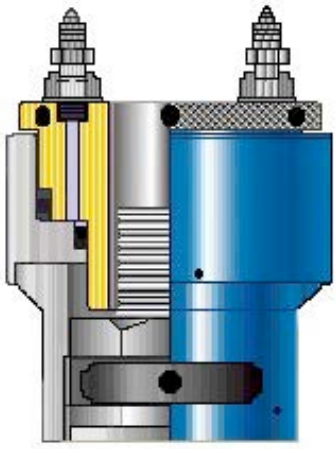
FASTORQ®

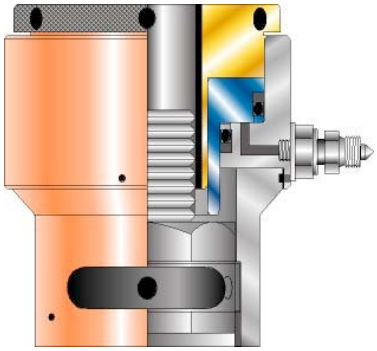
The Speed of Innovation.

AUTOTENSIONERSTUD TENSIONERS

Fixed and Variable Models



Fixed



Variable

Operation and Maintenance Manual

Keep for your records

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INTRODUCTION

You have acquired the finest hydraulic stud tensioner on the market.

AutoTENSIONER stud tensioners are dependable and durable. When operated properly, these tensioners deliver accurate pre- load within their specified range.

Please be sure to read this manual very carefully. Save it in a secure place and refer to it when needed.

For additional information call FASTORQ at 281.449.6466, Toll Free at 1.800.231.1075 or by e-mail at sales@fastorq.com.

POWER REQUIREMENTS

AutoTENSIONER hydraulic stud tensioners are hydraulically driven. They require a hydraulic pump unit that delivers up to 30,000 psi of hydraulic pressure.

The hydraulic pump can be driven by an air motor, an electric motor, or a diesel engine.

FASTORQ carries a wide range of power units that can be used with AutoTENSIONER tools.

For complete information on these units, contact your sales representative

UNPACKING

The AutoTENSIONER hydraulic stud tensioner is fully tested before it is shipped. Upon receiving your tensioner, verify that you have received the following items:

FIXED MODELS

Load Cell/ Puller Bar Assembly

Bridge and Nut Adapter Assembly

Tommy Bar

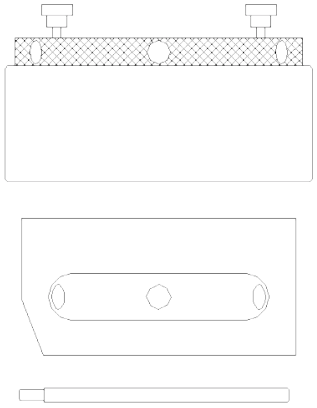

Figure 1

VARIABLE MODELS

Puller Bar

Load Cell and Piston Assembly

Bridge and Nut Adapter

Assembly Tommy Bar

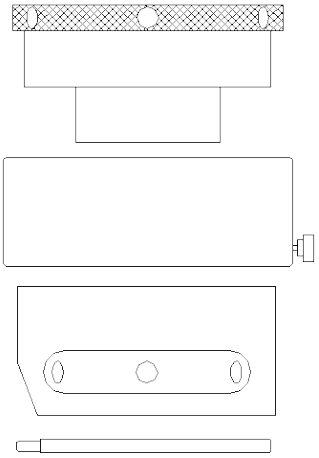

Figure 2

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SAFETY PRECAUTIONS

IMPORTANT

Please read and follow all instructions to avoid the risk of personal injury and / or property damage.

CAUTION

Always wear safety goggles or safety glasses, and protective gloves when operating stud tensioners.

WARNING

Do not allow the hydraulic hoses to kink, twist, curl or bend so tightly that the oil flow within the hose is blocked or reduced. Never attempt to grasp a leaking hose under pressure with your hands.

Never apply pressure when the tensioner is not on a stud. The piston and load cell will separate and destroy the seals.

Never exceed the rated pressure of the tensioner or the maximum allowable stroke.

Use the bolt load values specified by your equipment manufacturer whenever it is available. For convenience, a chart of suggested bolt loads for common size studs is included. This chart should not be used for studs of other sizes, materials, or threads, as improper loading of the studs may cause damage to your equipment.

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ASSEMBLY INSTRUCTIONS

Insure that the threads are clean and in excellent condition. This is verified when the nuts are being assembled onto the studs. The nuts should screw on the studs freely by hand. Insure that the bolts in the flange are assembled with a minimum length equal to the diameter of the stud, protruding from the nut on the side where the stud tensioners will be used.

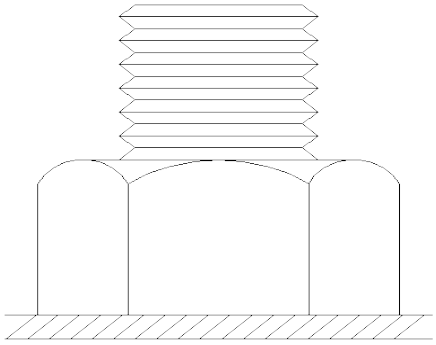

Figure 3

Tip: Divide the number of bolts in the flange by the number of stud tensioners available to determine how to spread the stud tensioners evenly around the flange. For example, if there are 16 bolts in the flange, and you have 8 stud tensioners, install a stud tensioner on every other bolt. Otherwise, if you have only 4 stud tensioners, install a stud tensioner on every fourth bolt.

FIXED STUD TENSIONER

Position the Bridge / Nut Adapter assembly over a bolt to be tightened or loosened.

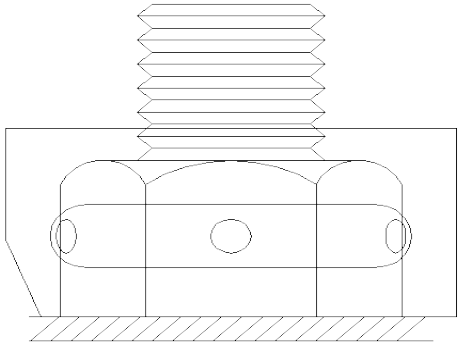

Figure 4

Place the Load Cell / Puller Bar assembly over the Bridge while aligning the inside threads of the Puller Bar with the end of the bolt. Screw it down until it stops turning.

NOTE: When de-tensioning, back the puller bar off one full turn.

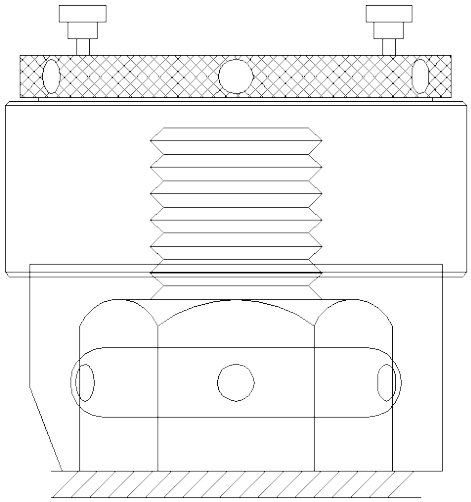

Figure 5

VARIABLE STUD TENSIONER

Position the Bridge / Nut Adapter assembly over a bolt to be tightened or loosened.

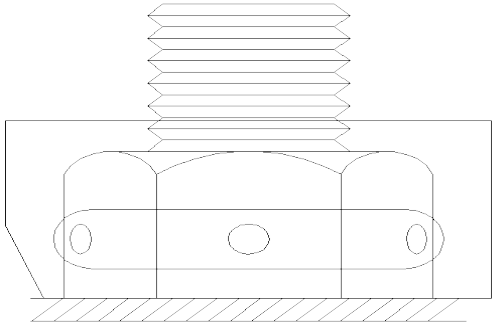

Figure 6

Place the Load Cell/Piston assembly over the Bridge / Nut Adapter Assembly.

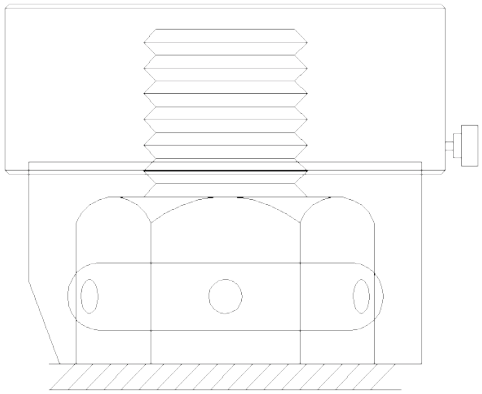

Figure 7

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Place the Puller Bar, inside the Load Cell and over the Bridge, while aligning the inside threads of the Puller Bar with the end of the bolt. Screw it down until it stops turning.

NOTE: When de-tensioning, back the puller bar off one full turn.

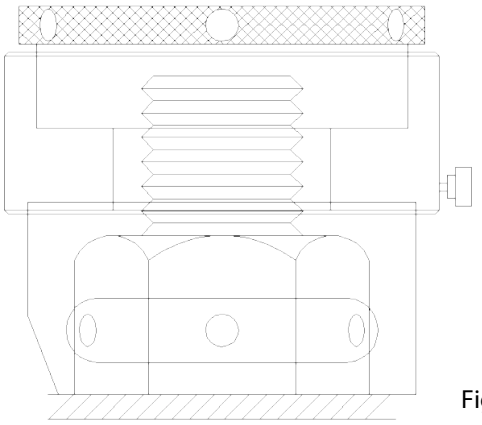


Figure 8

Tip: It is always recommended to use specific bolting procedures when tightening bolts. FASTORQ specializes in bolting technology.

Call us at 1.800.231.1075 (Toll Free US & Canada) or 1.281.449.6466 (Global) for more information.

Connect each stud tensioner to the one next to it all around the flange. Use your interconnecting hydraulic hoses.

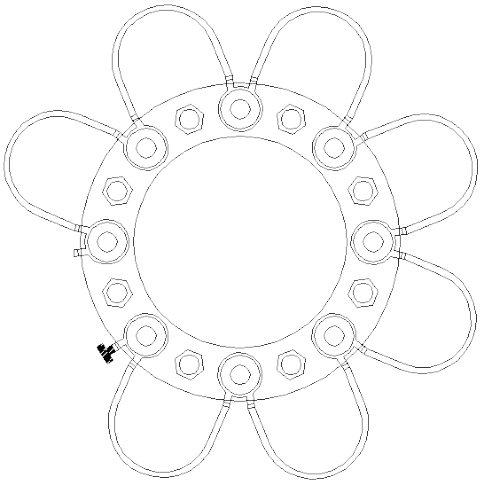


Figure 9

At a suitable location near the pump unit, connect the appropriate stud tensioner to the pump unit to close the circuit.

The system is now ready to be pressurized.

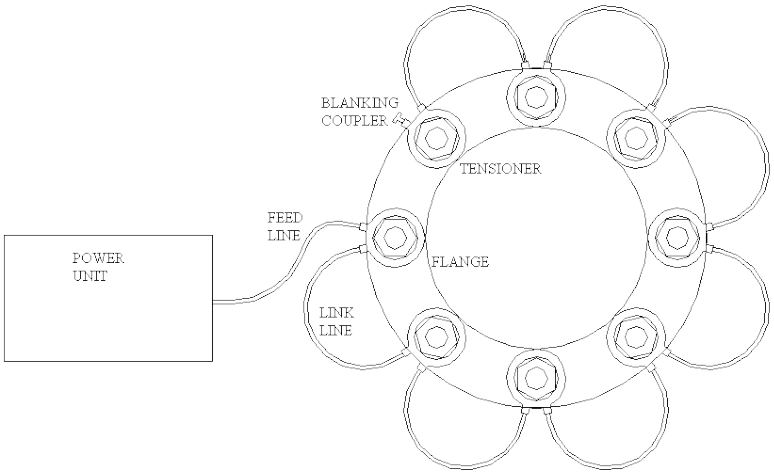


Figure 10

OPERATION INSTRUCTIONS

TIGHTENING

Hint: In order to achieve a desired bolt load, it is necessary to use two different pressure settings. Let's call the first pressure P_a, and the second, lower pressure P_b.

1. Install the stud tensioners on the first set of bolts as explained in the previous section, "Assembly Instructions."

   NOTE: It is recommended to use 50% coverage when tensioning bolts. In this case, there will be only 2 sets of bolts, and pressure Pb is applied to the second set.

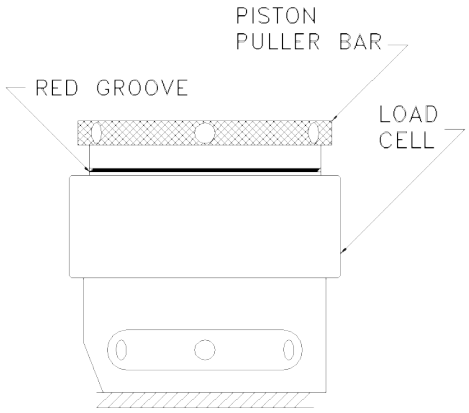
   If less than 50% coverage is available, several sets of bolts will exist. Apply pressure Pa to half of the sets, and pressure Pb to the other half while alternating. For example, if you have sets "A", "B", "C", "D"; Apply pressure Pa to sets "A" and "C", and pressure Pb to sets "B" and "D".

2. Set the pump to pressure Pa.

3. Apply pressure Pa to the stud tensioners.

   NOTE: If the gap between the piston and the load cell reaches the maximum allowable distance (as indicated by the red groove) before the pressure Pa is reached, stop pressurizing immediately, and proceed to the next step.

   It is most likely that the gap reaches its maximum during the first cycle because it is then when any slack in the flange assembly is taken up by the stud tensioners.



4. Tighten down the nuts using a Tommy bar through the slot in each bridge.

5. Release the hydraulic pressure.

6. Disconnect all link hoses between stud tensioners.

7a. If your pump is equipped with a return port; connect a bleed line from one tensioner to the return port on the pump.

7b. If your pump is not equipped with a return port; Connect a bleed line from one tensioner to a bucket to collect the hydraulic oil.

8. Press the piston back in each load cell manually. Screw down the puller bar with a Tommy bar if necessary.

> **NOTE:** If your pump is equipped with Vacuum Retract, switch your connection from the pressure side to the return side and activate the suction pump to automatically retract the piston.

9. Repeat steps 7 & 8 for every stud tensioner.

10. Repeat steps 3 through 9 as necessary.

11. Transfer the stud tensioners to the next set of bolts.

12. Set the pump to the appropriate pressure. Refer to the note in step 1 for explanation.

13. Apply pressure Pb to the stud tensioners.

14. Repeat steps 4 through 10.

15. Repeat steps 11 through 14 when necessary.

16. After all bolts have been tensioned once, transfer two stud tensioners back to two diametrically opposite bolts in the first set of bolts to check the remaining load.

17. Start with a pressure lower than the lowest pressure used previously. Slowly increase the pressure until the nut turns loose.

18a. If this pressure is equal to or greater than P_b;

Re-tighten the nuts, and remove all stud tensioners;
Tightening is complete.

18b. If this pressure is lower than P_b;

With the stud tensioners on the same set of bolts, repeat steps 2 through 15.

NOTE: If you are using less than 50% coverage, execute steps 17 & 18 between each set of bolts, and stop when step 18a is satisfied.

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LOOSENING

1. Determine how many stud tensioners are necessary given the number of bolts on the flange.

2. Install the stud tensioners on the first set of bolts as explained in the previous section, "Assembly Instructions."

> **NOTE:** *Insure that the puller bar is backed off one full turn after full threads engagement..*

3. Apply enough pressure to allow the nuts to turn loose. Start low and gradually increase the pressure. Never exceed the allowable pressure of the stud tensioners.

4. Loosen each nut one full turn.

5. Release the pressure.

6. Back off the puller bar another full turn.

7. Repeat steps 3 through 6.

8. Transfer the stud tensioners to the next set of bolts.

> **NOTE:** *If you are using 50% coverage, there will be two sets of bolts. Otherwise, if you are using less than 50% coverage, several sets of bolts will exist.*

9. Repeat steps 3 through 8 until all bolts are loose.

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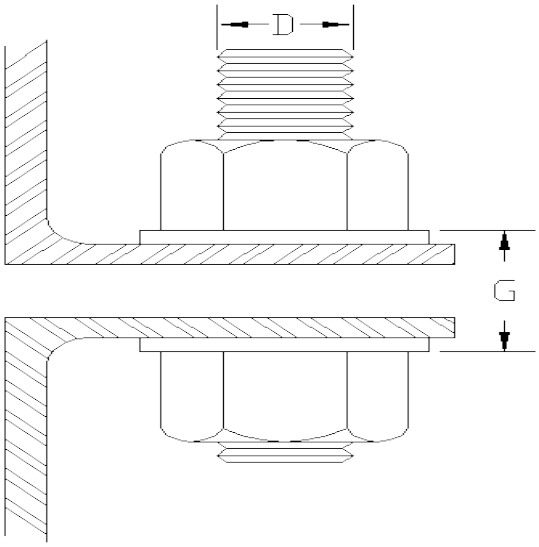
PRESSURE CALCULATIONS

The pressure applied when using hydraulic stud tensioners depends on the required residual bolt load. The bolt load in turn depends on several factors like operating pressure, material, and gasket. Consult your equipment manufacturer for assistance.

The necessary pressure to be applied on the stud tensioners in order to achieve the desired bolt load can be calculated as follows: (go to step 5 if the residual bolt load is known)



1. Determine the bolt material and find its yield strength. (Y)
2. Find or calculate the stress area of that bolt diameter. (A1)
3. Decide how much residual stress (S) or what percentage of yield (%Y) is desired on each bolt.

4. Calculate the desired load (L1) by multiplying the value in step 2 by the stress value in step 3.
5. Calculate the effective grip length of the bolt. (G)

   NOTE: G is the sum of the total flange thickness, the gasket thickness, and the washers' thickness (if applicable); it is the distance from the inside face of the nut to the inside face of the other nut.

6. Calculate the ratio (R) of the grip length G over the diameter D of the bolt. (R = G / D)
7. Find the load loss factor (F) from the following graph using the value of R found in the previous step.
8. Calculate the intermediate load (L2) by multiplying L1 by the value for F found in the previous step.
9. Look up the piston area (A2) in the stud tensioner specifications.
10. Divide L2 by A2 to find the higher pressure P_a.
11. Divide L1 by A2 to find the lower pressure P_b.

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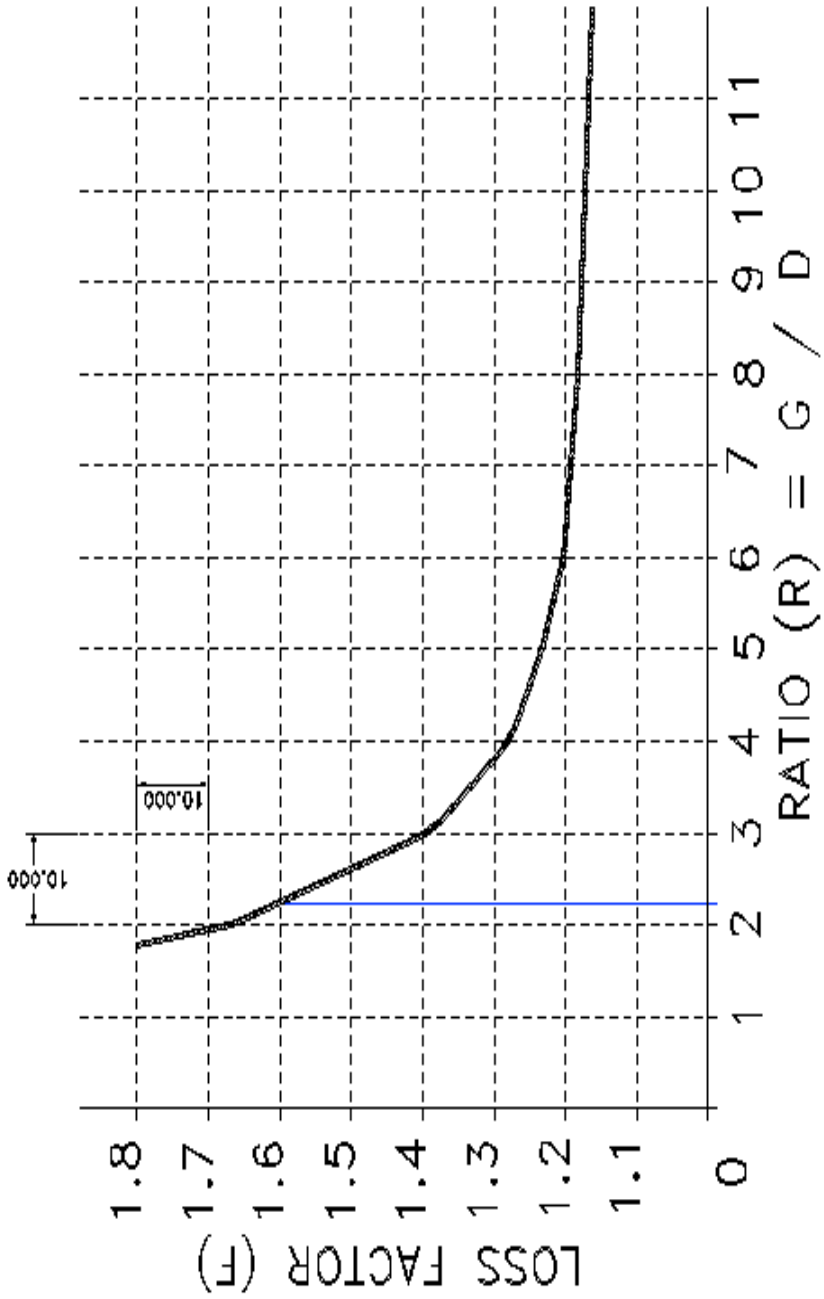
LOSS FACTOR (F)
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
0
1
2
3
4
5
6
7
8
9
10
11
RATIO (R) = G / D
.010
.010

The following are suggested bolt load values based on ASTM A193-B7 studs, at 50% of their yield strength.

Stud Dia.	Stress Area		Suggested Bolt	
(in)	(in^2)	*(mm^2)*	(lb)	*(Kgf)*
3/4	0.334	*215*	17,535	*7954*
7/8	0.462	*298*	24,255	*11000*
1	0.606	*391*	31,815	*14431*
1-1/8	0.790	*510*	41,475	*18813*
1-1/4	1.000	*645*	52,500	*23814*
1-3/8	1.233	*795*	64,733	*29362*
1-1/2	1.492	*962*	78,330	*35530*
1-5/8	1.780	*1148*	93,450	*42388*
1-3/4	2.080	*1342*	109,200	*49532*
1-7/8	2.410	*1555*	126,525	*57391*
2	2.770	*1787*	145,425	*65964*
2-1/4	3.560	*2297*	186,900	*84776*
2-1/2	4.440	*2865*	210,900	*95663*
2-3/4	5.430	*3503*	257,925	*116993*
3	6.510	*4200*	309,225	*140262*
3-1/4	7.690	*4961*	365,275	*165686*
3-1/2	8.960	*5781*	425,600	*193049*
3-3/4	10.340	*6671*	491,150	*222782*
4	11.810	*7619*	560,975	*254454*
4-1/4	13.385	*8635*	501,687	*227561*

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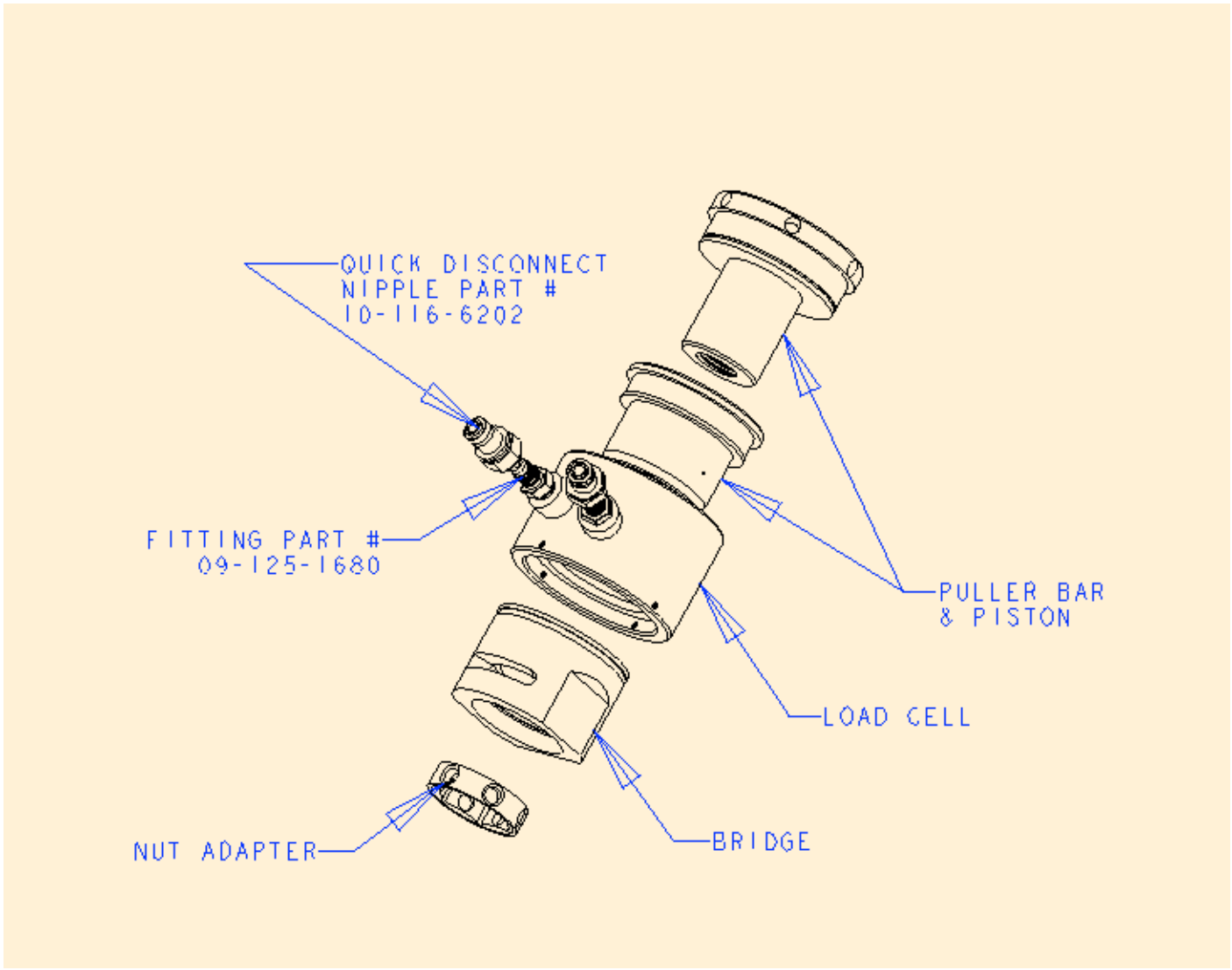
TROUBLE SHOOTING

SYMPTOMS	CAUSE	SOLUTIONS
Nut not turning under bridge with system under pressure.	Improper hydraulic connection resulting in no real effect on bolt. Damaged threads on nut and / or stud.	Release pressure, and check your connections. Remove stud
Tensioner locks up on bolt or can't be removed, when loosening studs.	Improper practices while assembling stud tensioners for loosening.	Pressurize stud tensioner gradually until the nut rotates. Tighten the nut half a turn. Release the pressure. Turn Puller Bar counter clockwise one full turn. Pressurize stud tensioner. Turn nut one full turn, in the counter clockwise direction. Release the pressure.
Oil leaking from hydraulic connection.	Connection is loose Connection is too tight	Tighten connection Replace Fitting
Piston will not retract / or advance	Hydraulic connections not connected	Reconnect fittings
Hydraulic connection will not lock / or will not release	Hydraulic pressure on the line	Release the pressure in the hose

STORING TIPS

- Always have the piston retracted.
- Rinse and clean the stud tensioners after every job, and lubricate with light oil film.
- Cover the internal threads of the Puller Bar.

EXPLODED VIEW



PARTS LIST - FIXED STUD TENSIONERS

Model	Pull.Bar/ Piston	Load Cell	Bridge	Nut Adapter	Retaining Ring	Seal Kit	Set Screw
F012	B97051-1	B97050-1					
F014	B97051-2	B97050-2					
F100	B97051-3	B97050-3					
F102	B97051-4	B97050-4	B99017	A99018	WH244	208P 113P	
F104	B97051-5	B97050-5	B99015	A99016	WH268	212P 114P	
F106	B97051-6	B97050-6	B97142	A97143	WH268	X-46310 X-46320	
F108	B97051-7	B97050-7	B97065	A95036	WH300	X-46578 X-46573	
F110 FM042	B97051-8 B97051-19	B97050-8	B97066	A95033	WH318	X-46581 X-46574	
F112	B97051-9	B97050-9	B97083	A95037	WH350	X-46583 X-46576	
F114	B97051-10	B97050-10	B97067	A97074	WH362	X-46584 X-46576	
F200	B97051-11	B97050-11	B97023	A97075	WH387	X-46586 X-46577	
F204	B97051-12	B97050-12	B95057	A94112	WH450	X-46587 X-46579	
F208	B97051-13	B97050-13	B93017	B93018	WH500	X-46588 X-46580	
F212	B97051-14	B97050-14	B97071	B93083	WH537	X-46589 X-46582	
F300	B97051-15	B97050-15	B93077	B93076	WH587	X-46590 X-46583	
F304	B97051-16	B97050-16	B93080	B93079	WH629	X-46591 X-46585	
F308	B97051-17	B97050-17	B93080	B93079	WH675	X-46592 X-46587	
F312	B99004	B99005	B99006	B99003	WH725	M-6646 M-6644	
F400	B94098	B94093	B94099	B94100	RP3-24	M-6646 M-6644	
F404	B94092	B94093	B94094	B94095	RP3-24	M-6646 M-6644	
F408	C2K206	C2K205	C2K207	B2K208	WH850	X-46710 X46720	

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PARTS LIST - VARIABLE STUD TENSIONERS

Model	Puller Bar	Piston	Load Cell	Bridge	Nut Adapte	Retaining Ring	Seal Kit	Set Screw
V100		B99083	B99082				X-46576 X-46578	
V102	B99084	B99083	B99082	B99085	A99018	WH244	X-46576 X-46578	
V104		B99083	B99082				X-46576 X-46578	
V106	B94038	A94041	B94042	B94037	A94036	WH300	M-6440 M-6442	
V108	B95035	A94041	B94042	B98011	A98010	WH318	M-6440 M-6442	
V110	B95032	A94041	B94042	B98011	A95033	WH318	M-6440 M-6442	
V112	B95039	B95040	B95041	B95038	A95037	WH350	M-5861 M-5862	
V114	B95044	B95040	B95041	B98018	A98014	WH387	M-5861 M-5862	
V200	B95047	B95040	B95041	B98018	A97075	WH387	M-5861 M-5862	
V204	B98019	B98017	B98016	B98021	A98015	WH437	M-5779 P-1298	
V208	B98020	B98017	B98016	B98022	B93018	WH493	M-5779 P-1298	
V212	B98025	B98026	B98027	B98028	B98029	WH551	P-1301 P-1299	
V300	B98031	B98026	B98027	B98028	B98030	WH551	P-1301 P-1299	
V304	B98032	B98033	B98034	B98035	B98036		P-1300 P-1302	
V308	B98038	B98033	B98034	B98035	B98037		P-1300 P-1302	

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AutoTENSIONER FIXED STUD TENSIONERS					
MODEL	STUD DIA.	PISTON AREA		LOAD	
		(in^2)	(mm^2)	(lb)	(Kgf)
F012	3/4″	1.976	1275	43,472	19718
F014	7/8″	2.488	1605	54,736	24828
F100	1″	2.880	1858	63,360	28739
F102	1-1/8″	3.908	2521	85,976	38998
F104	1-1/4″	4.859	3135	106,898	48488
F106	1-3/8″	5.463	3525	120,186	54515
F108	1-1/2″	6.340	4090	139,480	63267
F110	1-5/8″	8.269	5335	181,918	82516
F112	1-3/4″	10.465	6752	230,230	104430
F114	1-7/8″	10.667	6882	234,674	106446
F200	2″	13.008	8392	286,176	129807
F204	2-1/4″	13.066	8430	287,452	130385
F208	2-1/2″	14.756	9520	354,200	160,662
F212	2-3/4″	18.237	11766	401,214	181987
F300	3″	23.060	14877	507,320	230115
F304	3-1/4″	25.529	16470	561,638	254753
F308	3-1/2″	31.408	20263	690,976	313420
F312	3-3/4″	41.913	27040	922,086	418249
F400	4″	41.913	27040	922,086	418249
F404	4-1/4″	41.913	27040	922,086	418249
F408	4-1/2″	44.913	28975	988,086	448186

AutoTENSIONER VARIABLE STUD TENSIONERS					
MODEL	STUD DIA.	PISTON AREA		LOAD	
	(in)	(in^2)	(mm^2)	(lb)	(Kgf)
V012	3/4	1.920	1239	42,240	19160
V014	7/8	1.920	1239	42,240	19160
V100	1	4.282	2763	94,204	42730
V102	1-1/8	4.282	2763	94,204	42730
V104	1-1/4	4.282	2763	94,204	42730
V106	1-3/8	6.602	4259	145,244	65881
V108	1-1/2	6.602	4259	145,244	65881
V110	1-5/8	6.602	4259	145,244	65881
V112	1-3/4	11.379	7341	250,338	113551
V114	1-7/8	11.379	7341	250,338	113551
V200	2	11.379	7341	250,338	113551
V204	2-1/4	14.092	9092	310,024	140624
V208	2-1/2	14.092	9092	310,024	140624
V212	2-3/4	21.620	13948	475,640	215746
V300	3	21.620	13948	475,640	215746
V304	3-1/4	27.451	17710	603,922	273933
V308	3-1/2	27.451	17710	603,922	273933
V312	3-3/4	35.100	22645	772,200	350262
V400	4	35.100	22645	772,200	350262
V404	4-1/4	35.100	22645	772,200	350262

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LIMITED WARRANTY

FASTORQ warrants its products against defects in workmanship and materials for 180 days from date of delivery.

Warranty does not cover ordinary wear and tear, abuse, misuse, overloading, or altered products.

REPAIR AND SERVICE

FASTORQ shall provide complete and prompt service on all its products.

It is recommended to return the unit to the factory in the event of a failure or a general maintenance requirement. FASTORQ's trained and experienced technicians can properly inspect and repair the unit.

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ASSISTANCE

FASTORQ provides technical support and assistance to all its customers. Help is available 7 days a week, 24 hours a day by calling 281.449.6466 or Toll Free 1.800.231.1075.

Please contact us whenever you have a question or need assistance. We may be reached by phone or e-mail (sales@fastorq.com).

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