

TOPSIDE BOLT TENSIONER



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Ref: BAH/OPS/TT/002

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Introduction

The Topside bolt tensioning system has been developed for use on bolted joints in areas where speed reliability and simple operation are essential. They are hydraulically operated tools being connected to a hydraulic pump via hydraulic harness assembly.

The tensioning tool comprises of a hydraulic load cell, a threaded insert, a nut rotation disc and a bride piece. The application requires extended bolt over which the Nut Rotating Disc (NRD) and the Bridge Piece and Load Cell are located (generally these parts are fitted together to form a single piece -the tool). An extension of bolt equal to approximately 1 x the nut height above the nut is required. The Threaded Insert then screws onto the portion of the stud protruding above the hydraulic load cell.

Tensioning tools are used in multiples, one tool and reaction nut usually being applied to each bolt. This provides uniform tightening of the joint. The tools are connected in series to a pump unit via a harness assembly. A pump pressure is determined for the bolt load required and the system pressurised to this pressure. As the hydraulic load cells become pressurised, the piston extends and reacts against the Threaded Insert thus inducing a load in the bolt. The load applied to bolts result in bolt extension and joint compression. When the required pressure is reached, the drilled nut under the tensioner is turned securely down against the joint face using the NRD's and a tommy bar. When the tool pressure is released the bolt load is transferred from the Threaded Insert to the nut on the joint (just tightened with the tommy bar). The Harness Assembly, Threaded Insert, and Tool assemblies (Load Cell, Bridge & NRD's) can then be removed and the joint is tensioned.

Safety Notes

The Topside bolt tensioning system must only be used for the purpose for which it is intended. That is the tightening and loosening of bolted joints. The tools should not be used for any other purpose or modified or adapted to other application without prior consultation with B & A Hydraulics. The following safety notes are not an exhaustive list but serve to provide a framework for considerations to be observed whilst using the equipment.

1. Read the operating instruction manual
2. Always wear personal protective equipment - eye protection is essential
3. Keep personnel clear of the equipment when pressurisation takes place. Only approach the equipment once the pressure has stabilised. Never position yourself in-line with a bolt being tensioned.
4. Never exceed the equipment's stated maximum working pressure
5. Do pressurise UN-COUPLED male 'Quick Disconnect Couplings'.
6. the Quick Reaction Nut.
7. Never attempt to tighten or loosen any part of the hydraulic system while it is still under pressure.
8. If in doubt - ASK.

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Preliminary System Checks

Prior to using any B & A Hydraulics Bolt Tensioning Equipment ensure the following requirements have been met:

Topside Bolt Tensioner - See Appendix 1

The correct size of Tensioner has been selected for the application. (including Threaded Insert, Bridge, NRD and Load Cell)

The correct amount of Bolt Tensioners and Threaded Inserts have been selected for the method of tensioning to be used i.e. 50% or 100% tensioning. Note: 100% is standard.

All Tensioner pistons are at zero stroke i.e. level with the top of the body.

The Tensioners and Threaded Inserts are in good condition and have not incurred any damage, look for damage to the couplings on the Tensioners and the threads of the Threaded Inserts.

The Correct length of Stud protrusion is available to fit the Bolt Tensioner.

A number of the correct size of Tommy bars to suit the Threaded Inserts and NRD's are available.

Hose Whips - See Appendix 2

Sufficient amounts of Interconnecting Hoses are available to suit the amount of Tensioners being used.

The Hoses are in good condition and have not incurred any damage. Look for any crushing, cuts or kinks in the hose.

Air Driven Pump - See Appendix 3

The pump unit reservoir is filled with hydraulic oil.

There is an air supply capable of delivering 100 - 120 PSI @ 56 C.F.M available.

The pump unit is in good condition and has not incurred any damage.

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Flange Checks

Prior to Bolt Tensioning ensure the following Flange Checks have been made.

Flanges

The Flanges to be tensioned are the correct mating flanges

Both Flanges are free from damage

Both Flange faces are clean and free from debris

Gaskets

The correct Gasket has been selected

The Gasket is free from damage

Stud Bolts

The correct number and size of Stud Bolts for the flange have been selected

Each Stud Bolt has one drilled and one plain nut.

Both the Stud Bolts and nuts are free from damage.

On completion of the above checks the flanges are ready for assembly.

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Flange Assembly

Pull the flanges together using B & A Hydraulics Hydraulic Flange Pullers until there is a gap of approximately 2 1/2 - 3 inches.

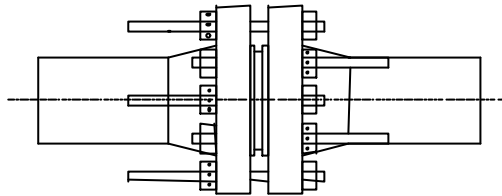
Insert the Gasket

Continue to pull up the flanges using the Flange Pullers until the flanges are firmly together and the gasket seated.

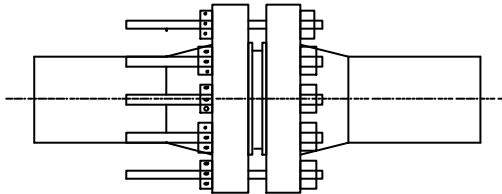
Insert the stud bolts in 4 opposite facing bolt holes i.e. at 12, 3, 6 & 9 o'clock, and hand tighten the nuts.

Remove the Flange Pulling Equipment.

Insert the remaining bolts as per diagrams below.



Ensure the stud bolts have extra length protruding to allow for the Bolt Tensioners. These should be inserted as above for 100% Tensioning and as below for 50% Tensioning



Check the Flange gap is even by taking measurements at 12, 3, 6 & 9 o'clock positions.

Record results on the Flange Tensioning Results Sheet

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System Set-Up

Hydraulic Pump Unit - Setting the Stall Pressure:

Connect air supply line to the air line connection (1/2" NPT female).

Connect Hose Whip Male Coupling to Female Coupling on pump outlet ensure hose whip has either a Female High Pressure Coupling or Blanking Plug fitted.

Ensure the Air On /Off valve is in the closed position and that the Hydraulic Pressure Release valve is fully open (turn anti-clockwise).

Lift the knob on the air pressure regulator and reduce air pressure to zero (turn adjusting knob anti-clockwise.)

Open the Air On / Off valve and slowly turn the air pressure regulator knob clockwise the air pressure is indicated on the air pressure gauge.

Open the Air On /Off valve and allow the pump to cycle.

Close the Pressure Release Valve and pressure will build up. This will be indicated on the Pressure Gauge, continue to increase the air pressure until the required hydraulic pressure is shown on the Pressure Gauge.

Close the Air On /Off valve. Pressure will at this point be held constant at the 'Stall Pressure'.

Release the pressure from the pump by slowly opening the pressure release valve, this will allow the hydraulic oil to return to tank.

The pump unit is now ready for use.

To operate the pump, close the Hydraulic Release valve, and open the Air On / Off valve the pressure will begin to rise.

When the required pressure is reached shut the Air On / Off valve and the pressure will be held.

Release the pressure by opening the Hydraulic Release valve.

Deploy the Downline

Connect the hose from the pump unit to the Downline (Remove any Blanking plugs first)

System Set-Up Cont'd

Tensioner Set Up

Place tools on all the studs with additional stud protrusion for a 100% procedure. Or on every other stud for a 50% procedure. - See section Flange Assembly for 100% & 50% options.

To set up the tools ensure there is at least 1 x the nut height of stud protrusion above the nut then place the tool (Nut Rotating Disc, Bridge Assembly & Load Cell) over the stud & nut.

Run the Threaded Inserts down the studs until they are approximately 2-3 mm from the top of the tool.

Connect the feed hose to a Tensioner.

Connect the tools via the Harness Assembly. Best practice is :

Connect a whip to the available female coupling on the tool connected to the feed hose. Connect the other end of the hose to the male coupling on the tool situated on the next adjacent stud. Continue until all tools on one side of the flange are connected, take a whip and cross-over to the other side of the flange and continue.

Once the tools are connected there should be one tool left with a female coupling unconnected, insert a bleed nipple.

Operate the pump unit.

Oil should be noted escaping from the bleed nipple. This confirms the tools have been connected correctly and simultaneously purges the system of any trapped air.

Stop the Pump, remove the bleed nipple and leave open the female coupling.

The Tensioning Operation can begin.

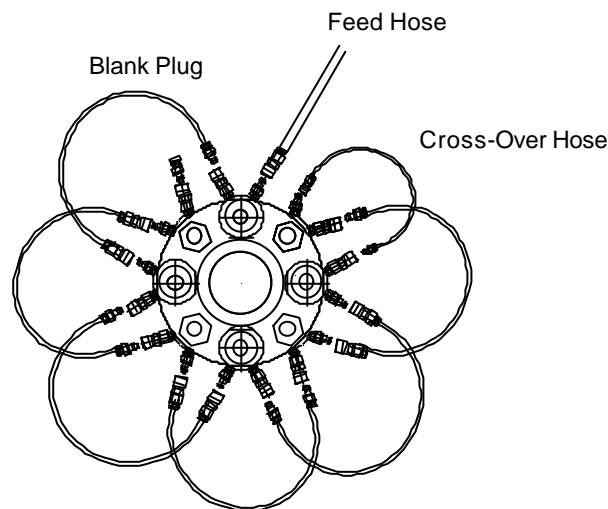


Diagram shows Hose Assembly for a 100% Tensioning Procedure

System Operation

100% Tensioning

Ensure the pump unit Stall Pressure is set at required pressure.

Complete all the Set up procedures.

Pressure up to 1,000 Psi and check for leaks.

If there are no leaks continue to increase the pressure evenly to full pressure for 100% tensioning.

If at any time there is a leak immediately release the pressure by opening the Hydraulic Valve and closing the Air On / Off Valve on the pump unit. Replace the leaking component.

Once full pressure is reached, using a Tommy bar, run all the NRD's down tight against the flange. Record the amount of flats turned.

Release the pressure.

Measure the flange gap

Repeat the above steps a further 3 times, or, if movement of the NRD's can still be noted, continue until no movement can be noted.

On completion of the above the tensioning procedure is complete

Stroke back the Tensioner pistons by winding the Threaded Inserts down to the top of the tensioner using the Tommy bars

Remove all Hose Whips, Threaded Inserts & Tools from the flange.

NOTE:

Do not exceed maximum piston stroke of the tool (see relevant data sheet for details).

If max. stroke is reached prior to finishing the tensioning procedure:

Stop the pump and wind the NRD's down against the flange face.

Release the pump pressure

Wind the Threaded Insert down the stud, this will retract the pistons.

On completion of stroking back the piston resume the tensioning procedure as before.

System Operation - Cont'd

50% Procedure

Ensure the pump unit Stall Pressure is set at required pressure.

Complete all the Set up Procedures ensuring the tools are set up for 50% procedure.

Pressure up to 1,000 Psi and check for leaks.

If there are no leaks continue to increase the pressure evenly to 1st pass pressure for 50% Tensioning.

If at any time there is a leak immediately release the pressure by opening the Hydraulic Valve and closing the Air On / Off Valve on the pump unit. Replace the leaking component.

Once 1st Pass pressure is reached, using a Tommy bar, run all the NRD's down tight against the flange. Record the amount of flats turned.

Release the pressure.

Measure the flange gap

Repeat the above a further two times, or if movement of the NRD's can still be noted continue until no movement can be noted

Remove the Tensioners and set them up on the remaining 50% of studs (Second Set)

Pressure up to 1,000 Psi and check for leaks.

If there are no leaks continue to increase the pressure evenly to 2nd Pass pressure for 50% Tensioning.

If at any time there is a leak immediately release the pressure by opening the Hydraulic Valve and closing the Air On / Off Valve on the pump unit. Replace the leaking component.

Once 2nd Pass pressure is reached, using a Tommy bar, run all the NRD's down tight against the flange. Record the amount of flats turned.

Release the pressure.

Measure the Flange Gap.

Repeat the above on the second set a further two times, or, if movement of the NRD's can still be noted, continue until no movement can be noted.

Remove the Tensioners and set them up on the first set (50% of studs)

Pressure up to 1,000 Psi and check for leaks.

If there are no leaks continue to increase the pressure evenly to 2nd Pass pressure for 50% Tensioning.

If at any time there is a leak immediately release the pressure by opening the Hydraulic Valve and closing the Air On / Off Valve on the pump unit. Replace the leaking component.

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System Operation - Cont'd

Once 2nd Pass pressure is reached, using a Tommy bar, run all the NRD's down tight against the flange. There should be no movement of the nuts if this is the case the tensioning procedure is complete. If movement is noted then apply the 2nd Pass pressure a further two times.

Release the pressure.

Measure the Flange Gap.

Remove the Tensioners and set them up on the second set.

Pressure up to 1,000 Psi and check for leaks.

If there are no leaks continue to increase the pressure evenly to 2nd Pass pressure for 50% Tensioning.

If at any time there is a leak immediately release the pressure by opening the Hydraulic Valve and closing the Air On / Off Valve on the pump unit. Replace the leaking component.

Once 2nd Pass pressure is reached, using a Tommy bar, run all the NRD's down tight against the flange. There should be no movement.

Release the pressure, the Tensioning Operation is now complete

Stroke back the Tensioner pistons by winding the Threaded Inserts down to the top of the tensioner using the Tommy bars

Remove all Hose Whips, Threaded Inserts & Tensioners from the flange.

System Operation - Cont'd

De-Tensioning

100% De-Tensioning

Ensure the pump unit Stall Pressure is set at the required De-Tensioning pressure.

Complete all the Topside Set up procedures.

Complete all the Subsea Set up Procedures ensuring the tools are set up for 100% procedure and a gap of approx. 5 mm is left between the Threaded Insert and the top of the tool..

Pressure up to 1,000 Psi and check for leaks.

If there are no leaks continue to increase the pressure evenly to full pressure for De-Tensioning.

If at any time there is a leak immediately release the pressure by opening the Hydraulic Valve and closing the Air On / Off Valve on the pump unit. Replace the leaking component.

Once full pressure is reached, using a Tommy bar, loosen all the NRD's off by approx. 5 mm from the flange.

Release the pressure.

On completion of the above the De-Tensioning procedure is complete

Stroke back the Tensioner pistons by winding the Threaded Inserts down to the top of the tensioner using the Tommy bars

Remove all Hose Whips, Threaded Inserts & Tensioners from the flange.

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System Operation - Cont'd

50% De-Tensioning Procedure

Ensure the pump unit Stall Pressure is set at required pressure.

Complete all the Topside Set up procedures.

Complete all the Subsea Set up Procedures ensuring the tools are set up for 50% procedure and a gap of approx. 5 mm is left between the Threaded Insert and the top of the tool.

Pressure up to 1,000 Psi and check for leaks.

If there are no leaks continue to increase the pressure evenly to 1st Pass pressure for De-Tensioning.

If at any time there is a leak immediately release the pressure by opening the Hydraulic Valve and closing the Air On / Off Valve on the pump unit. Replace the leaking component.

Once full pressure is reached, using a Tommy bar, loosen all the NRD's off by approx. 5 mm from the flange

Release the pressure.

Remove the Tensioners and set them up on the remaining 50% of studs (Second Set)

Pressure up to 1,000 Psi and check for leaks.

If there are no leaks continue to increase the pressure evenly to 2nd Pass pressure for De-Tensioning.

If at any time there is a leak immediately release the pressure by opening the Hydraulic Valve and closing the Air On / Off Valve on the pump unit. Replace the leaking component.

Once full pressure is reached, using a Tommy bar, loosen all the NRD's off by approx. 10 mm from the flange.

Release the pressure.

The De-Tensioning Operation is now complete.

Stroke back the Tensioner pistons by winding the Threaded Inserts down to the top of the tensioner using the Tommy bars

Remove all Hose Whips, Threaded Inserts & Tensioners from the flange.

Maintenance

After each operation of the system it is recommended that the following post-use maintenance procedures be carried out.

In general clean all equipment parts with WD40 or similar to remove any dirt or grease. If corrosion is evident clean the effected areas using a wire brush or wire wool and WD40 or similar.

Topside Bolt Tensioner

Each Tensioners piston is fully retracted

Spay the Quick Disconnect couplers with a water repellent such as WD40 or similar. Particular attention should be given to the ball bearings in the female coupler. If corrosion is evident spray with WD40 or similar and wire brush the effected areas.

Spray the pins and threaded portions of the Threaded with WD40 or similar. If corrosion is evident spray with WD40 or similar and wire brush the effected areas.

Do not use grease on any of the moving parts - this will attract grit & debris sand and could cause the mechanism to jam.

Hose Whips

Spay the Quick Disconnect couplers with a water repellent such as WD40 or similar. Particular attention should be given to the ball bearings in the female coupler. If corrosion is evident spray with WD40 or similar and wire brush the effected areas

Air Driven Pump

Spay the Quick Disconnect couplers with a water repellent such as WD40 or similar. Particular attention should be given to the ball bearings in the female coupler. If corrosion is evident spray with WD40 or similar and wire brush the effected areas

Refill the pump unit reservoir if necessary.

Ensure the air lubricator oil reservoir has sufficient oil

Bolt Tensioning Record Sheet

Company	
Project	
Flange Connection	
No. of Bolts	
Bolt Size	
Final Pump	PSI
Residual Bolt Load	Tonf / Knf

Pressure	Remarks	Gap (mm) @ Clock Position			
		3	6	9	12
	Initial results prior to Tensioning				
Psi	Check for Leaks				
Psi	Mid Pressure				
Psi	1 st Pass				
Psi	2 nd Pass				
Psi	3 rd Pass				
Psi					
Psi					

	No. of Flats Turned for Stud Number											
	1	2	3	4	5	6	7	8	9	10	11	12
Pre Tensioning												
1st Pressurisation												
2nd Pressurisation												
3rd Pressurisation												
	13	14	15	16	17	18	19	20	21	22	23	24
Pre Tensioning												
1st Pressurisation												
2nd Pressurisation												
3rd Pressurisation												
	25	26	27	28	29	30	31	32	33	34	35	36
Pre Tensioning												
1st Pressurisation												
2nd Pressurisation												
3rd Pressurisation												

Comments:

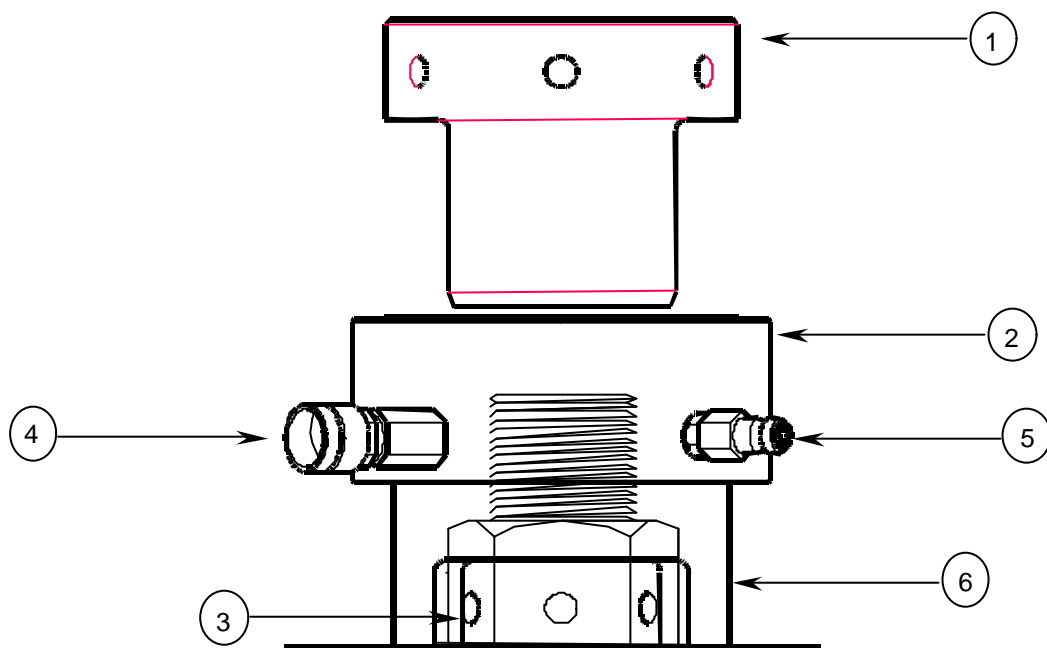
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Signed Date

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Appendix 1 - Topside Bolt Tensioner

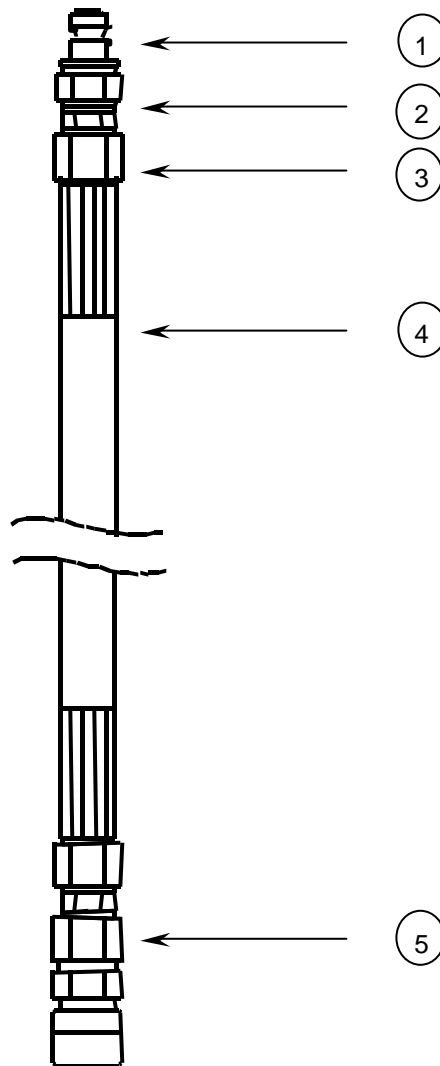
Item No	Description	Qty
1	Threaded Insert	1
2	Load Cell	1
3	Nut Rotating Disc (NRD)	2
4	Female Coupling Assembly (1 x 1/4" x 1/4" mm Bsp Adpt & 2 x 1/4" Dowty)	1
5	Male Coupling Assembly (1 x 1/4" x 1/4" mm Bsp Adpt & 2 x 1/4" Dowty)	1
6	Bridge	1



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Appendix 2 - Hose Assembly

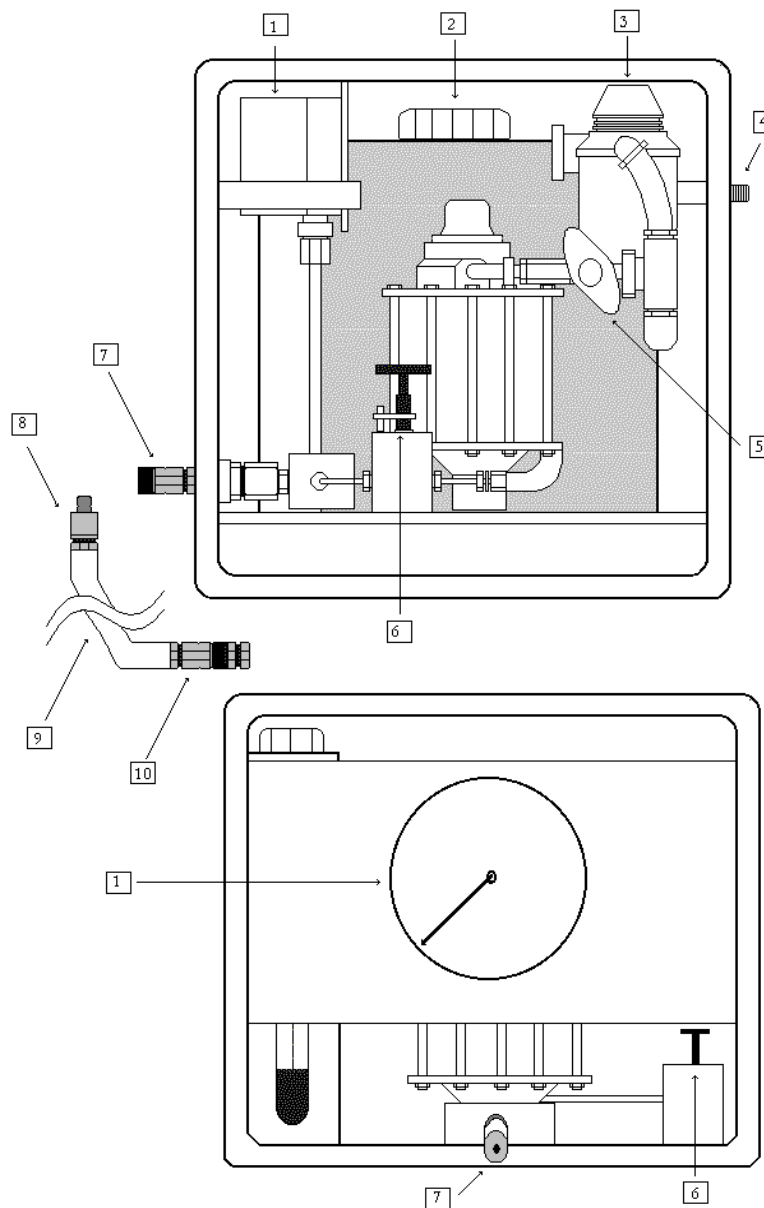
Item No	Description	Qty
1	Cejin 116 Series Nipple	1
2	Adapter Assembly (1 off 1/4" x 1/4" Bsp m/m & 1 off 1/4" Dowty)	2
3	1/4" Bsp Female Swivel Swaged Hose End	2
4	1m or 3m Hose 21,750 Psi MWP Hose	1
5	Cejin 116 Series Coupling	1



Ref: BAH/OPS/TT/002

Appendix 3 - Air Driven Pump Unit

Item No	Description	Qty
1	Pressure Gauge	1
2	Pump Unit Reservoir	1
3	Air Pressure Regulator	1
4	Air Line Connection (1/2" NPT female)	1
5	Air On / Off Valve	1
6	Hydraulic Release Valve	1
7	Female High Pressure Coupling	1
8	Male Coupling	1
9	High Pressure Hose	1
10	Cejin 116 Series Coupling Assembly	1



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