



Unit 17 Denmore Industrial Estate, Denmore Road, Bridge of Don, AB23 8JW

User Manual
15K Quad BOP Assembly

This Manual Covers the Following Part Numbers:

194-3063-HV0



User Manual

15k Quad BOP Assembly

Revision History

Issue, Date	Remarks
Rev A, 01 Nov 10	Initial Issue
Rev B, 19 Sept 11	Actuator Update new Piston Pt No 190-4346-480 and Redress kit Update



User Manual

15k Quad BOP Assembly

Revision History.....	i
Safety	iv
1 Introduction.....	1
1.1 General	1
1.2 Product Identification	2
2 Technical Specification.....	3
3 Technical Description	6
3.1 Basic Description.....	6
4 Operation.....	7
4.1 Operating the Rams	7
4.2 Equalising across the rams.....	8
4.3 Testing The Top Connection To The Riser	12
4.4 Assembling the Bottom Grayloc Connection	12
4.5 Job Planning.....	14
5 Maintenance.....	15
5.1 Introduction	15
5.2 Schedule	15
5.3 Safety	15
5.4 Tools	16
5.5 Ram Seal Redress	16
5.6 Maintenance Record Sheet	24
6 Testing	25
6.1 Prepare BOP for pressure testing.....	25
6.2 Body Test.....	25
6.3 Ram test: Shear seal	26
6.4 Wireline Ram Seal Test (Between the ram)	26
6.5 Post Test Procedure.....	27
6.6 Actuator.....	27
7 Parts List and Drawings.....	28
8 Spares.....	39
8.1 Redress Kits	39
Table 1: Technical Specification	3
Table 2: Shear Data.....	4
Table 3: Maintenance Record.....	24
Table 4: BOP Parts List Part No 194-3063-HV0	28
Table 5: Wireline Ram Assembly Parts List Part No 190-3752-HV0	31
Table 6: Shear Ram Assembly Parts List Part No 190-3757-HV0.....	31
Table 7: Actuator Parts List Part No 190-3293-HV0.....	32
Table 8: Equalising Block Assembly Parts List Part No 190-3446-HV0.....	34
Table 9: HP Check Valve Assembly 190-3751-HV0	35
Table 10: Saver Injection Assembly Parts List Part No 190-3750-HV0	36
Table 10: Top Sub Assembly Part No 125-3069-HV0	37
Table 10: Top Sub Assembly Part No 125-3070-HV0	38
Table 11: BOP Redress Kit Part No. RDK-3063-HV0	39
Table 12: Actuator Redress Kit Part No. RDK-3293-HV0.....	39



User Manual

15k Quad BOP Assembly

Table 13: Equalisation Block Redress Kit Part No. RDK-3446-HV0	39
Table 14: Saver Injection Assembly Redress Kit Part No. RDK-3750-HV0 ...	40
Table 14: Saver Injection Assembly Redress Kit Part No. RDK-3069-HV0	Error! Bookmark not defined.
Table 4 : Supporting Equipment	40
Figure 1: BOP Safety	iv
Figure 2: BOP General Layout.....	5
Figure 3: Section through typical BOP rams (closed position).....	6
Figure 4: Equalizing Layout	8
Figure 5: Equalization Operation 1.....	9
Figure 6: Equalization Operation 2.....	10
Figure 7 Equalization Operation 3.....	11
Figure 8: Accessing the rams	16
Figure 9: BOP Wireline Rams.....	17
Figure 10: BOP Shear Rams	18
Figure 11: Actuator Assembly Steps – Part 1	20
Figure 12: Actuator Assembly Steps – Part 2	21
Figure 13: BOP Assembly Steps – Part 1	22
Figure 14: BOP Assembly Steps – Part 2	23
Figure 15: BOP Assembly Drawing 194-3063.....	29
Figure 16: BOP Assembly Drawing 194-3063.....	30
Figure 17: Wireline Ram Assembly Drawing 190-3752	31
Figure 18: Shear Ram Assembly Drawing 190-3757	31
Figure 19: Actuator Assembly Drawing 190-3293	33
Figure 20: Equalisation Block Drawing 190-3446.....	34
Figure 21: Check Valve Assembly Drawing 190-3751	35
Figure 22: Saver Injection Assembly Drawing 190-3750.....	36
Figure 22: Top Sub Assembly Drawing 125-3069.....	37
Figure 22: Bottom Sub Assembly Drawing 125-3070.....	38

Safety

WARNING: Trapped air requires considerable time to compress and when it is compressed is highly dangerous. It has enough stored energy to separate parts with considerable force.

Seals in high-pressure vessels are also susceptible to explosive decompression; the O-rings or rubber gaskets used to seal pressurised pipelines tend to become saturated with high-pressure gases. If the pressure inside the vessel is suddenly released, then the gases within the rubber gasket may expand violently, causing blistering or explosion of the material.

This product contains high pressures, when in operation. Failure of any part may cause injury. Welding, corrosion, rough handling, or other abuse may affect the Integrity of this product.

All pressure equipment has a particular pressure rating and care must be taken to ensure that no item is used in a situation that may cause its working pressure to be exceeded.

All personnel involved in pressure testing must be formally trained, competent and utilise the appropriate PPE.

Ensure the identification plate is fitted and is displaying the correct information

This equipment and the equipment it is attached to is heavy never position yourself below a suspended load

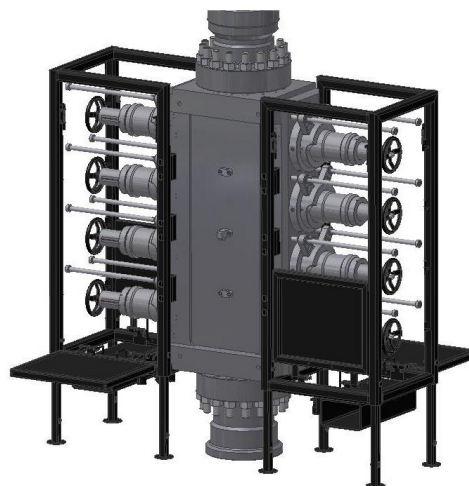


Figure 1: BOP Safety



User Manual

15k Quad BOP Assembly

1 Introduction

1.1 General

The Blow out Preventer (BOP) provides essential safety barriers against well pressure during wireline operations. It is either located directly above the wellhead flange or above the wellhead risers. The BOP has two sets of rams sealing against well head pressure and an inverted set to allow grease injection for braided line operations. The lower set contains shear rams that will cut the wire when required to allow operations to be aborted and allow the wellhead valves to close.

The ram consists of a hydraulic piston that can be extended or retracted to energise or retract the ram. The ram has a set of inner and horse shoe outer seals that when compressed against the opposite ram forms a continuous seal that is further energised by the application of pressure in one direction. The ram consequently can be arranged so that it holds pressure from below the BOP or from above.

Across the rams there is an equalisation valve assembly. This is used to equalise pressure across the rams so that the rams can be withdrawn to open up the well bore. The equalisation valve assembly consists of a cone seal set on a screw. Unwinding the screw opens the valve and allows equalisation across the rams. Tightening the screw closes the seal and prevents pressure from passing through the valve assembly. There is also a circuit to allow the injection of chemicals into the well or across the equalisation valves, and can be used to prevent the valves freezing while bleeding down gas (injecting glycol for example). The injection port has a check valve to prevent well pressure entering the injection system.

Between the middle and lower ram, it is possible to inject grease through the injection port. For braided line operations or in cases where an effective seal cannot be achieved, the injection port can be used to inject grease at pressures greater than the well head pressure, limited to the max working pressure of the BOP. The injection port has a check valve to prevent well pressure entering the injection system.

The BOP is mounted to a crash frame assembly that provides forklift pockets protection during transport. The crash frame has foldable platforms for the operators to stand on when operating or maintaining the BOP.

This user manual serves as an introduction to the equipment and contains the relevant specifications, operation, planning and maintenance instructions, parts list and drawings.



User Manual

15k Quad BOP Assembly

1.2 Product Identification

Phuel products are identified by a unique serial number that facilitates full product traceability. Each product is supplied with a documentation pack that contains product certification and material/inspection reports. The serial number is always etched on the surface of the product but can sometimes be difficult to find or read after painting. A customer identification number is also included to allow the customer to track the asset in their system.

A stainless steel band secures the nameplate tag that is stamped with the information shown below. This tag should be located in the first instance to ensure that this manual refers to the correct equipment.

PHUEL OIL TOOLS LTD
DESCRIPTION & SIZE
CUSTOMER ID No
PHUEL ID No YY-XXX-XX
MWP & SERVICE
TEST DATE



User Manual

15k Quad BOP Assembly

2 Technical Specification

Part No	194-3063-HV0
Top Connection	7-1/16 BX 15M Studded Flange 15-2 Quick Union (with
Bottom Connection	7-1/18 BX 15M Studded Flange
Height (Make Up)	96.87"/ 2.46 m
Width	79.67"/ 2.02 m
Breadth	28.46"/ 0.72m
Working Pressure	15,000 PSI (1035 Bar)
Test Pressure	22,500 PSI (1551 Bar)
Service	H ₂ S
Hydraulic Pressure	3,000 psi (210 Bar) Max
Stroke Volume	105 cu-in to close – 100 cu-in to open – Total=205 cu-in (3.36 litres)
Weight	10,370 lbs. (4,704 Kg)
Hydraulic Connections	Rams – 3/8" Phoenix Beattie HP Quick Release Coupling (QR74 Range)
	Actuators – 1/4" NPT x 3/8" Tube
	Grease Injection – 9/16" AEMP (15,000 psi max WP)
	Chemical Injection – 9/16" AEMP (15,000 psi max WP)
	Gauge Port – 9/16" AEMP (15,000 psi max WP)

Table 1: Technical Specification



User Manual 15k Quad BOP Assembly

Wire Diameter	Breaking Strength	Shear Strength	Number of whole diameters that can be cut at well pressure (psi) with 2900 psi applied to BOP										
			0	1000	2000	3000	4000	5000	6000	7000	8000	10000	15000
0.125	3045	2284	6	6	6	6	6	6	6	6	6	6	6
0.21875	8370	6278	5	5	4	4	4	3	3	3	2	2	2
0.28125	10000	7500	4	4	3	3	3	3	2	2	2	2	1
0.3125	17550	13163	2	2	2	2	1	1	1	1	1	1	1
0.4375	18500	13875	2	2	2	2	1	1	1	1	1	1	1
0.4680	18500	13875	1	1	1	1	1	1	1	0	0	0	0

Table 2: Shear Data

Note: The shear blades are designed to cut only once and must be replaced after an operation if they are used to cut wire

User Manual

15k Quad BOP Assembly

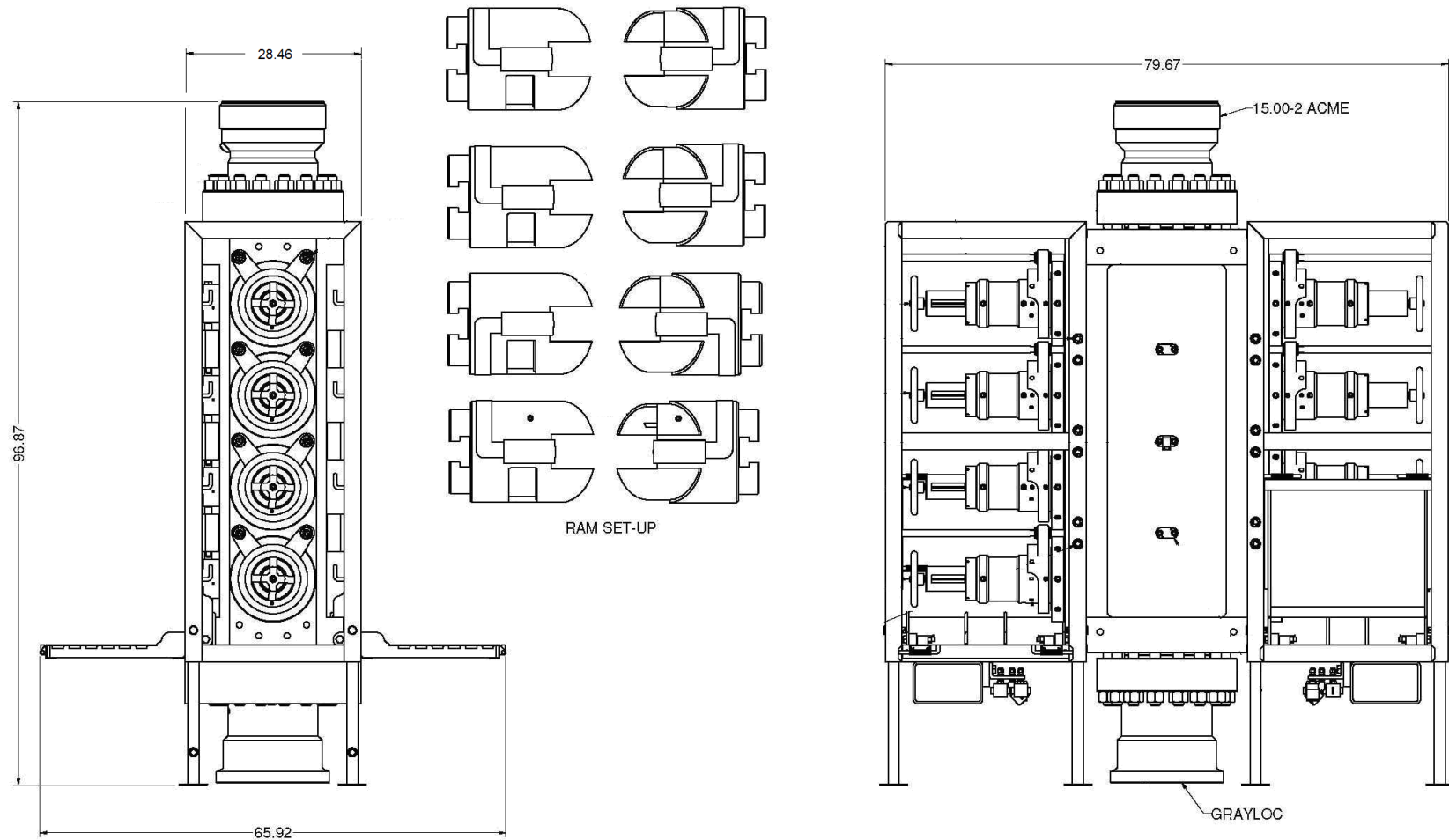


Figure 2: BOP General Layout

3 Technical Description

3.1 Basic Description

The Phuel BOP provides a positive barrier against well pressure while performing intervention operations. The equipment consists of four sets of hydraulically operated rams that can be individually pumped closed to form a seal against pressure. The orientation of the ram outer seal determines whether the rams hold pressure from above or below. By opposing adjacent ram sets it is possible to apply pressure between the rams through a grease injection port, normally at a pressure greater than the well pressure, and thus form a positive protection barrier. This technique is particularly effective when sealing against braided wire-line as a leak tight seal cannot be obtained due to the construction of the wire. The high viscosity of the grease allows the pressure to be maintained even though a small leak (of grease) still exists.

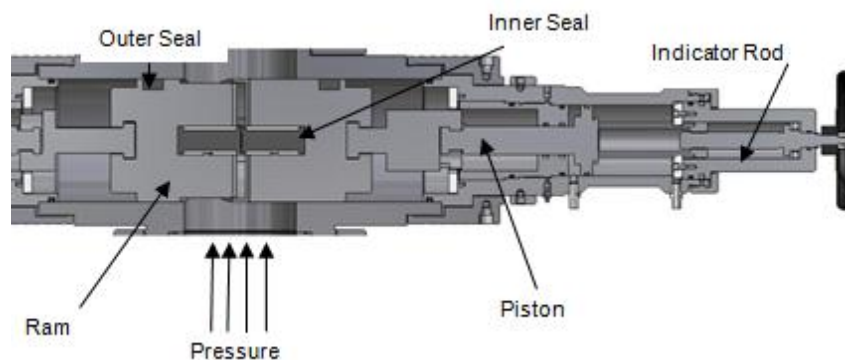


Figure 3: Section through typical BOP rams (closed position)

The rams are driven by a hydraulic actuator, which consists of a piston with an indicator rod to provide visual confirmation of the position of the rams. A manual locking mechanism is also provided to ensure that when the BOP is closed hydraulically during operations it cannot be opened again until the mechanism is deliberately withdrawn. Each of the actuators assemblies are identical on the Phuel BOP and so can be positioned in any ram bore. This provides excellent flexibility for maintenance and redress of the equipment.

4 Operation

4.1 Operating the Rams

Note – Always ensure that the pressure across the rams has been equalised before opening.

4.1.1 Hydraulic Operation

The BOP has been provided with flexible armoured piping to offer the required fire protection level. Two connections are required for each ram set for open and close. It is important that both connections are connected, as the fluid displaced by the movement of the piston must be allowed to pass through the valve system back to the reservoir.

A Well Control Unit (WCU) is normally used to operate the BOP in an offshore environment. Refer to the relevant manual for that equipment for details of operation and connection. An alternative pump pack may be used for onshore maintenance work but the operation of this equipment is out with the scope of this manual

4.1.2 Manual Operation

The rams can be closed manually (but not opened again) by turning the hand wheel in a clockwise direction some 30-40 turns providing that the hydraulic fluid from the other side (open port) is allowed to escape. The hydraulic connections must still, therefore, be made up to the WCU even when intending to operate the rams manually.

Once the rams have been closed using the manual method it is not possible to open them again without hydraulic pressure. The Hand wheel, however, must still be turned in an anti-clockwise direction until it stops to allow the piston to move fully back.

4.1.3 Locking the Rams

After closing with hydraulic pressure the piston can be mechanically locked by winding in the manual mechanism. Turning the hand wheel in a clockwise direction will advance the locking mechanism by 3mm per turn. It is therefore necessary to turn the hand wheel 30-40 turns to lock in the piston. Continue to turn until the hand wheel stops, indicating that the piston is now against the back-up lock.

For safety reasons and to reduce the mechanical effort required, **Phuel recommends that the hydraulic pressure be removed or reduced while closing the mechanical back up.** This reduces the risk of injury caused by the failure of a seal under hydraulic pressure and decreases the time required to implement the back up feature.

It is important to remember that the manual lock must be fully withdrawn before the rams can be opened. No damage to the mechanism will occur if pressure is reversed with the lock in place – providing that the maximum operating pressure is not exceeded.

4.1.4 Proper Use

In the event that the BOP is closed against wire during an operation, it is essential that the Inner seals are replaced after that job has been completed. The seals have been qualified to seal to full working pressure after three closing cycles on the wire but this is only intended to allow flexibility during a single job. Working practice and procedures must reflect this requirement.

4.2 Equalising across the rams

Each ram has a dedicated equalising valve block and these blocks are connected together to allow single point chemical injection, pressure measurement and dump facility.

There are four valves on each block, two are for equalising and two are for isolation. By opening and closing the appropriate valves it is possible to either equalize the pressure across closed rams, inject chemicals above or below any of the rams or a combination of both. There are two isolated external ports that allow the connection of a pressure gauge and drain hose if required.

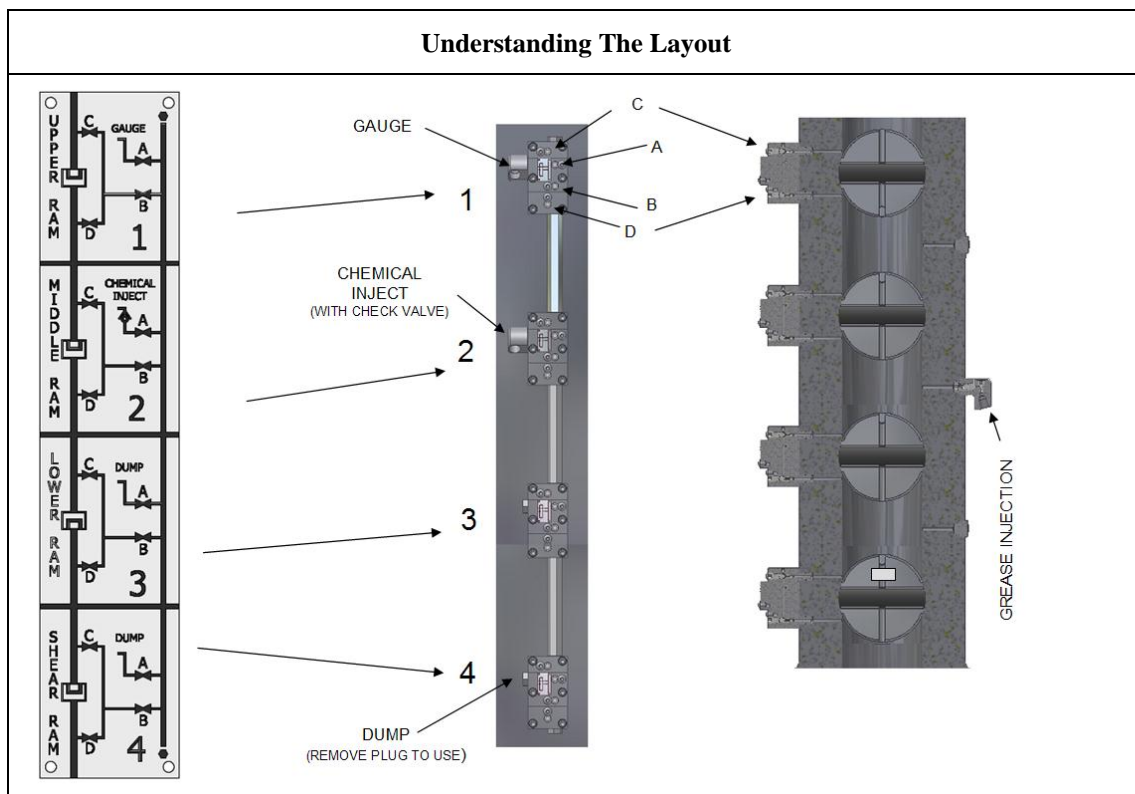


Figure 4: Equalizing Layout

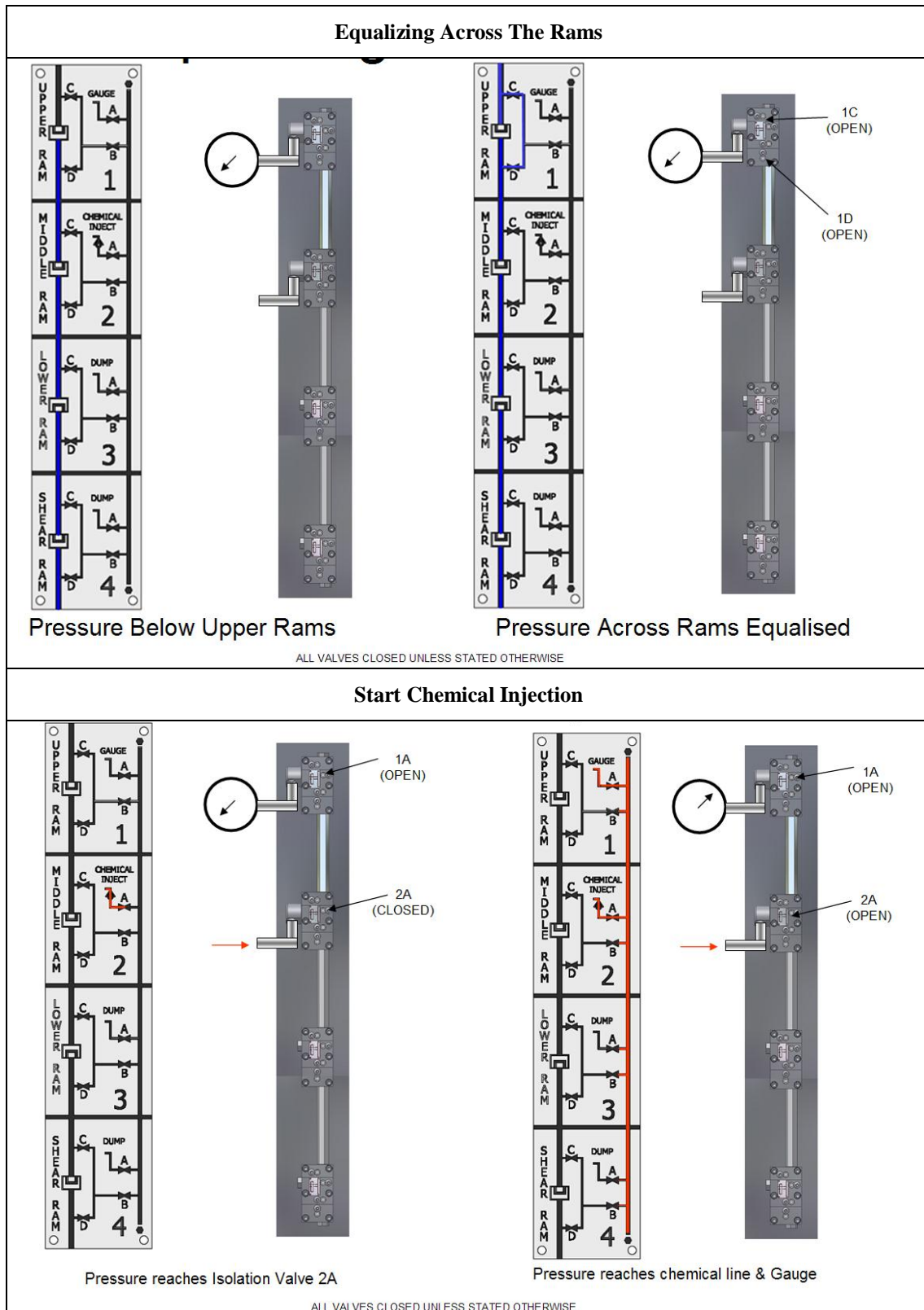


Figure 5: Equalization Operation 1

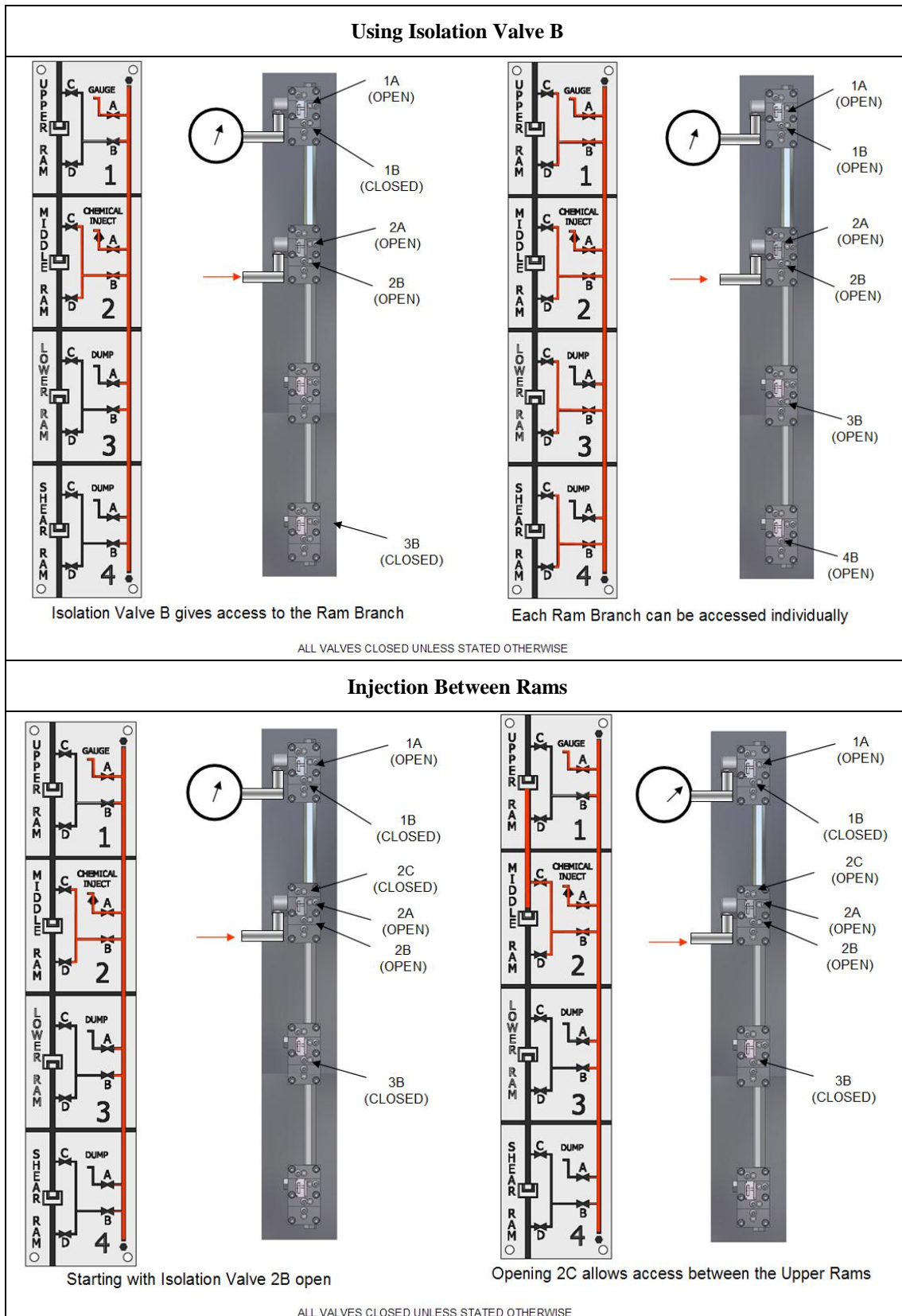


Figure 6: Equalization Operation 2

User Manual

15k Quad BOP Assembly

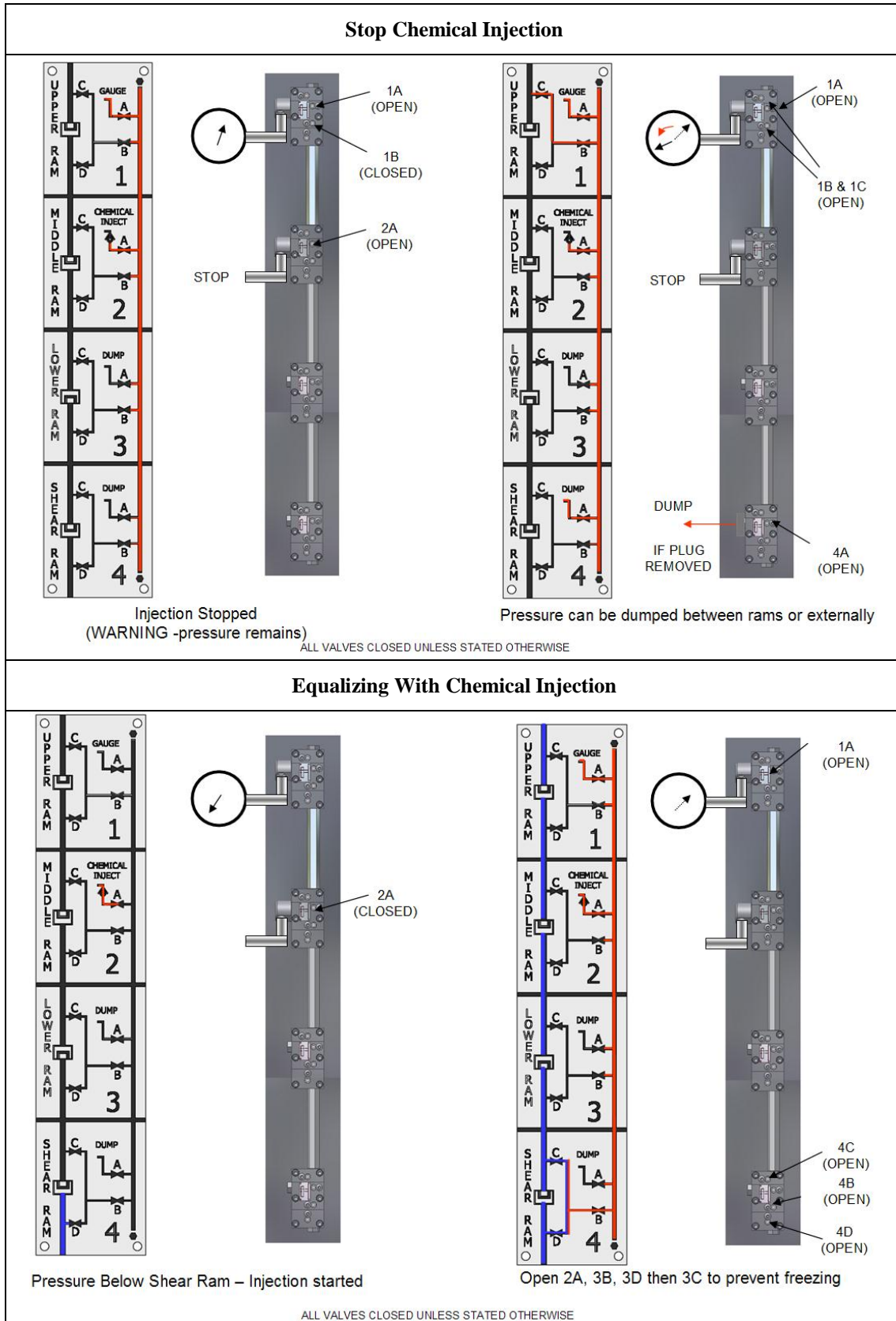


Figure 7 Equalization Operation 3

4.3 Testing The Top Connection To The Riser

Note – This is for the Top Sub assembly 125-3069-HV0 – included here for clarity

- Remove the thread protectors of both ends.
- Inspect the seals for any signs of damage and apply grease if required
- Inspect the mating bore and thread for any signs of damage or debris and clean and grease if necessary
- Stab together the connection and centralise to ensure that the sales are not loaded on one side. Ensure that the connection has stabbed as fully in as possible and that there are no signs of seal debris.
- Make up the collar and use the threads to drive the connection together. Make up the collar fully and then back off by $\frac{1}{4}$ turn.
- Store the thread protectors in a safe place for use later.
- The sealing integrity of the connection can be tested using a suitable pump. Connect the pump to the fitting on the saver sub.
- Close the isolation valve
- Pressure up against the isolation valve to 5,000 psi and then open the isolation valve and confirm that the pressure drops – this confirms that we are now testing against the two seals.
- Increase the pressure to 15,000 psi (or 1.2 x maximum well pressure) and hold for 10 minutes without leaks. (The volume is small and it may take some time to settle due to trapped air. If this is the case try bleeding off and re-applying the pressure a few times to remove the trapped air until a successful test is achieved).
- Bleed off the pressure and close the isolation valve.
- Remove the test pump from the connection.

4.4 Assembling the Bottom Grayloc Connection

Note – This is for the Bottom Sub assembly 125-3070-HV0 – included here for clarity

4.4.1 Before Assembly

- The Grayloc seal ring does not seat until the connection is fully tightened; therefore, a small clearance, or standoff, between the ring rib and hub face should be observed when the ring is placed into a mating hub. If no standoff is present, use a new seal ring.
- Clean all lubricants and foreign matter from the hub seating surfaces before installation. Use a non-abrasive material to clean the seal rings of all foreign matter. Normally, all seal rings have a coating or plating (cadmium, PTFE, MoS₂) which acts as a lubricant during make-up. In some applications where uncoated/ unplated seal rings are used, a light film of clean lubricant is recommended.
- When applying lubricant, take special care to ensure that no solid or foreign particles are present in the lubricant. Also, take care to prevent mechanical damage to the seal ring and the hub sealing surfaces.



User Manual

15k Quad BOP Assembly

- Before assembly, the hubs must be aligned to allow engagement of the seal ring lips to the hub sealing surfaces. This will ensure proper engagement of the hub and clamp segments.

4.4.2 Assembly

- Align the hubs so that the seal ring can be installed between the hubs.
- Install the seal ring in the sealing surface of the hubs. The seal ring should rock slightly; i.e., the seal ring rib should not be able to firmly contact the hub face. If it does not rock, use a new seal ring.
- Install the clamps around the hubs. Apply lubrication to the hub-clamp contact area to reduce friction; this will aid assembly.
- Insert the stud bolts into the bolt holes of the clamp ears. Install the nuts, ensuring that the spherical surfaces of the nuts and the clamp are in proper position for mating.
- Lubrication of the bolting and the spherical faces of the nuts and the clamp is recommended.
- Tighten the bolting in a criss-cross pattern (i.e., bolt #1, #3, #2, #4) to keep the spacing between the clamp halves approximately equal.
- To properly preload the Grayloc connector against gasket loads, fluid pressure loading, thermal shock loading, and normal pipe reaction loads, the torque values of 870 lbft (1180 Nm) is recommended. Note that torque wrenches are not required, but are recommended to ensure that the minimum preload values are met.
- Assembly should include jarring the clamps during the bolting procedures, i.e., a sound blow to the back of the clamp with a soft hammer (torque, jar, torque, jar, etc.) until bolt torque does not change after jarring.
- At full make-up, the hub faces will shoulder flush against the seal ring rib. The seal ring rib will prevent over torquing from causing seal damage, but to prevent permanent damage from distortion of the other components of the connection, the maximum torque applied to the connection should not be more than twice the values shown in the table. For extreme misalignment and/or extreme piping loads, torque values 1½ to 2 times the table values are recommended. Lubricated bolting should be used to assemble the Grayloc connector...

4.4.3 Disassembly

Before disassembling the Grayloc connector, bleed all pressures. When removing the clamp, first loosen the bolting and the clamp set from the hubs to allow the safe release of any trapped loads. Then, remove the bolting completely.



User Manual

15k Quad BOP Assembly

4.5 Job Planning

4.5.1 Before the Job

- Check that the certification is within date and that the scheduled maintenance is up to date.
- All inner seals need to be inspected after 50 pressure cycles, and replaced where necessary.
- Examine the BOP Assembly, to make sure that it is good operating order and assembled with the Rams in the correct orientation for the desired operation.
- Functioning of the Rams may be checked, by running both Rams to the closed position. Do not exceed the maximum operating pressure when closing the Rams. Pressure test the rams from the direction of the well (or applied) pressure that is expected during the operation. This also verifies that the rams are in the correct orientation.

4.5.2 During the Job

- Special care should be taken that the Rams are fully open when passing any equipment through them. The impact of a collar hitting a Ram may damage the Ram to such an extent that the Ram may no longer Seal, or prevents it from fully opening.
- Only lift the BOP using suitable lift caps. Do not sling or attach lifting equipment to the crash frame to lift the BOP assembly.
- Care should be taken to completely remove any residual pressure or accumulated pressure existing on Lubricator equipment above the BOP, before disconnecting the Lubricator.
- Hydraulic Hose ends should never be allowed to drop in to dirt or grit, or otherwise become contaminated with foreign matter. Any dirt or grit introduced into the BOP is very injurious to the equipment. If end connections become dirty, they should be cleaned thoroughly with solvent and dried.
- Only clean Hydraulic fluid should be used (Shell Tellus 22 is recommended) to operate the BOP. The use of mixed types, dirty, or very old fluid of unknown origin is not recommended. When one of these conditions is known or suspected, the hydraulic system should be flushed and the hydraulic fluid replaced.

4.5.3 After the Job

After each job, the BOP should be thoroughly cleaned, repaired as may be required and re-tested to verify that it is ready to be used again.



User Manual

15k Quad BOP Assembly

5 **Maintenance**

5.1 **Introduction**

Regular maintenance of the equipment using Phuel redress kits or approved spares is essential to its continued safe operation. Ensure that the pre and post job operating procedures are followed and that maintenance records are kept.

5.2 **Schedule**

The maintenance schedule may be governed by international or company standards and the following is considered to be the minimum requirements.

5.2.1 **Pre & Post Job**

Refer to Section 4.5.1 and Section 4.5.3 for details.

5.2.2 **Yearly**

- Disassemble BOP and degrease all components.
- Inspect the condition of sealing surfaces and surface coatings, repair/replace as necessary.
- Re-coat threads and sealing surfaces if necessary. Contact Phuel if in doubt.
- Replace all elastomeric seals.
- Re-assemble BOP
- Pressure Test to maximum working pressure and 300 psig per API 6A – PSL3 (Witnessed by certifying authority where applicable).
- Inspect paintwork and repair where necessary.

5.2.3 **Five Yearly**

- Yearly maintenance, plus the following.
- Carry out surface NDE on all component threads and damaged surfaces.
- Pressure Test to maximum test pressure and 300 psig per API 6A – PSL3 (Witnessed by certifying authority where applicable).

5.3 **Safety**

- This product contains high pressures, when in operation. Failure of any part may cause injury. Welding, corrosion, rough handling, or other abuse may affect the Integrity of this product.
- Many of the components are heavy and should not be lifted without lifting aids.
- Wear appropriate personal protective equipment.
- Do not over exert yourself while using torque wrenches. Use appropriate mechanical advantages when available.

- Ensure that all tools and equipment are in good condition and are suitable for intended use.

5.4 Tools

The following tools are required.

- Non marking Memac Chain Wrench.
Other pipe wrenches may be used but will mark equipment.
- Piston Seal Sub Assembly Tool (Part No. 900-1577-400).
- Allen Key's (7/32, 5/16" & 3/8" long version for removing Actuators from the BOP).
- Adjustable Spanner's.
- External Circlip Pliers.
- 1/4"-20 UNC Socket Head Cap Screw x 1" Long.
- Pair of Long Nose Pliers.
- Large Flat ended Screwdriver.
- Hide or Rubber Mallet.
- Silicon Grease.
- Seal Grease
- Oil spillage-cleaning kits.
- 5K Hydraulic pump and Gauge to operate Actuators.
- Lifting equipment/Aids, as required.

5.5 Ram Seal Redress

5.5.1 Access Rams

This procedure results in the removal of the actuator assembly from the BOP body in order to gain access to the rams.

- Ensure Rams are fully opened.
- Back off the Actuator from the BOP using the extended 3/8" Allen Key in the Cap Screw heads on the Locking Sleeve. Do not loosen the cap screws during this process.
- Once the thread is fully disengaged, pull the Actuator fully back to the End Stops.

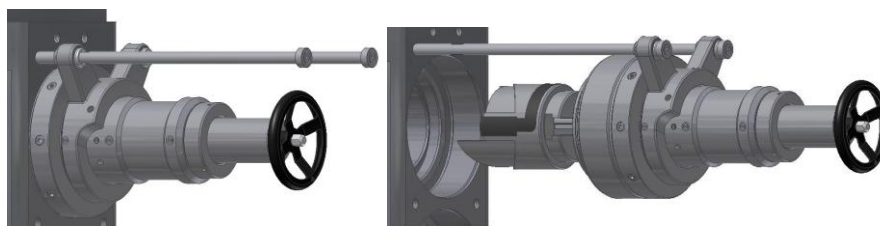


Figure 8: Accessing the rams

5.5.2 Ram Removal (not required to redress ram seals)

- Remove Ram from Actuator, by sliding the Ram off the Ram Tee.
- Pump the ram forward by about 2" if required to clear the housing.

5.5.3 Wireline Ram Seal Redress

- The Inner Ram Seals can be removed by simply sliding the seal out to either side
- The Outer Seal can be removed by levering out one end with a suitable instrument and simply pulling off.
- The Ram is now completely stripped down. Clean and inspect all parts for evidence of damage or excessive wear. Check the seals and replace if required. Repair or replace any damaged or worn parts. If the seals are to be redressed use the parts from the specified redress kit.
- Assemble Outer Seals by pushing the tab into the slot in the ram and working it around the radius of the ram. Tap home using a rubber or hide mallet and if required use a screwdriver to lever the second tab over the edge of the slot. Take care not to significantly damage Seal during assembly but expect that some slithers of rubber will be produced as the corners of the rubber seals are removed by the assembly operation. Tap all around the circumference of the seal to ensure that it is bedded into the groove and that the seal is not protruding above the ram diameter.
- Slide the Inner Seals into Ram taking care not to dislodge the outer seal in the process.

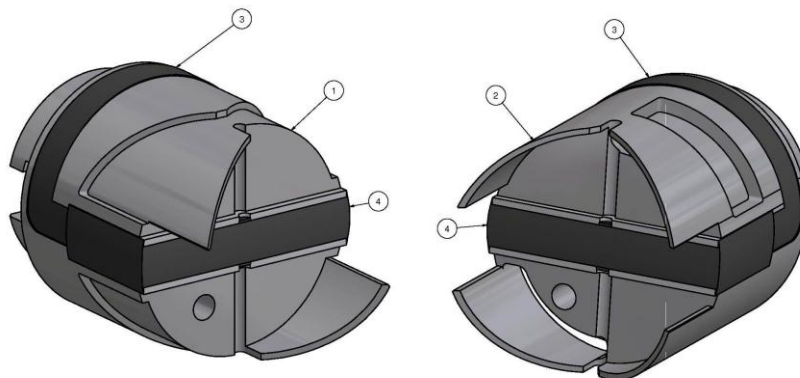


Figure 9: BOP Wireline Rams

5.5.4 Shear Blade Redress

- The shear blades must be replaced if they have been used to cut the wire. If they have not been used then there is usually no need to replace them.
- Remove the rubber grommet (7) and withdraw the pin (6).
- Remove the shear blade – taking note of the orientation so that it can be replaced in the same way.
- Re-assembly is the reverse of dis-assembly – ensure that the blades have the correct orientation so that they overlap each other when the rams are closed. It is recommended that the rams be fitted together on the bench before installing in the BOP body.
- The inner and outer seals are replaced in the same was as described earlier

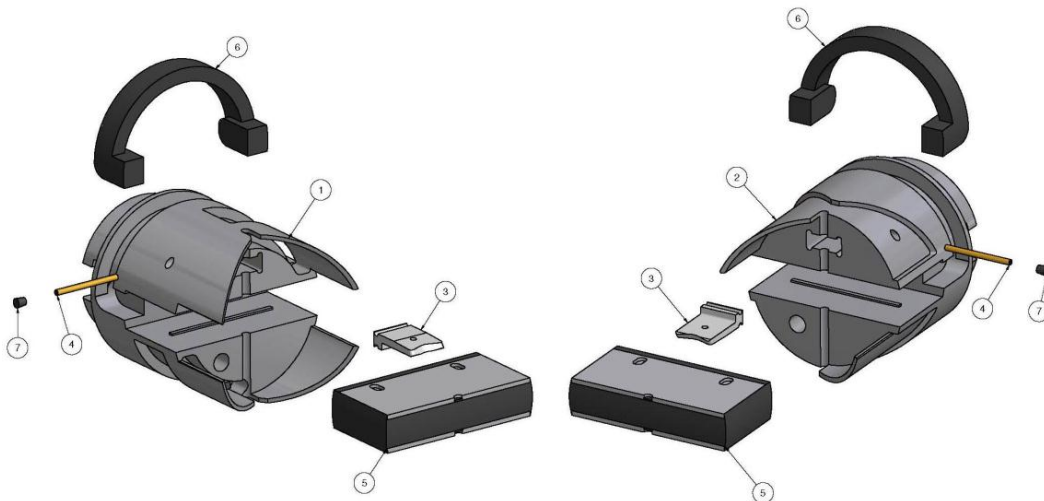


Figure 10: BOP Shear Rams

5.5.5 Re-attach to BOP Body

- If the rams were removed from the actuator (Section 5.5.2) then slide the ram back onto the Tee taking careful note of the orientation of the rams depending on its intended use for the BOP assembly. (i.e. if pressure is to be held from below then the outer seal must be on top – otherwise it must be on the bottom). Attach a hydraulic pump to the open port of the actuator and pump the rams back into the recess in the actuator ensuring that the ram does not hang up on the actuator front face. When fully back remove the hydraulic pump.

Note - It is still possible to assemble the actuator to the BOP without pumping back the rams but more effort may be required to allow the thread to make up.

- Apply a generous coating of grease to the inner and outer seals.
- Push the Actuator back into BOP Body taking care that the edges of the guide pass into the seal bore and make-up the thread using a 3/8"



User Manual

15k Quad BOP Assembly

hex key in the cap head screws to provide the torque. Making up the thread will drive the actuator assembly fully home.

Note – When making up Actuator thread into the BOP Body, ensure the Hydraulic line fittings line up, with the Actuator Lines, as the Actuator is being made up.

- Make up the hydraulic fittings hand tight. Do not over tighten as this causes problems when disassembling again later.
- The Ram Assembly is now fully made up. Repeat this procedure for each ram seal that need to be replaced.

User Manual

15k Quad BOP Assembly

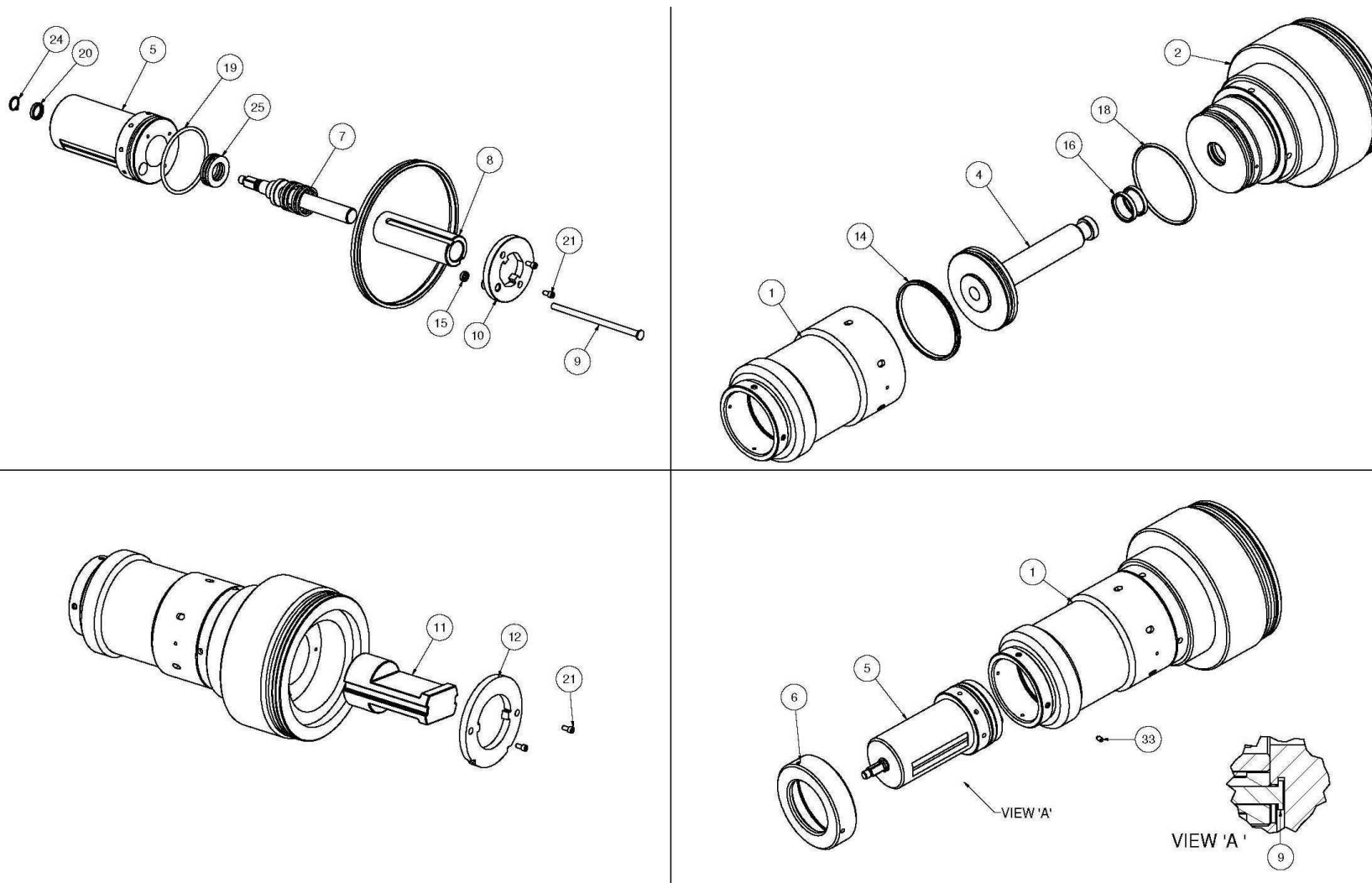


Figure 11: Actuator Assembly Steps – Part 1

User Manual

15k Quad BOP Assembly

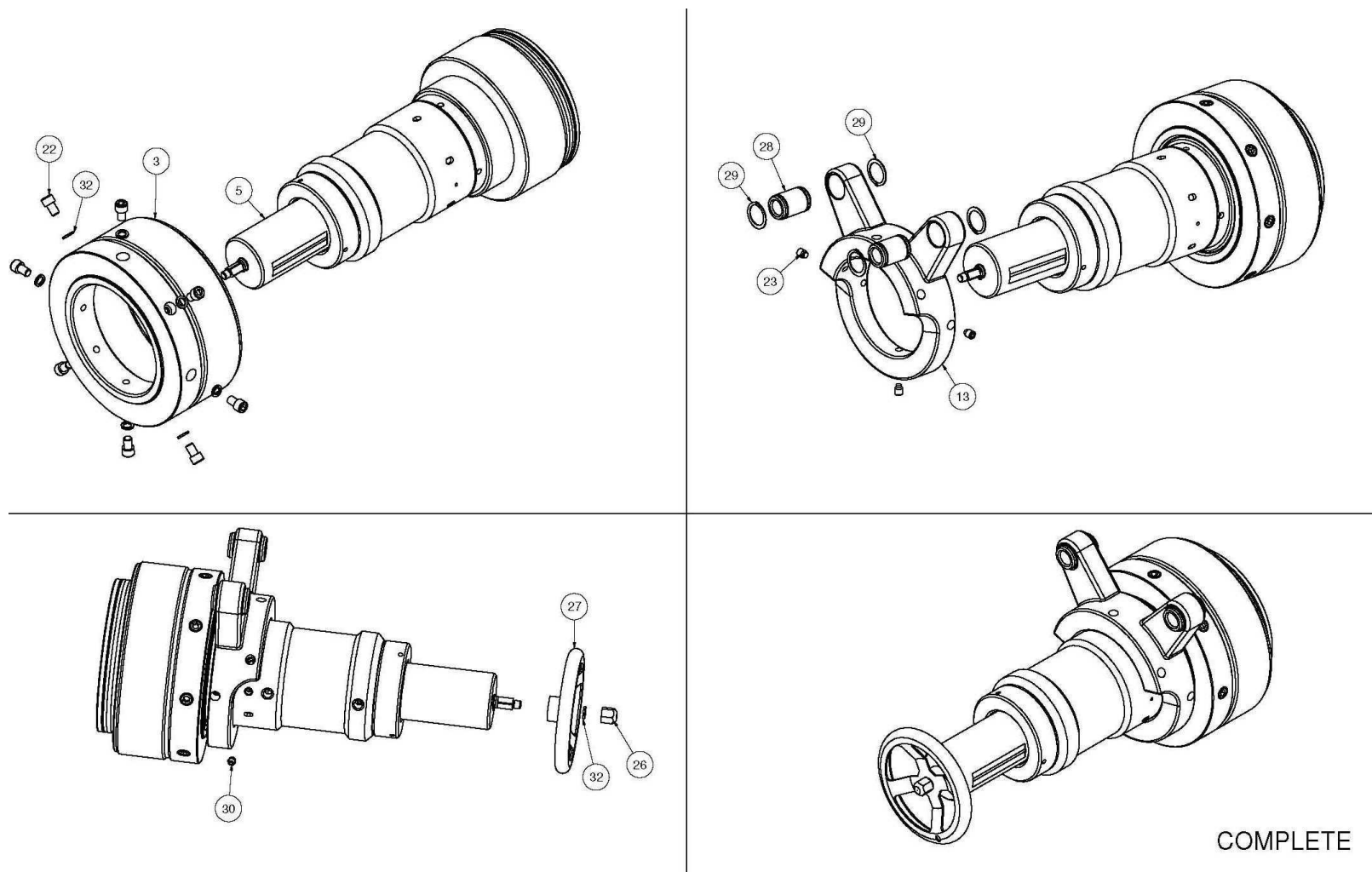


Figure 12: Actuator Assembly Steps – Part 2

User Manual

15k Quad BOP Assembly

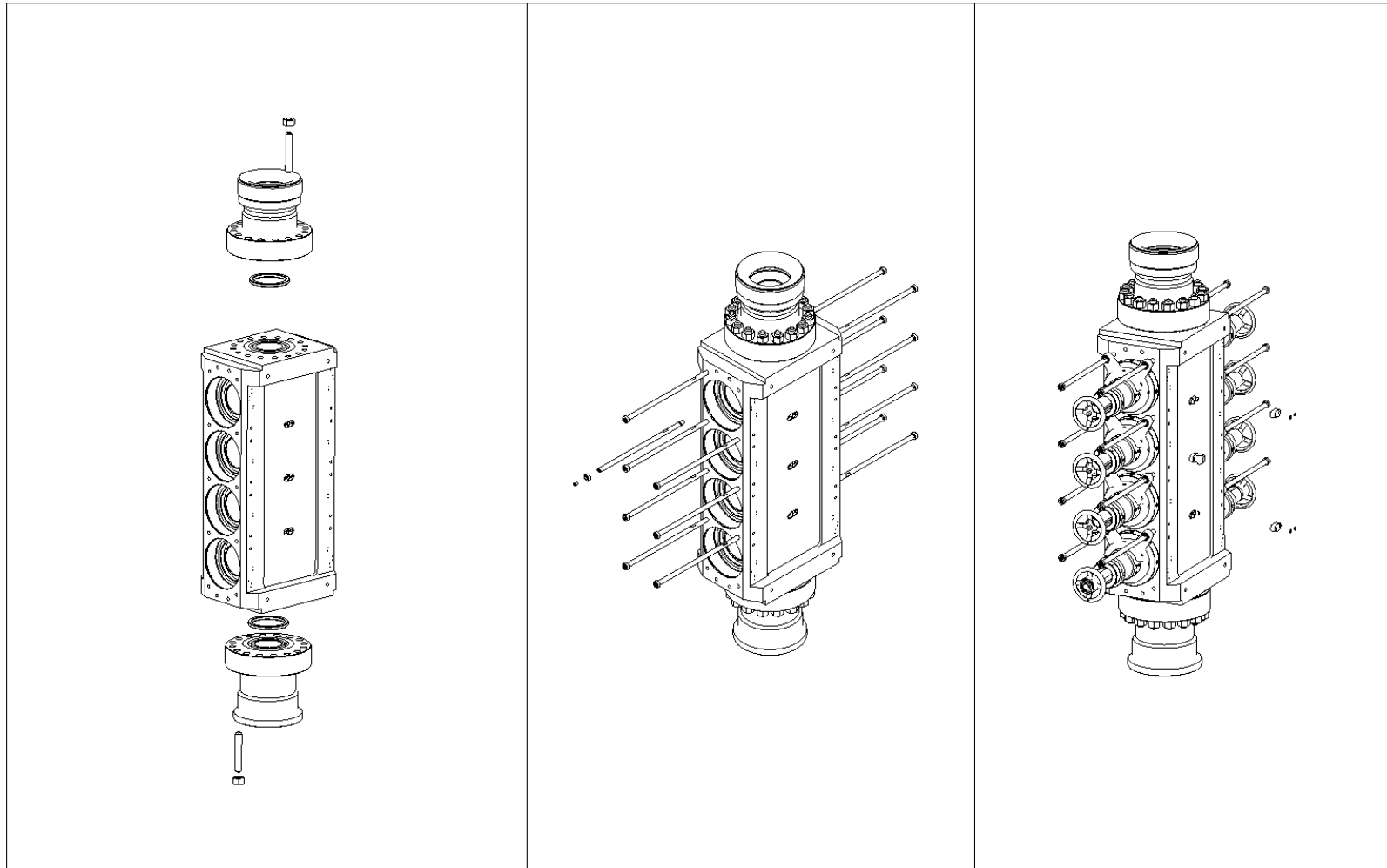


Figure 13: BOP Assembly Steps – Part 1

User Manual 15k Quad BOP Assembly

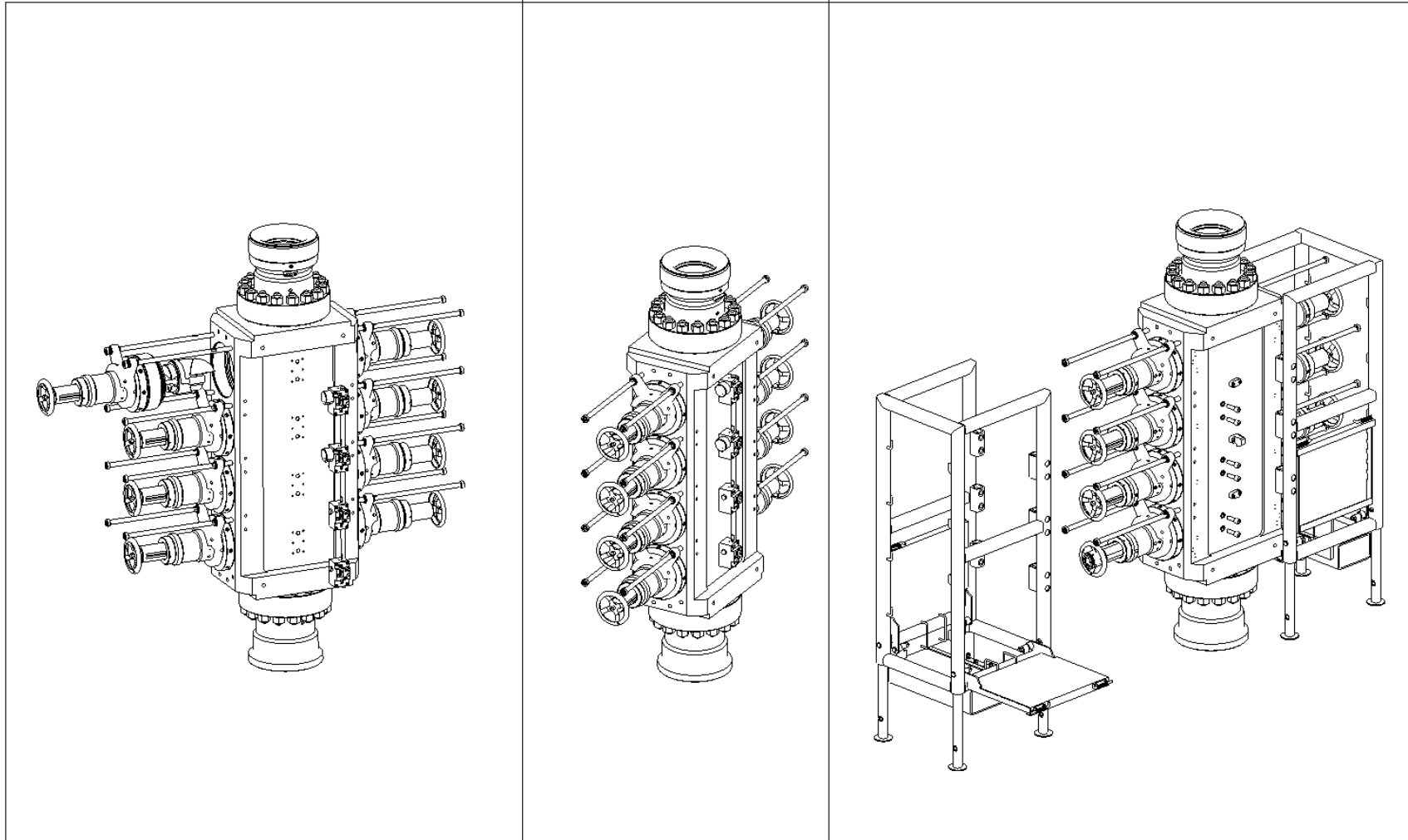


Figure 14: BOP Assembly Steps – Part 2



User Manual 15k Quad BOP Assembly

5.6 Maintenance Record Sheet

Date Performed	Type of Maintenance	Performed By	Verified By	Comments

Table 3: Maintenance Record



User Manual

15k Quad BOP Assembly

6 Testing

All testing is to be carried out in the designated test area and by suitably qualified and competent personnel.

WARNING: Trapped air requires considerable time to compress and when it is compressed is highly dangerous. It has enough stored energy to separate parts with considerable force

6.1 Prepare BOP for pressure testing

- Check the pressure rating for all test equipment is sufficient to allow testing to be carried out.
- Check / replace o-ring on the pin part of the BOP.
- Ensure BOP is placed in an area suitable for pressure testing.
- Fit the BOP to the test stump using the grayloc clamp.
- Fill BOP with test fluid.
- Connect the hydraulic hoses from the BCU to BOP to operate the rams.
- Check all connections / hoses that they are secured with safety wire before use
- Vent BOP Rams by hydraulic operation of the Rams.
- On completion of venting the Rams fit test cap, ensuring the valve is in the open position to allow air to vent and top up the BOP with Test Fluid. Once all air is expelled close valve.
- The BOP is now prepared for testing

6.2 Body Test

- Ensure that all the rams are in the open position
- Close equalizing valve 1A, all other equalizing valves to be open.
- Disconnect pipe on the grease injection and the chemical injection connector plate to test check valves.
- Fit the pressure test hose with security link
- Pump slowly up to 300 psi and observe for leaks. Hold Time 5 min
- Bleed the pressure to zero
- Pressurize to MWP of BOP and observe for leaks. Hold Time 15 min
- Bleed of pressure to zero and drain BOP.



User Manual

15k Quad BOP Assembly

6.3 Ram test: Shear seal

- With BOP Rams in the open position and fill up the bop with the test medium by using the test pump. Ensure valve on test cap remains open for the duration of this test.
- Close Shear Ram, this is done by activating the BCU Shear seal valve to "close" position, then pressurize up to a maximum of 2700 psi on the ram – Test fluid will be observed coming out of the Test Cap valve.
- Close equalizing valves. (Note - equalizing valve setup to be added to the test chart with number and position)
- Connect pressure test pump to the Test Stump so that pressure testing is done from the underside of rams and up
- Observe Test Cap valve during testing for fluid leaking out under pressure.
- Pressurize up to 300 psi low pressure test - observe if there are leaks. Hold Time 5 min
- Bleed the pressure to zero
- Press up to the MWP for the bop in accordance documentation - keep pressure in 15 min.
- Bleed the pressure to zero.
- Open rams on bop by enabling BCU Shear seal valve to "open" position.

6.4 Wireline Ram Seal Test (Between the ram)

- Ensure Test Cap is not fitted
- Ensure all Rams are in open position
- Open the equalizer valve between the respective rams to be tested.
- Connect the test hose in the 1A on equalizing block (gauge port)
- Close the Middle Ram.
- Open Snaptite connector on the test stump for verification of leakage on the lower ram.
- Fill the BOP with test fluid to above the Upper Ram. Close the Upper Ram pair by setting Ram to 2700 psi by activating the valves on the BCU to "close position."
- Pump test medium thru the equalizing. Block 1C to see fluid is rising above the upper ram.
- **Close equalizing valve 1C, 2A, 2B, 3A, 3B, 3C & 3D.**
- **Open equalizing valve : 1A, 1B, 1D, 2C & 2D**
- Pressure up to 300 psi in 5 minutes and observe for leaks
- Bleed off to zero
- Press up to MWP for bop according to documentation for current bop for 15 min
- Bleed pressure to zero.



User Manual

15k Quad BOP Assembly

- **Close equalizing valve 1B & 2C.**
- **Open equalizing valves 1C, 1D, 2B & 2D**
- Pressure up to 300 psi in 5 minutes and observe for leaks
- Bleed off to zero
- Press up to MWP for bop according to documentation for current bop for 15 min
- Bleed pressure to zero.
- Open the rams- open lower first, and then the upper ram.

6.5 Post Test Procedure

- Disconnect All Hoses
- Remove Test Cap
- Remove BOP from Test Stump
- Grease end connections and fit oiled thread protectors

6.6 Actuator

- Connect both ports to a suitable pump system (preferably with two way valve and reservoir). Use a good quality hydraulic fluid (Tellus 22).
- Pump into the open port to fill the system and drive the piston fully back. Do not exceed the maximum operating pressure of the cylinder (3,000 psi). Reverse the direction of the valve and pump the piston to the fully open position to displace any remaining air for the system.
- Increase pressure to 3,000 psi and maintain for 10 minutes to ensure that all seals are holding. Reverse the valve and pump the piston to the closed position. Increase the pressure to 3,000 psi and maintain for 10 minutes to ensure that all seals are holding. Strip down and replace any seals that are leaking until this test can be achieved successfully.
- Remove the pump.

7 Parts List and Drawings

Item Number	Part No	Quantity	Description
1	194-2924-480	1	QUAD BOP BODY
2	190-3293-HV0	8	15K ACTUATOR ASSY
3	Not Used		
4	190-3752-HV0	3	15K WIRELINE GUIDE RAM ASSEMBLY
5	190-3757-HV0	1	15K SHEAR RAM ASSEMBLY
6	190-3446-HV0	4	HP EQUALISATION BLOCK
7*	125-3070-HV0	1	7-1/16 BX 15M FLANGE X GRAYLOC M72P
8*	125-3069-HV0	1	7-1/16 BX 15M FLANGE X 15-2 QU BOX
9	190-3350-STL	1	15K QUAD CRASH FRAME
10	190-3750-HV0	1	HP SAVER INJECTION ASSEMBLY
11	190-3751-HV0	1	HP CHECK VALVE
20	190-3730-480	3	15K EXTENSION BAR
21	190-3720-480	2	15K BOP BLANK SUB
23	190-2413-X90	16	SLIDER ROD 21.5 LONG
24	190-1537-316	16	END STOP
25	190-3731-480	4	15K PORT BLANK END
26	190-3732-480	1	15K RIGHT ANGLED PORT
27	190-3383-316	1	VALVE PLATE (QUAD)
30	802-3802-H80	11	PISTON T-SEAL (0.575)
31	801-0115-V90	2	O-Ring - B.S Size 115
32	900-2218-STL	2	SEAL RING BX 156
33	SHC-0587-3A4	4	Soc Hd Cap Size 1/2 Length 1.5 in
34	WNL-0580-316	4	WASHER NORDLOCK (M12)
35	SHC-0668-HTS	24	Soc Hd Cap Size 3/4 Length 2.5 in
36	CSU-0585-3A4	26	CSink Soc Hd Size 1/2 Length 1 in
37	WNL-0660-316	24	Nordlock Washer size 3/4
38	125-3371-AB7	32	STUD 1.500-8 UN - 2A X 9.500 LONG
39	128-2280-A2H	32	HEAVY DUTY NUT 1.500-8 UN
41	801-3729-PEK	2	BACK UP (115)
100	910-3191-N66	1	15-2 MALE PROTECTOR

Table 4: BOP Parts List Part No 194-3063-HV0

** Items 7 & 8 are not part of the BOP assembly 194-3063-HV0 but have been included for clarity*

User Manual

15k Quad BOP Assembly

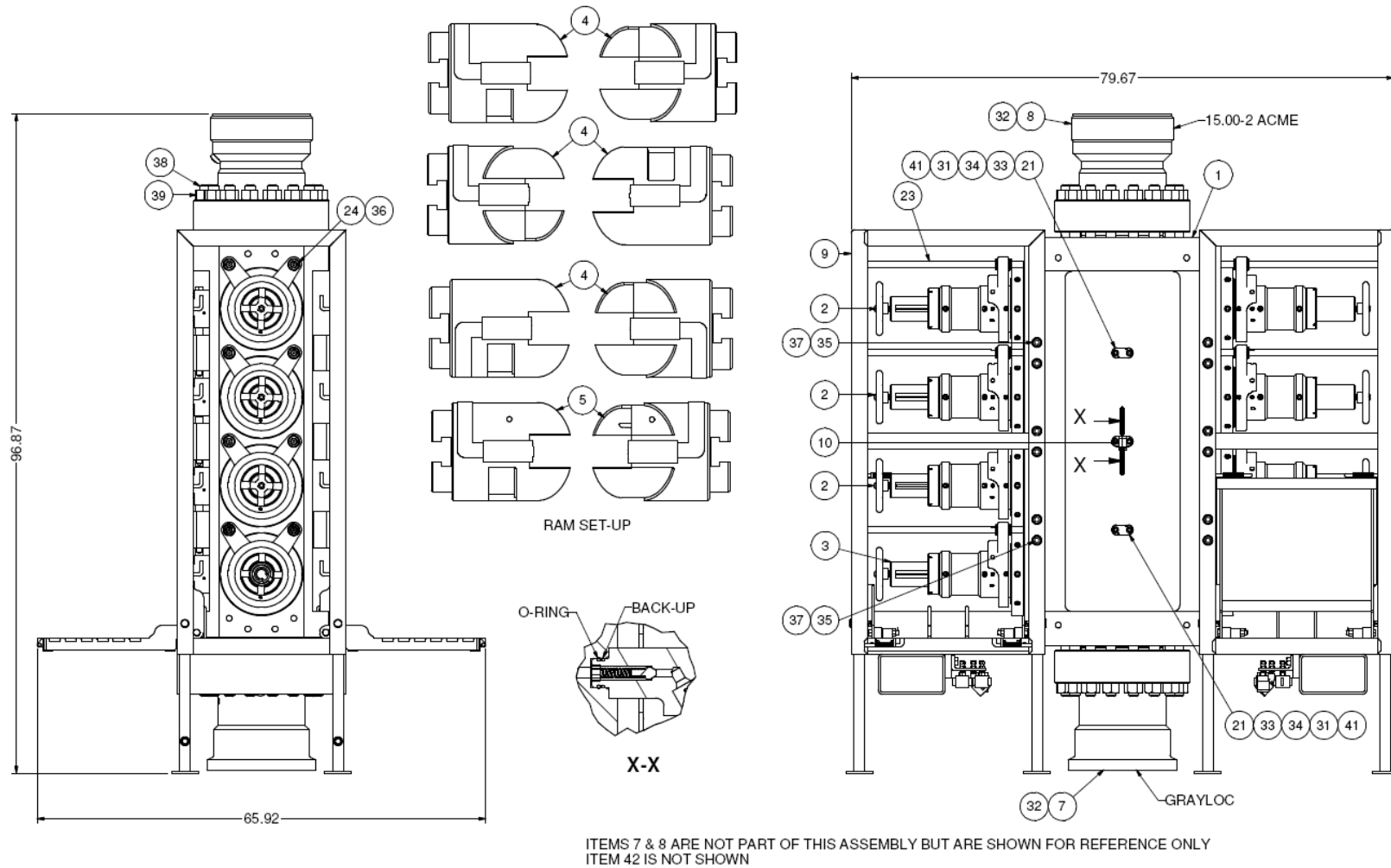


Figure 15: BOP Assembly Drawing 194-3063

User Manual

15k Quad BOP Assembly

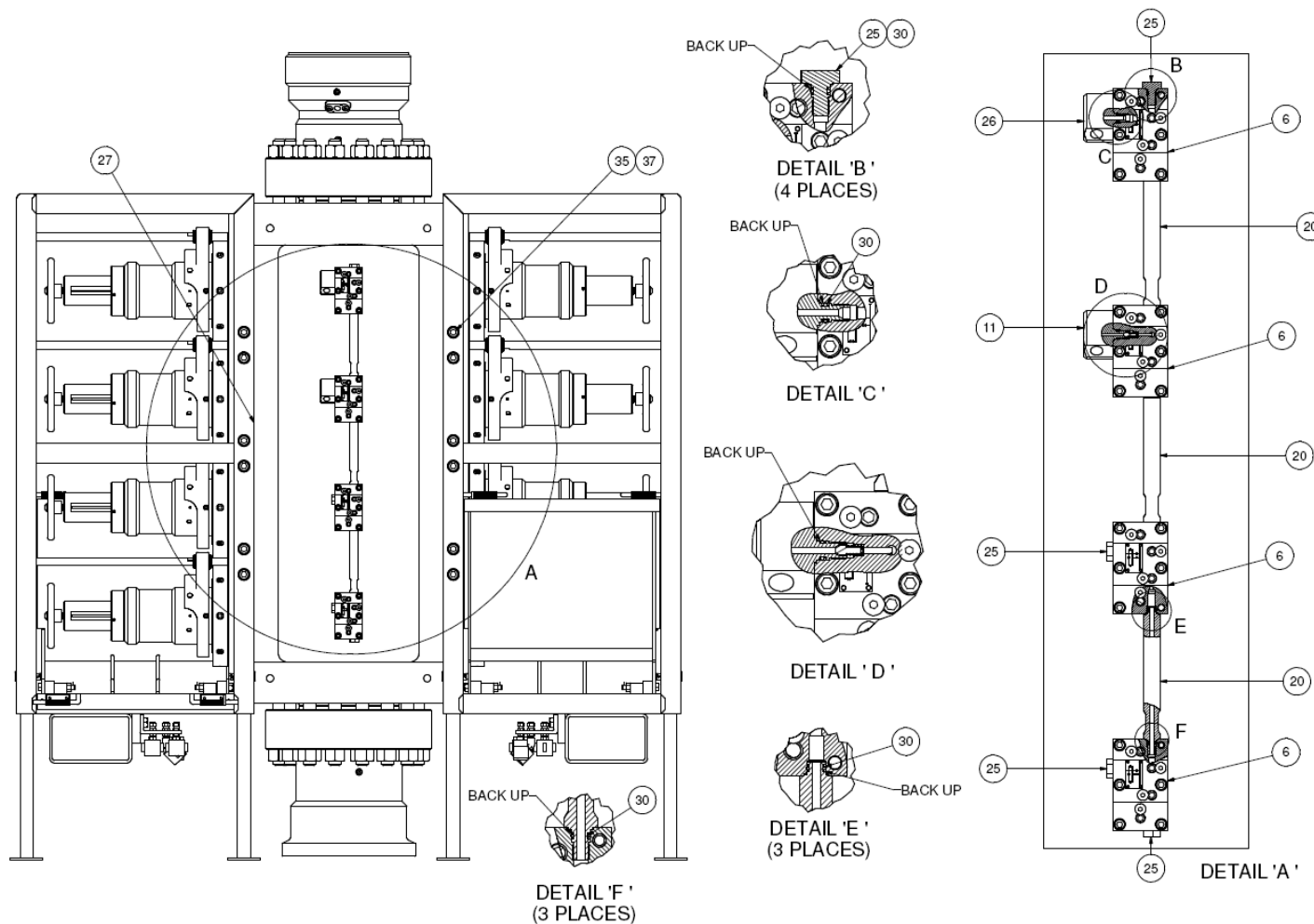


Figure 16: BOP Assembly Drawing 194-3063

Item Number	Part No	Quantity	Description
1	190-3715-480	1	HP SINGLE GUIDED RAM
2	190-3714-480	1	HP GUIDE RAM 6-3/8
3	190-1715-H90	2	OUTER SEAL - SIZE 7.00
4	190-3702-H90	2	BOP INNER SEAL SIZE 7.20

Table 5: Wireline Ram Assembly Parts List Part No 190-3752-HV0

Item Number	Part No	Quantity	Description
1	190-3743-480	1	HP GUIDE SHEAR RAM - 6-3/8
2	190-3744-480	1	HP SINGLE GUIDE SHEAR RAM -6-3/8
3	190-3740-411	2	SHEAR BLADE
4	190-3741-B21	2	SHEAR BLADE PIN
5	190-3702-H90	2	BOP INNER SEAL SIZE 7.20
6	190-1715-H90	2	OUTER SEAL - SIZE 7.00
7	190-3776-EP4	2	TAPERED BUNG

Table 6: Shear Ram Assembly Parts List Part No 190-3757-HV0

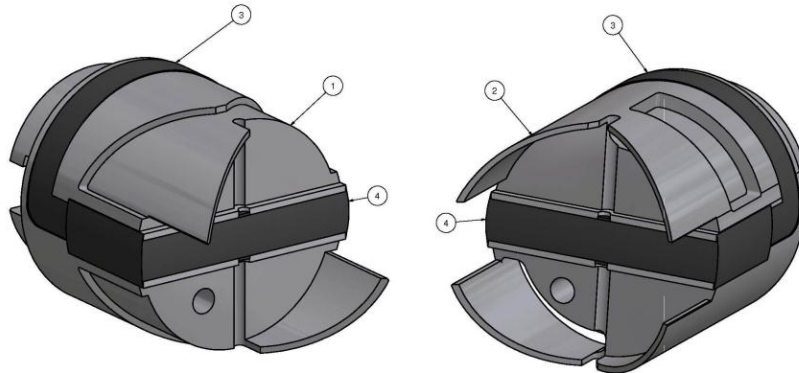


Figure 17: Wireline Ram Assembly Drawing 190-3752

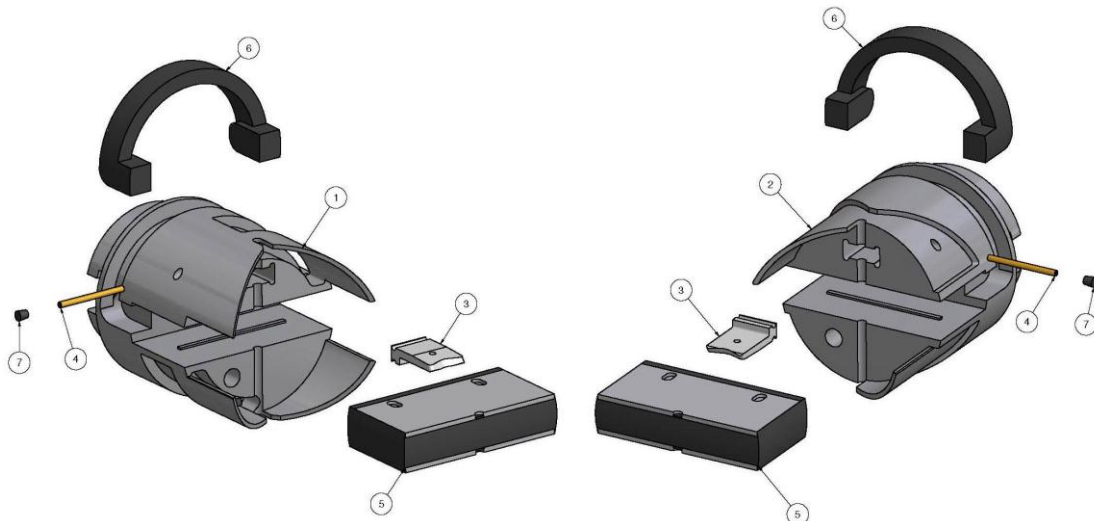


Figure 18: Shear Ram Assembly Drawing 190-3757



User Manual

15k Quad BOP Assembly

Item Number	Part No	Quantity	Description
1	190-3272-480	1	15K PISTON HOUSING
2	190-3669-480	1	15K PISTON SEAL SUB
3	190-3668-480	1	15K LOCKING SLEEVE
4	190-4346-480	1	PISTON
5	190-2927-480	1	ROTATE CYLINDER CAP
6	190-1649-480	1	CAP COLLAR
7	190-2772-480	1	DRIVE ROD
8	190-1726-480	1	DRIVE SLEEVE
9	190-1645-316	1	INDICATOR ROD
10	190-1773-STL	1	DRIVE KEY PLATE (CAST)
11	190-1774-STL	1	RAM TEE
12	190-2838-480	1	RAM KEY PLATE
13	190-3269-480	1	15K ACTUATOR BRACKET
14	802-2163-H85	1	PISTON T-SEAL 5.500
15	802-1699-H85	1	Rod T-Seal Assy
16	802-3677-H85	2	15K ROD T-SEAL 1.625
17	802-3678-H85	1	PISTON T-SEAL 9.625
18	801-0354-V90	1	O-Ring - B.S Size 354
19	801-0345-V90	1	O-Ring - B.S Size 345
20	802-2505-H85	1	ROD T-SEAL 0.825 DIA
21	SHC-0503-HTS	2	Soc Hd Cap Size 1/4 Length 0.5 in
22	SHC-0585-3A4	8	Soc Hd Cap Size 1/2 Length 1 in
23	SDU-0582-HTS	6	Set Screw Dog Point 1/2 UNC X 0.625 in
24	190-2491-STL	1	EXTERNAL CIRCLIP - 0.750 DIA
25	190-1696-STL	1	Thrust Bearing (FAG 812 06)
26	190-1704-STL	1	Acorn Nut 1/2-13
27	190-1702-STL	1	Hand Wheel
28	190-1608-STL	2	Ball Slide (TK-25-UU)
29	190-1756-STL	4	EXTERNAL CIRCLIP
30	100-2179-STL	1	GREASE NIPPLE 1/8 NPT
31	801-0254-V90	1	O-Ring B.S Size 254
32	WNL-0580-316	9	WASHER NORDLOCK (M12)
33	SDU-0503-HTS	1	Set Screw Dog Point Size 1/4 Length 0.5 in
35	SHC-0502-HTS	2	Soc Hd Cap 1/4 UNC x 0.38 Long

Table 7: Actuator Parts List Part No 190-3293-HV0

User Manual

15k Quad BOP Assembly

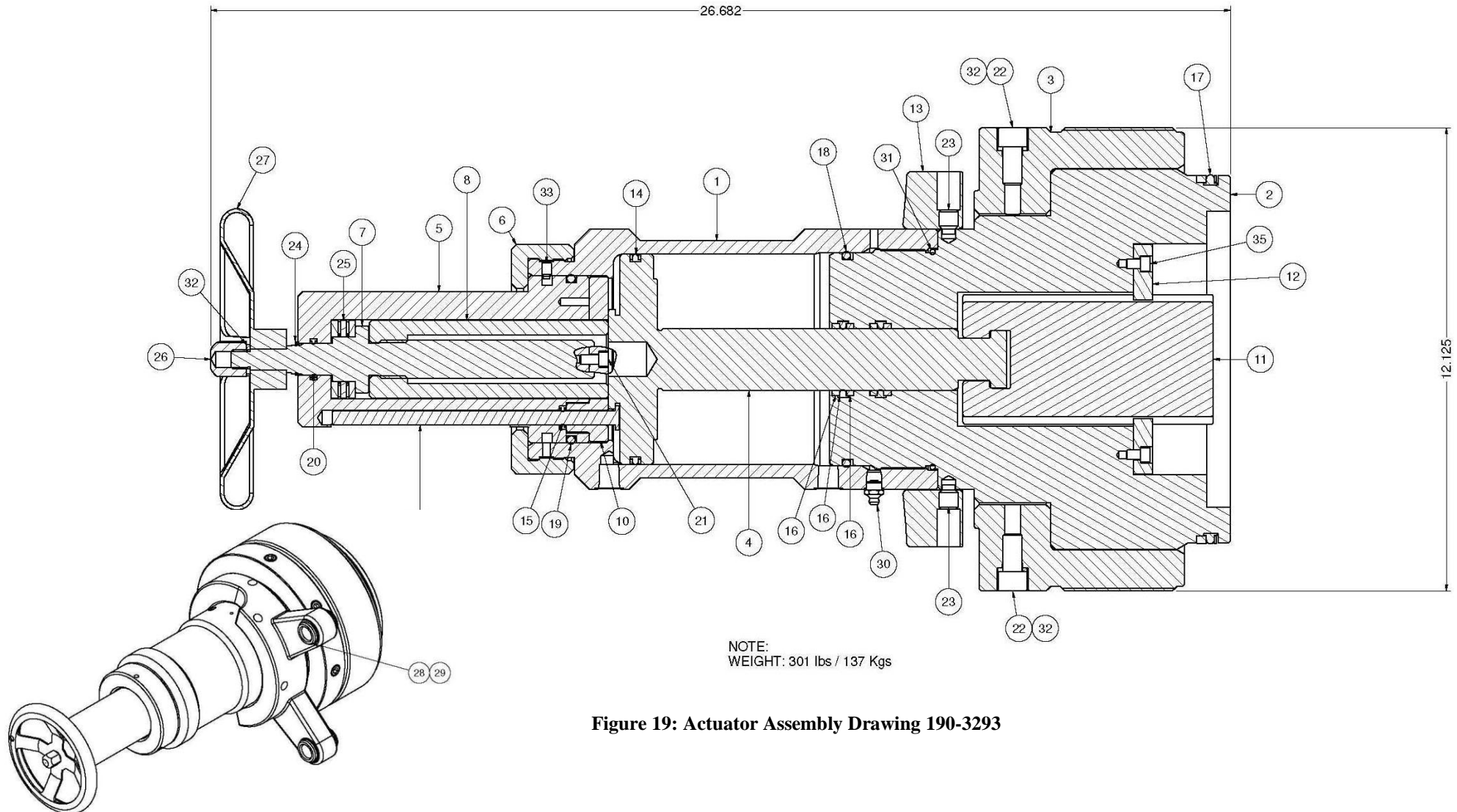


Figure 19: Actuator Assembly Drawing 190-3293

Item Number	Part Number	Quantity	Description
1	190-3718-480	1	15K EQUALISING BLOCK
2	110-3127-316	4	HP ISOLATION VALVE
3	190-2823-PEK	4	VALVE SEAT
4	190-1758-416	2	AFO Plug
5	802-3801-H80	4	PISTON T-SEAL (0.456)
7	802-3803-H80	2	PISTON T-SEAL (0.795)
9	SHC-0555-HTS	6	SOC HD SCREW 3/8 UNC X 3.0 LONG
10	SBC-0543-304	4	Button Hd Screw Size 3/8 Length 0.625 in
11	WNL-0540-316	10	Nord Lock Washer Size 3/8
12	190-3328-316	1	VALVE PLATE

Table 8: Equalising Block Assembly Parts List Part No 190-3446-HV0

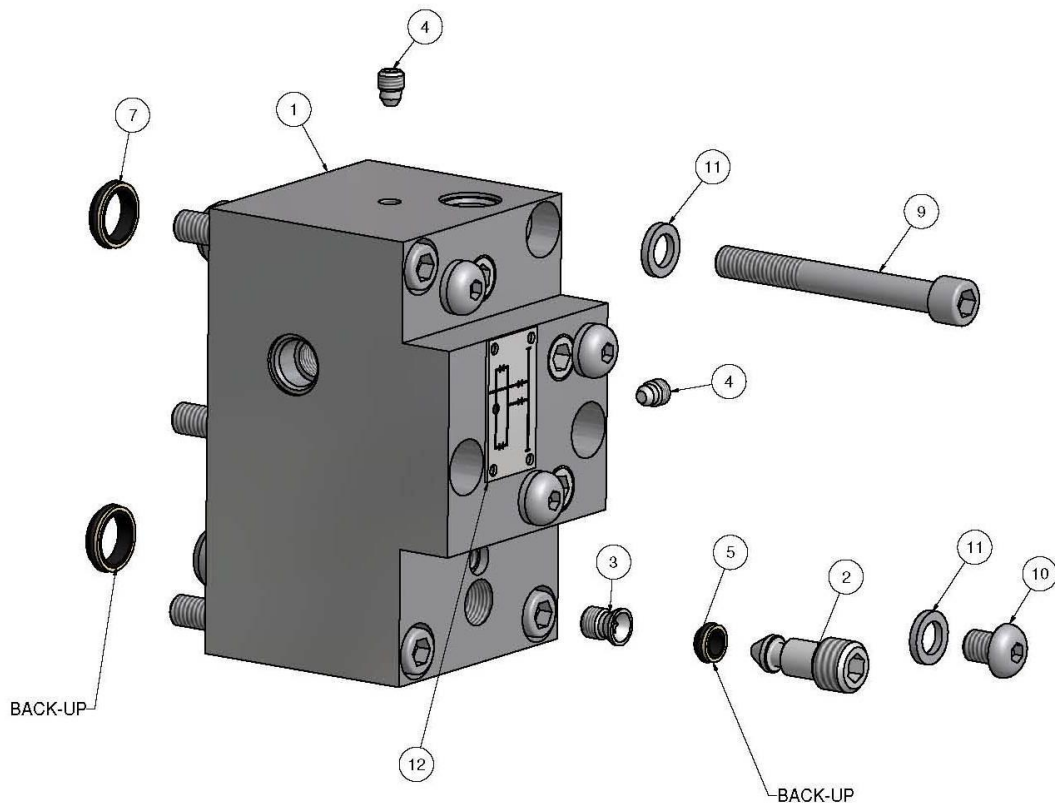


Figure 20: Equalisation Block Drawing 190-3446

Item Number	Part Number	Quantity	Description
1	190-3732-480	1	15K RIGHT ANGLED PORT
2	100-2114-PEK	1	CHECK VALVE SEAL
3	145-2185-STL	1	COMP SPRING
4	802-3802-H80	1	PISTON T-SEAL (0.575)
100	910-2186-N66	1	1/2in SHIPPING CAP PLUG

Table 9: HP Check Valve Assembly 190-3751-HV0

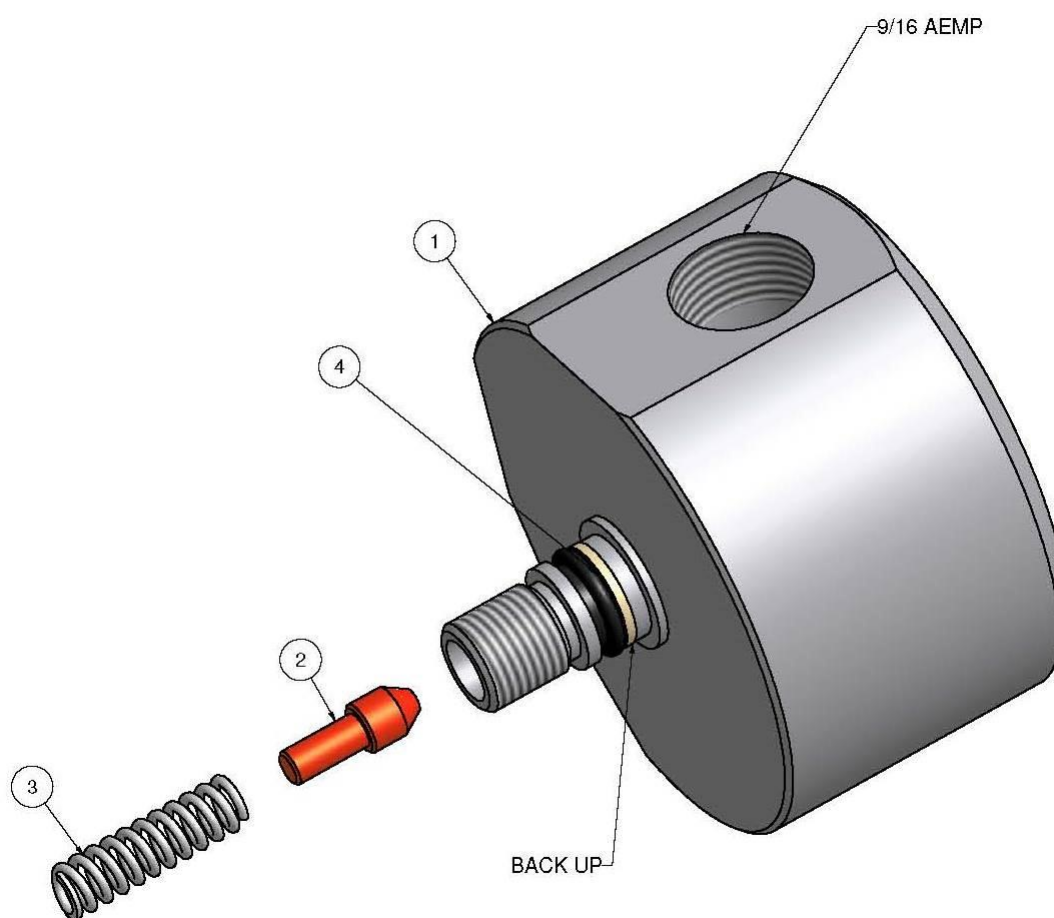


Figure 21: Check Valve Assembly Drawing 190-3751

Item Number	Part Number	Quantity	Description
1	190-3719-480	1	15K BOP CHECK HOUSING
2	100-2114-PEK	1	CHECK VALVE SEAL
3	801-3729-PEK	1	BACK UP (115)
4	190-3200-STL	1	HOLLOW LOCK SCREW
5	100-2212-STL	1	COMP SPRING
6	801-0115-V90	1	O-Ring - B.S Size 115
7	WNL-0580-316	2	WASHER NORDLOCK (M12)
8	SHC-0587-3A4	2	Soc Hd Cap Size 1/2 Length 1.5 in

Table 10: Saver Injection Assembly Parts List Part No 190-3750-HV0

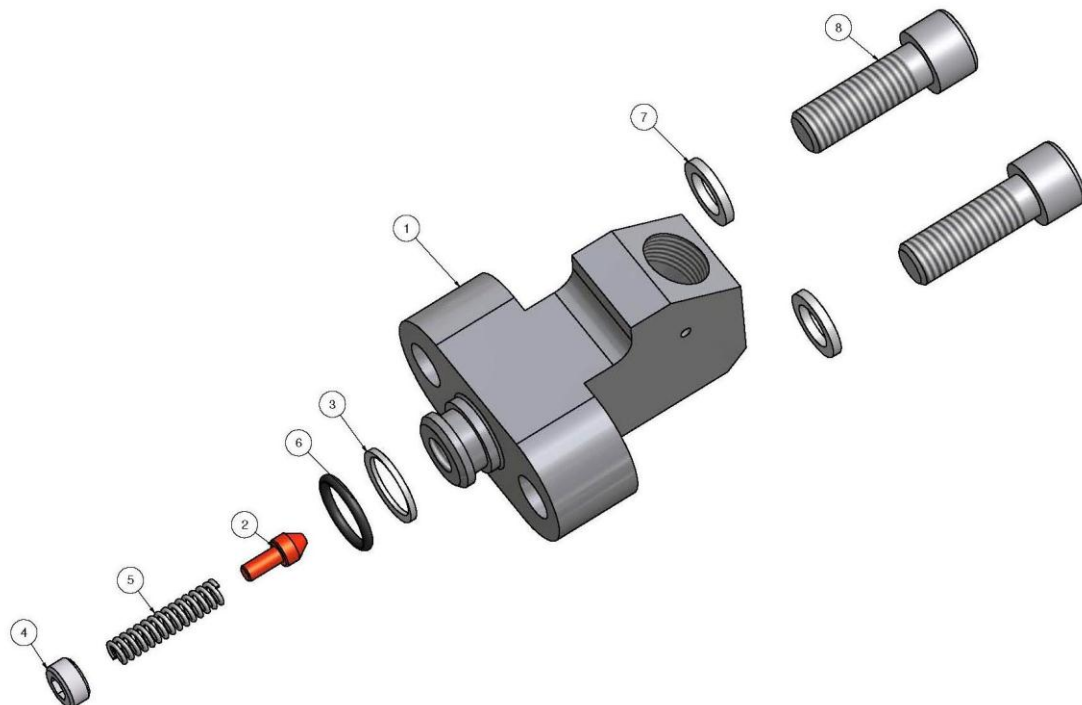


Figure 22: Saver Injection Assembly Drawing 190-3750

Item Number	Part Number	Quantity	Description
1	125-2991-480	1	FLANGE X-OVER 7 1/16 X 15-2
2	110-2986-480	1	SAVER SUB (15K WP)
3	110-3127-316	1	HP ISOLATION VALVE
4	190-2823-PEK	1	VALVE SEAT
5	801-3126-PEK	1	BACKUP (114)
6	801-0114-V90	1	O-Ring - B.S Size 114
7	801-0108-V90	1	O-Ring - B.S Size 108
8	117-2166-STL	1	CIRCLIP INTERNAL 18mm (DHO-18)
9	WNL-0580-316	2	WASHER NORDLOCK (M12)
10	SHC-0585-3A4	2	Soc Hd Cap Size 1/2 Length 1 in
11	801-3125-PEK	1	BACKUP (108)
100	910-3192-N66	1	15-2 FEMALE PROTECTOR

Table 11: Top Sub Assembly Part No 125-3069-HV0

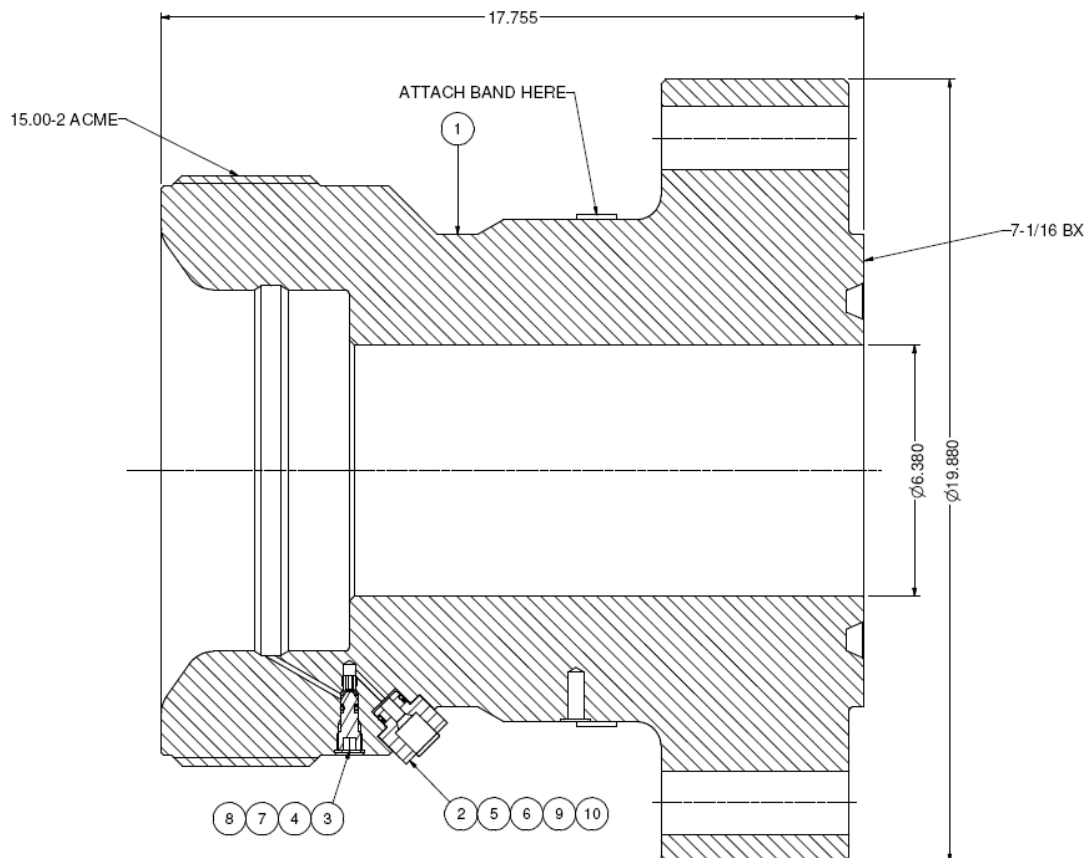


Figure 23: Top Sub Assembly Drawing 125-3069

Item Number	Part Number	Quantity	Description
1	125-2989-480	1	FLANGE X-OVER 7 1/16 X GRAYLOC M72P

Table 12: Top Sub Assembly Part No 125-3070-HV0

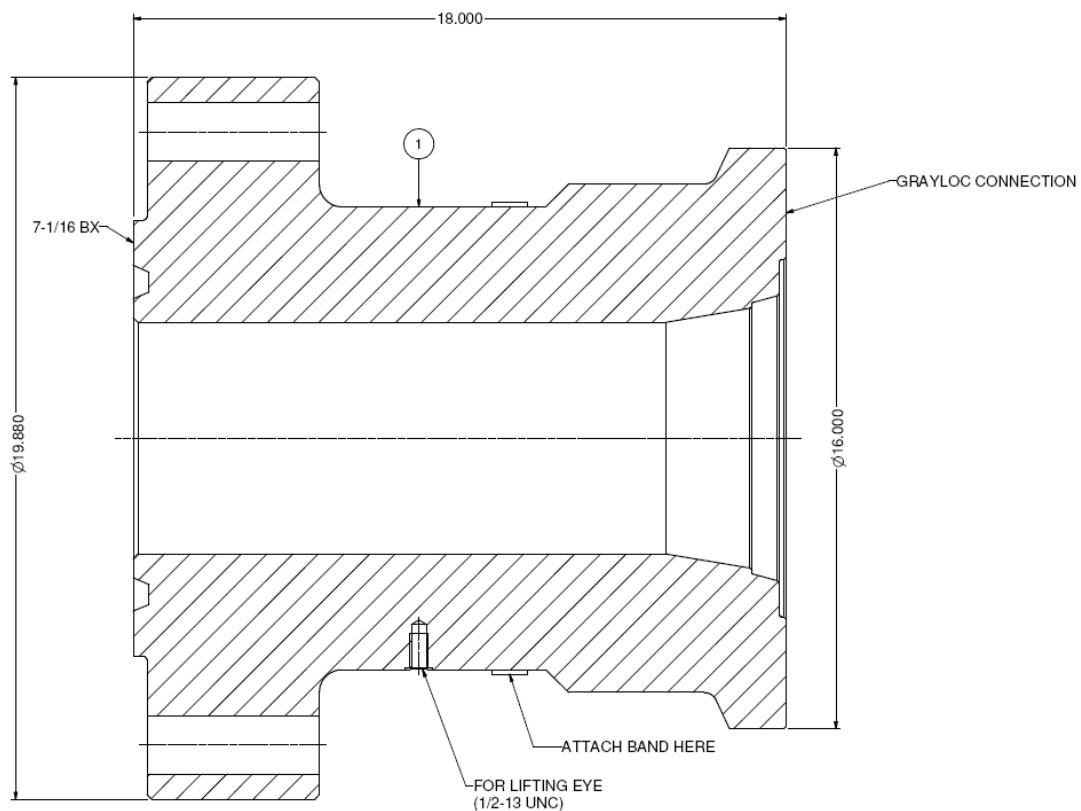


Figure 24: Bottom Sub Assembly Drawing 125-3070

8 Spares

Use only spares supplied or approved by Phuel Oil Tools Ltd.

It is recommended that sufficient quantities of the following spares be maintained to ensure that the equipment is always available when required.

Elastomeric spares are supplied in Viton material as standard. Other materials are available please specify when ordering.

8.1 Redress Kits

Part No.	Qty	Item Description	Comments
RDK-3293-HV0	8	Redress Kit for 190-3293-HV0 Actuator	All seals required for a full redress.
RDK-3446-HV1	4	Redress Kit for Equalisation Assembly	All seals required for a full redress.
RDK-3750-HV0	1	Redress Kit for Saver Injection Assembly	All seals required for a full redress.
802-3802-H80	12	Piston T-Seal (0.575)	1 required for 190-3751 (Check Valve Assembly)
801-0115-V90	2	O-Ring – B.S Size 115	
801-3729-PEK	2	Back Up (115)	

Table 13: BOP Redress Kit Part No. RDK-3063-HV0

Part No.	Qty	Item Description
802-2163-H85	1	PISTON T-SEAL 5.500
802-1699-H85	1	Rod T-Seal Assy (TR004)
802-3677-H85	2	15K ROD T-SEAL 1.625
802-3678-H85	1	PISTON T-SEAL 9.625
801-0354-V90	1	O-Ring - B.S Size 354
801-0345-V90	1	O-Ring - B.S Size 345
802-2505-H85	1	ROD T-SEAL 0.825 DIA
801-0254-V90	1	O-Ring B.S Size 254

Table 14: Actuator Redress Kit Part No. RDK-3293-HV0

Part No.	Qty	Item Description
802-3801-H80	4	PISTON T-SEAL (0.456)
802-3803-H80	2	PISTON T-SEAL (0.795)
190-2823-PEK	4	VALVE SEAT

Table 15: Equalisation Block Redress Kit Part No. RDK-3446-HV1



User Manual

15k Quad BOP Assembly

Part No.	Qty	Item Description
801-0115-V90	1	O-Ring - B.S Size 115
801-3729-PEK	1	Back Up (115)

Table 16: Saver Injection Assembly Redress Kit Part No. RDK-3750-HV0

8.1.1 Supporting Equipment

The following are available for order directly from Phuel Oil Tools Ltd or can be procured directly from your local Grayloc distributor.

Part No.	Item Description	Comments
A90501-9	Grayloc Clamp 12M	AISI 4140 NACE (ASTM A 193 B7M)
H90136-17	Studs & Nuts for Clamp 12M	ASTM A193 B7/A194 Gr2H, Zinc Plated

Table 17 : Supporting Equipment