www.pquip.com
info@pquip.com

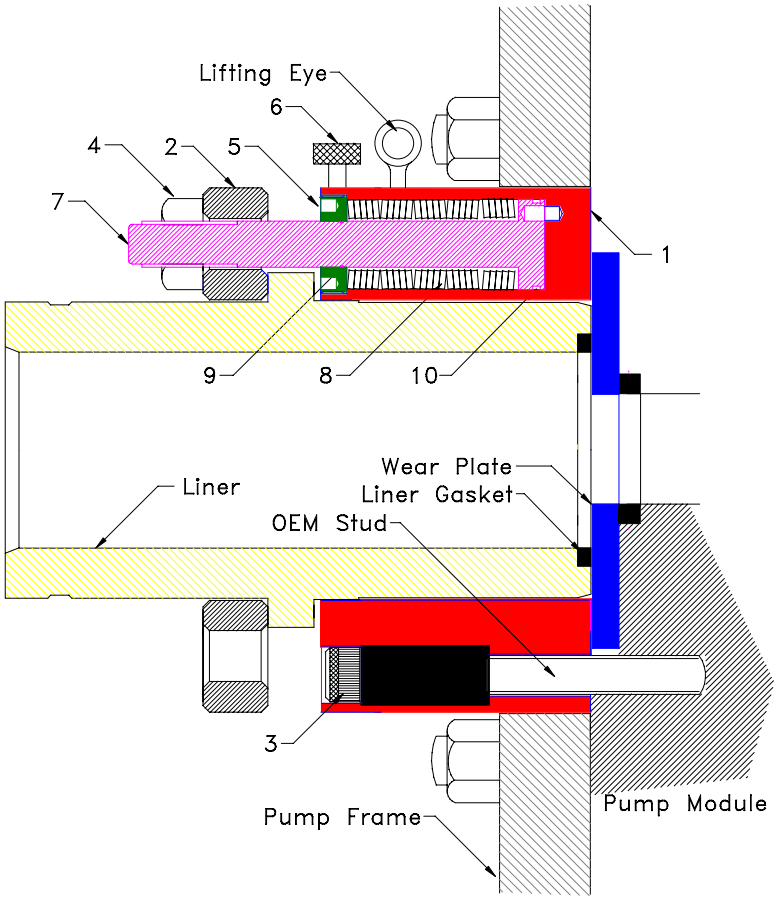
P-QUIP Ltd
Units 2&3, River Place, Paddockholm Ind Est,
Kilbirnie, Ayrshire, KA25 7EN, Scotland U.K.

Tel: 01505 685434 Int. (44) 1505-685434
Fax: 01505 682756 Int. (44) 1505-682756

Instructions for the Safe Use of P-Quip Liner Retention Systems – Pt. No. 75000001

This product is a direct replacement for the Original Equipment supplied for a **National Oilwell 14-P-220** Mud Pump, or a **Lewco W2215** that has been fitted with National, Southwest or similar, 14-P-220 type modules.

Revision date: October 4, 2005







Item	Part No	Description	Qty./ Unit	Qty./ Pump	Unit Weight
0	75000001	Liner Retention Assembly. *Includes parts 1,2,3,4,6,*	1	3	260kg
1	75001100	Liner retention body complete with fitted piston assemblies	1	3	210kg
2	75000400	Retention flange	1	3	50kg
3	75001101	Liner retention Body Fixing Nut	6	18	
4	72000700	Retention Nut	4	12	
5	72000200	Cylinder Cover Nut	4	12	
6	72000400	Pressure Fitting	1	3	
7	72000100	Piston Rod	4	12	
8	72000300	Disc Spring	108	324	
9	72000600	Small O'Ring	4	12	
10	72000500	Large O'Ring	4	12	
11	72000800	Piston Rod Assembly. Includes parts 4,5,7,8,9,10,	4	12	
12	59000114	Hexagon socket wrench for Body Fixing Nut – *not shown*	1 per rig		
13	59000113	Hand Operated Hydraulic Pump – *not shown*	1 per rig		
14	59000116	Air Driven Hydraulic Pump – *not shown*	1 per rig		
15	72000201	Pin Wrench For Cylinder Cover Nut– *not shown*	1 per rig		
16	72000411	Dust Cap for Pressure Fitting– *not shown*	1	3	
17	59000109	Box Wrench for Retention Nuts– *not shown*	1 per rig		
18	10000002	Anti Rotation Dowel	4	12	

Specification:

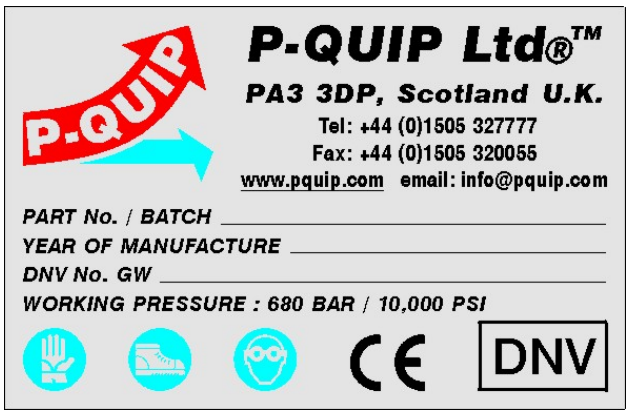
1) This product is a direct replacement for the Original Equipment supplied for a **National Oilwell 14-P-220 Mud Pump, or a Lewco W2215 that has been fitted with National or Southwest 14-P-220 type modules**. It is intended to allow faster and safer liner changes than with the original equipment.
2) The range of liners that this device will retain is 5" through to 8"
3) This product is designed to work up to the maximum pump pressure / liner size combinations recommended by the Mud Pump Manufacturer.
4) The working pressure of the Liner Retention Body (1) is 680bar / 10,000psi.
5) The weights of the various components are clearly marked on the product and on page 1 of this document.
6) The noise level of this product does not exceed 70dB(A).

Principles of operation:

1. Hydraulic pressure is applied through the Pressure Fitting (6)
2. Hydraulic pressure is fed to all 4 No. Piston Rods (7) simultaneously.
3. The Piston Rods (7) are thus forced against the Springs (8), causing them to be compressed.
4. The liner is retained against the wear plate by the Retention Flange (2).
5. The 4 No. Retention Nuts (4) are tightened on to the Retention Flange (2).
6. When the pressure is released the springs (8) will apply their force to the liner through the Piston Rod, the Retention Nut and the Retention Flange.
7. In the operational situation the springs are fully compressed and the internal pressure is zero.

Labeling:

The following label will be seen on the product. Should this label become worn or defaced it should be replaced.



General Safety:

1) These safety notes should be read in conjunction with local rules and working procedures, particularly where permit to work systems are in place.
2) Prior to working on the mud pump the unit must have its motive power isolated and locked off and hydraulic flow lines isolated and locked off. The pump valve modules should be vented to atmosphere.
3) The following protective clothing should be worn while working with this equipment.
   - Eye protection suitable to protect from inadvertent discharge of pressurized oil.
   - Foot protection suitable to protect the operator from accidental dropages.
   - Hand protection suitable to protect against the effect of mineral oil on the skin.
   - Coveralls to allow more efficient lifting and handling.
4) Great care should be taken when handling this equipment as various components are over 25kg (N.B. all items heavier than 25kg are marked with their weights) and it may not be practical to use mechanical lifting aids. During regular use it will be necessary to man handle the Retention Flange (2). Care must be taken during these operations to position the body over the component being lifted by standing in the cofferdam.
5) Extra care must be taken when manually handling these components, as they are prone to become slippery due to the spillage of oil and mud.

Regular Safety Checks:

1) Check that the appropriate protective clothing warning signs are posted in the pump room or workspace and are clearly legible.
2) Check that these equipment operating instructions are posted in the pump room or workspace and are clearly legible.
3) Check the hydraulic hose and pressure gauge on the pump is undamaged.
4) Test the hydraulic pump for safety and efficiency by removing the adaptor from the Liner Retention System and energizing the hose to 10000psi / 680bar. Check that the gauge holds the pressure for one minute and that there are no visible leaks. This action will prove the integrity and efficiency of the pump.

Installation and Preparation Instructions:

1) Assembling a liner Retention System in to the pump is a two-person job. Note carefully that no hammering will be necessary.
2) Prior to starting to fit the Liner Retention System, remove and set aside the rod system except for the Power End Rod (Pony Rod / Crosshead Extension Rod), and the liner. If an Original retention system is fitted to the mud pump then this should be completely removed, following the instructions given in the manufacturers instruction manual. The parts to be removed and discarded are the Liner Clamp, The Liner Bushing and the nuts holding the Liner Bushing on. Lay the original parts safely to one side for disposal.
3) The aperture in the pump frame, from which the Liner bushing was pulled, must be thoroughly cleaned. The bore of the pump frame must be cleaned to bare metal using wire brushes and emery. This is essential or the future removal of the Liner Retention Body (1) will be very dificult.
4) Remove the wear plate using the instructions given by the manufacturer and check for wear and damage. Thoroughly clean the area and replace the wear plate utilizing a new seal.
5) Liberally coat the pump frame bore with high temperature grease (Copper coat / Mollyslip etc.). Coat the 6 No. studs with a good quality thread lubricant.
6) Check the area of the Liner Retention Body (1) that will be entering the pump frame, for nicks and burrs and remove as necessary.
7) Lift the Liner Retention Body (1) with a mechanical lifting device that is configured such that it will allow the Body to be suspended in the mouth of the pump frame bore. The body is fitted with a suitable lifting eye and the weight is indicated on the unit and on the parts list above.
8) Once the Body is suspended in place the operative should squat in the cofferdam facing the Body and adjust the lift until the 6 No. studs line up with the 6 No. holes in the Body. When the unit is lined up it should be pushed on to the studs while adjusting the mechanical lift.
9) Once the Body is pushed up the studs to the face of the pump frame it will be possible to start the 6 No. Fixing Nuts (3) on to the stud threads. Remove the lifting device.
10) The Body is equipped with a substantial “lead taper” that will allow it to enter the pump frame bore. The Fixing Nuts (3) should now be used to draw the Body into the bore of the pump frame. The Hexagon Socket Wrench (12) should be utilized with a manual ratchet wrench. Care must be taken to ensure that the Body enters the bore evenly until it is fully home.
11) Ensure that the body is entered correctly by viewing through the center hole that the Body is closed against the wear plate.
12) Once the Body is satisfactorily in place the Fixing Nuts (3) should be tightened to 1100 lb.ft. / 1500N.m. (Note that this figure is the theoretical “dry thread” figure. The figure must be adjusted by the lubrication factor given by the thread lubricant manufacturer. Typically, if Molybdenum Disulfide was used the torque could be reduced to approximately 370 lb.ft. / 500 N.m.).
13) The hexagon sockets should then be filled with general purpose grease and the plastic caps re-fitted. This action will preserve the integrity of the hexagon sockets, until it is necessary to use them for loosening. Replacement plastic plugs will be supplied upon request.
14) Prepare the hydraulic pump (13or14) by removing the transport plug and replacing with the vented filler plug. Top up the hydraulic pump with hydraulic oil (preferably EP32 but any grade will be adequate).
15) When an air driven hydraulic pump (14) is used, connect the pump to a suitable air supply using a length of standard air hose. The air supply should be fitted with a water separator, a lubricator and a pressure regulator set to 110 psi / 7.5bar.

Operating Instructions: Fitting A Liner to the Pump

1) Assembling a liner in to the pump is a two-person job. Note carefully that no hammering will be necessary.
2) Select the appropriate size of Liner to be fitted to the Pump. Clean the bore of the liner and check its condition. Liners that have excessive wear, blow holes, grooves etc. should be discarded.
3) Clean all paint from the portion of the outer surface of the liner that enters the Liner Retention Body (1). If any nicks or burrs are noticed they should be carefully removed by filing and rubbing with emery.
4) Fit a fresh seal into the groove on the liner and coat the seal area and bore with a good quality non-metallic grease.
5) Thoroughly coat the bore of the Body (1) with high temperature grease (Copper coat / Mollyslip etc.).
6) Lift the liner in to position using a mechanical lifting device if possible and enter the liner in to the bore of the Body (1).
7) Once the liner is safely entered, remove the lifting tackle and push the liner fully home to contact with the wear plate. Note that when the liner is fully home the gap between the Body (1) and the liner flange will be approximately 10mm. It will be possible to make a quick check of this with experience.
8) Thoroughly coat the 4 No. Piston Rod (7) threads with high temperature grease (Copper coat / Mollyslip etc.).
9) Lift, preferably using a mechanical device, the Retention Flange (2) over the exposed end of the liner and on to the 4 Piston Rods (7). This Retention Flange is “reversible”. Slide the Retention Flange along the liner and over the Piston Rods until it is hard up against the liner flange.
10) Screw 4 No. Retention Nuts (4) on to the 4 No. Piston Rods (7) by hand evenly so that the Retention Flange is squarely butted against the liner flange.
11) Connect the Hydraulic Pump (13 or 14) hose to the Pressure fitting (6) on the Body. Ensure that the connector is fully screwed together or the fluid will not flow through the connector. Energize the system to 680bar / 10,000psi.
12) When the system is energized it will be possible to observe the 4 No. Retention Nuts (4) moving away from the Retention Flange (2) by approximately 5-7mm. This movement is the result of pressure being applied to the Piston Rods (7) and forcing them to compress the Springs (8).
13) The 4 No. Retention Nuts (4) should now be tightened on to the Retention Flange (2). Tighten the 4 No. nuts (4) evenly as if bedding a pipe flange. The Socket Wrench (17) should be used with a 24” ratchet. Final tighten the nuts to approx 300 lb.ft. / 400N.m. This figure is not critical. Over-tightening will not be possible providing that only the tools described are used.
14) The hydraulic pressure should now be released while the assembly is being observed. There should be almost zero movement as the pressure is relieved as the assembly should be all “metal to metal” leaving no room for movement. If a measurable movement is seen to take place then the Retention Springs will become uncompressed and loose their retention force. If

movement takes place then the pressurizing and nut tightening operation should be repeated until there is no obvious movement upon release of the pressure.

15) The liner is now correctly retained and ready to work. Disconnect the pump hose from the Body.
16) Refit the pump rod system as per separate instructions.

Operating Instructions: Removing a Liner from the Pump

1) Removing a liner from the pump is a two-person job. Note carefully that no hammering will be necessary.
2) Remove and set aside the rod system except for the Power End Rod (Pony Rod / Crosshead Extension Rod),
3) Connect the Hydraulic Pump (13 or 14) hose to the Pressure fitting (6) on the Body. Ensure that the connector is fully screwed together or the fluid will not flow through the connector. Energize the system to 680bar / 10,000psi.
4) The 4 No. Retention Nuts (4) should now be loosened. The Socket Wrench (17) should be used with a 24" ratchet. The torque required to loosen the Nuts should be similar to that to which they were initially tightened.
5) Screw 4 No. Retention Nuts (4) off of the 4 No. Piston Rods (7) by hand.
6) Slide the Retention Flange along the liner and over the Piston Rods until it is approximately 50mm from the end of the liner. Preferably using a mechanical devise, lift the Retention Flange (2) off the end of the liner and rest safely in the bottom of the cofferdam.
7) Using a pinch bar at the 10mm gap between the Retention Body (1) and the liner flange, free the liner from the Body. Slide the liner out until there is approximately 100mm remaining in the Body bore.
8) Connect a mechanical lifting device safely to the liner and slide completely clear of the Body bore. Care should be taken to ensure that the liner remains balanced during the lifting process.
9) If a liner is going to be reinstalled immediately then the unit may be left pressurized in preparation. If not the pressure should be released and the pump hose disconnected.

Operating Instructions: Removing a Liner Retention body in order to Access the Wear Plate or Other Operational Reason.

1) Removing a Liner Retention System from the pump is a two-person job. Note carefully that no hammering will be necessary.
2) Remove and set aside the rod system except for the Power End Rod (Pony Rod / Crosshead Extension Rod),
3) Connect the Hydraulic Pump (13 or 14) hose to the Pressure fitting (6) on the Body. Ensure that the connector is fully screwed together or the fluid will not flow through the connector. Energize the system to 680bar / 10,000psi.
4) The 4 No. Retention Nuts (4) should now be loosened. The Socket Wrench (17) should be used with a 24" ratchet. The torque required to loosen the Nuts should be similar to that to which they were initially tightened.
5) Screw 4 No. Retention Nuts (4) off of the 4 No. Piston Rods (7) by hand.
6) Slide the Retention Flange along the liner and over the Piston Rods until it is approximately 50mm from the end of the liner. Preferably using a mechanical devise, lift the Retention Flange (2) off the end of the liner and rest safely in the bottom of the cofferdam.
7) Using a pinch bar at the 10mm gap between the Retention Body (1) and the liner flange, free the liner from the Body. Slide the liner out until there is approximately 100mm remaining in the Body bore.
8) Connect a mechanical lifting device safely to the liner and slide completely clear of the Body bore. Care should be taken to ensure that the liner remains balanced during the lifting process.
9) The unit may be left pressurized.
10) Loosen and remove the 6 No. Fixing Nuts (3) using the Socket Wrench (12).
11) Place a 25mm thick, 240mm diameter packer, in the bore of the Body (1), against the wear plate.
12) Lift the liner, with its gasket removed back in to position using a mechanical lifting device if possible and enter the liner in to the bore of the Body (1).
13) Once the liner is safely entered, remove the lifting tackle and push the liner fully home to contact with the packer.
14) Lift, preferably using a mechanical devise, the Retention Flange (2) over the exposed end of the liner and on to the 4 Piston Rods (7). This Retention Flange is "reversible". Slide the Retention Flange along the liner and over the Piston Rods until it is hard up against the liner flange.
15) Screw 4 No. Retention Nuts (4) on to the 4 No. Piston Rods (7) by hand evenly so that the Retention Flange is squarely butted against the liner flange.
16) Tighten the 4 No. Nuts (4) evenly as if bedding a pipe flange. The Socket Wrench (17) should be used with a 24" ratchet. Final tighten the nuts to approx 300 lb.ft. / 400N.m. This figure is not critical. Over-tightening will not be possible providing that only the tools described are used.
17) The hydraulic pressure should now be released while the assembly is being observed. The system will apply its spring force to retain the liner but as the Retention Body (1) is no longer fixed to the pump module, then the Body will be drawn out of the bore of the pump frame. This initial operation should free the Body if it has become stuck in the pump frame bore. Once the Body is freed, it will be possible to continue drawing the Body from the bore by manually tightening the Retention nuts. When the liner flange is hard against the Body (i.e. 30mm movement) the operation may be repeated with another packer (approx 25mm thick) inserted into the Body bore prior to the liner. With the addition of packers and re-tightening of the Nuts the Body may be drawn completely clear of the pump frame.
18) Once the Body starts to move, connect a mechanical lifting device that is configured such that it will allow the Body to be suspended in the mouth of the pump frame bore. The body is fitted with a suitable lifting eye and the weight is indicated on the unit and on the list above.
19) Lift the Body clear.

Maintenance / Troubleshooting

1) **Preferable hydraulic oil**; ISO grade 32; ISO oil type HM. – This material has no known hazard as defined by local laws. This material if discarded is not expected to be a characteristic hazardous waste. Disposal should be in compliance with federal, state and local laws. All components are in compliance with EC Seventh Amendment Directive 92/32/EEC. Toxic fumes or vapors may evolve on burning.
2) **Liner Retention Body (1)** ***Corrosion protection***: The Body (1) is manufactured from carbon steel and as such will rust. The unit, except for its bore should be painted regularly. Do not paint over the label. The piston rods, where they extend from the Body should not be painted but must be generously coated with high temperature grease. The bore of the body must be generously coated with high temperature grease. The Pressure Fitting (6) should be oiled or lightly greased and the Dust Cover (16) must be fitted to protect the threads and attachment mechanism.
3) **Liner Retention Body (1)** ***Pressure Integrity***: The Body (1) will have its ability to retain its working pressure tested at each use. It will not be necessary to carry our regular pressure tests. Each time the device is used, a leak check should be carried out. If the pressure in the system leaks off slowly it is probably due to one of the following reasons:-
    1. Hydraulic pump is not retaining pressure (Refer to manufacturers instructions).
    2. Leak at the Pressure Fitting (6) (Refit fitting using new bonded washers and PTFE tape etc.
    3. Leak at one of the 1/8" BSP porting plugs on the outside of the body. This will probably require the unit to be removed to the bench for repair. The leaking plug should be removed and replaced utilizing PTFE tape to seal the threads. The unit should then be tested at working pressure for 15 minutes prior to refitting.

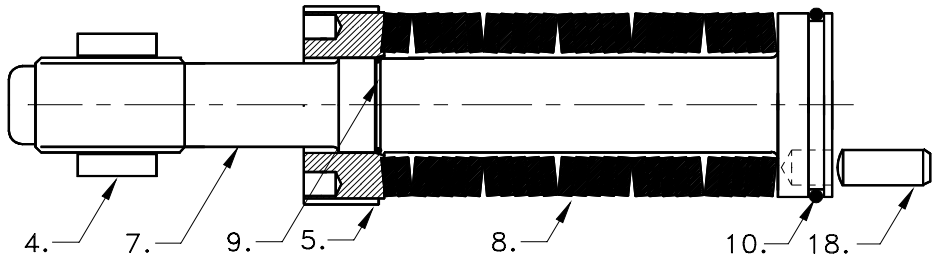
    If the pressure in the system leaks off rapidly then it is probably due to the failure of one of the Large O'rings (10) on the Piston Rod (7). This will be confirmed when oil is seen to emit from the area of the Cylinder Cover Nut (5). If this is proved to be the case it will be necessary to remove the Body from the pump (see; "Operating Instructions: Removing a Liner Retention body in order to Access the Wear Plate or Other Operational Reason." Above) and carry out the following procedure on the bench: -
    1. Confirm that there is no pressure retained within the body.
    2. Remove the cylinder cover nut (5) using the pin spanner part no (15)
    3. Remove the Pressure Fitting (6) to prevent a vacuum being created behind the piston as it is being removed.
    4. Lay the body on its back and stand over it.
    5. Grasp the Piston Rod (7) and pull until the Piston (7) comes clear of the body.
    6. Check that the springs (8) are not rusted or broken and replace as required. Assemble springs exactly as shown in drawing herein.
    7. Check that the anti rotation dowel (18) is glued in place in the hole in the body (you will observe 2 holes in the bottom of the cylinder. The dowel (18) should be fitted to the hole that does not connect with the internal oil-ways). Glue it in using Locktite 638 or similar.
    8. The cylinder should be inspected for damage in its bottom 1" / 25mm of its bore. The outside surface of the piston (7) should also be checked for scores in the area around the O'ring (10)
    9. Fit new O'rings (9 & 10)
    10. Ensure that the threads in the Body and on the Cylinder Cover Nut (5) are in perfect condition and are clean. Immerse the assembled Piston Rod In hydraulic oil. Stand over the Body and aim the Piston into the bore so that the hole in the bottom of the Piston lines up with the Dowel (18).
    11. Push the Piston into the bore using your own body weight. The piston will slide easily in the bore until the final 1" / 25mm. Tap the piston fully home with a soft hammer while turning it slightly in order to locate the Dowel. Ensure that the unit is fully home by comparing its height above the Body, with the others.
    12. Coat the Cylinder Cover Nut (5) with a copper-based grease and screw in to the Body. It should be possible to screw the Cylinder Cover Nut down on to the Springs easily, using the Pin Spanner (15). If the threads become tight before the Cylinder Cover Nut is flush with the top of then Body the nut must be removed, cleaned and checked. On no account must undue force be used when screwing the Cylinder Cover Nut into the Body. The Cylinder cover nut should be screwed down until it is just bearing on the Springs.
    13. The Pressure Fitting (6) should then be refitted and the unit pressure tested at 680bar / 10,000psi.. The test pressure should be held for 15 minutes. During the test oil will be observed seeping out from the threads of the cylinder cover nut. This will almost certainly be residue of the oil used in assembly, and should not be assumed to be a leak. **Remember that if the unit holds its test pressure then there is no leak.**
    14. The Cylinder Cover Nut should then be screwed down again until it is just bearing on the Springs. Finally the Cylinder Cover Nut should be turned a further ¼ turn by light hammering on the Pin Spanner (15)
    15. Finally fit the Body back in to the pump as per *"Installation and Preparation Instructions:"*

4) **Liner Retention Body (1)** ***Loss or reduction of Retention force***:

After a long period of use (Generally around 3-4 years) the retention force will drop off due to spring fatigue. If spring fatigue is suspected then the Liner Retention System must be removed from the pump (see; "Operating Instructions: Removing a Liner Retention body in order to Access the Wear Plate or Other Operational Reason." Above) and the following procedure carried out on the bench.

1. Confirm that there is no pressure retained within the body.
2. Remove the cylinder cover nut (5) using the pin spanner part no (15)
3. Remove the Pressure Fitting (6) to prevent a vacuum being created behind the piston as it is being removed.
4. Lay the body on its back and stand over it.
5. Grasp the Piston Rod (7) and pull until the Piston (7) comes clear of the body.

6. Check that the anti rotation dowel (18) is glued in place in the hole in the body (you will observe 2 holes in the bottom of the cylinder. The dowel (18) should be fitted to the hole that does not connect with the internal oil-ways). Glue it in using Locktite 638 or similar.
7. The cylinder should be inspected for damage in its bottom 1" / 25mm of its bore. The outside surface of the piston (7) should also be checked for scores in the area around the O'ring (10)
8. Fit new O'rings (9 & 10)
9. Assemble the new Springs (8) on to the Piston (7) exactly as shown on the drawing below.
10. Ensure that the threads in the Body and on the Cylinder Cover Nut (5) are in perfect condition and are clean. Immerse the assembled Piston Rod In hydraulic oil. Stand over the Body and aim the Piston into the bore so that the hole in the bottom of the Piston lines up with the Dowel (18).
11. Push the Piston into the bore using your own body weight. The piston will slide easily in the bore until the final 1" / 25mm. Tap the piston fully home with a soft hammer while turning it slightly in order to locate the Dowel. Ensure that the unit is fully home by comparing with the height of the others above the Body.
12. Coat the Cylinder Cover Nut (5) with a copper-based grease and screw into the Body. It should be possible to screw the Cylinder Cover Nut down on to the Springs easily, using the pin spanner (15). If the threads become tight before the Cylinder Cover Nut is flush with the top of the Body, the nut must be removed, cleaned and checked. On no account must undue force be used when screwing the Cylinder Cover Nut in to the Body. The Cylinder cover nut should be screwed down until it is just bearing on the Springs.
13. The Pressure Fitting (6) should then be refitted and the unit pressure tested at 680bar / 10,000psi.. The test pressure should be held for 15 minutes. During the test oil will be observed seeping out from the threads of the cylinder cover nut. This will almost certainly be residue of the oil used in assembly, and should not be assumed to be a leak. **Remember that if the unit holds its test pressure then there is no leak.**
14. The Cylinder Cover Nut should then be screwed down again until it is just bearing on the Springs. Finally the Cylinder Cover Nut should be turned a further ¼ turn.
15. Finally fit the Body back in to the pump as per *"Installation and Preparation Instructions:"*





5) **Liner Retention Body (1)** ***Failure to release***: In the event of the hydraulic system failing while the liner is retained, it will still be possible to remove the liner. It should be understood that the tension applied to the Retention Nut (4) by the springs is no more than would be applied by fully torquing the nut in the conventional manner. The nuts (4) may be removed using conventional tools such as impact wrenches and torque multipliers. The wrench (17) is of impact quality and will be suitable for this job.
6) **Retention Flange (2)** : Re-paint as necessary.
7) **Liner Retention Body Fixing Nut (3):** These nuts should have their external surface protected from corrosion so that they are in a sound condition when it is required to remove them. It is recommended that they are removed, cleaned, lubricated and re-fitted every 6 months if they are not removed for operational purposes more frequently.
8) **Retention Nut (4).** These Nuts should be discarded after 6 months use. They should be liberally coated with grease during use to limit corrosion.
9) **Pressure Fitting (6)** If these fittings are damaged and require replacement special note should be taken of the fact that they are NOT standard quick release couplers. The units fitted are altered to avoid hydraulic fluid being trapped within the body. Should fluid be trapped in the body it will expand with temperature rise and energize the system thus lowering the retention force.
10) **Piston Rod (7)** This item is produced from carbon steel and as such should be protected from corrosion by liberal coating with grease. The threads (M36x4) can generally be recovered following impact damage by hammering on the nut in order to reform them.
11) **O'rings (9 or 10)** O'rings are made from Viton and as such are suitable for all temperatures that are likely to be experienced on a mud pump.
12) **Hydraulic Pump (13 or 14)** Refer to manufacturer instructions.

Recommended Spares

The following parts should be held on the rig as spares. The life expectation of all parts other than "consumables is many years.

Quantity	Part Number	Description	Reason
20	72000700	Retention Nut	Consumable
2	72000800	Piston Assy	For Damage Spare
2	72000400	Pressure Fitting	For Damage Spare
2	75001101	Fixing Nut	For Loss Spare

Modifications

Under no circumstance must this equipment be modified without the express written permission of P-Quip Ltd.