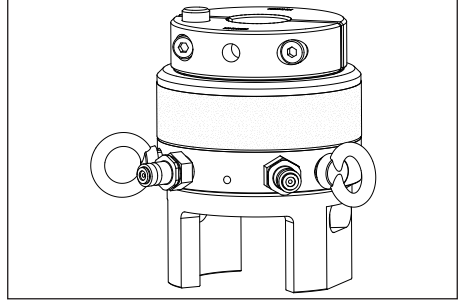




L4374 Rev. F 02/24

CONTENTS

1.0 INTRODUCTION.....	1
2.0 SAFETY	2
3.0 SPECIFICATIONS.....	4
4.0 FEATURES AND COMPONENTS.....	4
5.0 SETTING UP.....	5
6.0 INSTALLATION	5
7.0 TENSIONING AND DE-TENSIONING	15
10.0 STORAGE.....	23
11.0 TROUBLESHOOTING	24
12.0 TECHNICAL DATA.....	26



1.0 INTRODUCTION

Overview

The aim of the AquaJack Bolt Tensioning System is to quickly and accurately apply a pre-determined load to a nut and bolt assembly. It has been primarily developed for use in the underwater environment where speed, ease of operation and reliability are paramount.

In use, AquaJack Bolt Tensioners are attached to every stud bolt in the joint assembly allowing simultaneous and uniform bolt tightening.

AquaJack Bolt Tensioners are to be used as part of a complete hydraulic system, alongside a pump, hose arrangement and reaction nuts.

The AquaJack series can be used on a wide range of bolt size and pressure requirements.

Delivery Instructions

Upon delivery all components must be inspected for damage incurred during shipping. If damage is found the carrier should be notified at once. Shipping damage is not covered by the Enerpac warranty.

Warranty

- Enerpac guarantees the product only for the purpose for which is intended.
- Refer to the Enerpac Global Warranty document for terms and conditions of the product warranty.

Any misuse or alteration invalidates the warranty.

- Observe all instructions as communicated in this manual.
- When replacement parts are needed, use only genuine Enerpac replacement parts.

Modification to any part of the equipment outlined in this manual should not be attempted, nor any component part be replaced without first consulting Enerpac. Modifications may render the equipment dangerous. Component parts are each rated to suit the demands of the overall equipment design and replacement with similar items without provenance may lead to unexpected and dangerous accidental features.

If any equipment abuse is evident, the warranty will be invalidated and Enerpac will not be made responsible for an injury due to misuse or failure to comply with the above safety notes.

Conformance to National and International Standards

•EAJ1 •EAJ2 •EAJ3 •EAJ4 •EAJ5
•EAJ6 •EAJ7 •EAJ8



These tools conform with the requirements for CE and UKCA.

Enerpac declares that the product(s) have been tested and conforms to applicable standards and the product(s) are compatible to all EU and UK Requirements.

Copies of the EU Declaration as well as the UK Self-Declaration are enclosed with each shipment.

2.0 SAFETY

Read all introductions carefully. Follow all recommended safety precautions to avoid personal injury as well as damage to the product and / or damage to other property. Enerpac cannot be responsible for any damage or injury from unsafe use, lack of maintenance, or incorrect operation. Do not remove warning labels, tags, or decals. In the event of any questions or concerns arising, contact Enerpac or a local Enerpac distributor for clarification.

If you have never been trained on high-pressure hydraulic safety, consult your distributor or service centre for information about Enerpac Hydraulic Safety Courses.

This manual follows a system of safety alert symbols, signals, words, and safety messages to warn the user of specific hazards. Failure to comply with these warnings could result in death or serious personal injury, as well as damage to the equipment or other property.



The Safety Alert Symbol appears throughout this manual. It is used to alert you to potential physical injury hazards. Pay close attention to Safety Alert Symbols and obey all safety messages that follow this symbol to avoid the possibility of death or serious injury.

Safety Alert Symbols are used in conjunction with certain Signal Words that call attention to safety messages or property damage messages and designate a degree or level of hazard seriousness. The Signal Words used in this manual are WARNING, CAUTION, and NOTICE.

⚠ DANGER Indicates a hazardous situation that, if not avoided, **will** result in death or serious personal injury.

⚠ WARNING Indicates a hazardous situation that, if not avoided, **could** result in death or serious personal injury.

⚠ CAUTION Indicates a hazardous situation that, if not avoided, **could** result in minor or moderate personal injury.

NOTICE Indicates information considered important, but not hazard related (e.g. messages relation to property damage). Please note that Safety Alert Symbol will **not** be used with the signal word.

2.1 Safety Precautions - AquaJack Tensioners



Failure to observe and comply with the following precautions could result in death or serious personal injury. Property damage could also occur.

- Read and completely understand the safety precautions and instructions in this manual before operating the tensioners or preparing them for use. Always follow all safety precautions and instructions, including those that are contained within the procedures of this manual.
- When the system is under pressure DO NOT STAND IN LINE with the direction of force of the tensioners. Keep this area clear of personnel at all times when the system is under pressure. If the bolt should fail, serious personal injury or death could result if loose or broken parts become projectiles.

- Operating procedures will vary, depending on the system arrangement. Always read, follow and completely understand all manufacturers' instructions when operating pumps, valves and all other devices used with the tensioners. Follow all safety precautions contained in the manufacturer's manuals. Use only for intended purpose.
- Wear personal protective gear when operating hydraulic equipment. Always wear eye protection. Safety equipment such as dust mask, non-skid safety shoes, hard hats, gloves or hearing protection (used as appropriate) will reduced personal injuries.
- Ensure that the strengths of the bolts are known and that the recommended tensioning applied loads are well within the safe limits.
- Do not handle pressurized hoses. Escaping oil under pressure can penetrate the skin. If oil is injected under the skin, see a doctor immediately.
- Do not pressurize disconnected couplers.
- The system operating pressure must not exceed the pressure rating of the lowest rated component in the system.
- Install pressure gauge(s) in the system to monitor operating pressure. It is your window to see what is happening in the system.
- Never set a relief valve to a higher pressure than the maximum rated pressure of the pump and tensioner. If ratings are different, relief valve setting should not exceed the setting of the lowest rated component (pump or tensioner).
- Do not exceed equipment ratings. Never attempt to apply more load to a bolt than the maximum capacity of the tensioner. Overloading may cause equipment failure and possible personal injury.

⚠ CAUTION

Failure to observe and comply with the following precautions could result in minor or moderate personal injury. Property damage could also occur.

- Be careful to avoid damaging hydraulic hoses. Avoid sharp bends and kinks when routing hydraulic hoses.
- Do not bend beyond the minimum bend radius specified by the hose manufacturer. Using a bent or kinked hose will cause severe back-pressure. Sharp bends and kinks will internally damage the hose, leading to premature hose failure.
- Do not lift hydraulic equipment by the hoses or couplers. Use the tensioner lifting eyes-bolts and appropriately rated lifting equipment, where appropriate.
- 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 hydraulic equipment to temperatures of 150°F [65°C] or higher.
- Immediately replace worn or damaged parts with genuine Enerpac parts. Enerpac parts are designed to fit properly and to withstand high loads. Non-Enerpac parts may break or cause the product to malfunction.
- Use hydraulic tensioners only in a coupled system. Never use a tensioner with uncoupled couplers.

NOTICE

- Hydraulic equipment must only be serviced by a qualified hydraulic technician. For repair service, contact the Enerpac Authorized Service Centre in your area.
- Rope off working area and place warning signs.
- To help ensure proper operation and best performance, use of Enerpac oil is strongly recommended.

3.0 SPECIFICATIONS

Major tensioner specifications, such as maximum working pressure, maximum load and maximum stroke are stamped into the side of the hydraulic tensioner body. See Figure 1. Be aware of these specifications during installation and set-up.

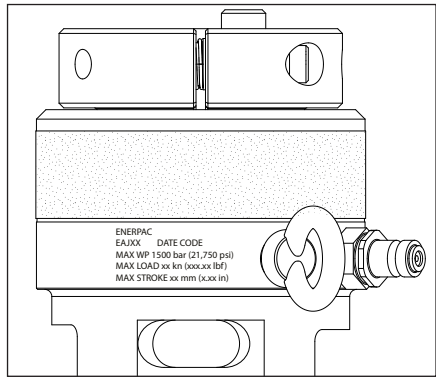


FIGURE 1, TENSIONER DATA

4.0 FEATURES AND COMPONENTS

Refer to Figure 2 for a diagram of AquaJack Series tensioner major components.

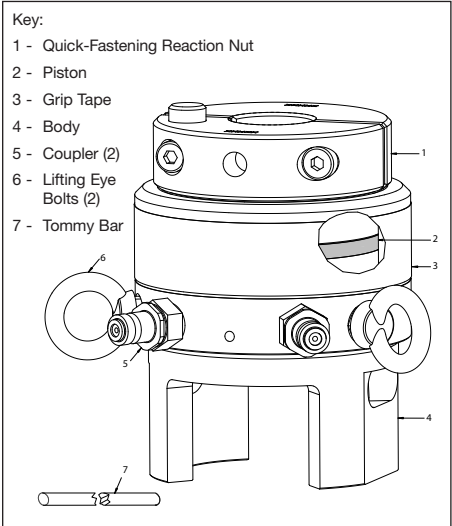


FIGURE 2, TENSIONER MAJOR COMPONENTS

4.1 Maximum Stroke Indicator

Maximum allowable tensioner stroke is visually indicated by a painted groove located on the puller's circumference.

Continually watch for the maximum stroke indicator during tensioning procedures. Stop pressurizing the system immediately if the indicator becomes visible.

If during any tensioning procedure, the maximum stroke indicator appears before the desired hydraulic pressure is reached: STOP the pump, tighten nut(s) at the tensioner(s) and release hydraulic pressure. Then, turn down the quick fastening nut(s) to return the piston(s) back into the tensioner(s).

To ensure proper tensioning, always repeat the tensioning stage (start over) if the maximum stroke indicator appears before the desired hydraulic pressure is reached.

⚠ WARNING Continuing to pressurize the system after the maximum stroke indicator becomes visible may result in high pressure hydraulic oil leakage. Serious personal injury could result if a stream of pressurized hydraulic oil penetrates the skin. Damage to tensioner components and joint may also occur if maximum stroke is exceeded.

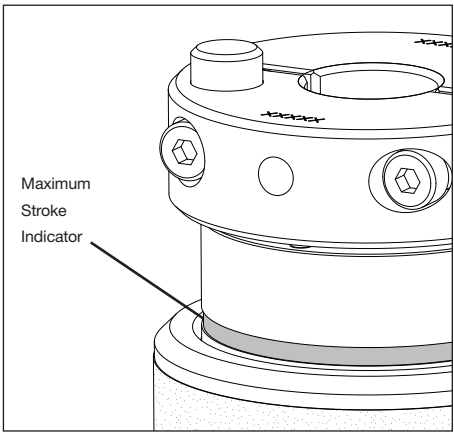


FIGURE 3, MAXIMUM STROKE INDICATOR

5.0 SETTING UP

5.1 Hydraulic Oil

Oil requirements will vary, depending on pump model and type. Refer to your pump instruction manual for oil specifications. Failure to use genuine Enerpac hydraulic oil may void warranty.

5.2 Hoses and Fittings

All hydraulic hoses and fittings used in the circuit must be rated at or above the maximum working pressure of the tensioner - 1500 bar [21,750 psi].

To ensure safe and reliable operation, use of Enerpac approved high pressure hoses is strongly recommended. Refer to the Enerpac Bolting Solutions Catalogue for a complete list of available hoses, fittings and related accessories.

5.3 Pump Requirements

This bolt tensioning equipment has been designed to be used in conjunction with a hydraulic pump unit. Enerpac can offer a range of pump options to suit particular applications and thus operators should refer to the specific instruction manual for the pump to be used. The safety rationale used in the design of this tensioner has assumed a pump maximum working pressure appropriate for the tool and using hydraulic oil Enerpac HF oil ISO32. Enerpac HF oil is available at your local Enerpac Distributor or Authorized Service Centre.

Hydraulic connection is made using quick disconnect male & female couplers. In the event an alternative pump unit is used, additional safety measures such as pressure relief valves or bursting discs must be considered to ensure over-pressurisation cannot occur.

The following are recommended pump parameters:

AIR SUPPLY : 1/2" nominal bore supply line

AIR CONSUMPTION: 50 CFM

AIR PRESSURE: 75 psi

See pump manual for operating instructions.

6.0 INSTALLATION

6.1 Before You Begin

1. Be sure that ALL calculations (bolt load, hydraulic pressure, etc.) have been made prior to starting the tensioning process and that they have been reviewed and approved by a qualified engineer with bolting experience.
2. Be sure all personnel involved in this procedure are trained in joint tightening procedures and the tensioning equipment being used. Ensure that all personnel read and understand the safety information contained in sections 2.1 and 2.2 of this document.
3. Be sure that the pump reservoir oil capacity is adequate for the number of tensioners to be used in the circuit. Refer to Table 1 for tensioner oil volumes.
4. Be sure all personnel are aware of the maximum working pressure and maximum stroke applicable to the tensioner(s) being used. This information is stamped on the tensioner body. See Section 3.0 for additional information.
5. Inspect the studs to verify that they contain no obvious damage or defects, and that they appear capable of withstanding the force that will be applied by the tensioners.

Table 1 - Tensioner Oil Volumes		
Series	Maximum Oil Volume at Maximum Stroke (each tensioner)	
	fluid ounces (US)	cubic cm
EAJ1	0.7	20.2
EAJ2	1.7	49.8
EAJ3	2.6	75.7
EAJ4	3.7	110.6
EAJ5	6.0	177.3
EAJ6	8.4	249.4
EAJ7	12.5	371.1
EAJ8	15.7	464.2
Note: To determine total oil volume required, multiply the oil volume for your tensioner series by the number of tensioners to be used in the circuit. Oil volumes shown are approximate. Additional oil will be contained inside hoses and fittings.		

6. Be sure that all nuts and threaded pullers are free running on the studs over the entire stud length protruding through the joint.

6.2 Application Preparation

Hexagonal Nut Drill Details:

In order to allow the rotation of the standard hexagonal nut, tommy bar holes are required to be drilled into the flat of each nut. Drilling details are shown below in Figure 4.

NOTICE

1. TABLES 1.0 AND 2.0 are for use with imperial heavy series nuts and metric series hexagon nuts to ANSI B18.2.2 only. (Where the nut height = the stud diameter).
2. Dimension 'C' denotes maximum hole depth to drill point. Unless otherwise specified.

* Indicates the use of a Flat Bottom Drill

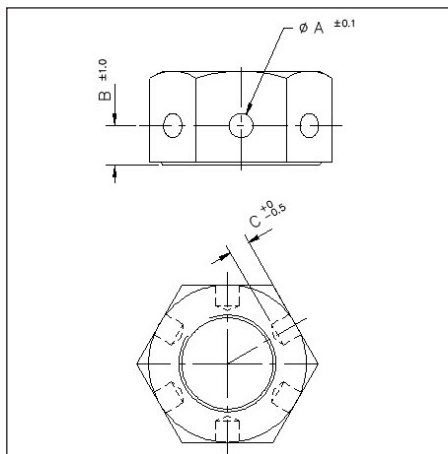


FIGURE 4, DRILLED NUT

**Table 1 - Hexagon Nut Drilling
Metric Heavy Series**

BOLT DIA.	Ø A	Ø B	Ø C	NUT A/F	TOMMY BAR DIAMETER
	mm	mm	mm	mm	
M16	5.2	7	4*	24	5
M20	5.2	7	4*	30	5
M22	5.2	7	4*	32	5
M24	6.2	9	5*	36	6
M27	6.2	9	5*	41	6
M30	8.2	12	6*	46	8
M33	8.2	12	7*	50	8
M36	10.2	15	8*	55	10
M39	10.2	15	8	60	10
M42	10.2	15	9	65	10
M45	10.2	15	9	70	10
M48	12.4	18	11	75	12
M52	12.4	18	12	80	12
M56	14.4	21	12	85	14
M60	14.4	21	12	90	14
M64	16.4	24	14	95	16
M68	16.4	24	14	100	16
M72	16.4	24	14	105	16

Table 2 - Hexagon Nut Drilling Metric Heavy Series (continued)					
BOLT DIA.	Ø A	Ø B	Ø C	NUT A/F	TOMMY BAR DIAMETER
	mm	mm	mm	mm	
M76	16.4	24	15	110	16
M80	16.4	30	15	115	16
M85	16.4	30	15	120	16
M90	16.4	30	18	130	16
M95	16.4	30	18	135	16
M100	16.4	30	18	145	16

Table 2 - Hexagon Nut Drilling Imperial Heavy Series					
BOLT DIA.	Ø A	Ø B	Ø C	NUT A/F	TOMMY BAR DIAMETER
	mm	mm	mm	inch	
5/8"	6.2	7	4*	1.1/16"	6
3/4"	6.2	9	5*	1.1/4"	6
7/8"	6.2	9	5*	1.7/16"	6
1"	6.2	9	6*	1.5/8"	6
1.1/8"	6.2	9	6*	1.13/16"	6
1.1/4"	8.2	12	8*	2"	8
1.3/8"	8.2	12	8*	2.3/16"	8
1.1/2"	10.2	15	9	2.3/8"	10
1.5/8"	10.2	15	9	2.9/16"	10
1.3/4"	10.2	15	10	2.3/4"	10
1.7/8"	10.2	15	10	2.15/16"	10
2"	12.4	18	12	3.1/8"	12
2.1/4"	12.4	18	12	3.1/2"	12
2.1/2"	14.4	21	14	3.7/8"	14
2.3/4"	14.4	21	14	4.1/4"	14
3"	16.4	24	16	4.5/8"	16
3.1/4"	16.4	24	17	5"	16
3.1/2"	16.4	24	18	5.3/8"	16
3 3/4"	16.4	24	18	5 3/4"	16
4"	16.4	24	18	6 1/8"	16

6.3 Bolt Preparation

Simple bolt preparation, carried out topsides, will significantly reduce the risk of problems occurring during tensioner application and operation. Therefore, we would recommend that the following preparations and checks are adopted whenever possible.

- 1. To accommodate the AquaJack tensioner an extended portion of bolt is required above the drilled hexagonal nut (Figure 5). It is recommended that this extension (length A) be pre-set before lowering the bolts underwater.
- 2. The required bolt protrusion must be through a drilled hexagonal nut and nut washer faces must point inwards. Visibly check that the nut drilled holes are nearest to the nut washer face.
- 3. The drilled hexagonal nut must be free-running on all bolts over the entire length A and especially over the 30 mm length B (Figure 5).
- 4. Assemble the Quick-Fastening reaction nuts to the end of the bolt protrusions, length C (Figure 5), ensuring that the Quick-Fastening reaction nut locking mechanism fully and easily engages.

Alternatively, if solid reaction nuts are used, ensure free running over bolt protrusion, length C.

- 5. Protect the bolt protrusion using sleeves, adhesive tape, etc. This will not only protect the threads from knocks and damage during installation but prevent movement of the pre-drilled nut, which may alter the pre-set length A.

Table 3 - AquaJack Bolt Protrusion		
AquaJack	BOLT DIA.	LENGTH A
EAJ1	3/4" 7/8"	119
EAJ2	1" 1 1/8"	152
EAJ3	1 1/4" 1 3/8"	163
EAJ4	1 1/2" 1 5/8"	176
EAJ5	1 3/4" 1 5/8" 2"	189
EAJ6	2 1/4" 2 1/2"	206
EAJ7	2 3/4" 3"	235
EAJ8	3 1/4" 3 1/2"	252

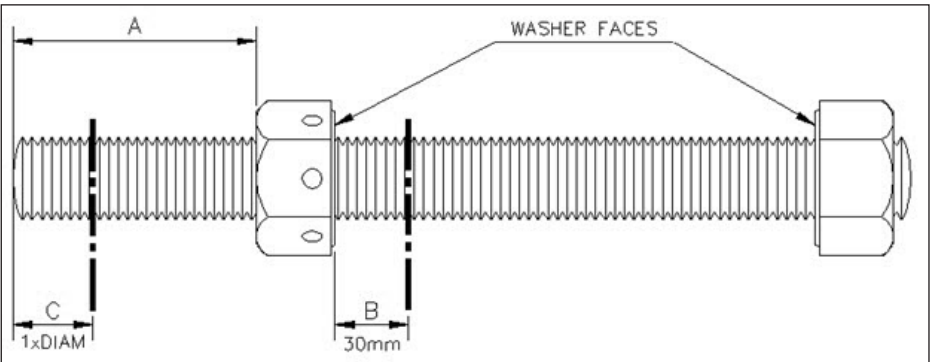


FIGURE 5, BOLT PREPARATION

6.4 Flange and Bolt Assembly

Prior to installation of the flange bolts, it is recommended that the flange is squared and brought into close contact using methods such as the Enerpac flange puller. Once the flange faces are square and in close proximity the bolts and gasket may then be installed.

The bolts must be installed in a specific manner depending upon whether 100% tensioner coverage or 50% coverage is adopted.

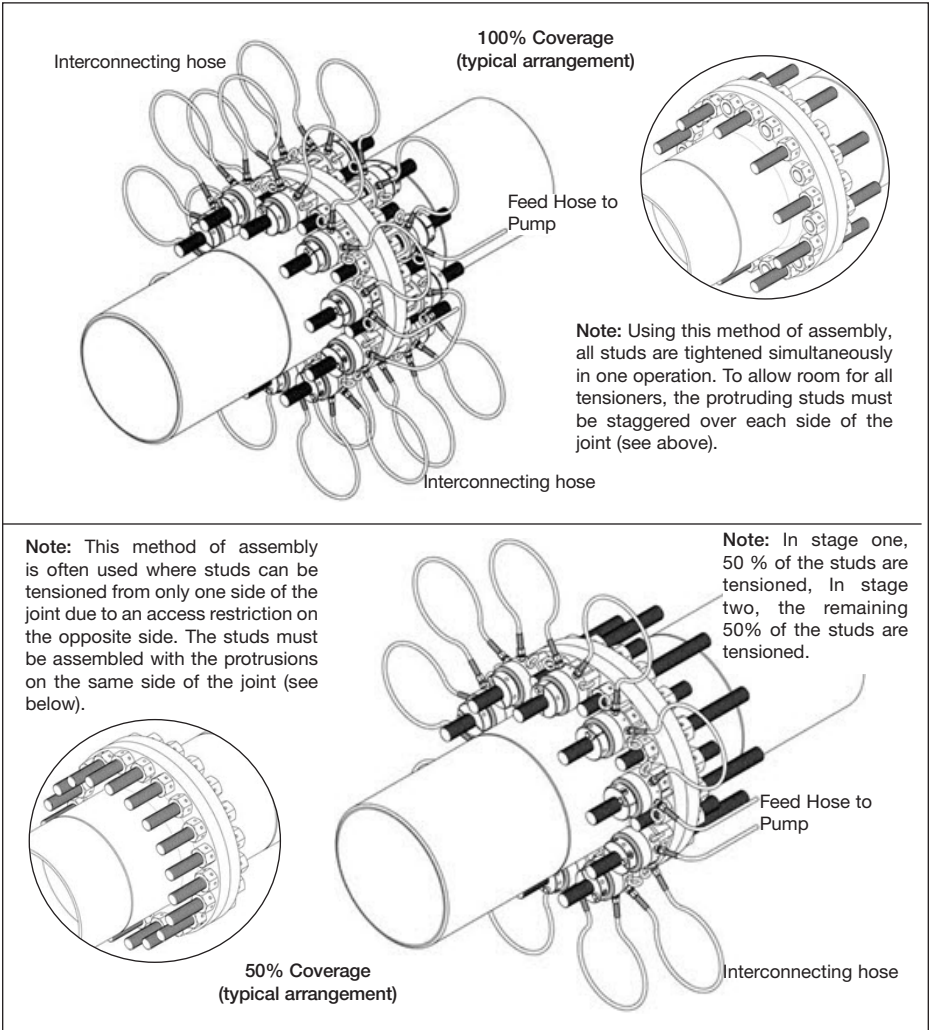


FIGURE 6, HYDRAULIC TENSIONER MOUNTING ARRANGEMENTS (TYPICAL)

6.5 Assembling AquaJack Tensioners

Note: If de-tensioning, refer to Section 7.3.

1. Ensure that all pistons are fully retracted, i.e. pistons flush with the top of the body. See Figure 7.
2. Assemble one tensioner onto every bolt (every other bolt for 50% coverage) by sliding them over the bolt protrusions. See Figure 8.
3. Slide the Quick-Fastening reaction nut over the remaining bolt thread protrusion, tapered side toward the AquaJack, and squeeze the nut halves together until the locking mechanism engages. See Figure 9.
4. Whilst supporting the weight of the tool, if located horizontally, and ensuring the bridge access window points radially outward, using a Tommy bar, screw the Quick-Fastening reaction nut down until it firmly seats against the piston taper. Do not advance the piston to the Quick-Fastening reaction nut as this does not ensure correct engagement. This, in effect, will centralise the assembly, retain the AquaJack and lock the Quick-Fastening reaction nut in position. See Figure 10

Note: If solid reaction nuts are used, ensure that they do not bind on the bolt threads causing the bolt to turn through the hexagonal nut on the opposite side of the flange. Should this occur, then upon application of tensioning load, insufficient thread engagement may exist and could lead to stripping of the bolt threads.

5. The AquaJack Tensioners are now assembled, ready for hose connection.

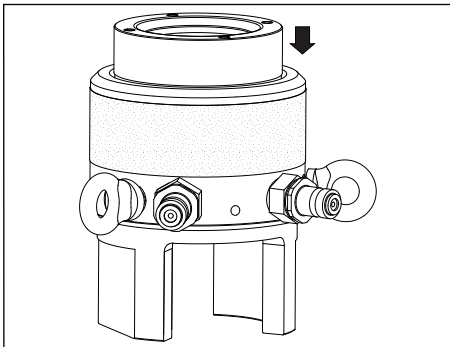


FIGURE 7, FULLY RETRACT PISTON

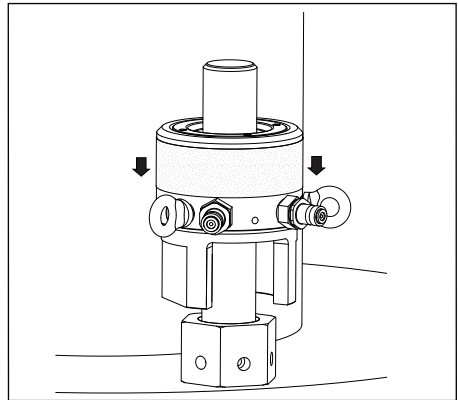


FIGURE 8, PLACE TENSIONER ONTO TO STUDBOLT

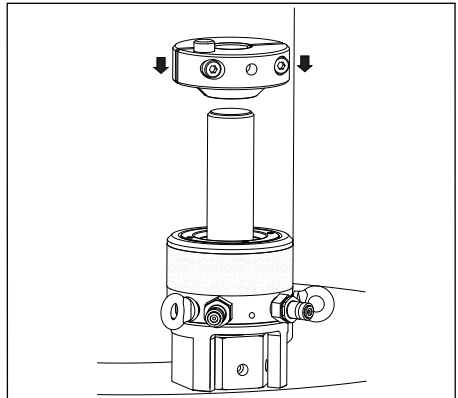


FIGURE 9, SLIDE QUICK-FASTENING REACTION NUT INTO PLACE

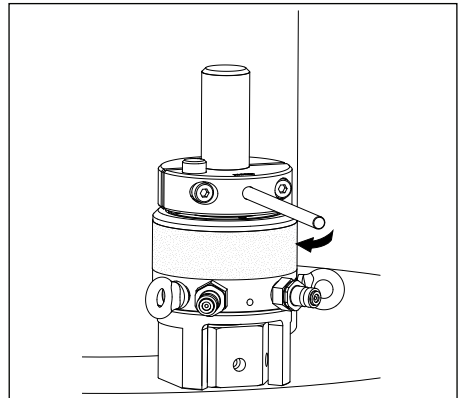


FIGURE 10, COMPLETE QUICK-FASTENING REACTION NUT INSTALLATION

6.6 Hose Connections

Note: Refer to Section 6.4 for an explanation of 100% Coverage and 50% Coverage.

Hose Connection Notes

1. Ensure the pump hydraulic oil return valve is fully open.
2. Always link AquaJack together working either in a clockwise or anticlockwise direction around the flange. This will minimise incorrect connections.
3. Ensure that a link hose exists connecting tensioners on one side of the flange to the other. (100% tensioner coverage only).
4. Both feed hoses must always be used with the down-line manifold.
5. The female quick disconnect coupling on down-line hoses only, are equipped with locking collars which when screwed up behind the coupling sleeve prevents disengagement. The locking collar on the end of the down-line must be backed off before the down-line hoses can be disconnected.
6. Should an interconnecting or feed hose be missing or damaged then the down-line is equipped with a 'sacrificial hose' which is connected between the manifold and the end of the down-line. This may be disconnected, the manifold re-connected to the end of the down-line and the sacrificial hose used to replace the damaged or missing hose.

NOTICE After removing the sacrificial hose, before the down-line can be re-connected the adapter coupling (chained to the end of the down-line) must first be disconnected. See Figure 6.

7. When the hydraulic circuit is complete, no unconnected couplings should exist.
8. All hoses are fitted with self-sealing quick disconnect couplings ensuring that hydraulic fluid will not flow through the coupling unless fully connected. Therefore it is extremely important to check for complete coupling connection prior to pressurisation of the system.

Should any of the quick disconnect couplings prove difficult to fully assemble, then it may be due to the following:

- Coupling locking collars not fully screwed back (on down-line hoses only).

- Internal pressure within the AquaJack due to over tightening the reaction nut during assembly. In such a case, the reaction nut must be released, the hose connected, and the reaction nut re-tightened.
- Internal pressure within the hose itself caused by previous use at a greater depth. This may be remedied by returning the hose to the surface and venting the internal pressure as described in Section 9.5.

6.6 Hose Connections - Restricted Access

In certain situations, where access is restricted, it may not be possible to attach the hydraulic hoses to the AquaJack as shown in Figure 12 and 13. In such situations, it may be necessary to attach the hoses at 90° to that shown. This is achieved using banjo assemblies.

Assembly of Banjo Fittings

Banjo fittings are used as a method of re-orientating the quick disconnect couplings when access is difficult. The general configuration is shown below:

1. Remove the standard male quick disconnect coupling and associated adaptor from the AquaJack.
2. The banjo block is fitted with a male quick disconnect coupling, 1/4" BSP adaptor and O-ring seal with steel back up ring. If these items are not already fitted to the banjo block, then the block should be gripped in a soft jawed vice and the coupling / adaptor assembled in accordance with the instructions above entitled 'QUICK DISCONNECT COUPLING SEALS'.
3. Ensure that the AquaJack body counter-bore is clear of dirt and debris and insert an O-ring and back-up ring.
4. Insert an O-ring and back-up ring into the counter-bore on the outside face of the banjo block, before inserting the banjo bolt through the bore of the banjo block.
5. The threads on the banjo bolt should be coated with Omega 95 (or similar lubricant with a coefficient of friction (μ) = 0.12).
6. Insert the banjo bolt into the port on the AquaJack body and when the banjo block is in the desired orientation, the banjo bolt should be tightened to a torque of 45 lb-ft (61 Nm).

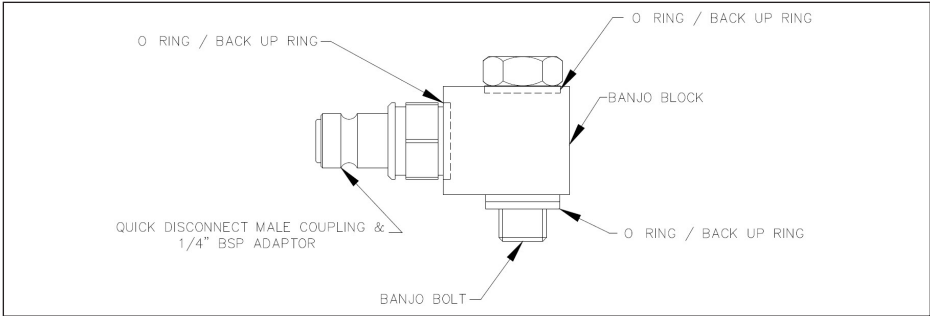


FIGURE 11, COMPLETE QUICK-FASTENING REACTION INSTALLATION

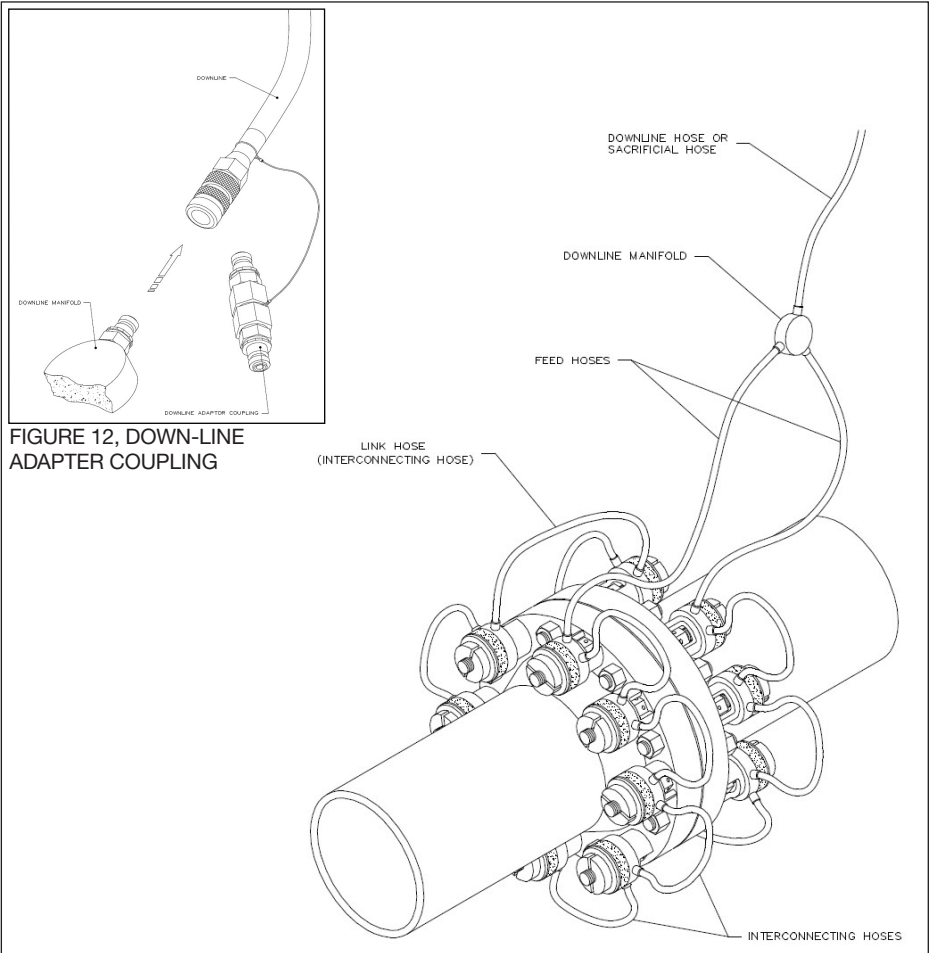


FIGURE 12, DOWN-LINE
ADAPTER COUPLING

FIGURE 13, 100% TENSIONING HYDRAULIC CIRCUIT WITH A BANJO FITTING

6.6 Air Drive Pump Unit

Refer to Section 3.3 for pump requirements.

Also refer to the pump operation manual.

Pump Unit Description

1. Pump

An air operated reciprocating piston type pump, which operates on the principle of pressure intensification via differential areas, i.e. a large, low pressure air piston drives a much smaller hydraulic piston to provide oil flow at high pressure.

2. Air Filter/ Regulator

A combined unit consisting of an air filter, air pressure gauge and air pressure regulator assembly. The air filter removes water and foreign particles from the inlet air supply, and should be periodically cleaned and drained.

The air regulator is used to regulate the incoming air pressure and can be used to set the pump to stall when a predetermined hydraulic pressure is attained.

The inlet air supply is connected directly to the air filter/regulator unit via a quick disconnect coupling.

3. Air Lubricator

Connected directly onto the air filter/regulator unit, it is used to lubricate the incoming air supply and hence lubricate the pump unit.

4. Pump Start/ Stop Valve

A simple manual on/off valve to start and stop the air supply to the pump. The speed of operation of the pump can be finely regulated using this valve.

5. Hydraulic Oil Return Valve

A high pressure valve allowing hydraulic pressure to be built up when closed, and released when opened, diverting the hydraulic oil back to the reservoir.

6. Pump Exhaust/ Silencer

A muffle/filter connected to the pump exhaust port to reduce the operating noise level.

7. Pressure Gauge

A Budenberg 0-25000 psi hydraulic oil pressure gauge positioned behind a protective wire guard.

8. Hydraulic Reservoir

A tank of approximately 9 litres (2 gallons) capacity incorporating an external transparent tube type level indicator. Filters are fitted into the filler neck and the oil outlet port.

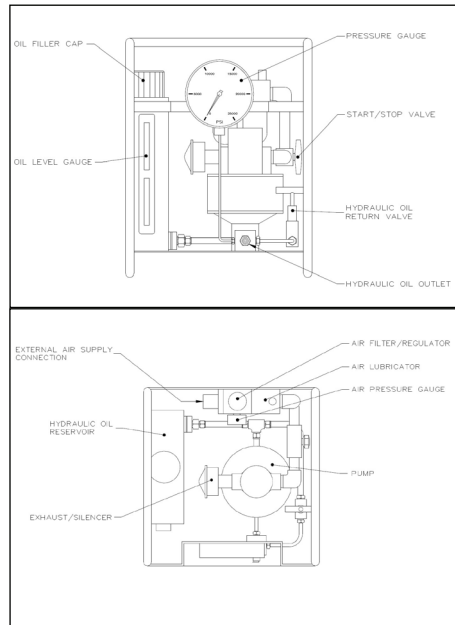


FIGURE 14, AIR OPERATED PUMP UNIT ARRANGEMENT

Pump Unit Ancillary Equipment

1. Pump Unit

A high delivery air powered pump unit used to supply hydraulic oil to the AquaJack tensioner.

2. Feed Hose

3 metres long, used to connect pump unit to hose reel/down-line and down-line manifold to AquaJack tensioner/ hydraulic circuit.

3. Interconnecting Hose

1 metre long, used to link the AquaJacks together constructing a ring main hydraulic circuit.

4. Down Line

Made up in 30 metre lengths, used to connect the AquaJack hydraulic circuit to the topsides pump unit.

5. Hose Reel

Used to carry the 30 metre lengths of down-line.

6. Down-line Manifold

A 3 way manifold used to connect the down-line to the AquaJack tensioner hydraulic circuit.

7. Sacrificial Hose

A 3 metre feed hose connected between the down-line and the down-line manifold - used as an emergency replacement feed or interconnecting hose.

8. Down-line Adaptor Coupling

Used to connect the sacrificial hose to the down-line.

9. Open Ended Female Quick-Disconnect Coupling *

Used for AquaJack piston retraction.

10. Open Ended Male Quick-Disconnect Coupling *

Used for hose venting following use at depth.

11. Blank Female Quick-Disconnect Coupling *

Used to blank the pump hydraulic oil outlet when pre-setting the pump hydraulic pressure.

* Included in standard accessory kit

Pump Unit Operation

It is always good practice to regulate the pump to stall at the pre-determined hydraulic pressure required to achieve the desired bolt load. The recommended pump operating procedure is indicated as follows.

1. Connect blanked-off female quick disconnect couplings to the pump hydraulic oil outlets, or connect feed hose between the couplings.
2. Open the hydraulic oil return valve to tank. Ensure the valve is fully open.
3. Close the pump start/stop valve (handle in vertical position).
4. Connect an external air supply line to the pump unit.
5. Turn the air pressure regulator adjusting screw anti-clockwise until zero pressure reads on the air pressure gauge.
6. Open the pump start/stop valve. The pump should not operate as the regulator has been set to produce zero air pressure. Should the pump operate, then re-adjust the air pressure regulator until the pump stops.
7. Close the hydraulic oil return valve.
8. Turn the air pressure regulator adjusting screw slowly clockwise until the pre-determined hydraulic oil pressure reads on the oil pressure gauge.
9. Close the pump start/stop valve.
10. Slowly open the hydraulic oil return valve to release the system pressure. Ensure the valve is fully opened.

The pump is now ready to be operated by using the pump start/stop valve. When the pre-determined required hydraulic oil pressure is reached then the pump will automatically stall.

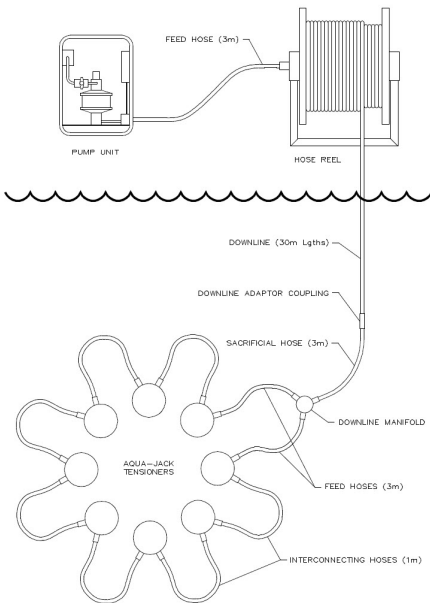


FIGURE 15, PUMP ANCILLARY EQUIPMENT ARRANGEMENT

Safety Notes On Pump Operation

1. Although the pump has been set to stall at the desired hydraulic pressure, it is always advisable to monitor the pressure as it is applied.
2. Never pressurise the pump unit without either a blank quick disconnect coupling or the system hoses attached. (The maximum disconnected coupling pressure is 1000 psi).
3. Wear safety glasses at all times during pump operation.
4. Always de-pressurise the system when leaving unattended.

7.0 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 is not exceeded. Refer to the specifications stamped on the tensioner body. Also see Table 2 at the end of this document.

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

IMPORTANT: Read precautions and instructions at beginning of Section 7.0 before beginning the following steps. Also refer to safety information contained in Section 2.1.

For each flange/joint to be tensioned a 'Subsea Bolt Tensioning Data Sheet' will be provided by Enerpac (see appendix C for a sample sheet). This data sheet will show relevant flange and bolt details together with a calculated hydraulic tool pressure to achieve the required bolt load. In order to correctly apply this required residual bolt load a controlled tensioning procedure must be adopted.

A general sub-sea tensioning procedure, for 100% tensioner coverage is described below.

1. Ensure that the gap between the flange faces is uniform around the entire perimeter. Assemble the AquaJack and hydraulic circuit as per sections 6.4 and 6.6. Obtain final confirmation from the diver at the work site that he is satisfied with the set-up and ready for pressurisation to begin.

2. Apply a nominal hydraulic tool pressure of 1000 psi. Check AquaJack tensioners for squareness and centralisation. Ensure reaction nuts are firmly engaged.
3. Apply the hydraulic tool pressure as specified on the 'Subsea Bolt Tensioning Data Sheet', and check to ensure that all pistons project from the AquaJack body. Turn down the pre-drilled hexagonal nuts within the AquaJack bridge window using a tommy bar, firmly seating each nut against the flange surface.

NOTICE Do not use intermediate hydraulic tool pressures as this may interfere with the primary over-stroke elimination feature (see Section 7.4).

4. Release the system pressure and repeat **Step 3** twice further, i.e., the hydraulic tool pressure is applied and the nuts turned down three times.
5. As a final check, ensure the gap between the flange faces is still uniform, apply the hydraulic tool pressure once more and attempt to further tighten the nuts using a tommy bar. If the nuts cannot be turned then tensioning is complete and the system may be de-pressurised and the AquaJack removed.

If the nuts can be turned, then **Steps 4 AND 5** must be repeated until the nuts cannot be rotated any further. Should repeated cycling be necessary, check that the correct grade of studbolt/nut is being used.

The above tensioning procedure is typical only. Should the operator wish to adopt their own 'tried and tested' subsea tensioning procedures with the AquaJack equipment then Enerpac will be pleased to advise accordingly.

7.2 Tensioning Instructions - 50% Coverage (tensioner installed on every other stud)

IMPORTANT: Read precautions and instructions at beginning of Section 7.0 before beginning the following steps. Also refer to safety information contained in Section 2.1.

For each flange/joint to be tensioned a 'Subsea Bolt Tensioning Data Sheet' will be provided by Enerpac (see appendix C for a sample sheet). This data sheet will show relevant flange and bolt details together with a calculated hydraulic tool pressure to achieve the required bolt load.

In order to correctly apply this required residual bolt load a controlled tensioning procedure must be adopted.

A general sub-sea tensioning procedure, for 50% tensioner coverage is described below.

1. Ensure that the gap between the flange faces is uniform around the entire perimeter.

Assemble the AquaJack and hydraulic circuit to the first 50% of the bolts as per Section 6.4. Obtain final confirmation from the diver at the work site that he is satisfied with the set-up and ready for pressurisation to begin.

2. Apply a nominal hydraulic tool pressure of 1000 psi. Check AquaJack tensioners for squareness and centralisation. Ensure reaction nuts are firmly engaged.
3. Apply the 1st pass hydraulic tool pressure as specified on the 'Subsea Bolt Tensioning Data Sheet' and check to ensure that all pistons project from the AquaJack body. Turn down **ALL** of the pre-drilled hexagonal nuts, including those without AquaJack's fitted, using a tommy bar, firmly seating each nut against the flange surface.

See Figure 16 for typical tensioner arrangement. Also refer to Section 6.4 for additional tensioner installation and hook-up instructions.

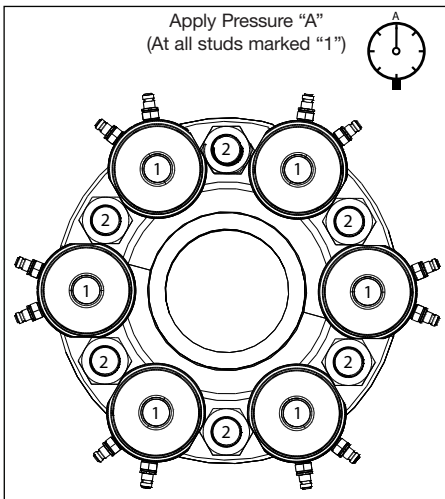


FIGURE 16, TENSIONER ARRANGEMENT, FIRST PASS - TYPICAL (50% TENSIONER COVERAGE)

NOTICE Do not use intermediate hydraulic tool pressures as this may interfere with the primary over-stroke elimination feature (see section 7.4).

4. Release the system pressure and repeat

STAGE 3 twice further, i.e. Apply the 1st pass pressure and turn down nuts three times.

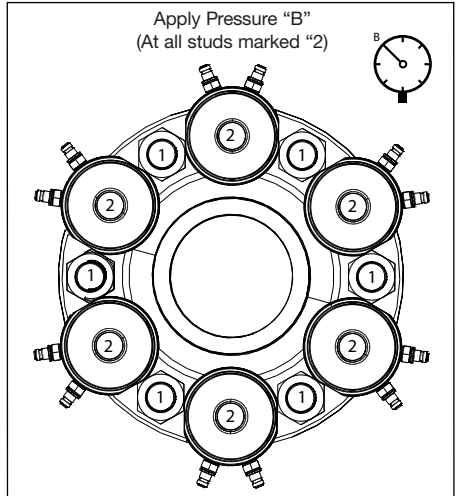


FIGURE 17, TENSIONER ARRANGEMENT, SECOND PASS - TYPICAL (50% TENSIONER COVERAGE)

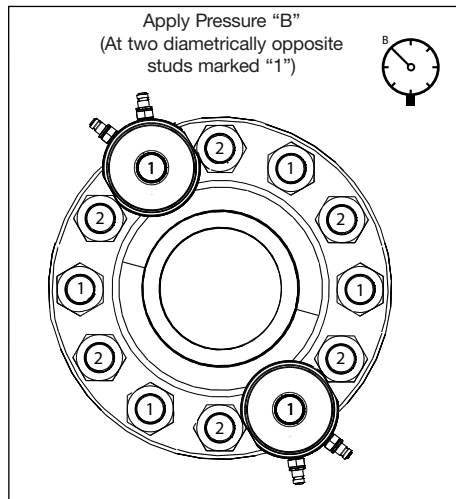


FIGURE 18, RECHECKING FIRST PASS TENSION (50% TENSIONER COVERAGE)

NOTICE At this stage, if the AquaJack pistons have advanced more than 3/4 of their maximum stroke due to pulling in the joint, then the tensioners must be manually retracted by screwing down the reaction nut using a tommy bar.

5. Transfer the AquaJack to the remaining 50% of the bolts and apply a nominal hydraulic tool pressure of 1000 psi. Check the AquaJack tensioners for squareness and centralisation. Ensure the reaction nuts are firmly engaged.
6. Apply the 2nd pass hydraulic tool pressure as specified on the 'Subsea Bolt Tensioning Data Sheet' and turn down the pre-drilled hexagonal nuts within the AquaJack bridge using a tommy bar, firmly seating each nut against the flange surface. See Figure 17.
7. Release the system pressure and repeat **Step 6** twice further. See Figure 18
8. As a final check, reassemble the AquaJack to the initial 50% of the bolts.
9. Ensuring that the gap between the flange faces is still uniform, apply the 2nd pass hydraulic tool pressure and attempt to further tighten the pre-drilled nuts using a tommy bar.
If the nuts cannot be turned then tensioning is complete and the system may be de-pressurised and the AquaJack removed.
10. Transfer the AquaJack to the remaining 50% of the bolts and repeat **Steps 9 and 10** until the nuts cannot be rotated any further. Should repeated cycling be necessary, check that the correct grade of stud bolt/nut is being used.

The above tensioning procedure is typical only. Should the operator wish to adopt their own 'tried and tested' subsea tensioning procedures with the AquaJack equipment then Enerpac will be pleased to advise accordingly.

7.3 De-tensioning Instructions

IMPORTANT: Read precautions and instructions at beginning of Section 7.0 before beginning the following steps. Also refer to safety information contained in Section 2.1.

A hydraulic tool pressure for de-tensioning is not normally provided as it is not always possible to predict the pressure at which the nut will break free. However, it is beneficial to be aware of the original 'make-up' tensioning pressure before the de-tensioning procedure is carried out as generally, the de-tensioning pressure is marginally higher than the original make-up pressure.

A general subsea de-tensioning procedure is described below.

1. Pre-set the pump unit to deliver the maximum system working pressure of 21750 psi (1500 bar).
2. Before lowering the AquaJack underwater, advance the piston of each AquaJack approximately 10 mm.
3. Assemble the AquaJack and hydraulic circuit as per Section 6.4. Obtain final confirmation from the diver at the work site that he is satisfied with the set-up and ready for pressurisation to begin.
4. With the AquaJack assembled and the hydraulic circuit connected, apply a nominal hydraulic tool pressure of 1000 psi.
Check the AquaJack tensioners for squareness and centralisation. Ensure the reaction nuts are firmly engaged.
5. Apply hydraulic pressure to the system until the pre-drilled hexagonal nuts within the AquaJack bridges can be released. (This pressure is normally slightly higher than the make-up tensioning pressure).
6. Turn back each pre-drilled nut two complete turns i.e. 12 flats.
7. De-pressurise the system and remove the AquaJack.

7.4 AquaJack Retraction

The AquaJack tensioner piston must be retracted if:

1. The maximum piston stroke indicator becomes visible (The stroke indicator is in the form of a yellow band marked around the periphery of the piston).
2. The operator is unsure of the maximum piston stroke.

3. The operator would like to ensure that maximum stroke is available.

Under normal circumstances piston retraction will only be carried out during post-use maintenance, as the piston stroke available is more than adequate for most subsea tensioning operations. However, occasionally the AquaJacks may be required to be retracted during subsea tensioning, particularly where long strokes are used to close joints or if the two pass tensioning procedure is adopted (50% tensioner coverage).

Piston Retraction During Subsea Use

1. Prior to opening the pump hydraulic oil return valve, turn down the pre-drilled nuts within the AquaJack bridge window. This will prevent the joint from re-opening as the pressure is released.

NOTICE When attempting to turn down the pre-drilled nuts, should one or two of the nuts be locked onto the underside of the tensioner (due to over-stroking, see Section 11), do not attempt to release the locked nuts but simply turn down the remaining 'free' nuts. The locked nuts will become free when the system pressure is released and can then be turned down.

Should all, or the majority, of the pre-drilled nuts be locked onto the underside of the tensioner, then momentarily open, then shut the pump hydraulic oil return valve until the nuts become free and can then be turned down.

2. De-pressurise the system and ensure the pump hydraulic oil return valve is FULLY open.
3. Screw down the reaction nuts, using a tommy bar if necessary, until all pistons are fully retracted.

Piston Retraction Topside

1. Refer to Section 9 Maintenance.

7.4 AquaJack Retraction

The AquaJack tensioner has been purposely designed with a long piston stroke to ensure that the majority of tensioning operations can be completed without the fear of the piston over-stroking.

Over-stroking the piston can be dangerous and injury may occur by the high pressure oil released from the tensioner as the piston is ejected from the cylinder.

The AquaJack tensioner possesses two safety features to counteract this dangerous situation. However, it must be stressed that piston over-stroke will not be encountered if the piston stroke is continually monitored, the moment that the maximum stroke indicator band becomes visible, the pump stopped and the pistons retracted.

Primary Over-stroke Elimination (No Oil Spill)

This is the main over-stroke elimination feature which utilises the standard pre-drilled hexagonal nut for operation. As the AquaJack operates, the pre-drilled nut lifts from the flange surface at a proportional rate to the piston stroke. As the piston approaches its maximum stroke, the top surface of the pre-drilled nut will contact the underside of the tensioner body, preventing further movement of the piston. At this point the maximum stroke indicator will be clearly visible and the pistons must be retracted, as described in fig. 19 illustrates the system.

NOTICE The above primary over-stroke eliminator will only operate if the following parameters are met.

1. The pre-drilled hexagonal nuts must be of standard heavy series form, i.e. nut height equal to one bolt diameter. Nut heights less than one bolt diameter may still be tensioned but primary over-stroke elimination will not be operative.
2. The pre-drilled nuts must not be turned down until the pre-determined hydraulic pressure has been reached. Neither should they be turned down whilst the system is building up pressure, nor at intermediate pressures such as half pressure, three quarters pressure, etc.
3. Prior to tensioning, pistons must be fully retracted and the reaction nuts firmly seated.

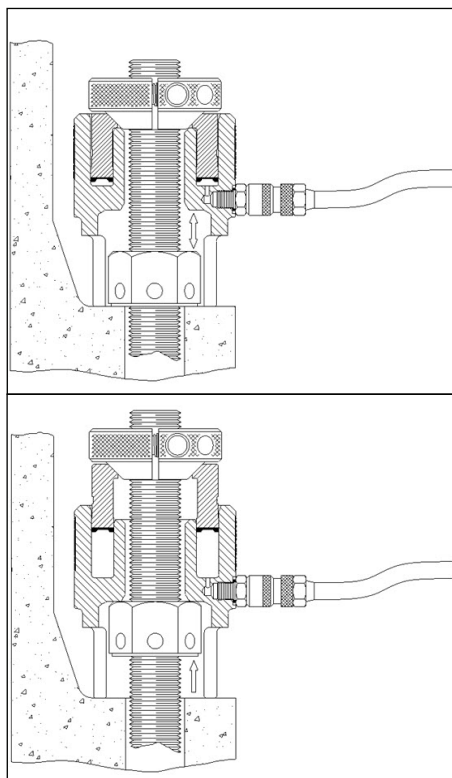


FIGURE 19, PRIMARY OVER-STROKE ELIMINATION

Secondary Over-stroke Elimination

Should the above parameters not be met, i.e., nut heights less than one bolt diameter or nuts required to be intermediately turned down, then the secondary over-stroke elimination device will operate, should the piston exceed its maximum stroke.

If the maximum stroke is exceeded, the piston will become free of the cylinder and the high pressure oil will be safely released integrally. This feature is only included as a fail-safe safety measure and is not intended to be used continually, as hydraulic seal damage will occur when the high pressure oil is released, rendering the AquaJack inoperative. Although the suspect AquaJack will require removal and replacement, this in comparison to a potentially injured operator is insignificant.

NOTICE Should this feature operate, the piston will become free from the cylinder, therefore, before the AquaJack is removed it is advisable to partially retract the piston by screwing down the reaction nut.

8.0 EMERGENCY MEASURES

Standard Hexagonal Nuts Used as Reaction Nuts

WARNING A standard hexagonal nut **CANNOT** be used as a direct replacement for a reaction nut. Damage will occur to the AquaJack piston (and possibly the cylinder) if a hexagonal nut is used and any warranty or guarantee will be invalidated.

In instances where a reaction nut is lost or misplaced, then spare solid reaction nuts are included with the standard accessory kit and these should be used.

In cases of extreme emergency a standard hexagonal nut can be used **PROVIDED** that a thick washer, large enough in diameter to cover the entire piston surface, is fitted underneath the standard hexagonal 'reaction' nut.

Hose Connection In Space Restricted Applications

Should difficulty be experienced in routing interconnecting hoses due to space restrictions such as overhead pipes, etc. then included in the standard accessory kit are elbow couplings which can quickly be assembled onto the hose allowing the hose to be directed axially rather than radially outward.

9.0 MAINTENANCE

It is recommended that repairs and servicing be carried out by Enerpac at intervals agreed by Enerpac and customer. All parts will be thoroughly inspected and replaced where necessary, certain components (e.g. seals) will be replaced automatically. Tensioners will be re-assembled, pressure tested and a test certificate issued.

Note: All parts will have been manufactured, inspected and tested in accordance with Enerpac's stringent requirements. Any parts failing in use that are found upon Enerpac's inspection not to be Enerpac's genuine spare parts will invalidate any operative warranty or guarantee.

The tool is of rugged construction and utilises reliable seals. The only maintenance that may be occasionally required is the replacement of seals or repair of a hydraulic fitting.

Note: It is strongly recommended that in the event of seal failure the tensioners are returned to Enerpac for seal replacement, however if this is not possible then the enclosed procedure should be followed.

9.1 Pre-Use Maintenance

Assemble the tensioner onto a suitable bolt (see Section 6.0), check that the bolt material is capable of taking the applied load i.e. do not pressurise to max working pressure if the bolt is not strong enough to withstand the full load of the tool. Piston stroke should be minimised to prevent the over-stroke eliminator valve being activated.

Pressurise for approximately one minute, a pressure drop of 50 bar is acceptable during this time.

If the tensioner passes this test, then the piston should be reset and the tensioner is ready for use.

If any leakage is noticed within the head assembly, then a full strip down will be necessary to change the seals, as described in Section 9.4.

9.2 Post-Use Maintenance

In order to keep the equipment in good working condition it is important that at the end of each period of use, prior to being replaced into dry storage, a post-use maintenance is carried out.

1. AquaJack Tensioner

Thoroughly rinse each AquaJack under running fresh water (not sea water).

Retract the pistons by attaching open ended female quick-disconnects (supplied in the standard accessory kit) to the AquaJack male inlets. With the AquaJack standing on the ground and a suitable container positioned below the open ended couplings to catch the hydraulic fluid, push the piston back to its fully retracted position. The hydraulic fluid which has been bled from the tool during retraction must be discarded as it will be contaminated with sea water. It must NOT be returned into the pump unit hydraulic fluid reservoir.

Coat each AquaJack in a water repellent spray such as WD40 or similar. Alternatively rinse in light oil.

If any leakage is noticed within the head assembly, then a full strip down will be necessary to change the seals, as described in Section 9.4.

If tensioners are subject to a lot of use it is advisable to fully strip them and clean and inspect all components, at least once a year. Refer to Section 9.3.

2. Quick-Fastening Reaction Nuts

Thoroughly rinse each Quick-Fastening reaction nut under running fresh water (not seawater) continuously operating the locking mechanisms to clear any debris which may have become lodged.

Coat each Quick-Fastening reaction nut in a water repellent spray such as WD40 or similar. Alternatively, rinse in light oil.

3. Hoses and Ancillaries

Vent each interconnecting hose, feed hose, down line and manifold by connecting an open ended male quick-disconnect coupling (supplied in the standard accessory kit) into each female coupling. The couplings may be required to be forced together should internal pressure exist within the hoses resulting from being used at depth.

NOTICE Any hydraulic fluid which has vented from the hoses must be discarded as it will be contaminated with seawater. It must NOT be returned into the pump unit hydraulic fluid reservoir.

Coat each quick disconnect coupling in a water repellent spray such as WD40 or similar, retracting and releasing the collars several times. Ensure that the collars do not seize in the retracted position.

9.3 AquaJack Tensioner Full Maintenance/ Servicing

It is recommended that repairs and servicing be carried out by Enerpac at intervals agreed by Enerpac and customer. All parts will be thoroughly inspected, specified parts will be non-destructively tested using MPI techniques and replaced where necessary, certain components (e.g. seals) will be replaced automatically.

Tensioners will be re-assembled, pressure tested and a test certificate issued.

Note: All parts will have been manufactured, inspected and tested in accordance with Enerpac's stringent requirements. Any parts failing in use that are found upon Enerpac's inspection found not to be Enerpac's genuine spare parts will invalidate any operative warranty or guarantee.

1. Inspect the tensioner for any visible damage/ leaks etc.
2. Unscrew the quick disconnect couplings.
3. Replace the seals as described in the following Section 9.4.
4. Refit the quick disconnect nipples.
5. Assemble the tensioner onto a suitable bolt (see Section 6.0) check that the bolt material is capable of taking the applied load i.e. do not pressurise to max working pressure if the bolt is not strong enough to withstand the full load of the tool. Pressurise for approximately one minute, a pressure drop of 50 bar is acceptable during this time.
6. Having removed the tensioner from the bolt, coat each sub-assembly in a water repellent spray such as WD40 or similar.
7. Replace the dust caps on the quick disconnect couplings.

9.4 Changing Tensioner Seals

1 Precautions

The following precautions must be taken with the assembly of the hydraulic seals:

- Avoid sharp edges (cover thread areas)
- Remove all dust, dirt, swarf and foreign particles.
- Do not use sharp edged tools.
- Lubricate all components before assembly.

Hydraulic seal replacement must only be carried out should the seals become damaged. The seals should not be removed during routine maintenance.

2 Ram

Legend for Figures

1. Seal
2. Ram
3. Anti-Extrusion Ring (AER)
4. Pliers
5. Blunt Edged Dolly

3. Seal Removal

Remove the spring housing retaining screws; this will allow the spring housing and springs to be removed.

Note: As a nominal load is retained in the ram springs, care must be taken when removing the final screws, it may be necessary to use some threaded bar and nuts to gradually release the spring load.

Fit an open-ended female quick-disconnect coupler to a tensioner coupler. Remove the two plastic grub screws located in the ram surface, fit two appropriate ram extraction bolts and use them to pull the ram free from the body bore.

To remove the hydraulic seals and Anti-Extrusion Rings (AER's):

Using a pair of pliers, grip the sealing lip of the hydraulic seal and pull the seal away from the ram. Take care not to damage the edge of the ram.

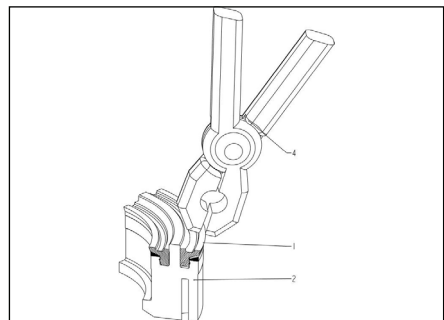


FIGURE 20 - REMOVAL OF SEALS

Discard the seal, remove the extraction bolts and replace the two plastic grub screws.

4. Seal Replacement

Inspect the seal housing grooves within the ram. Using either a clean cloth or compressed air, remove all dirt and debris from the ram and body. It is very important that all dust and debris be removed from the seal/AER as failure to do so may result in seal failure.

Fit the AER's to the seal, the tapered surface of the AER must face the taper of the seal as shown below. This applies to both outer and inner AER's.

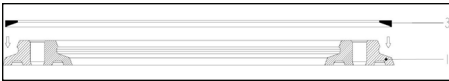


FIGURE 21 - AER LOCATION

Install the seal assembly into the ram, pressing down firmly until the seal fully enters the ram seal housing.

Engage the seal retaining clip by pushing down around the periphery using a blunt edged dolly in the position shown below. A 'click' will be sensed when the seal fully engages.

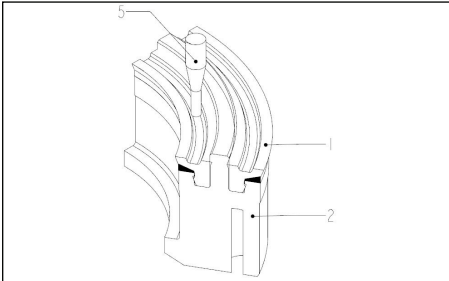


FIGURE 22 - ENGAGING THE SEAL

When there are no gaps between the ram, AER and seal the assembly is correct, see below.

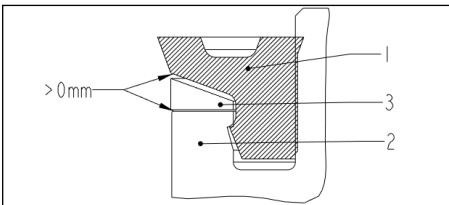


FIGURE 23A - INCORRECT AER ASSEMBLY

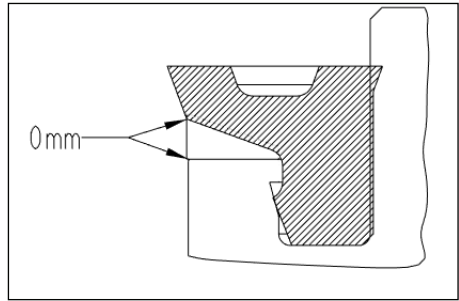


FIGURE 23B - CORRECT AER ASSEMBLY

Lubricate the seal and tensioner bores with silicone grease or clean hydraulic oil in preparation of installing the ram.

Push the ram into the body bore ensuring that the seal does not become nipped. The outer seal will be the first to enter and can be used as a guide to square up the ram prior to entering the inner seal. Should difficulty be encountered in entering seals, a slight rotation of the ram whilst pushing the ram into the body may aid the installation.

5 Coupler Seals - 1/4" BSP Fittings

A simple sealing arrangement exists between the AquaJack tensioner body and the coupler. The seal is a 1500 Bar [21750 psi] rated Bonded Seal; it is located inside a counter-bore on the tensioner body behind the coupler. Should the seal leak or become damaged then it should be replaced as follows.

Unscrew the male quick-disconnect coupler.

Note: A 1/4" BSP threaded adaptor is fitted into the male quick-disconnect coupler. Under normal circumstances this will remain an integral part of the coupler and should not be removed. However, should the adaptor and coupler become separated or unscrewed, then the adaptor must be reassembled into the coupler and re-tightened. The 1/4" BSP adaptor must never be installed into the tensioner body before the coupler and seals are attached. Follow the procedure below if the adaptor has separated from the coupler.

- a. Clean the coupler thread and adaptor, removing all traces of debris.

b. Coat the end of the adaptor which is to be screwed into the coupler (i.e. the end with the spigot and the female hexagon), with 'Loctite 270' and screw into the coupler until it is finger tight.

c. Remove surplus 'Loctite'.

d. Leave the assembly for a minimum of 30 minutes curing time before proceeding with assembly into the AquaJack tensioner body.

Remove and discard the bonded seal.

Clean any dirt and debris from the tensioner body counter-bore and the coupler spigot face. Insert a new bonded seal into the counter-bore.

Lubricate the thread on the adaptor with Omega 95 (or similar lubricant with a coefficient of friction = 0.12), and tighten to a torque of 45 lbf.ft (61 Nm). Ensure that the bonded seal does not become nipped or dislodged during tightening.

6 Assembly of Banjo Fittings

Refer to Section 6.6 - Hose Connections - Restricted Access.

9.5 Pump Unit Maintenance/ Servicing

Although there is not a set time interval for routine maintenance it is advisable to periodically check the fluid levels, particularly before pump use.

1. Hydraulic Fluid Reservoir

Ensure tank is full, top up if necessary. Use Houghtosafe 620 (available from Enerpac).

2. Air Lubricator

Check level. To fill, unscrew the bowl and fill to within 1/4" of the top. Use pneumatic tool oil, typically Silkolene Icefree (available from Enerpac). Check the lubricator oil drip feed rate. With the pump running, (ensure the hydraulic oil return valve is fully open) adjust the drip rate to give one drop of oil to every twenty strokes of the pump.

3. Air Filter/ Regulator

Drain water from the filter bowl before it reaches the level of the lower baffle. Use drain plug/valve situated on the bottom of the filter bowl.

4. Servicing Of The Pump

Repairs and servicing should be carried out at intervals agreed by Enerpac and Customer. It is not recommended that the customer services or repairs their own pump unit, but should return it to Enerpac where the pump can be serviced and repaired by qualified technicians. New components will be fitted where necessary and the pump calibrated and tested.

Note: All parts will have been manufactured, inspected and tested in accordance with Enerpac's stringent requirements. Any parts failing in use that are found upon Enerpac's inspection not to be Enerpac's genuine spare parts will invalidate any operative warranty or guarantee.

10.0 STORAGE

Store tools fully retracted.

The finish will protect the tools from rust etc. but for added protection a light coating of oil or rust inhibitor should be applied to all plated surfaces.

Cover the internal threads on the inside of the puller bar and reaction nuts with a rust inhibitor.

Store tools upright.

Keep dust caps on the oil inlet nipples and couplers.

Hydraulic Hose(s)

Wipe all hoses clean and apply a light coating of oil or suitable rust inhibitor to all couplers and tee blocks.

Always keep dust caps fitted to couplers.

Pump Unit

Always store the pump upright.

Apply a light oil coating or suitable rust inhibitor to all exposed unplated metal items.

Leave the oil return to tank valve in the open position.

Always keep dust caps on inlet and outlet hydraulic fittings.

11.0 TROUBLESHOOTING

Fault	Possible Cause	Corrective Action
Hoses difficult to assemble	1. Damaged coupler 2. Coupler locking collars not fully screwed back 3. Internal pressure in hose	1. Replace coupler 2. Screw back collars 3. Vent hose
Oil is leaking from the hydraulic connection.	Connection is not seating properly.	Tighten the connection. Where applicable replace connection components.
Pump does not operate	1. Air supply not connected 2. Air regulator closed 3. Start/stop valve closed	1. Connect air supply 2. Set air regulator 3. Operate valve
Pump is not building pressure with oil return to tank valve closed.	1. Oil return to tank valve may be defective. 2. Check valve may be sticking inside the pump head.	1. Replace the return to tank valve. 2. Tap the pump head lightly with a hide hammer. If this fails the pump must be stripped down.
Pump stalls prior to reaching required pressure	1. Insufficient air supply 2. Air pressure regulator	1. Increase air supply 2. Adjust air regulator
Maximum pressure cannot be achieved, even when pump is running continuously	1. Leaking couplers 2. Leaking tensioner seals 3. Hydraulic oil return valve 4. Air in system	1. Replace suspect couplers 2. Replace suspect seals 3. Fully close valve or replace 4. Run pump for short period with oil return valve open
Pump runs erratically/jerky after a period of time	Foreign matter in hydraulic oil	Renew hydraulic oil
Pressure reading erratic	Defective gauge	Replace gauge
Piston will not retract.	1. Oil return to tank valve is not open. 2. Coupling not assembled	1. Ensure that the oil return to tank valve is fully open. 2. Check couplings
Pistons do not stroke (with no gauge pressure build up)	1. Open pump hydraulic oil return valve 2. Leaking/burst hose 3. Leaking coupler/seals 4. Leaking tensioner seals 5. Defective pump unit	1. Close valve 2. Replace hose 3. Replace coupler/seals 4. Replace seals 5. Check pump for oil delivery

Fault	Possible Cause	Corrective Action
Pistons do not stroke (with gauge pressure build up)	1. Coupler not assembled 2. Incorrect hydraulic circuit assembly	1. Check couplers 2. Check hydraulic circuit
When detensioning tool becomes locked onto the bolts.	Tools not stroked prior to de-tensioning process	See Section 7.3
The nut is not turning when the system is under pressure.	1. The hydraulic hose is not connected properly to the tool. 2. The bolt thread may be damaged.	1. Release the pressure and check the hose connection. 2. Release the pressure, remove the tool and rectify.
Quick-Fastening reaction nut will not engage	1. Oversize bolts 2. Differing thread form	1. Check bolt size 2. Check thread form
Hydraulic fluid visible at top/bottom of tensioner Oil is leaking from the tensioner body.	1. Maximum stroke achieved – Relief valve activated 2. Leaking tensioner seals	1. Tighten nut and repeat procedure 2. Replace seals

12.0 TECHNICAL DATA

12.1 AquaJack Tensioner Specifications

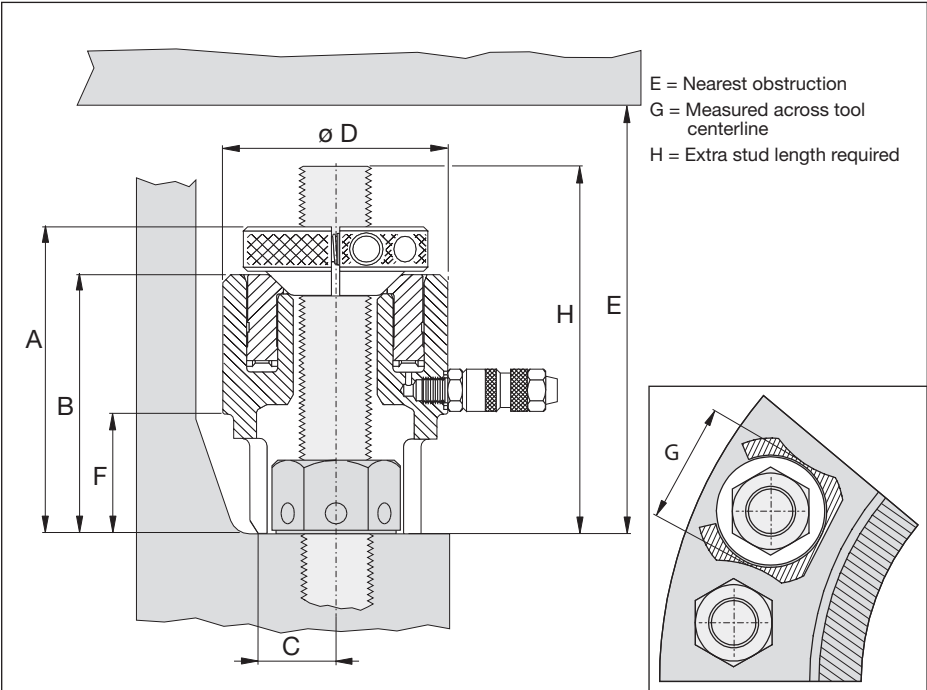


FIGURE 24

12.2 AquaJack Tensioner Specifications Metric Table
(see Fig 24 for locations of dimensions A, B, C, D, E, F, G and H)

Load Cell Model Number	Thread Size	Quick Fastening Nut Model Number	Cylinder Effective Area (mm ²)	Maximum Load Capacity (kN)	Stroke (mm)	Dimensions (mm)								Tool Weight (kg)
						A	B	C	D	E	F	G	H	
EAJ1LC	¾" - 10 UN	EAJ1QFN0750U10	1008.7	151.3	20	114	91	19	66	217	35	53	96	1.5
	7/8" - 9 UN	EAJ1QFN0875U09												
	M20 x 2.5	EAJ1QFNM02025												
	M22 x 2.5	EAJ1QFNM02225												
EAJ2LC	1" - 8 UN	EAJ2QFN1000U08	1658.4	248.7	30	147	120	25	82	289	50	62	125	3.0
	M24 x 3.0	EAJ2QFNM02430												
	M27 x 3.0	EAJ2QFNM02730												
	1 1/8" - 8 UN	EAJ2QFN1125U08												
EAJ3LC	M30 x 3.5	EAJ2QFNM03035	2524.3	378.6	30	158	131	28	98	307	58	78	130	4.5
	1 ¼" 8 UN	EAJ3QFN1250U08												
	M33 x 3.5	EAJ3QFNM03335												
	1 3/8" - 8 UN	EAJ3QFN1375U08												
EAJ4LC	M36 x 4.0	EAJ3QFNM03640	3686.7	553.0	30	171	136	33	114	319	63	91	135	6.0
	1 ½" - 8 UN	EAJ4QFN1500U08												
	M39 x 4.0	EAJ4QFNM03040												
	1 5/8" - 8 UN	EAJ4QFN1625U08												
EAJ5LC	M42 x 4.5	EAJ4QFNM04245	5908.7	886.3	30	184	146	40	139	342	70	114	140	9.0
	1 ¾" - 8 UN	EAJ5QFN1750U08												
	M45 x 4.5	EAJ5QFNM04545												
	1 7/8" - 8 UN	EAJ5QFN1875U08												
	M48 x 5.0	EAJ5QFNM04850												
	2" - 8 UN	EAJ5QFN2000U08												
	M52 x 5.0	EAJ5QFNM05250												

Load Cell Model Number	Thread Size	Quick Fastening Nut Model Number	Cylinder Effective Area (mm ²)	Maximum Load Capacity (kN)	Stroke (mm)	Dimensions (mm)								Tool Weight (kg)
						A	B	C	D	E	F	G	H	
EAJ6LC	M56 x 5,5	EAJ6QFNM05655	8312.8	1246.9	30	201	161	49	164	367	82	138	150	13.0
	2¼" - 8 UN	EAJ6QFNM2250U08												
	M60 x 5,5	EAJ6QFNM06055												
	2½" - 8 UN	EAJ6QFNM2500U08												
	M64 x 6,0	EAJ6QFNM06460												
EAJ7LC	M68 x 6,0	EAJ7QFNM06860	12,369.0	1855.4	30	230	178	75	192	400	95	154	165	19.0
	2¾" - 8 UN	EAJ7QFNM2750U08												
	M72 x 6,0	EAJ7QFNM07260												
	M76 x 6,0	EAJ7QFNM07660												
	3" - 8 UN	EAJ7QFN3000U08												
EAJ8LC	M80 x 6,0	EAJ8QFNM08060	15,473.0	2320.9	30	247	193	68	216	412	109	182	165	24.5
	3¼" - 8 UN	EAJ8QFNM3250U08												
	M85 x 6,0	EAJ8QFNM08560												
	3½" - 8 UN	EAJ8QFNM3500U08												
	M90 x 6,0	EAJ8QFNM09060												

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