嚴重的人員傷亡。非必要或壓力穩定情況下，才允許操作者到加壓拉伸器附近持續觀察壓力計。



切勿在斷開連接的公接頭背面施壓。斷開的公接頭無法承受高壓。只有液壓管路中最後一個拉伸器上的母接頭可以保持斷開狀態。所有其他接頭都必須緊密連接。



1. 安全預防措施

▲ 警告

請務必遵守下列高壓油壓安全要求。

務入配戴安全護目鏡；當正在使用或在高壓油壓設備附近時。

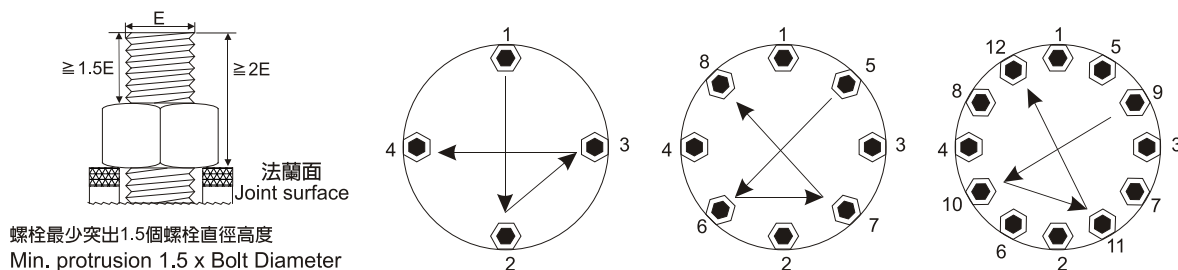
操作油壓設備前,請確認下列事項是否安全無虞:

1. 確認所有油壓安全帶(環) 是否已完全連接。所有的公接頭應完全和母接頭完全密合。
2. 請確認所有的母接頭正確且符合的鎖住公接頭。
3. 確認拉伸器一部份的牙已鎖在螺栓柱上且完全咬合。

注意: 螺帽上突出的螺牙長與咬合的拉伸器應至少留有與螺栓直徑等數的長度。

(例如:使用SBT-35拉出M36*4螺栓,使用者需預留36mm螺牙長度於螺帽上的螺栓柱)

確認拉伸器穩固地安裝於架橋上,而架橋穩固且垂直的安裝於工作件上。



千萬不可超壓使用於螺栓柱或拉伸器。拉伸器標準使用最大壓力為 21,750 psi ($\approx 1500\text{bar} / \text{kg/cm}^2$).

千萬不可將設備超揚程使用。

當系統持續增壓時,需隨時注意壓力錶變化, 當接近壓力值即可停止增壓動作。

千萬不可使壓力系統離開注意範圍。假如使用者必需離開壓力注意範圍時,務必使壓力洩壓並確保泵浦的回流閥已完全開啟。

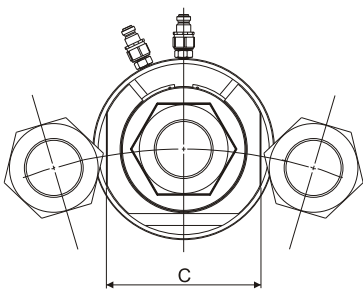
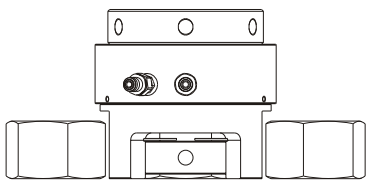
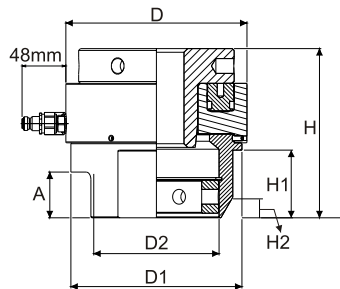
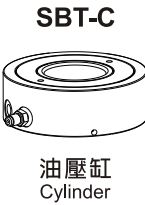
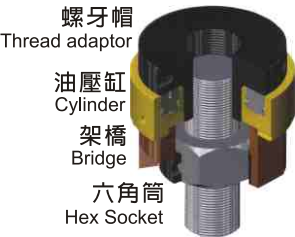
操作前需詳讀所有拉伸器和手動 / 氣動泵浦操作及維修手冊。

在控制台或泵浦尚未完全連接拉伸器時,千萬不可開啟增壓。

切記: 請務必遵守高壓液壓安全規範。

SUN RUN 不負因不當使用而造成的個人損害、財產損失、交易上的阻礙、利潤損失..諸如此類之責任。此外維修或更換已損壞、不當使用、未經其原廠授意之維修品或第三方之維修品 **SUN RUN** 亦不負予保固責任。

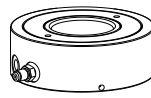
2.規範



型 號 Model		SBT-20	SBT-35	SBT-50	SBT-60	SBT-90	SBT-130	SBT-160	SBT-200	SBT-250	SBT-310
螺栓尺寸 Bolt dimension (ϕ *pitch)	公制 Metric	M20*2.5	M27*3	M36*4	M42*4.5	M45*4.5	M60*5.5	M72*6	M80*6	M100*6	M125*6
		M22*2.5	M30*3.5	M39*4	M45*4.5	M48*5	M64*6	M76*6	M85*6	M110*6	M130*6
		M24*3	M33*3.5	M42*4.5	M48*5	M52*5	M68*6	M80*6	M90*6	M120*6	M140*6
		M27*3	M36*4	M45*4.5	M52*5	M56*5.5	M72*6		M95*6	M125*6	M150*6
					M60*5.5	M76*6		M100*6			
螺牙尺寸 Threads (ϕ in-)	英制 imperial	3/4"-10	1"-8	1-3/8"-6	1-1/2"-6	1-3/4"-5	2-1/2"-4	2-3/4"-4	3-1/4"-4	3-3/4"-4	5"-4
		7/8"-9	1-1/8"-7	1-1/2"-6	1-3/4"-5	2"-4-1/2	2-3/4"-4	3"-4	3-1/2"-4	4"-4	5-1/4"-4
		1"-8	1-1/4"-7	1-3/4"-5	2"-4-1/2	2-1/4"-4-1/2			3-3/4"-4	4-1/4"-4	5-1/2"-4
			1-3/8-6							4-1/2"-4	5-3/4"-4
									4-3/4"-4		
最大壓力 Max. Pressure	(bar) (psi)	1500 21756	1500 21756	1500 21756	1500 21756	1500 21756	1500 21756	1500 21756	1500 21756	1500 21756	1500 21756
油壓面積 Hydraulic area	(cm ²) (in ²)	20 3.1	35 5.43	50 7.75	60 9.3	90 13.95	130 20.15	160 24.8	200 31	250 38.75	310 48.05
最大油壓荷重 Max.hydraulic load	(kN) (lbf)	300 67443	525 118025	750 168606	900 202328	1350 303492	1950 438377	2400 539541	3000 674426	3750 843032	4650 1045360
揚 程 Piston stroke	(mm)	8	8	8	8	8	8	10	10	10	10
D (mm)		86	109	128	144	170	198	220	244	300	340
H (mm)		105	116	128	140	154	185	190	203	235	268
H1 (mm)		25	35	45	54	59	74	74	97	131	156
H2 (mm)		5.2	5.2	10.39	10.39	13.86	22.52	22.52	22.52	22.52	32.52
D1 (mm)		74	97	116	133	154	187	203	232	272	313
D2 (mm)		56	73	90	102	114	137	145	180	223	260
A (mm)		26	31	38	40	42	50	50	60	73	86
C (mm)		66	83	100	118	134	167	175	210	253	293
重 量 Weight	(kg)	3	4.8	7.5	11	17.3	25	33	39	56	77

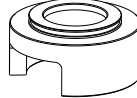
2. 規範

SBT-C



油壓缸
Cylinder

SBT-J



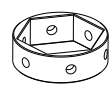
架橋
Bridge

SBT-T



螺牙帽
Thread adaptor

SBT-H

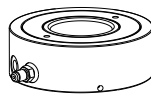


六角筒
Hex Socket

Model Number 型號	Bolt dimension 螺栓尺寸	Cylinder Model 油壓缸型號	Bridge Model 架橋型號	Thread adaptor Model 螺牙帽型號	Hex. Socket Model 六角筒型號
SBT-20 M20-2.5	M20*2.5	SBT-20C	SBT-20J	SBT-20T M20-2.5	SBT-20H 30
SBT-20 M22-2.5	M22*2.5			SBT-20T M22-2.5	SBT-20H 32
SBT-20 M24-3	M24*3			SBT-20T M24-3	SBT-20H 36
SBT-20 M27-3	M27*3			SBT-20T M27-3	SBT-20H 41
SBT-20 3/4"-10	3/4"-10			SBT-20T 3/4"-10	SBT-20H 32
SBT-20 7/8"-9	7/8"-9			SBT-20T 7/8"-9	SBT-20H 36
SBT-20 1"-8	1"-8			SBT-20T 1"-8	SBT-20H 41
SBT-35 M27-3	M27*3	SBT-35C	SBT-35J	SBT-35T M27-3	SBT-35H 41
SBT-35 M30-3.5	30*3.5			SBT-35T M30-3.5	SBT-35H 46
SBT-35 M33-3.5	M33*3.5			SBT-35T M33-3.5	SBT-35H 50
SBT-35 M36-4	M36*4			SBT-35T M36-4	SBT-35H 55
SBT-35 1"-8	1"-8			SBT-35T 1"-8	SBT-35H 41
SBT-35 1-1/8"-7	1-1/8"-7			SBT-35T 1-1/8"-7	SBT-35H 46
SBT-35 1-1/4"-7	1-1/4"-7			SBT-35T 1-1/4"-7	SBT-35H 50
SBT-35 1-3/8"-6	1-3/8"-6			SBT-35T 1-3/8"-6	SBT-35H 55
SBT-50 M36-4	M36*4	SBT-50C	SBT-50J	SBT-50T M36-4	SBT-50H 55
SBT-50 M39-4	M39*4			SBT-50T M39-4	SBT-50H 60
SBT-50 M42-4.5	M42*4.5			SBT-50T M42-4.5	SBT-50H 65
SBT-50 M45-4.5	M45*4.5			SBT-50T M45-4.5	SBT-50H 70
SBT-50 1-3/8"-6	1-3/8"-6			SBT-50T 1-3/8"-6	SBT-50H 55
SBT-50 1-1/2"-6	1-1/2"-6			SBT-50T 1-1/2"-6	SBT-50H 60
SBT-50 1-3/4"-5	1-3/4"-5			SBT-50T 1-3/4"-5	SBT-50H 70
SBT-60 M42-4.5	M42*4.5	SBT-60C	SBT-60J	SBT-60T M42-4.5	SBT-60H 65
SBT-60 M45-4.5	M45*4.5			SBT-60T M45-4.5	SBT-60H 70
SBT-60 M48-5	M48*5			SBT-60T M48-5	SBT-60H 75
SBT-60 M52-5	M52*5			SBT-60T M52-5	SBT-60H 80
SBT-60 1-1/2"-6	1-1/2"-6			SBT-60T 1-1/2"-6	SBT-60H 60
SBT-60 1-3/4"-5	1-3/4"-5			SBT-60T 1-3/4"-5	SBT-60H 70
SBT-60 2"-4.5	2"-4.5			SBT-60T 2"-4.5	SBT-60H 80
SBT-90 M45-4.5	M45*4.5	SBT-90C	SBT-90C	SBT-90T M45-4.5	SBT-90H 70
SBT-90 M48-5	M48*5			SBT-90T M48-5	SBT-90H 75
SBT-90 M52-5	M52*5			SBT-90T M52-5	SBT-90H 80
SBT-90 M56-5.5	M56*5.5			SBT-90T M56-5.5	SBT-90H 85
SBT-90 M60-5.5	M60*5.5			SBT-90T M60-5.5	SBT-90H 90
SBT-90 1-3/4"-5	1-3/4"-5			SBT-90T 1-3/4"-5	SBT-90H 70
SBT-90 2"-4.5	2"-4.5			SBT-90T 2"-4.5	SBT-90H 80
SBT-90 2-1/4"-4.5	2-1/4"-4.5	SBT-130C	SBT-130J	SBT-90T 2-1/4"-4.5	SBT-90H 90
SBT-130 M60-5.5	M60*5.5			SBT-130T M60-5.5	SBT-130H 90
SBT-130 M64-6	M64*6			SBT-130T M64-6	SBT-130H 95
SBT-130 M68-6	M68*6			SBT-130T M68-6	SBT-130H 100
SBT-130 M72-6	M72*6			SBT-130T M72-6	SBT-130H 105
SBT-130 M76-6	M76*6			SBT-130T M76-6	SBT-130H 110
SBT-130 2-1/2"-4	2-1/2"-4			SBT-130T 2-1/2"-4	SBT-130H 100
SBT-130 2-3/4"-4	2-3/4"-4	SBT-160C	SBT-160J	SBT-130T 2-3/4"-4	SBT-130H 108
SBT-160 M72-6	M72*6			SBT-160T M72-6	SBT-160H 105
SBT-160 M76-6	M76*6			SBT-160T M76-6	SBT-160H 110
SBT-160 M80-6	M80*6			SBT-160T M80-6	SBT-160H 115
SBT-160 2-3/4"-4	2-3/4"-4			SBT-160T 2-3/4"-4	SBT-160H 108
SBT-160 3"-4	3"-4			SBT-160T 3"-4	SBT-160H 118

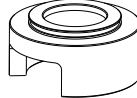
2. 規範

SBT-C



油壓缸
Cylinder

SBT-J



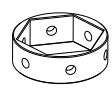
架橋
Bridge

SBT-T



螺牙帽
Thread adaptor

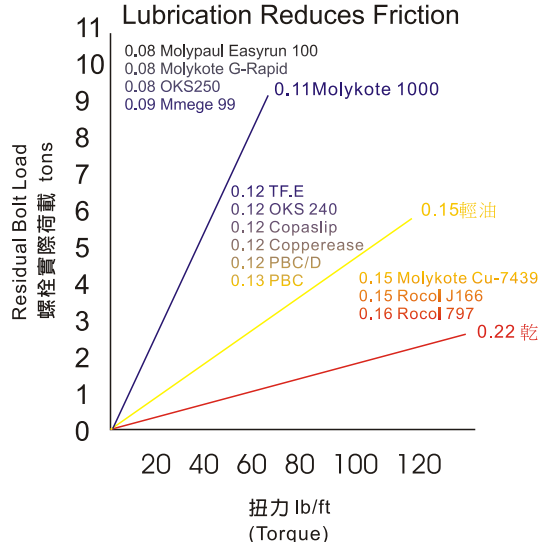
SBT-H



六角筒
Hex Socket

Model Number 型號	Bolt dimension 螺栓尺寸	Cylinder Model 油壓缸型號	Bridge Model 架橋型號	Thread adaptor Model 螺牙帽型號	Hex. Socket Model 六角筒型號
SBT-200 M80-6	M80*6	SBT-200C	SBT-200J	SBT-200T M80-6	SBT-200H 115
SBT-200 M85-6	M85*6			SBT-200T M85-6	SBT-200H 120
SBT-200 M90-6	M90*6			SBT-200T M90-6	SBT-200H 130
SBT-200 M95-6	M95*6			SBT-200T M95-6	SBT-200H 135
SBT-200 M100-6	M100*6			SBT-200T M100-6	SBT-200H 145
SBT-200 3-1/4"-4	3-1/4"-4			SBT-200T 3-1/4"-4	SBT-200H 127
SBT-200 3-1/2"-4	3-1/2"-4			SBT-200T 3-1/2"-4	SBT-200H 137
SBT-200 3-3/4"-4	3-3/4"-4			SBT-200T 3-3/4"-4	SBT-200H 146
SBT-250 M100-6	M100*6	SBT-250C	SBT-250J	SBT-250T M100-6	SBT-250H 145
SBT-250 M110-6	M110*6			SBT-250T M110-6	SBT-250H 155
SBT-250 M120-6	M120*6			SBT-250T M120-6	SBT-250H 170
SBT-250 M125-6	M125*6			SBT-250T M125-6	SBT-250H 180
SBT-250 3-3/4"-4	3-3/4"-4			SBT-250T 3-3/4"-4	SBT-250H 146
SBT-250 4"-4	4"-4			SBT-250T 4"-4	SBT-250H 156
SBT-250 4-1/4"-4	4-1/4"-4			SBT-250T 4-1/4"-4	SBT-250H 165
SBT-250 4-1/2"-4	4-1/2"-4			SBT-250T 4-1/2"-4	SBT-250H 175
SBT-250 4-3/4"-4	4-3/4"-4			SBT-250T 4-3/4"-4	SBT-250H 184
SBT-310 M125-6	M125*6	SBT-310C	SBT-310J	SBT-310T M125-6	SBT-310H 180
SBT-310 M130-6	M130*6			SBT-310T M130-6	SBT-310H 185
SBT-310 M140-6	M140*6			SBT-310T M140-6	SBT-310H 200
SBT-310 M150-6	M150*6			SBT-310T M150-6	SBT-310H 210
SBT-310 5"-4	5"-4			SBT-310T 5"-4	SBT-310H 194
SBT-310 5-1/4"-4	5-1/4"-4			SBT-310T 5-1/4"-4	SBT-310H 203
SBT-310 5-1/2"-4	5-1/2"-4			SBT-310T 5-1/2"-4	SBT-310H 213
SBT-310 5-3/4"-4	5-3/4"-4			SBT-310T 5-3/4"-4	SBT-310H 222

加上潤滑劑能減少摩擦的產生
Lubrication Reduces Friction



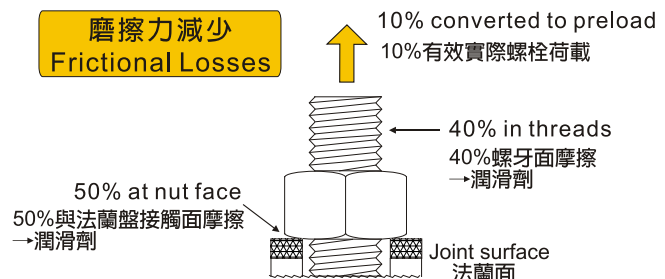
加潤滑劑的優點

1. 減少摩擦力。
2. 增加螺栓使用壽命。
3. 裝置螺栓的成功率提高。
4. 提高扭矩轉換率。

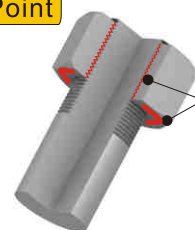
Advantages of Lubrication

1. Reduces the friction during tightening.
2. Increases bolt service life.
3. Decreases bolt failure during installation.
4. Higher friction results in less conversion of torque to preload.

摩擦點減少
Frictional Losses



摩擦點
Friction Point



須加潤滑劑
Lubricated

當將扭矩鎖緊時，接觸的摩擦點（螺牙面和法蘭接觸的面）都需使用潤滑劑。
Friction points should always be lubricated when using the torque tightening method.

2. 規範

公制螺栓及六角對邊對照 Metric Bolt

螺紋 Bolt	M	6	8	10	12	14	16	18	20	22	24	27	30	33	36	39	42	45	48	52	56	60	64	68
六角對邊 Hexagon	mm	10	13	17	19	22	24	27	30	32	36	41	46	50	55	60	65	70	75	80	85	90	95	100
厚度 Thickness	mm	5	6.5	8	10	11	13	15	16	18	19	22	24	26	29	31	34	36	38	42	45	48	51	54

螺紋 Bolt	M	72	76	80	85	90	95	100	105	110	115	120	125	130	140	150
六角對邊 Hexagon	mm	105	110	115	120	130	135	145	150	155	165	170	180	185	200	210
厚度 Thickness	mm	58	61	64		72		84								

英制螺栓及六角對邊對照 Imperial Bolt

螺紋 Bolt	Inch	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2
六角對邊 hexagon	mm	17	22	27	32	36	41	46	50	55	60	65	70	75	80
厚度 Thickness	mm	9.5	12.5	15.8	19	22	25	28	32	35	38	41	44	47	50
六角對邊 Hexagon	in	11/16	7/8	1-1/16	1 1/4	1 7/16	1 5/8	1 13/16	2	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8
厚度 Thickness	in	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2

螺紋 Bolt	Inch	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4	5	5 1/4	5 1/2
六角對邊 Hexagon	mm	90	100	108	118	127	137	146	156	165	175	184	194	203	213
厚度 Thickness	mm	57	63	70	76										
六角對邊 Hexagon	in	3 1/2	3 7/8	4 1/4	4 5/8	5	5 3/8	5 3/4	6 1/8	6 1/2	6 7/8	7 1/4	7 5/8	8	8 3/8
厚度 Thickness	in	2 1/4	2 1/2	2 3/4	3										

螺紋 Bolt	Inch	5 3/4	6
六角對邊 Hexagon	mm	222	232
厚度 Thickness	mm		
六角對邊 Hexagon	in	8 3/4	9 1/8
厚度 Thickness	in		

型 號 Model		SBT-20		SBT-35		SBT-50		SBT-60		SBT-90		SBT-130		SBT-160		SBT-200		SBT-250		SBT-310	
螺栓尺寸 Bolt dimension (ϕ *pitch)	公制 Metric	M20*2.5		M27*3		M36*4		M42*4.5		M45*4.5		M60*5.5		M72*6		M80*6		M100*6		M125*6	
		M22*2.5		M30*3.5		M39*4		M45*4.5		M48*5		M64*6		M76*6		M85*6		M110*6		M130*6	
		M24*3		M33*3.5		M42*4.5		M48*5		M52*5		M68*6		M80*6		M90*6		M120*6		M140*6	
		M27*3		M36*4		M45*4.5		M52*5		M56*5.5		M72*6				M95*6		M125*6		M150*6	
										M60*5.5		M76*6				M100*6					
螺牙尺寸 Threads (ϕ in-)	英制 imperial	3/4"-10		1"-8		1-3/8"-6		1-1/2"-6		1-3/4"-5		2-1/2"-4		2-3/4"-4		3-1/4"-4		3-3/4"-4		5"-4	
		7/8"-9		1-1/8"-7		1-1/2"-6		1-3/4"-5		2"-4-1/2		2-3/4"-4		3"-4		3-1/2"-4		4"-4		5-1/4"-4	
		1"-8		1-1/4"-7		1-3/4"-5		2"-4-1/2		2-1/4"-4-1/1/2						3-3/4"-4		4-1/4"-4		5-1/2"-4	
				1-3/8-6														4-1/2"-4		5-3/4"-4	
																		4-3/4"-4			
最大壓力 (MPa) Max. Pressure		150		150		150		150		150		150		150		150		150		150	
油壓面積 (cm²) Hydraulic area		20		35		50		60		90		130		160		200		250		310	
最大油壓荷重 (kN) Max.hydraulic load		300		525		750		900		1350		1950		2400		3000		3750		4650	
場 程 Piston stroke (mm)		8		8		8		8		8		8		10		10		10		10	
換算表 Chart																					
psi Bar		lbf KN		lbf KN		lbf KN		lbf KN		lbf KN		lbf KN		lbf KN		lbf KN		lbf KN		lbf KN	
1000	69	3100	14	5425	24	7750	34	9300	41	13950	62	20150	90	24800	110	31000	138	38750	172	48050	214
2000	138	6200	28	10850	48	15500	69	18600	83	27900	124	40300	179	49600	221	62000	276	77500	345	96100	427
3000	207	9300	41	16275	72	23250	103	27900	124	41850	186	60450	269	74400	331	93000	414	116250	517	144150	641
4000	276	12400	55	21700	97	31000	138	37200	165	55800	248	80600	359	99200	441	124000	552	155000	689	192200	855
5000	345	15500	69	27125	121	38750	172	46500	207	69750	310	100750	448	124000	552	155000	689	193750	862	240250	1069
6000	414	18600	83	32550	145	46500	207	55800	248	83700	372	120900	538	148800	662	186000	827	232500	1034	288300	1282
7000	483	21700	97	37975	169	54250	241	65100	290	97650	434	141050	627	173600	772	217000	965	271250	1207	336350	1496
8000	552	24800	110	43400	193	62000	276	74400	331	111600	496	161200	717	198400	883	248000	1103	310000	1379	384400	1710
9000	621	27900	124	48825	217	69750	310	83700	372	125550	558	181350	807	223200	993	279000	1241	348750	1551	432450	1924
10000	689	31000	138	54250	241	77500	345	93000	414	139500	621	201500	896	248000	1103	310000	1379	387500	1724	480500	2137
11000	758	34100	152	59675	265	85250	379	102300	455	153450	683	221650	986	272800	1213	341000	1517	426250	1896	528550	2351
12000	827	37200	165	65100	290	93000	414	111600	496	167400	745	241800	1076	297600	1324	372000	1655	465000	2068	576600	2565
13000	896	40300	179	70525	314	100750	448	120900	538	181350	807	261950	1165	322400	1434	403000	1793	503750	2241	624650	2779
14000	965	43400	193	75950	338	108500	483	130200	579	195300	869	282100	1255	347200	1544	434000	1931	542500	2413	672700	2992
15000	1034	46500	207	81375	362	116250	517	139500	621	209250	931	302250	1344	372000	1655	465000	2068	581250	2586	720750	3206
16000	1103	49600	221	86800	386	124000	552	148800	662	223200	993	322400	1434	396800	1765	496000	2206	620000	2758	768800	3420
17000	1172	52700	234	92225	410	131750	586	158100	703	237150	1055	342550	1524	421600	1875	527000	2344	658750	2930	816850	3634
18000	1241	55800	248	97650	434	139500	621	167400	745	251100	1117	362700	1613	446400	1986	558000	2482	697500	3103	864900	3847
19000	1310	58900	262	103075	459	147250	655	176700	786	265050	1179	382850	1703	471200	2096	589000	2620	736250	3275	912950	4061
20000	1379	62000	276	108500	483	155000	689	186000	827	279000	1241	403000	1793	496000	2206	620000	2758	775000	3447	961000	4275
21000	1448	65100	290	113925	507	162750	724	195300	869	292950	1303	423150	1882	520800	2317	651000	2896	813750	3620	1009050	4488
22000	1517	68200	303	119350	531	170500	758	204600	910	306900	1365	443300	1972	545600	2427	682000	3034	852500	3792	1057100	4702

p.s.i X 0.00689 = Mpa X 145 = p.s.i

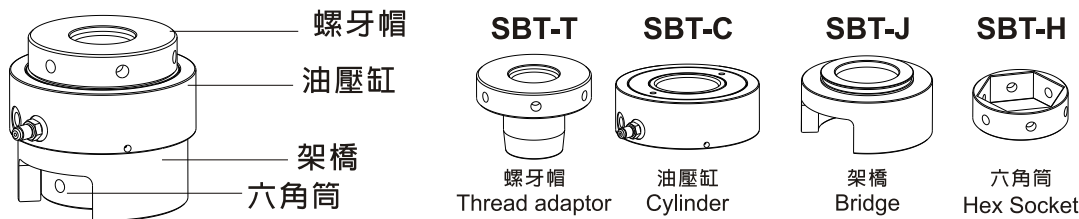
p.s.i X 0.0689 = bar X 14.5 = p.s.i

bar X 1.02 = kgf/cm² X 0.981 = bar

lb(pound) X 0.00445 = kN X 225 = lb(pound)

lb(pound) X 4.45 = N(newton) X 0.225 = lb(pound)

3. 安裝



3.1 請依第7頁選擇適用的泵浦壓力。將螺栓柱螺牙及拉伸器接觸面均塗薄油潤滑。

3.2 調整控制台或手動/氣動泵浦至最佳的操作範圍。

3.3 確認螺栓柱與螺帽已正確地組合。(如圖3.3-1)

注意: 螺帽上突出的螺牙長與咬合的拉伸器應至少留有與螺栓直徑等數的長度。(如圖3.3-2)
(例如:使用SBT-35拉出M36*4螺栓,使用者需預留36mm螺牙長度於螺帽上的螺栓柱)

3.4 確認拉伸器與法蘭面的分配方式。請參考 4.1

3.5 安裝第一個拉伸器前, 請確保螺栓螺紋部份和螺牙帽乾淨無牙損。

3.6 將六角筒輕易的套在螺母上請參考圖3.6 A

確保架橋開口朝外。

確保液壓接頭朝外, 便於連接油管。

將螺牙帽鎖於螺栓頂端。可使用扳桿輔助鎖緊直到螺牙帽頂部緊靠於主軸上為止。

3.7 依3.5~3.6說明, 以相同方式安裝系統內所有拉伸器。

3.8 確保動力泵的洩壓閥處於打開狀態。

3.9 緊密連接油管、拉伸器和泵浦。另請參考 4.1了解基本型油管連接佈置。

3.10 在每個螺栓位置上確認主軸已完全回縮至油缸內。

3.11 系統加壓前, 確保所有油管均緊密連接。每個公接頭必須與對應母接頭緊密連接。

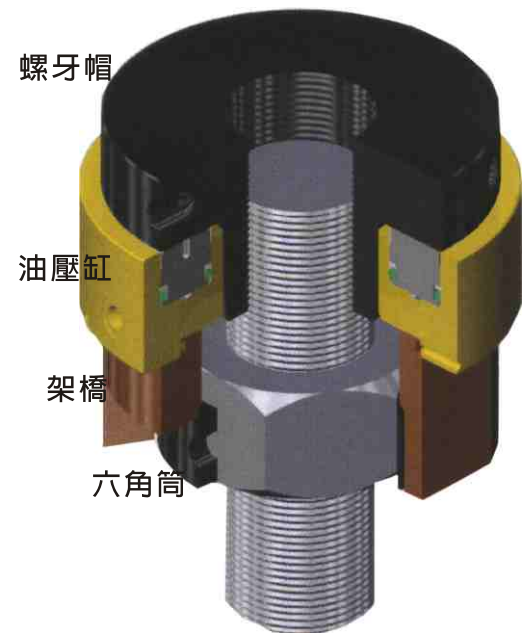
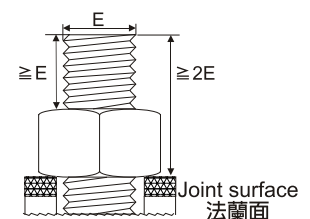


圖3.3-1



螺栓最少突出1~1.5個螺栓直徑高度
Min. protrusion 1~1.5 x Bolt Diameter

圖3.3-2

※重要

只有管路末端最後一個拉伸器上未使用的母接頭可以保持斷開狀態。

※警告

切勿在斷開連接(開端)的公接頭背面施加壓力。從背面施加壓力可能會使斷開連接的公接頭發生油漏。並且高壓液壓油會穿過皮膚造成傷害。

如果只使用一個拉伸器, **請務必只使用拉伸器公接頭給拉伸器施壓。**為防止可能發生的高壓液壓油洩漏, 千萬不可向母接頭施加壓力。

3. 安裝

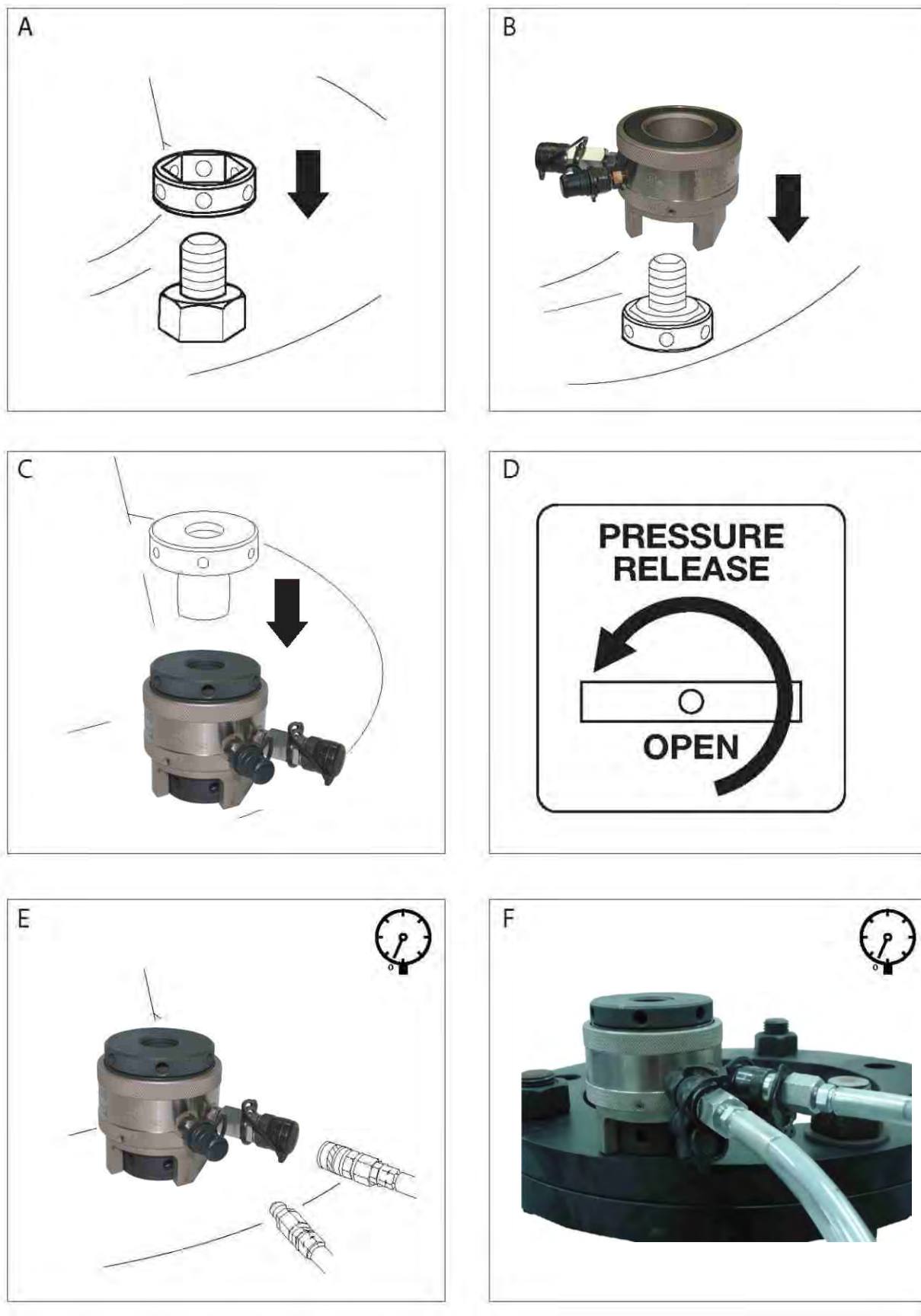


圖3.6 螺栓拉伸器安裝

4. 法蘭/ 拉伸器拆與拉

4.1 拉伸器布置 (基本型)

可根據可用空隙在法蘭的任意一側或二側安裝螺栓拉伸器。應儘可能將法蘭上的所有螺栓同時拉伸。圖 4.1 中所示為拉伸器覆蓋率為 100% 和 50% 的標準布置範例。有關 50% 以下覆蓋率拉伸布置的詳細說明，請連絡 SUN RUN。

※對於 100% 以下覆蓋率，請用可用的拉伸數量除以法蘭節中的螺栓數量便可得出每一次需要緊固的螺栓位置。例如：如果可為 36 個螺栓的法蘭節使用 18 個拉伸器，則表示每隔一個螺栓安裝一個拉伸器 (50% 覆蓋率)。如果有 12 個拉伸器可使用，則為每隔二個螺栓安裝一個拉伸器 (33% 覆蓋率)

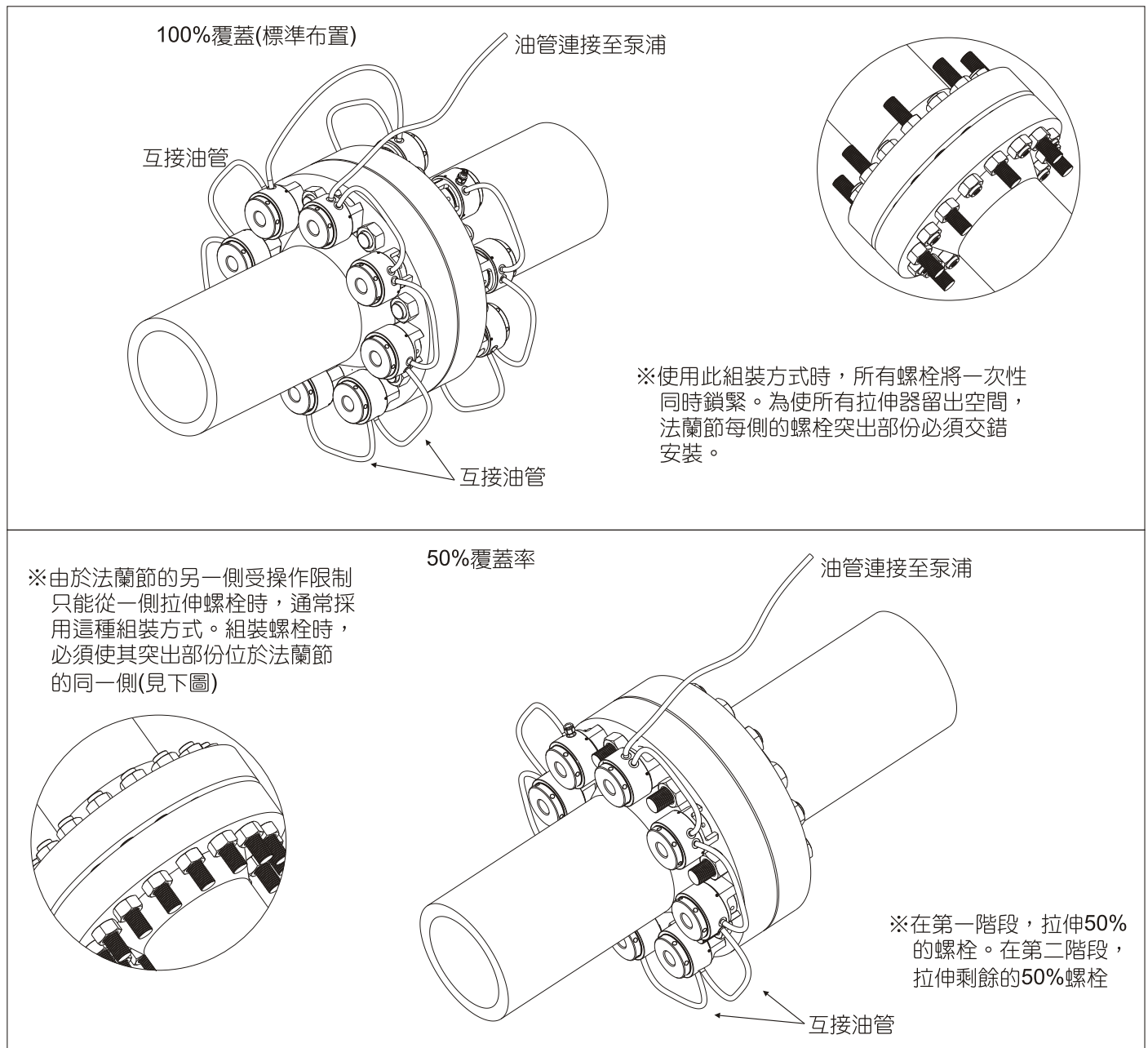


圖4.1 螺栓拉伸器安裝佈置 (基本型)

4. 法蘭/ 拉伸器拆與拉

※警告

切勿於系統加壓過程中站立於螺栓的同軸位置。
如果螺栓出現故障，鬆脫或損壞的零件可能會
射出，此可能會人員傷害。操作人員應隨時保
持警覺。

※警告

確保不要超過最大工作壓力和最大行程。請參
考拉伸器上銘刻內容。

※重要

如執行以下步驟時已達最大行程請立即停止泵浦
，鎖緊拉伸器的螺母，並釋放壓力。再來**降低
螺牙帽，使主軸回到拉伸器中**，再繼續操作。

※重要

如發生洩漏，請立刻停止泵浦，並打開洩壓閥。
確保油壓錶讀值為零。修復後再繼續拉伸程序。

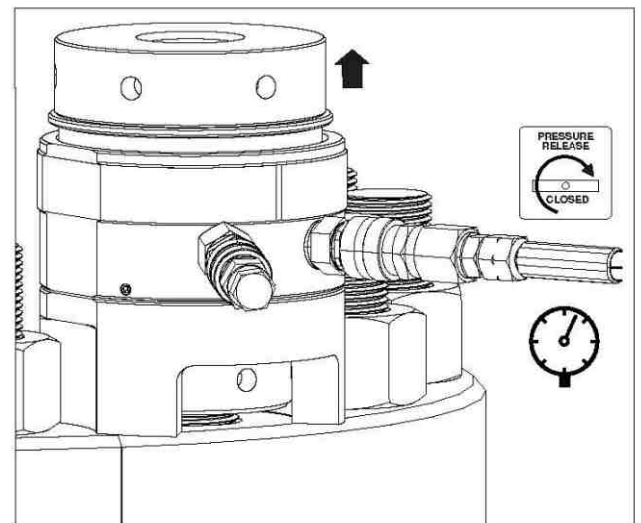


圖 4.2-1 拉伸器加壓

4.2 拉伸- 100%覆蓋率(每個螺栓上都安裝拉伸器)

4.2.1 確保正確地將法蘭節對準。

4.2.2 將拉伸器組裝到螺栓上，並連接油管。請參考
第3節說明。

4.2.3 確定所需液壓拉伸壓力。

4.2.4 啟動泵浦，將拉伸器一直加壓至約
70bar(1000psi)。檢查是否有無洩漏。

4.2.5 如無任何洩漏則繼續加壓到達4.2.3所需壓力
值。加壓期間須同時注意拉伸器行程和壓力值。

4.2.6 到達壓力值時，即將泵浦停止。再次檢查壓力
表。確保壓力穩定。此時在每個拉伸器的螺母
與法蘭節面間可看到螺紋。(圖 4.2-1)

4.2.7 保持穩定壓力，使用扳桿手動降低第一個
六角筒和螺母。繼續鎖緊，直到螺母緊靠在法
蘭節面為止。見圖 4.2-2和 4.2-3

4.2.8 對管路中所有其餘螺栓重複步驟 7。

4.2.9 緩慢打開洩壓閥，釋放壓力。確保壓力錶讀值
為零。

4.2.10 檢查主軸行程。必要時降低螺牙帽，直到
主軸完全回縮到拉伸器內。

4.2.11 重複步驟4~10。

4.2.12 再次重複步驟4~10。

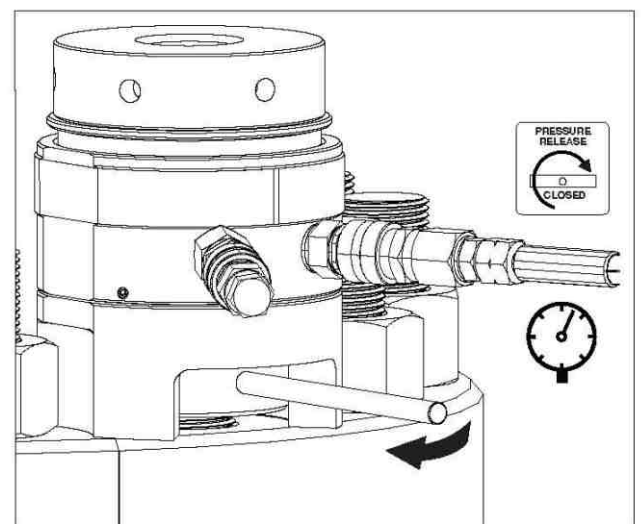


圖 4.2-2 降低六角筒和螺母

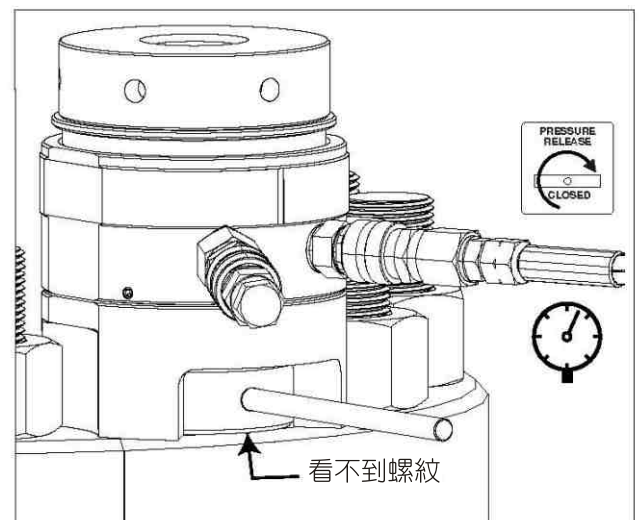


圖 4.2-3 六角筒和螺母緊靠法蘭節

4. 法蘭/ 拉伸器拆與拉

4.3 拉伸- 50%覆蓋率(每隔一個螺栓上都安裝拉伸器)

- 4.3.1 確保正確地將法蘭節對準。
- 4.3.2 每隔一個將所有螺栓編成1和 2號。
- 4.3.3 將拉伸器安裝到編號 1的螺栓上，並連接油管。
請參考4.3-3 拉伸器基本布置。另參考第 3節。
- 4.3.4 得出"第一遍"壓力"A"值。(此由具經驗的合格工程師計算出)

用於拉伸編號 "1"螺栓的壓力"A"值通常高於稍後用來做緊固編號 "2"螺栓的壓力"B"值。這是為了執行 100%以下覆蓋率拉伸時可能會發生的額外負載損失考量在內。

- 4.3.5 啟動泵浦後，將拉伸器一直加壓至 7bar(1000psi)後檢查洩漏情況。
- 4.3.6 如未發生任何洩漏，請重新啟動泵浦，將拉伸器加壓至步驟 4中計算出的"第一遍"壓力"A"值。在加壓期間，不斷持續觀察拉伸器行程和壓力。
- 4.3.7 達到"第一遍"壓力"A"時，將泵停止。停泵後再次檢查油壓計。確保壓力穩定。此時在每個拉伸器的螺母與法蘭節面間均可看到螺紋(圖4.2-1)
- 4.3.8 保持穩定壓力，使用扳桿手動降低第一個六角筒和螺母。繼續鎖緊，直至螺母緊靠法蘭節面為止。(圖4.2-2, 4.2-3)
- 4.3.9 對管路中其餘的 "第一遍"拉伸器步驟8。
- 4.3.10 緩慢打開洩壓閥，釋放壓力。確保壓力錶讀值為零(圖4.3-1)。
- 4.3.11 檢查管路中每個拉伸器行程。必要時降低螺牙帽，直至主軸完全回縮至油缸內。(圖4.3-2)

- 4.3.12 重複步驟 5~11(依壓力"A")
- 4.3.13 再次重複步驟 5~11(依壓力"A")
- 4.3.14 將拉伸器移動到其餘50%的螺栓(即所有編號為 "2"的螺栓)上(圖4.3-4)
- 4.3.15 得出"第二遍"壓力"B"值。此值必須由具備經驗合格的工程師計算出。
壓力"B"值通常低於壓力"A"值 (詳情請參考步驟4)
- 4.3.16 啟動泵，將拉伸器一直加壓至約 70bar(1000psi)檢查有無洩漏。
- 4.3.17 如未發現任何洩漏，將繼續將拉伸器加壓至步驟 15中的"第二遍"壓力 "B"值。加壓期間，持續觀察行程和壓力。

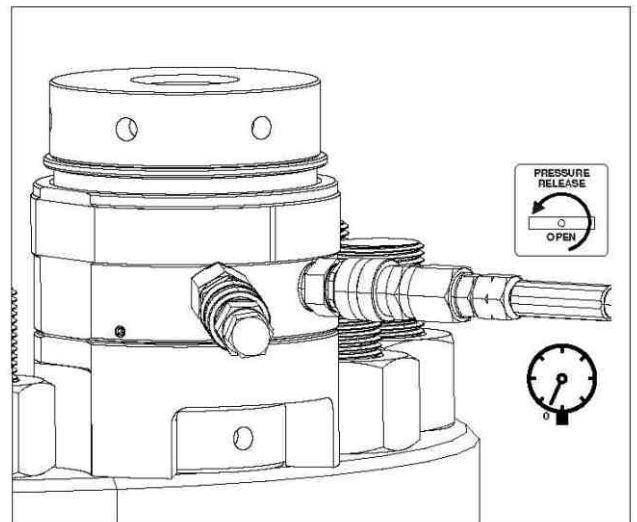


圖 4.3-1 降低螺母後壓力釋放

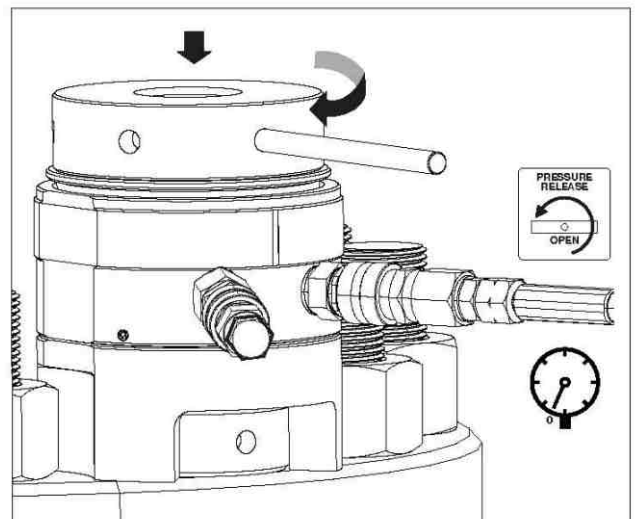


圖 4.3-2 降低螺牙帽 (視需求而定)

4. 法蘭/ 拉伸器拆與拉

施壓力"A"(在所有編號為 "1" 的螺栓處)

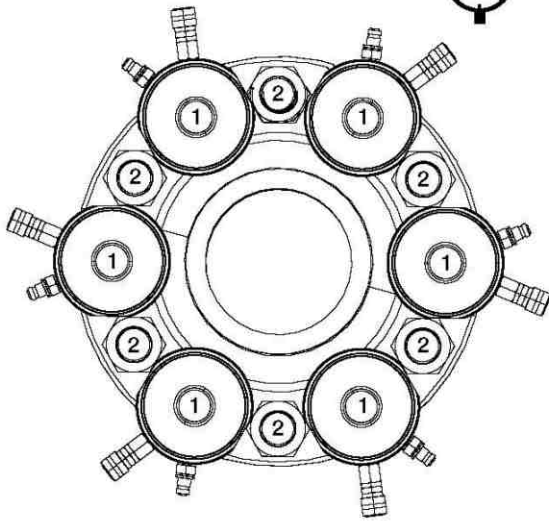


圖4.3-3 拉伸器布置，第一遍-基本型(覆蓋率50%)

施加壓力 "B"(在二個完全相對編號 "1" 螺栓處)

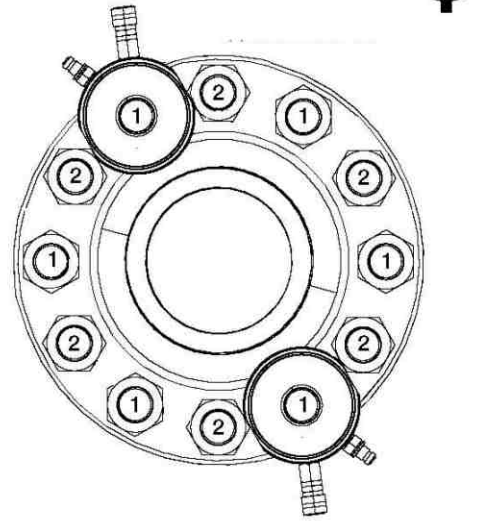


圖4.3-5 重新查第一遍拉伸(覆蓋率50%)

施壓力"B"(在所有編號為 "2" 的螺栓處)

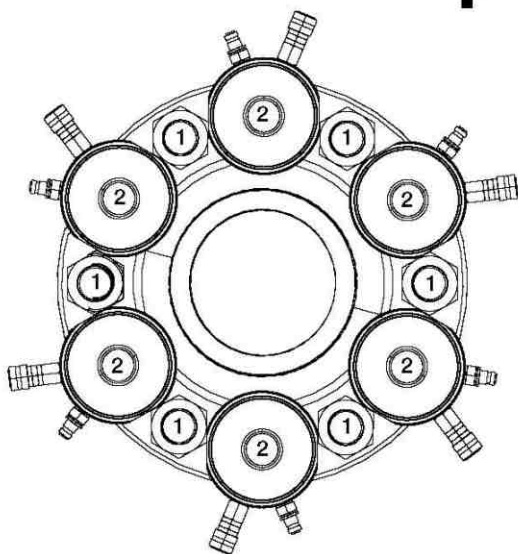


圖4.3-4 拉伸器布置，第二遍-基本型(覆蓋率50%)

- 4.3.18 到達"第二遍"壓力"B"時，停泵。停泵後再次檢查壓力計。確保壓力保持穩定。此時在每個拉伸器的螺母與法蘭節面間可看到螺紋(圖4.2-1)
- 4.3.19 保持壓力穩定，使用扳桿手動降低第一個六角筒和螺母。繼續鎖緊，直至螺母緊靠法蘭節面為止。(圖4.2-2, 4.2-3)

4.3.20 對管路中其餘的 "第二遍"拉伸器步驟19。

4.3.21 緩慢打開洩壓閥，釋放壓力。確保壓力錶讀值為零(圖4.3-1)。

4.3.22 檢查管路中每個拉伸器行程。必要時降低螺牙帽，直至主軸完全回縮至油缸內。(圖4.3-2)

4.3.23 重複步驟 6~22(依壓力"B")

4.3.24 再次重複步驟 6~22(依壓力"B")

4. 法蘭/ 拉伸器拆與拉

4.3.25 (可選檢查)確定緊固的前50%螺栓(編號"1"螺栓是否負載損失過大。

為任意二個彼此完全相對的"第一遍"螺栓(編號為"1")裝上拉伸器(圖4.3-5)連接油管

施加"第二遍"壓力"B"

使用扳手試著手動鎖緊這些螺栓的螺母。如果無法轉動螺母，即表示拉伸已完成。釋放壓力。轉至步驟 26。

如果螺母可轉動，則按步驟16~22所述，為其餘"第一遍"螺栓(編號"1")再次裝上拉伸器，施加"第二遍"壓力"B"，並再次降低螺母。

4.3.26 檢查壓力錶為零。

4.3.27 降低螺牙帽，直至主軸完全回縮。分開油管，為每個斷開的接頭蓋上防塵蓋，從螺栓上卸下拉伸器。

4.4 拆卸- 100%覆蓋率(每隔一個螺栓上都安裝拉伸器)

4.4.1 施壓前，根據需要升高每個螺栓的螺牙帽，使完全縮回的主軸與螺牙帽間出現約5mm/3/16" 的間隙(圖4.4-1)

4.4.2 啟動泵浦，將拉伸器一直加壓至約70bar/ 1000psi。檢查是否洩漏。

▲ 警告

在執行下列鬆開步驟時，確保液壓始終低於允許的最大壓力1500bar/21750psi，並且施加的負載不超過螺栓的抗拉強度。

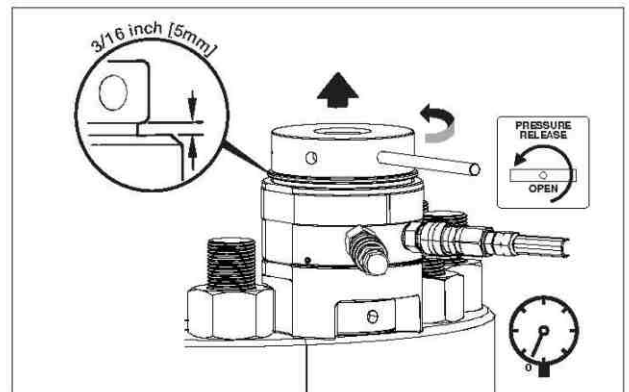


圖4.4-1 提高螺牙帽

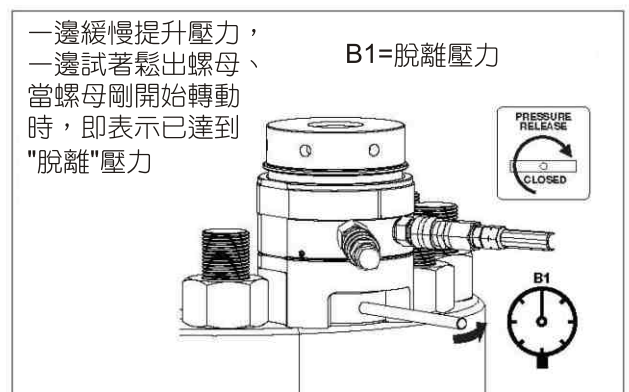


圖4.4-21 得出脫離壓力

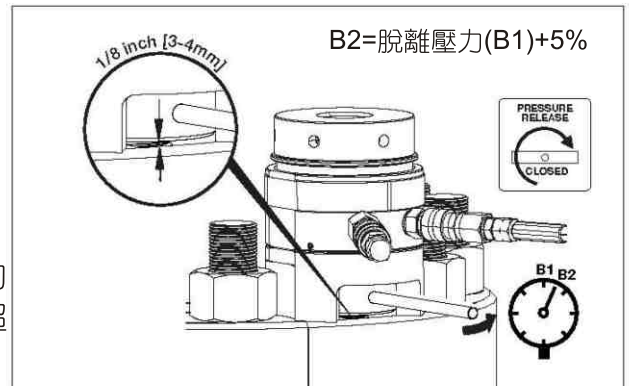


圖4.4-3 鬆出螺母

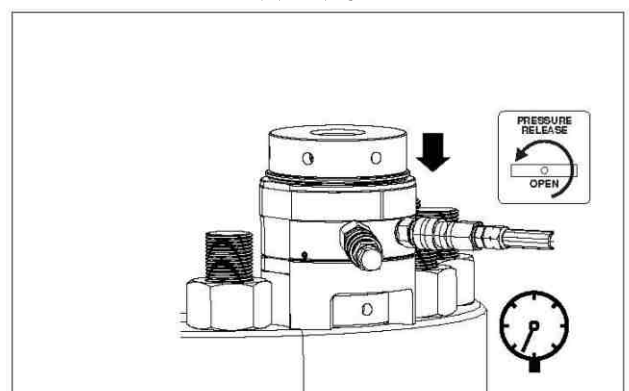


圖4.4-4 釋放壓力,鬆開螺母

4. 法蘭/ 拉伸器拆與拉

4.4.3 如果未發現任何洩漏，請繼續操作泵浦。緩慢提升壓力，直到到達"脫離"壓力油壓值。達到此壓力時，其中一個拉伸器上的螺母剛剛開始鬆動，可以使用扳桿手動轉動。記錄此壓力值供參考。(圖4.4-2)

4.4.4 將油壓提升至步驟 4 中記錄的"脫離"壓力值之上約5%將泵停止。

4.4.5 保持壓力穩定，鬆開第一個拉伸器的螺母，使螺母與法蘭節間出現約3~4mm的間隙(圖4.4-3)

步驟5中的間隙尺寸不得超過步驟1的間隙尺寸。

4.4.6 對所有剩餘螺栓重複步驟 5。

如果螺母難以轉動，可以5%增量進一步增加壓力。但切勿將壓力增加到1500bar以上。並確保所施壓力負載不超過螺栓抗拉強度。

4.4.7 緩慢打開洩壓閥，釋放壓力，檢查壓力錶讀值為零。此時螺栓已完全鬆開。

4.4.8 降低螺牙帽，直至主軸完全回縮。斷開油管，為每個斷開的接頭蓋上防塵蓋。

4.5 拆卸- 50%覆蓋率(每隔一個螺栓上都安裝拉伸器)

4.5.1 將拉伸器組裝到要鬆開的前 50%螺栓上，並連接油管。請參考第 3節，了解其他拉伸器和油管細節。

4.5.2 為前 50%螺栓執行 4.4 步驟1~7。

4.5.3 將拉伸器移至 其餘50%螺栓上。

4.5.4 為其餘的50%螺栓執行 4.4 步驟1~8。需注意第二組螺栓的"脫離"壓力可能與第一組大致相同或略低於第一組。

5. 保存

5.1 拉伸器的表層電鍍層有助於防銹。但為使其有更好的保護，應為其所有金屬表面略塗薄油。

5.2 為螺牙帽內螺紋塗上薄油或防銹油。

5.3 使主軸完全縮回油缸內，平放拉伸器。

5.4 不使用時，務必為拉伸器接頭蓋上防塵蓋。

出廠證明暨保固書

產品名稱：

型 號：

序 號：

出廠日期： / /

保固期間： / / ~ / /

該產品經公司嚴格品質管制,並測試合格出廠,本產品自驗收合格日起保固一年,如非人為使用不當或天然不可抗拒之災害,本公司免費維修,如非以上之原因本公司將酌收材料成本負責維修。

公司：巨輪興有限公司

負責人：蘇明益

高雄市岡山區岡山北路199號

TEL:886-7-6210505

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CHU LUN SING CO.,LTD

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OPERATING INSTRUCTIONS HYDRAULIC BOLT TENSIONER **SBT**



English : E1~E15

中文
English
Ver.16

1. SAFETY PRECAUTIONS



Fail to comply with the following cautions and warnings could cause equipment damage and personal injury.



IMPORTANT : 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 SUN RUN equipment. The operator is responsible for this activity towards other persons.



WARNING : To avoid personal injury and possible equipment damage, make sure all hydraulic components withstand the maximum pressure of 1520 bar (22,000psi).



WARNING: Always wear safety glasses. The operator must take precaution against injury due to failure of the tool or workpiece.



DANGER: To avoid personal injury keep hands and feet away from cylinder and workpiece during operation.



DANGER: Do not handle pressurized hoses. Escaping oil under pressure can penetrate the skin causing serious injury. If oil is injected under the skin, see a doctor immediately.



WARNING : The system operating pressure must not exceed the pressure rating of the lowest rated component in the system. Install pressure gauges in the system to monitor operating pressure. It is your window to what is happening in the system.



WARNING: Immediately replace worn or damaged parts with genuine SUN RUN parts. SUN RUN parts are designed to fit properly and withstand rated loads.

IMPORTANT: Hydraulic equipment must only be serviced by a qualified hydraulic technician. For repair service, contact the SUN RUN Service Center in your area. To protect your warranty, use only SUN RUN oil.



CAUTION: Avoid sharp bends and kinks that will cause severe back-up pressure in hoses. Bends and kinks lead to premature hose failure.



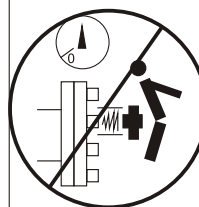
DO NOT drop heavy objects on hose. A sharp impact may cause internal damage to hose wire strands. Applying pressure to a damaged hose may cause it to rupture.



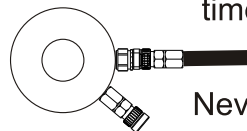
IMPORTANT: Do not lift hydraulic equipment by the hoses or couplers. Use the carrying handle or other means of safe transport.



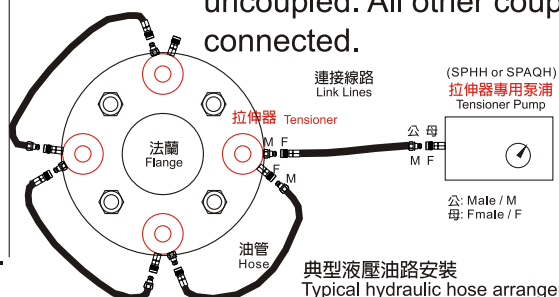
CAUTION : KEEP HYDRAULIC EQUIPMENT AWAY FROM FLAMES AND HEAT. Excessive heat will soften packings and seals, resulting in fluid leaks. Heat also weakens hose materials and packings. For optimum performance do not expose equipment to temperatures of 65°C (150°F) or higher. Protect hoses and cylinders from weld spatter.



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 be aware of this potential hazard at all times.



Never pressurize the back of a disconnected male coupler. Male couplers cannot withstand high pressures when disconnected. Only the female coupler on the LAST tensioner in the circuit can remain uncoupled. All other couplers must be connected.



2. SAFETY PRECAUTIONS

WARNING

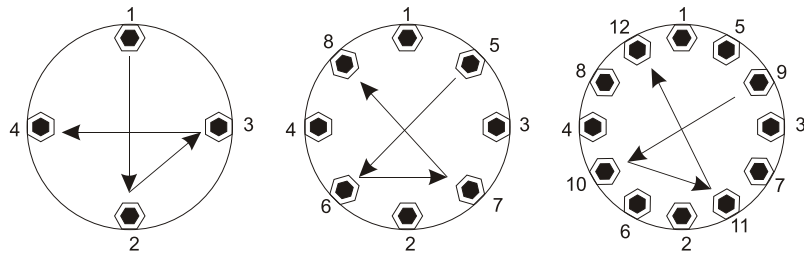
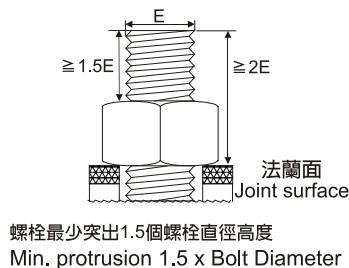
High pressure hydraulics requires that the following basic rules are followed.

ALWAYS WEAR SAFETY GLASSES when working with or near the pressurized hydraulic system.

Always check the following points before pressurizing the hydraulic system:

1. Check that the hydraulic harness is fully connected. There should be no loose ends and every male nipple should be connected to its corresponding female connector.
2. Check that each female connector is securely locked in position on the corresponding nipple by physically pulling the connection.
3. Check that the threaded portion of the tensioning tool is screwed on the stud and that the thread engagement is sufficient.

NOTE: The thread projection of the stud above the top of the nut should be sufficient to allow the tensioning tool to engage the stud a minimum of one stud diameter (for example: use a SBT-35 to pull a M36*4 bolt, user need to prerreserve minimum 36mm thread projection of the stud above the top of the nut). Check that the tensioner is seated squarely on the bridge piece, and that the bridge is seated squarely on the bridge piece, and that the bridge is seated squarely on the work piece.



Never exceed the maximum working pressure for each stud size or tensioner. Maximum working pressure for standard tensioners is 21,750 psi ($\approx 1500\text{bar} / \text{kg/cm}^2$).

Never exceed the maximum extension for the equipment.

When pressurizing the system, observe the gauge, and be ready to stop, at the required pressure.

Never leave the pressurized system unattended. If you must leave the area release the pressure and ensure that the return to tank valve on the pump unit is fully open.

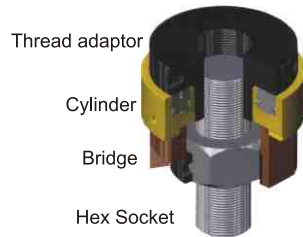
Read both Tooling and Hydraulic Hand / Air pump and Control Console Operation and Maintenance Manuals prior to operation.

Never pressurize the Control Console or Hand / Air Pump unless the outlet is either connected to the tensioning system or is safely blanked with a blanking plug.

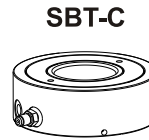
REMEMBER: HIGH PRESSURE HYDRAULIC ARE SAFER IF THE BASIC SAFETY RULES ARE FOLLOWED.

SUN RUN will not be held liable for any personal injury, property damage caused, interruption of business, loss of profits, losses of any kind, etc., Resulting from any failure that occurs from the use of this SUN RUN product. Additionally, SUN RUN will not be liable to repair or replace any product, which has been damaged, used improperly, or has been subject to an unauthorized repair by the purchaser or a third party.

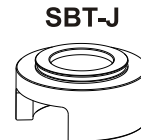
2.SPECIFICATION



Thread adaptor



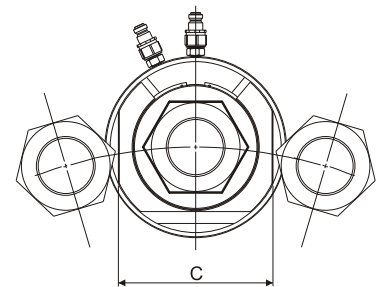
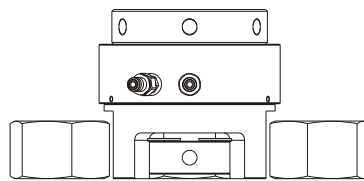
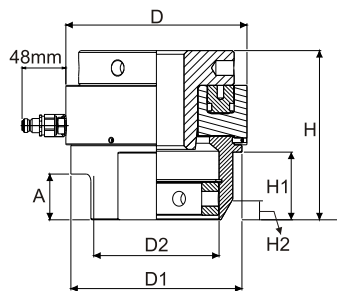
Cylinder



Bridge



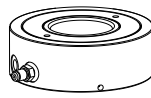
Hex Socket



Model	SBT-20	SBT-35	SBT-50	SBT-60	SBT-90	SBT-130	SBT-160	SBT-200	SBT-250	SBT-310
Bolt dimension (ϕ *pitch)	M20*2.5	M27*3	M36*4	M42*4.5	M45*4.5	M60*5.5	M72*6	M80*6	M100*6	M125*6
	M22*2.5	M30*3.5	M39*4	M45*4.5	M48*5	M64*6	M76*6	M85*6	M110*6	M130*6
	M24*3	M33*3.5	M42*4.5	M48*5	M52*5	M68*6	M80*6	M90*6	M120*6	M140*6
	M27*3	M36*4	M45*4.5	M52*5	M56*5.5	M72*6		M95*6	M125*6	M150*6
Threads (ϕ in-)	3/4"-10	1"-8	1-3/8"-6	1-1/2"-6	1-3/4"-5	2-1/2"-4	2-3/4"-4	3-1/4"-4	3-3/4"-4	5"-4
	7/8"-9	1-1/8"-7	1-1/2"-6	1-3/4"-5	2"-4-1/2	2-3/4"-4	3"-4	3-1/2"-4	4"-4	5-1/4"-4
	1"-8	1-1/4"-7	1-3/4"-5	2"-4-1/2	2-1/4"-4-1/2			3-3/4"-4	4-1/4"-4	5-1/2"-4
		1-3/8"-6							4-1/2"-4	5-3/4"-4
Max. Pressure (bar) (psi)	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
	21756	21756	21756	21756	21756	21756	21756	21756	21756	21756
Hydraulic area (cm ²) (in ²)	20	35	50	60	90	130	160	200	250	310
	3.1	5.43	7.75	9.3	13.95	20.15	24.8	31	38.75	48.05
Max.hydraulic load (kN) (lbf)	300	525	750	900	1350	1950	2400	3000	3750	4650
	67443	118025	168606	202328	303492	438377	539541	674426	843032	1045360
Piston stroke (mm)	8	8	8	8	8	8	10	10	10	10
D (mm)	86	109	128	144	170	198	220	244	300	340
H (mm)	105	116	128	140	154	185	190	203	235	268
H1 (mm)	25	35	45	54	59	74	74	97	131	156
H2 (mm)	5.2	5.2	10.39	10.39	13.86	22.52	22.52	22.52	22.52	32.52
D1 (mm)	74	97	116	133	154	187	203	232	272	313
D2 (mm)	56	73	90	102	114	137	145	180	223	260
A (mm)	26	31	38	40	42	50	50	60	73	86
C (mm)	66	83	100	118	134	167	175	210	253	293
Weight (kg)	3	4.8	7.5	11	17.3	25	33	39	56	77

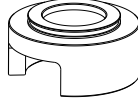
2.SPECIFICATION

SBT-C



Cylinder

SBT-J



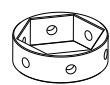
Bridge

SBT-T



Thread adaptor

SBT-H

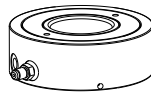


Hex Socket

Model Number	Bolt dimension	Cylinder Model	Bridge Model	Thread adaptor Model	Hex. Socket Model
SBT-20 M20-2.5	M20*2.5	SBT-20C	SBT-20J	SBT-20T M20-2.5	SBT-20H 30
SBT-20 M22-2.5	M22*2.5			SBT-20T M22-2.5	SBT-20H 32
SBT-20 M24-3	M24*3			SBT-20T M24-3	SBT-20H 36
SBT-20 M27-3	M27*3			SBT-20T M27-3	SBT-20H 41
SBT-20 3/4"-10	3/4"-10			SBT-20T 3/4"-10	SBT-20H 32
SBT-20 7/8"-9	7/8"-9			SBT-20T 7/8"-9	SBT-20H 36
SBT-20 1"-8	1"-8			SBT-20T 1"-8	SBT-20H 41
SBT-35 M27-3	M27*3	SBT-35C	SBT-35J	SBT-35T M27-3	SBT-35H 41
SBT-35 M30-3.5	30*3.5			SBT-35T M30-3.5	SBT-35H 46
SBT-35 M33-3.5	M33*3.5			SBT-35T M33-3.5	SBT-35H 50
SBT-35 M36-4	M36*4			SBT-35T M36-4	SBT-35H 55
SBT-35 1"-8	1"-8			SBT-35T 1"-8	SBT-35H 41
SBT-35 1-1/8"-7	1-1/8"-7			SBT-35T 1-1/8"-7	SBT-35H 46
SBT-35 1-1/4"-7	1-1/4"-7			SBT-35T 1-1/4"-7	SBT-35H 50
SBT-35 1-3/8"-6	1-3/8"-6			SBT-35T 1-3/8"-6	SBT-35H 55
SBT-50 M36-4	M36*4	SBT-50C	SBT-50J	SBT-50T M36-4	SBT-50H 55
SBT-50 M39-4	M39*4			SBT-50T M39-4	SBT-50H 60
SBT-50 M42-4.5	M42*4.5			SBT-50T M42-4.5	SBT-50H 65
SBT-50 M45-4.5	M45*4.5			SBT-50T M45-4.5	SBT-50H 70
SBT-50 1-3/8"-6	1-3/8"-6			SBT-50T 1-3/8"-6	SBT-50H 55
SBT-50 1-1/2"-6	1-1/2"-6			SBT-50T 1-1/2"-6	SBT-50H 60
SBT-50 1-3/4"-5	1-3/4"-5			SBT-50T 1-3/4"-5	SBT-50H 70
SBT-60 M42-4.5	M42*4.5	SBT-60C	SBT-60J	SBT-60T M42-4.5	SBT-60H 65
SBT-60 M45-4.5	M45*4.5			SBT-60T M45-4.5	SBT-60H 70
SBT-60 M48-5	M48*5			SBT-60T M48-5	SBT-60H 75
SBT-60 M52-5	M52*5			SBT-60T M52-5	SBT-60H 80
SBT-60 1-1/2"-6	1-1/2"-6			SBT-60T 1-1/2"-6	SBT-60H 60
SBT-60 1-3/4"-5	1-3/4"-5			SBT-60T 1-3/4"-5	SBT-60H 70
SBT-60 2"-4.5	2"-4.5			SBT-60T 2"-4.5	SBT-60H 80
SBT-90 M45-4.5	M45*4.5	SBT-90C	SBT-90C	SBT-90T M45-4.5	SBT-90H 70
SBT-90 M48-5	M48*5			SBT-90T M48-5	SBT-90H 75
SBT-90 M52-5	M52*5			SBT-90T M52-5	SBT-90H 80
SBT-90 M56-5.5	M56*5.5			SBT-90T M56-5.5	SBT-90H 85
SBT-90 M60-5.5	M60*5.5			SBT-90T M60-5.5	SBT-90H 90
SBT-90 1-3/4"-5	1-3/4"-5			SBT-90T 1-3/4"-5	SBT-90H 70
SBT-90 2"-4.5	2"-4.5			SBT-90T 2"-4.5	SBT-90H 80
SBT-90 2-1/4"-4.5	2-1/4"-4.5			SBT-90T 2-1/4"-4.5	SBT-90H 90
SBT-130 M60-5.5	M60*5.5	SBT-130C	SBT-130J	SBT-130T M60-5.5	SBT-130H 90
SBT-130 M64-6	M64*6			SBT-130T M64-6	SBT-130H 95
SBT-130 M68-6	M68*6			SBT-130T M68-6	SBT-130H 100
SBT-130 M72-6	M72*6			SBT-130T M72-6	SBT-130H 105
SBT-130 M76-6	M76*6			SBT-130T M76-6	SBT-130H 110
SBT-130 2-1/2"-4	2-1/2"-4			SBT-130T 2-1/2"-4	SBT-130H 100
SBT-130 2-3/4"-4	2-3/4"-4			SBT-130T 2-3/4"-4	SBT-130H 108
SBT-160 M72-6	M72*6	SBT-160C	SBT-160J	SBT-160T M72-6	SBT-160H 105
SBT-160 M76-6	M76*6			SBT-160T M76-6	SBT-160H 110
SBT-160 M80-6	M80*6			SBT-160T M80-6	SBT-160H 115
SBT-160 2-3/4"-4	2-3/4"-4			SBT-160T 2-3/4"-4	SBT-160H 108
SBT-160 3"-4	3"-4			SBT-160T 3"-4	SBT-160H 118

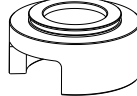
2.SPECIFICATION

SBT-C



Cylinder

SBT-J



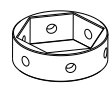
Bridge

SBT-T



Thread adaptor

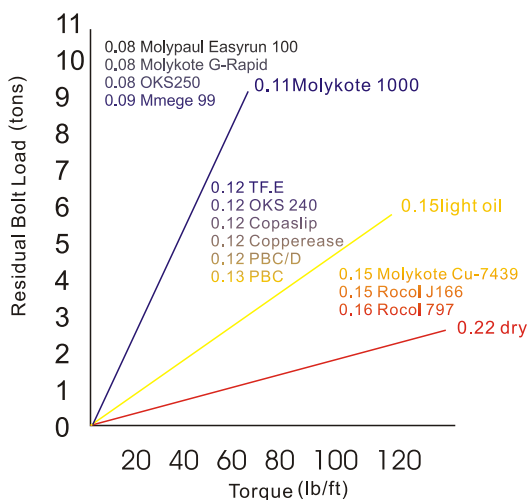
SBT-H



Hex Socket

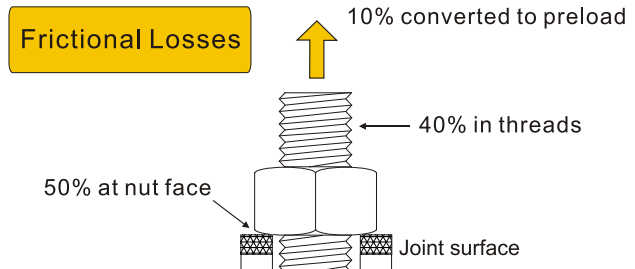
Model Number	Bolt dimension	Cylinder Model	Bridge Model	Thread adaptor Model	Hex. Socket Model
SBT-200 M80-6	M80*6	SBT-200C	SBT-200J	SBT-200T M80-6	SBT-200H 115
SBT-200 M85-6	M85*6			SBT-200T M85-6	SBT-200H 120
SBT-200 M90-6	M90*6			SBT-200T M90-6	SBT-200H 130
SBT-200 M95-6	M95*6			SBT-200T M95-6	SBT-200H 135
SBT-200 M100-6	M100*6			SBT-200T M100-6	SBT-200H 145
SBT-200 3-1/4"-4	3-1/4"-4			SBT-200T 3-1/4"-4	SBT-200H 127
SBT-200 3-1/2"-4	3-1/2"-4			SBT-200T 3-1/2"-4	SBT-200H 137
SBT-200 3-3/4"-4	3-3/4"-4			SBT-200T 3-3/4"-4	SBT-200H 146
SBT-250 M100-6	M100*6	SBT-250C	SBT-250J	SBT-250T M100-6	SBT-250H 145
SBT-250 M110-6	M110*6			SBT-250T M110-6	SBT-250H 155
SBT-250 M120-6	M120*6			SBT-250T M120-6	SBT-250H 170
SBT-250 M125-6	M125*6			SBT-250T M125-6	SBT-250H 180
SBT-250 3-3/4"-4	3-3/4"-4			SBT-250T 3-3/4"-4	SBT-250H 146
SBT-250 4"-4	4"-4			SBT-250T 4"-4	SBT-250H 156
SBT-250 4-1/4"-4	4-1/4"-4			SBT-250T 4-1/4"-4	SBT-250H 165
SBT-250 4-1/2"-4	4-1/2"-4			SBT-250T 4-1/2"-4	SBT-250H 175
SBT-250 4-3/4"-4	4-3/4"-4			SBT-250T 4-3/4"-4	SBT-250H 184
SBT-310 M125-6	M125*6	SBT-310C	SBT-310J	SBT-310T M125-6	SBT-310H 180
SBT-310 M130-6	M130*6			SBT-310T M130-6	SBT-310H 185
SBT-310 M140-6	M140*6			SBT-310T M140-6	SBT-310H 200
SBT-310 M150-6	M150*6			SBT-310T M150-6	SBT-310H 210
SBT-310 5"-4	5"-4			SBT-310T 5"-4	SBT-310H 194
SBT-310 5-1/4"-4	5-1/4"-4			SBT-310T 5-1/4"-4	SBT-310H 203
SBT-310 5-1/2"-4	5-1/2"-4			SBT-310T 5-1/2"-4	SBT-310H 213
SBT-310 5-3/4"-4	5-3/4"-4			SBT-310T 5-3/4"-4	SBT-310H 222

Lubrication Reduces Friction

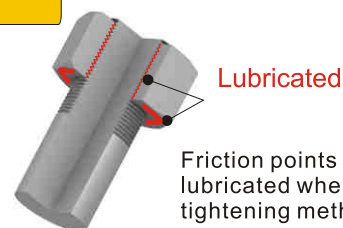


Advantages of Lubrication

- 1.Reduces the friction during tightening.
- 2.Increases bolt service life.
- 3.Decreases bolt failure during installation.
- 4.Higher friction results in less conversion of torque to preload.



Friction Point



Friction points should always be lubricated when using the torque tightening method.

2.SPECIFICATION

Metric Bolt

Bolt	M	6	8	10	12	14	16	18	20	22	24	27	30	33	36	39	42	45	48	52	56	60	64	68
Hexagon	mm	10	13	17	19	22	24	27	30	32	36	41	46	50	55	60	65	70	75	80	85	90	95	100
Thickness	mm	5	6.5	8	10	11	13	15	16	18	19	22	24	26	29	31	34	36	38	42	45	48	51	54

Bolt	M	72	76	80	85	90	95	100	105	110	115	120	125	130	140	150
Hexagon	mm	105	110	115	120	130	135	145	150	155	165	170	180	185	200	210
Thickness	mm	58	61	64		72		84								

Imperial Bolt

Bolt	Inch	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2
hexagon	mm	17	22	27	32	36	41	46	50	55	60	65	70	75	80
Thickness	mm	9.5	12.5	15.8	19	22	25	28	32	35	38	41	44	47	50
Hexagon	in	11/16	7/8	1-1/16	1 1/4	1 7/16	1 5/8	1 13/16	2	2 3/16	2 3/8	2 9/16	2 3/4	2 15/16	3 1/8
Thickness	in	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2

Bolt	Inch	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	4 1/4	4 1/2	4 3/4	5	5 1/4	5 1/2
Hexagon	mm	90	100	108	118	127	137	146	156	165	175	184	194	203	213
Thickness	mm	57	63	70	76										
Hexagon	in	3 1/2	3 7/8	4 1/4	4 5/8	5	5 3/8	5 3/4	6 1/8	6 1/2	6 7/8	7 1/4	7 5/8	8	8 3/8
Thickness	in	2 1/4	2 1/2	2 3/4	3										

Bolt	Inch	5 3/4	6
Hexagon	mm	222	232
Thickness	mm		
Hexagon	in	8 3/4	9 1/8
Thickness	in		

Instructions for: Hydraulic Bolt Tensioner

Models: SBT

Model		SBT-20		SBT-35		SBT-50		SBT-60		SBT-90		SBT-130		SBT-160		SBT-200		SBT-250		SBT-310	
Bolt dimension (φ *pitch)	Metric	M20*2.5		M27*3		M36*4		M42*4.5		M45*4.5		M60*5.5		M72*6		M80*6		M100*6		M125*6	
		M22*2.5		M30*3.5		M39*4		M45*4.5		M48*5		M64*6		M76*6		M85*6		M110*6		M130*6	
		M24*3		M33*3.5		M42*4.5		M48*5		M52*5		M68*6		M80*6		M90*6		M120*6		M140*6	
		M27*3		M36*4		M45*4.5		M52*5		M56*5.5		M72*6				M95*6		M125*6		M150*6	
Threads (φ in-)	imperial	3/4"-10		1"-8		1-3/8"-6		1-1/2"-6		1-3/4"-5		2-1/2"-4		2-3/4"-4		3-1/4"-4		3-3/4"-4		5"-4	
		7/8"-9		1-1/8"-7		1-1/2"-6		1-3/4"-5		2"-4-1/2		2-3/4"-4		3"-4		3-1/2"-4		4"-4		5-1/4"-4	
		1"-8		1-1/4"-7		1-3/4"-5		2"-4-1/2		2-1/4"-4-1/1/2						3-3/4"-4		4-1/4"-4		5-1/2"-4	
				1-3/8"-6														4-1/2"-4		5-3/4"-4	
Max. Pressure	(MPa)	150		150		150		150		150		150		150		150		150		150	
	(psi)	21756		21756		21756		21756		21756		21756		21756		21756		21756		21756	
Hydraulic area	(cm ²)	20		35		50		60		90		130		160		200		250		310	
	(in ²)	3.1		5.43		7.75		9.3		13.95		20.15		24.8		31		38.75		48.05	
Max.hydraulic load	(kN)	300		525		750		900		1350		1950		2400		3000		3750		4650	
	(lbf)	67443		118025		168606		202328		303492		438377		539541		674426		843032		1045360	
Piston stroke (mm)		8		8		8		8		8		8		10		10		10		10	
Chart																					
psi	bar	lbf	kN	lbf	kN	lbf	kN	lbf	kN	lbf	kN	lbf	kN	lbf	kN	lbf	kN	lbf	kN	lbf	kN
1000	69	3100	14	5425	24	7750	34	9300	41	13950	62	20150	90	24800	110	31000	138	38750	172	48050	214
2000	138	6200	28	10850	48	15500	69	18600	83	27900	124	40300	179	49600	221	62000	276	77500	345	96100	427
3000	207	9300	41	16275	72	23250	103	27900	124	41850	186	60450	269	74400	331	93000	414	116250	517	144150	641
4000	276	12400	55	21700	97	31000	138	37200	165	55800	248	80600	359	99200	441	124000	552	155000	689	192200	855
5000	345	15500	69	27125	121	38750	172	46500	207	69750	310	100750	448	124000	552	155000	689	193750	862	240250	1069
6000	414	18600	83	32550	145	46500	207	55800	248	83700	372	120900	538	148800	662	186000	827	232500	1034	288300	1282
7000	483	21700	97	37975	169	54250	241	65100	290	97650	434	141050	627	173600	772	217000	965	271250	1207	336350	1496
8000	552	24800	110	43400	193	62000	276	74400	331	111600	496	161200	717	198400	883	248000	1103	310000	1379	384400	1710
9000	621	27900	124	48825	217	69750	310	83700	372	125550	558	181350	807	223200	993	279000	1241	348750	1551	432450	1924
10000	689	31000	138	54250	241	77500	345	93000	414	139500	621	201500	896	248000	1103	310000	1379	387500	1724	480500	2137
11000	758	34100	152	59675	265	85250	379	102300	455	153450	683	221650	986	272800	1213	341000	1517	426250	1896	528550	2351
12000	827	37200	165	65100	290	93000	414	111600	496	167400	745	241800	1076	297600	1324	372000	1655	465000	2068	576600	2565
13000	896	40300	179	70525	314	100750	448	120900	538	181350	807	261950	1165	322400	1434	403000	1793	503750	2241	624650	2779
14000	965	43400	193	75950	338	108500	483	130200	579	195300	869	282100	1255	347200	1544	434000	1931	542500	2413	672700	2992
15000	1034	46500	207	81375	362	116250	517	139500	621	209250	931	302250	1344	372000	1655	465000	2068	581250	2586	720750	3206
16000	1103	49600	221	86800	386	124000	552	148800	662	223200	993	322400	1434	396800	1765	496000	2206	620000	2758	768800	3420
17000	1172	52700	234	92225	410	131750	586	158100	703	237150	1055	342550	1524	421600	1875	527000	2344	658750	2930	816850	3634
18000	1241	55800	248	97650	434	139500	621	167400	745	251100	1117	362700	1613	446400	1986	558000	2482	697500	3103	864900	3847
19000	1310	58900	262	103075	459	147250	655	176700	786	265050	1179	382850	1703	471200	2096	589000	2620	736250	3275	912950	4061
20000	1379	62000	276	108500	483	155000	689	186000	827	279000	1241	403000	1793	496000	2206	620000	2758	775000	3447	961000	4275
21000	1448	65100	290	113925	507	162750	724	195300	869	292950	1303	423150	1882	520800	2317	651000	2896	813750	3620	1009050	4488
22000	1517	68200	303	119350	531	170500	758	204600	910	306900	1365	443300	1972	545600	2427	682000	3034	852500	3792	1057100	4702

p.s.i X 0.00689 = Mpa X 145 = p.s.i

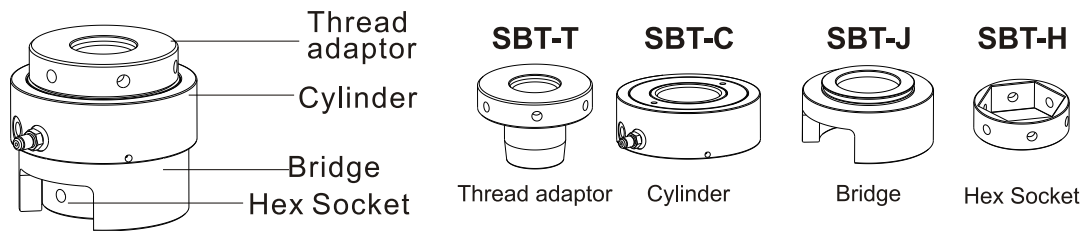
p.s.i X 0.0689 = bar X 14.5 = p.s.i

bar X 1.02 = kgf/cm² X 0.981 = bar

lb(pound) X 0.00445 = kN X 225 = lb(pound)

lb(pound) X 4.45 = N(newton) X 0.225 = lb(pound)

3.OPERATING



- 3.1 Determine the proper pump pressure as shown on page 7. Lubricate the threads on the stud and two mating surfaces of the tensioner.
- 3.2 Select the control console hand/ Air pump depending on which is best for the application.
- 3.3 Check that studs and nuts have been assembled correctly (as Fig 3.3-1)
NOTE: The thread projection of the stud above the top of the nut should be sufficient to allow the tensioning tool to engage the stud a minimum of one stud diameter (as Fig 3.3-2) (for example: use a SBT-35 to pull a M36*4 bolt, user need to preserve minimum 36mm thread projection of the stud above the top of the nut).
- 3.4 Determine the tensioner arrangement around the joint surface. (Refer to section 4.1)
- 3.5 Before installing the first tensioner, be sure that the threaded portions of the stud and threaded puller are clean and free of damage.
- 3.6 Ensure that the socket fits over the nut without force.
Ensure that the bridge is positioned outward.
Ensure that the hydraulic couplers are positioned outward, to allow easier connection of hydraulic hoses.
- 3.7 Assemble any additional tensioners in the system in the same manner, following steps 3 through 6 of this piston.
- 3.8 Check that the pump pressure release valve is OPEN.
- 3.9 Connect hydraulic hoses to the tensioners and pump. Also refer to Section 4.1 for typical hose connection arrangements.
- 3.10 At each stud, verify that the piston is fully retracted into the tensioner body.
- 3.11 Before pressurizing the system, be sure that all hydraulic hoses are connected.
Each male coupler must be connected to a corresponding female coupler.

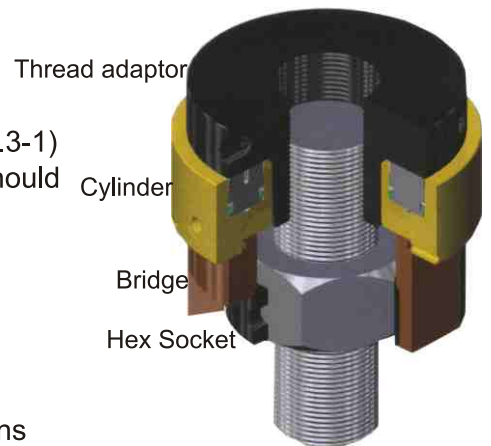


Fig 3.3-1

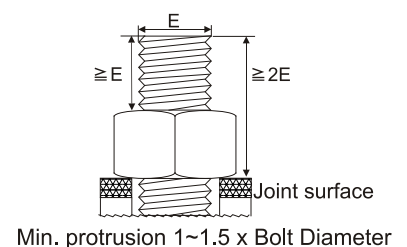


Fig 3.3-2

IMPORTANT : ONLY the unused male coupler on the LAST tensioner at the end of the circuit can remain disconnected.

WARNING

Never pressurize the back side of a disconnected (open ended) male coupler. Disconnected male couplers may leak when pressurized from the back side. Serious personal injury could result if leakage occurs, and a high pressure oil stream penetrates the skin.

WARNING

If only a single tensioner is being used, **always pressurize the tensioner using ONLY the MALE tensioner coupler.** To prevent possible high pressure oil leakage, NEVER use the male tensioner coupler to pressurize a single tensioner.

3.TIGHTENING PROCEDURE

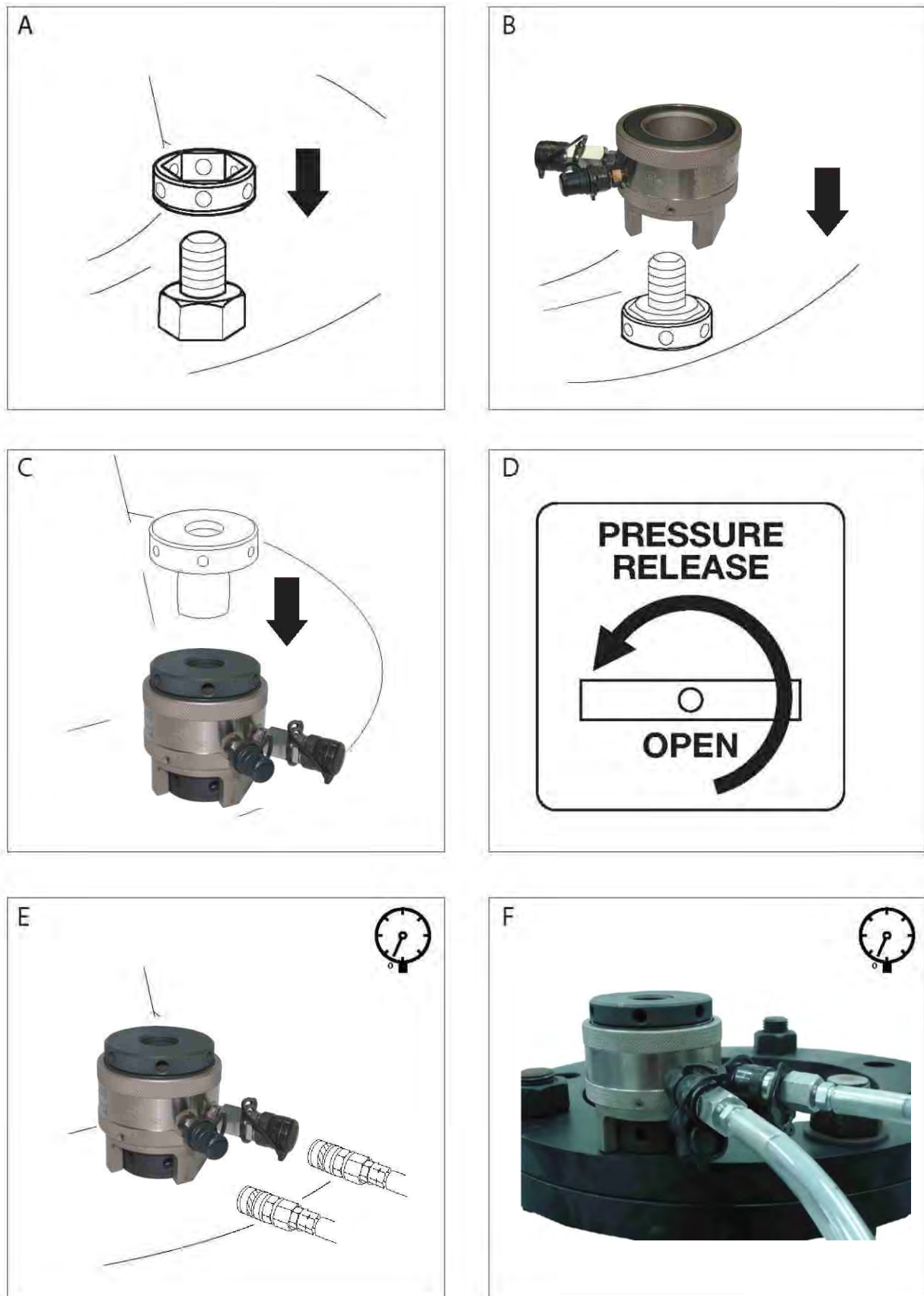


Fig. 3.6 Hydraulic Tensioner Installation

4.TENSIONING AND DE-TENSIONING

4.1Tensioner Arrangements (typical)

Hydraulic tensioners can be mounted on either one or both sides of the joint, depending on available clearance and work room. Whenever possible, all studs on the joint should be tensioned at the same time. Typical examples of 100% and 50% tensioner coverage are shown in Figure 4.1. Contact SUNRUN for additional information regarding tensioner arrangements of less than 50% coverage.

Note : For less than 100% coverage, divide the quantity of tensioners available into the quantity of studs in the joint. This will determine the stud locations to be tightened during each pass. For example, if 18 tensioners are available for 36 bolt joint, then every second stud will contain a tensioner (50% coverage). If 12 tensioners are available, then every third stud will contain a tensioner (33% coverage).

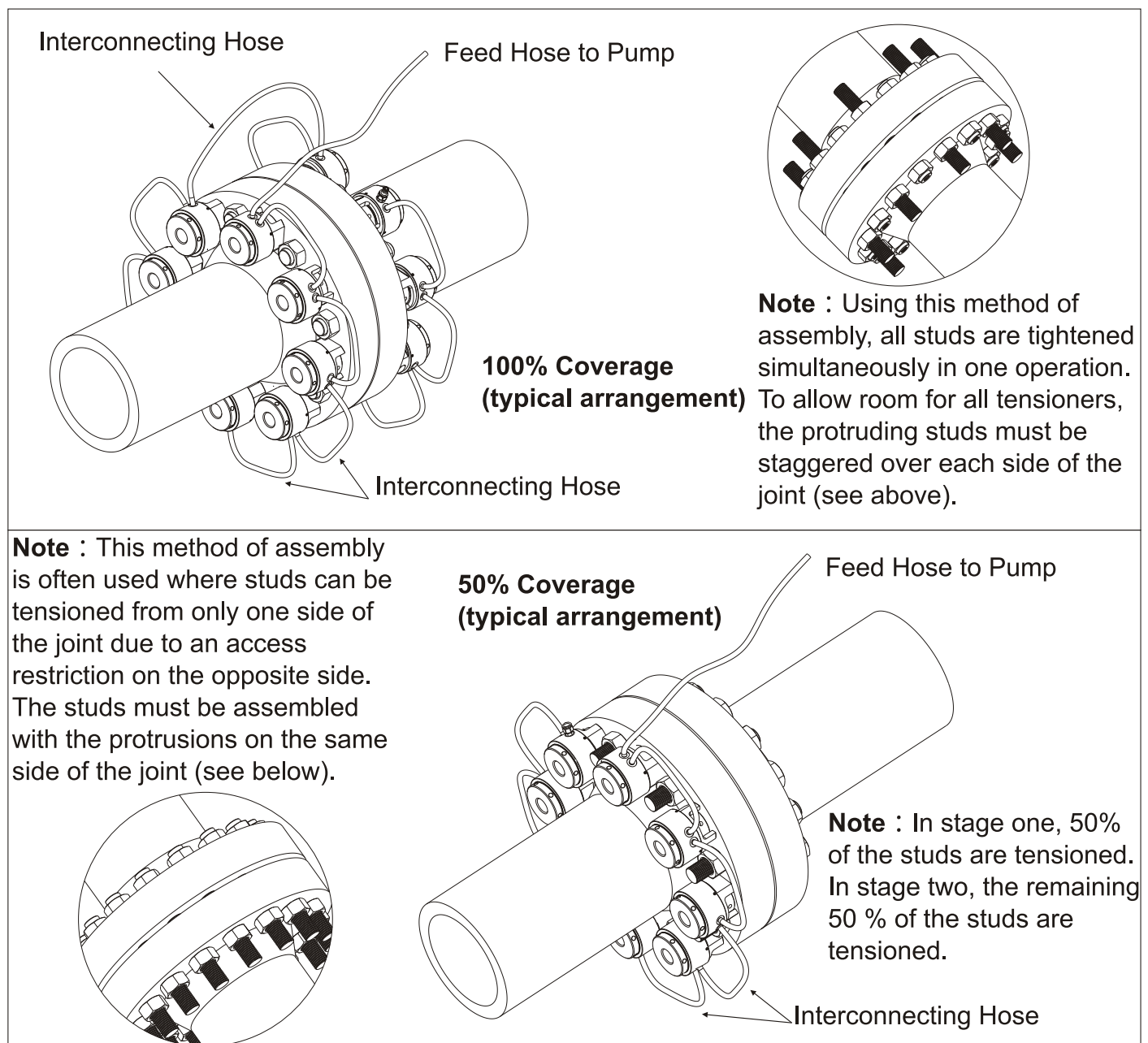


Figure 4.1 Hydraulic Tensioner Mounting Arrangement (typical)

4.TENSIONING AND DE-TENSIONING

⚠ WARNING

Never stand in-line with the bolt axis while the system is pressurized. If the bolt should fail, serious personal injury or death could result if loose or broken parts become projectiles. All personnel must be aware of this potential hazard at all times.

⚠ WARNING

Ensure that the maximum working pressure and maximum stroke are not exceeded. Refer to the specifications stamped on the tensioner body.

IMPORTANT : If the maximum stroke indicator appears at any time during the following procedures, immediately STOP the pump, tighten nut(s) at the tensioner(s) and release hydraulic pressure. Then, **turn down the threaded adaptor to return the plunger back into the tensioner(s) before continuing.**

IMPORTANT : If any leaks occur, immediately stop the pump and open the pressure release (return-to-tank) valve. Be sure that the oil pressure gauge indicates zero (0) psi/bar. Make repairs as required before continuing with tensioning procedures.

4.2 Tensioning Instructions - 100% Coverage (tensioner installed on each stud)

- 4.2.1 Ensure that the joint is correctly aligned.
- 4.2.2 Assemble the tensioner(s) to the stud(s) and connect hydraulic hoses. Refer to section 3.
- 4.2.3 Determine the required hydraulic tensioning pressure.
- 4.2.4 Operate the pump and pressurize the tensioners up to approximately 1000psi/70bar. Check for oil leaks.
- 4.2.5 If no leaks are found, continue pressurizing the tensioners to the calculated value determined in step 4.2.3. Continually observe the tensioner stroke and hydraulic pressure at all times during pressurization.
- 4.2.6 When the calculated hydraulic pressure is reached, stop the pump. Recheck the oil pressure gauge after pump has stopped. Be sure the pressure is stable. Threads may be visible between the nut and the joint surface at each tensioner. See Figure 4.2-1.
- 4.2.7 While holding the pressure constant, use a tommy bar to turn down the first socket and nut by hand. Continue tightening until the nut is firmly seated against the joint surface. See Figures 4.2-2 and 4.2-3.
- 4.2.8 Repeat step 7 for all remaining studs in the circuit.
- 4.2.9 Release the hydraulic pressure by SLOWLY opening the pump pressure release valve. Verify that the oil pressure gauge indicates zero (0) psi/bar.
- 4.2.10 Check the piston stroke. If necessary, turn down the threaded adaptor until the plunger is fully retracted into the tensioner body.
- 4.2.11 Repeat steps 4 through 10 a second time.
- 4.2.12 Repeat steps 4 through 10 a third time.

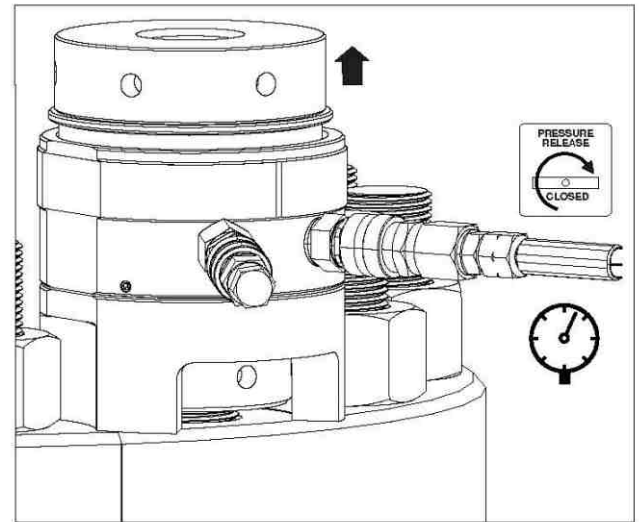


Figure 4.2-1 Pressurizing the Tensioner

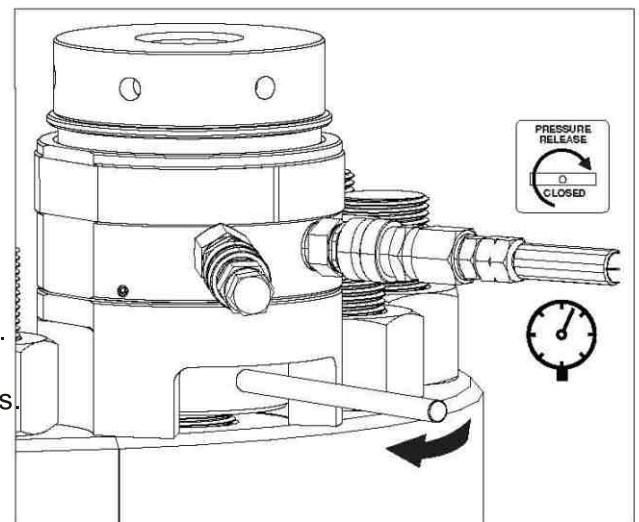


Figure 4.2-2 Turning Down the Socket and Nut

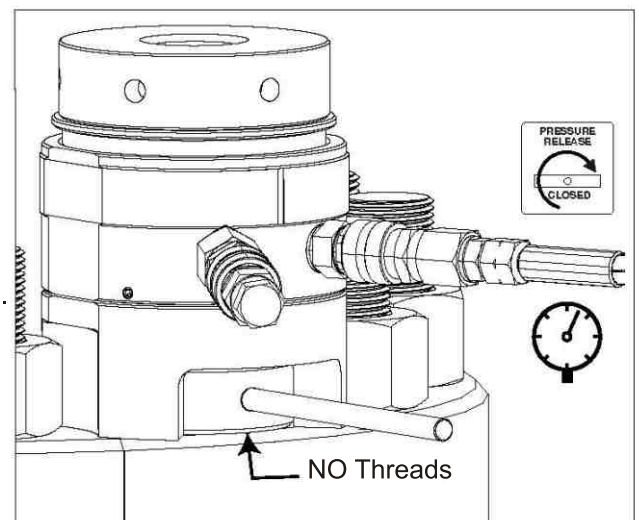


Figure 4.2-3 Socket and Nut Firm Against Joint

4.TENSIONING AND DE-TENSIONING

4.3 Tensioning Instruction - 50% Coverage (tensioner installed on every other stud)

- 4.3.1 Ensure that the joint is correctly aligned.
- 4.3.2 Alternately number each "1" and "2".
- 4.3.3 Assemble the tensioner(s) to the studs marked "1" and connect the hydraulic hoses. See Figure 4.3-3 for typical tensioner arrangement. Also refer to sections 3.
- 4.3.4 Determine the "first pass" pressure "A" value. This value must be calculated by a qualified engineer with bolting experience.

Note: The pressure "A" value used to tension the bolts marked "1" is typically *higher* than the pressure "B" value used later to tighten the bolts marks "2". This is to allow for additional load losses which may occur when performing less than 100% coverage tensioning.

- 4.3.5 Operate the pump and pressurize the tensioners up to approximately 1000 PSI [70 bar]. Check for oil leaks.
- 4.3.6 If no leaks are found, restart the pump and pressurize the tensioners to the "first pass" pressure "A" value determined in step 4. Continually observe the tensioner stroke and hydraulic pressure at all times during pressurization.
- 4.3.7 When the "first pass" pressure "A" is reached, stop the pump. Recheck the oil pressure gauge after pump has stopped. Be sure the pressure remains stable. Threads may be visible between the nut and the joint surface at each tensioner. See Figure 4.2-1.
- 4.3.8 While holding the pressure constant, use a tommy bar to turn down the first socket and nut by hand. Continue tightening until the nut is firmly seated against the joint surface. See Figures 4.2-2 and 4.2-3.
- 4.3.9 Repeat step 8 for the remaining "first pass" tensioners in the circuit.
- 4.3.10 Release the hydraulic pressure by SLOWLY opening the pump pressure release (return to tank) valve. Verify that the oil pressure gauge indicates zero (0) psi/bar. See Figure 4.3-1.
- 4.3.11 Check the piston stroke at each tensioner in the circuit. If necessary, turn down the threaded puller until the piston is fully retracted into the tensioner body. See Figure 4.3-2.
- 4.3.12 Repeat step 5 through 11 a second time (to pressure "A").
- 4.3.13 Repeat step 5 through 11 a third time (to pressure "A").
- 4.3.14 Move the tensioners to the remaining 50% of the bolts (i.e. All bolts numbered "2"). See Figure 4.3-4.
- 4.3.15 Determine the "second pass" pressure "B" value. This value must be calculated by a qualified engineer with bolting experience.

Note: The pressure "B" value is typically lower than pressure "A" value (see note after step 4 for additional information).

- 4.3.16 Operate the pump and pressurize the tensioners up to approximately 1000 PSI [70 bar]. Check for oil leaks.
- 4.3.17 If no leaks are found, continue pressurizing the tensioners to the calculated "second pass" pressure "B" value determined in step 15. Continually observe the tensioner stroke and hydraulic pressure at all times during pressurization.

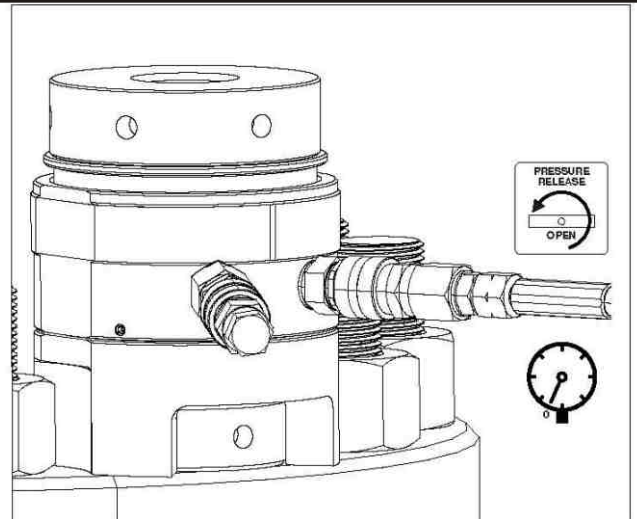


Figure 4.3-1 Pressure Released After Turning Down Nut

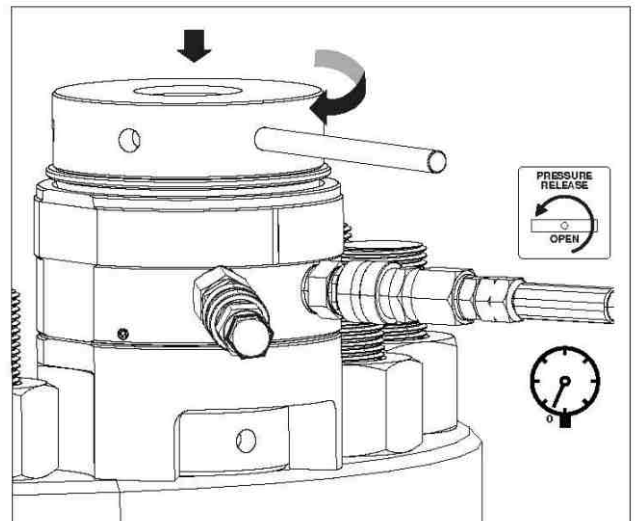


圖 4.3-2 降低螺牙帽 (視需求而定)

4.TENSIONING AND DE-TENSIONING

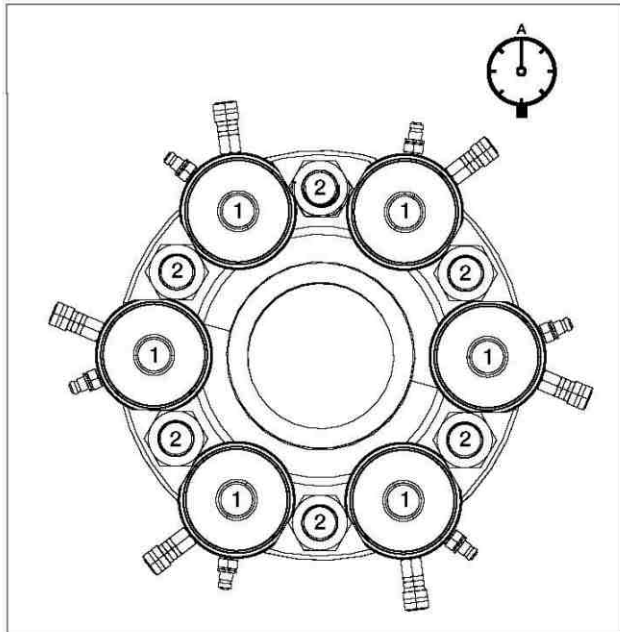


Figure 4.3-3 Tensioner Arrangement, First Pass-Typical
(50% Tensioner Coverage)

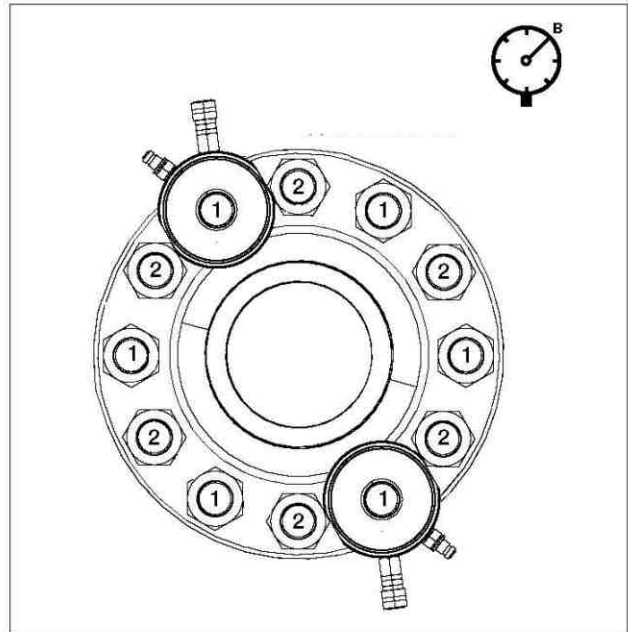


Figure 4.3-5 Rechecking First Pass Tension
(50% Tensioner Coverage)

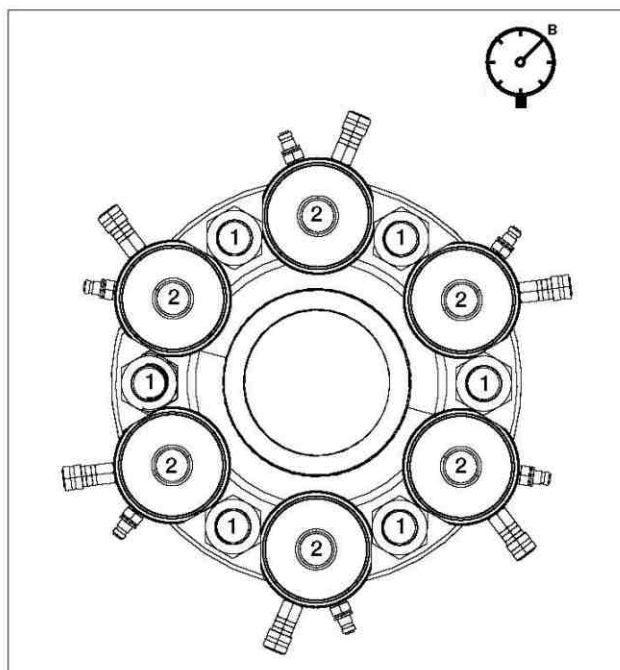


Figure 4.3-4 Tensioner Arrangement, Second Pass -
Typical (50% Tensioner Coverage)

4.3.18 When the "second pass" pressure "B" is reached ,stop the pump. Recheck the oil pressure gauge after pump has stopped. Be sure the pressure remains stable. Threads may be visible between the nut and the joint surface at each tensioner. See Figure 4.2-1.

4.3.19 While holding the pressure constant, use a tommy bar to turn down the first socket and nut by hand. Continue tightening until the nut is firmly seated against the joint surface. See Figure 4.2-2 and 4.2-3.

- 4.3.20 Repeat step 19 for the remaining "second pass" tensioners in the circuit.
- 4.3.21 Release the hydraulic pressure by SLOWLY opening the pump pressure release (return to tank) valve. Verify that the oil pressure gauge indicates zero (0) psi/bar. See Figure 4.3-1.
- 4.3.22 Check the piston stroke at each tensioner in the circuit. If necessary, turn down the threaded adaptor until the piston is fully retracted into the tensioner body. See Figure 4.3-2.
- 4.3.23 Repeat steps 16 through 22 a second time (to pressure "B").
- 4.2.24 Repeat steps 16 through 22 a third time (to pressure "B").

4.TENSIONING AND DE-TENSIONING

- 4.3.25 As an optional check to determine if an excessive load has been lost in the first 50% of bolts tightened (bolts number "1")
- Assemble tensioners on any two "first pass" bolts (labeled "1") located diametrically opposite of each other. See Figure 4.3-5.
 - Connect hydraulic hoses.
 - Apply the "second pass" pressure "B".
 - Using the tommy bar, attempt to tighten the nuts on these bolts by hand.
 - If the nuts cannot be turned, then tensioning is complete. Relieve hydraulic pressure. Go to Step 26.
 - If the nuts can be turned, then re-install the tensioners to the remainder of the "first pass" bolts (number "1"), apply the "second pass" pressure "B" and turn-down the nuts one more time as described in step 16 through 22.
- 4.3.26 Verify that the oil pressure gauge indicates zero (0) psi/bar.
- 4.3.27 Turn down the threaded pullers until the pistons are fully retracted. Disconnect hydraulic hoses and install a dust cap (not shown) over each disconnected coupler. Remove tensioners from the studs.

4.4 De-tensioning Instructions - 100% Coverage (tensioner installed on each stud)

- 4.4.1 BEFORE applying any hydraulic pressure, turn up the threaded puller at each stud as required, so that approximately a 3/16 inch [5 mm] gap appears between the fully retracted piston and the threaded puller. See Figure 4.4-1.
- 4.4.2 Operate the pump to pressurize the tensions up to approximately 1000 PSI [70 bar]. Check for oil leaks.

WARNING

In the following de-tensioning steps, be certain that the hydraulic pressure remains below the maximum allowable hydraulic pressure of 21,750 psi [1500 bar], and that the load applied does not exceed the tensile strength of the stud.

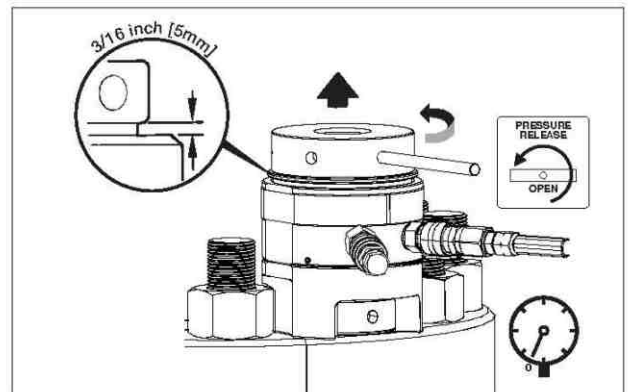


Figure 4.4-1 Turning Up the Threaded Puller

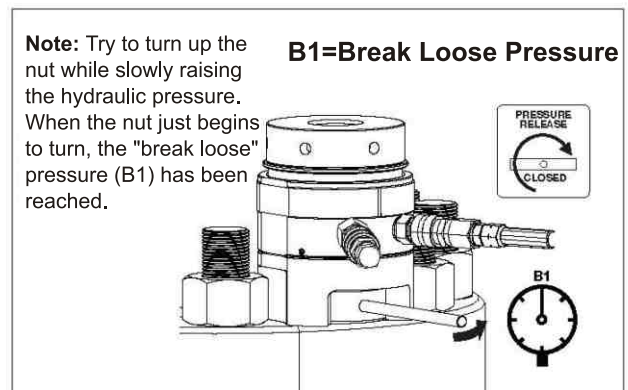


Figure 4.4-2 Determining the "Break Loose" Pressure

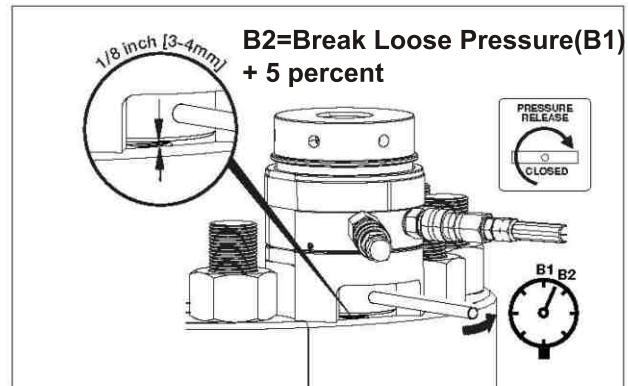


Figure 4.4-3 Turning Up the Nut

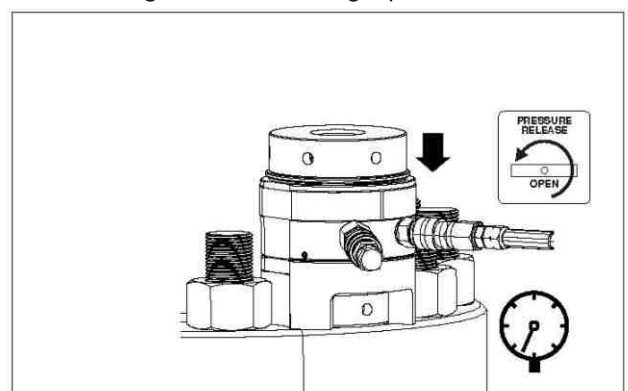


Figure 4.4-4 Pressure Released - Nut De-tensioned

4. TENSIONING AND DE-TENSIONING

4.4.3 If no leaks are found, continue operating the pump. Slowly raise the pressure until the "break loose" hydraulic pressure value is reached. This is the pressure at which a nut on one of the tensioners just begins to loosen and can be turned by hand with the tommy bar. Record this pressure for reference. See Figure 4.4-2.

4.4.4 Increase the hydraulic pressure approximately 5% above the "break loose" pressure recorded in step 3. Then, stop the pump.

4.4.5 While holding the pressure constant, turn up (loosen) the nut at the first tensioner, so that there is approximately a 1/8 inch [3-4 mm] gap between the nut and the joint surface. See Figure 4.4-3.

Note: Dimension of gap in step 5 must not exceed the dimension of gap in step 1.

4.4.6 Repeat step 5 at all remaining studs.

CAUTION

If nuts are difficult to turn, hydraulic pressure may be increased in additional 5% increment. However, NEVER raise hydraulic pressure above 1500bar. Ensure that the load applied does not exceed the tensile strength of the stud.

4.4.7 Release the hydraulic pressure by SLOWLY opening the pump pressure release (return to tank) valve. Verify that the oil pressure gauge indicates zero (0) psi/bar. The studs are now fully de-tensioned.

4.4.8 Turn down the threaded pullers the pistons are fully retracted. Disconnect hydraulic hoses and install a dust cap over each disconnected coupler.

4.5 De-tensioning Instructions - 50% Coverage (tensioner installed on every other stud)

4.5.1 Assemble the tensioner(s) to the first 50% of stud(s) to be de-tensioned and connect the hydraulic hoses. Refer to sections 3 for additional tensioner installation and hose connection instructions.

4.5.2 Follow steps 1 through 7 of Section 4.4 for the first 50% of studs.

4.5.3 Move the tensioners to the second 50% of studs.

4.5.4 Follow steps 1 through 8 of Section 4.4 for the remaining 50% of studs. Note that the "break loose" hydraulic pressure for the second set of studs will likely be about the same or slightly lower than that for the first set.

5. STORAGE

5.1 Electro nickel plating will help protect it from rust and corrosion. However, for added protection, a light coating of oil or rust inhibitor should be applied to all metal surfaces.

5.2 Cover the internal threads of the threaded puller with oil or a suitable rust inhibitor.

5.3 Store the tensioner upright, with the piston fully retracted inside the body.

5.4 Always keep dust caps installed on couplers when the tensioner is not being used.