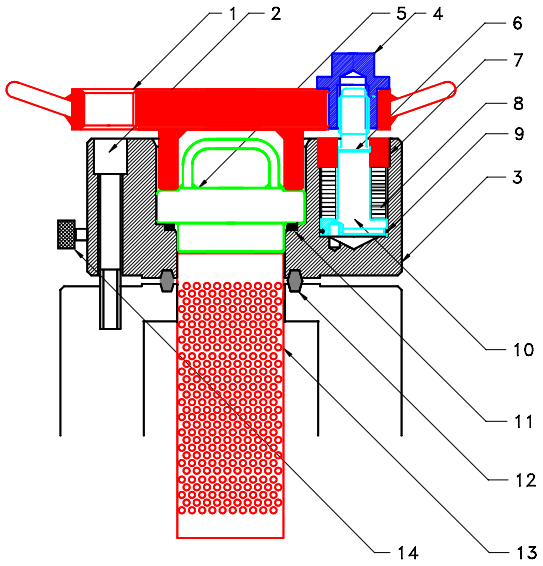
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Instructions for the Safe Use of P-Quip Strainer Cover Retention Systems – Pt. No. 24000002

Revision date: August 21, 2003





Item	Part No.	Description	Qty./ unit	Weight
0	24000002	Strainer Cover Retention System Assy. Complete – Includes items – 1,2,3,5,11,13,14,15,17.	1	
1	24000005	Locking Plate	1	
2	60007512	Body fixing Socket Screw	8	
3	24000003	Strainer Cover Retention System Body complete with fitted piston assemblies	1	
4	16000700	Retention Nut	4	
5	24000004	Inner Plug	1	
6	72000600	Small O'Ring	4	
7	16000900	Cylinder Cover Nut	4	
8	72000300	Disc Spring	56	
9	60000646	Large O'Ring	4	
10	16000800	Piston Rod	4	
11	24000008	Inner Plug Seal	1	
12	24007420	Body to Strainer Cross Gasket. – R44-D – *Not included*	1	
13	24002301	Strainer Tube	1	
14	72000400	Pressure Fitting	1	
15	16001000	Piston Rod Assembly. – Includes 4,6,7,8,9,10,22	4	
16	72000201	Pin Wrench for Cylinder Cover Nuts – *Not Shown*	1 per rig	
17	72000411	Dust Cap for Pressure Fitting– *Not Shown*	1	
18	59000113	Hand Operated Hydraulic Pump - *Not Shown*	1 per rig	
19	59000116	Air Driven Hydraulic Pump - *Not Shown*	1 per rig	
20	59000115	Hexagon socket wrench for Body Fixing Nut – *not shown*	1 per rig	
21	10000002	Anti Rotation Dowel	4	
22	16001200	Spring packer	4	

Specification:

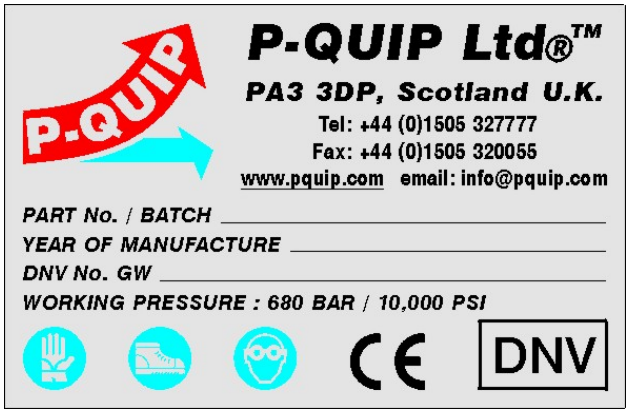
1) This product is a direct replacement for the Original Equipment supplied for a National Oilwell 12-P-160 Mud Pump discharge strainer fitted with standard strainer cross 1295225 or 1295215. It is intended to allow faster and safer cover opening and closing than with the original equipment.
2) This product is designed to work up to the maximum pump pressure recommended by the mud pump manufacturer.
3) The working pressure of the Strainer Cover Retention Body (1) is 680bar / 10,000psi.
4) The weights of the various components are clearly marked on the product and on page 1 of this document.
5) The noise level of this product does not exceed 70dB(A).

Principles of operation:

1. Hydraulic pressure is applied through the Pressure Fitting (14)
2. Hydraulic pressure is fed to all 4 No. Piston Rods (10) simultaneously.
3. The Piston Rods (10) are thus forced against the Springs (8), causing them to be compressed.
4. The Inner Plug (5) is retained against the shoulder in the strainer cross by the Locking Plate (1).
5. The 4 No. Retention Nuts (4) are tightened on to the Locking Plate (1), which in turn bears against the Inner Plug (5).
6. When the pressure is released the springs (8) will apply their force to the Inner Plug through the Piston Rod, the Retention Nut and the Locking Plate.
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 Locking Plate (1). Care must be taken during these operations to position the body close to the component being lifted.
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 Strainer Cover Retention System on to the strainer cross is a two-person job.
2) Prior to starting to fit the Strainer Cover Retention System, the original National clean out flange should be completely removed, following the instructions given in the National instruction manual. The parts to be removed and discarded are the clean out flange, the strainer tube, the 8 No. nuts used to retain the clean out flange and the 8No. studs. Lay the original parts safely to one side for disposal.
3) Using a 1 ½" x 6 TPI UN tap, dress the threads in the face of the strainer cross to a depth of 40mm.
4) The face of the strainer cross must be thoroughly cleaned.
5) Thoroughly clean the metal gasket seating area.
6) Coat the 8 No. Cap Screws (2) with a good quality thread lubricant.

7) Fit a new metal gasket (12)
8) Lift the Retention Body (3) with a mechanical lifting device. This operation may be simplified by leaving the unit assembled as packed and using the lifting lugs on the handle of the Locking Plate (1).
9) Land the Body (3) on to the face of the strainer cross with the Pressure Fitting orientated in the most convenient position with regard to access. Screw Cap Screws (2) into the accessible holes.
10) If the Locking Plate (1) is still fitted then remove it now.
11) Screw the 8 No. Cap Screws (2). Hand tighten.
12) Once the Body is satisfactorily in place the Cap Screws (2) should be tightened to 1800 lb.ft. / 2400N.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 600 lb.ft. / 800 N.m.).A Socket Wrench (20) is supplied for this purpose.
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 (18or19) 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 (19) 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: Closing the Strainer System

1) Assembling a Cover onto the strainer is a one-person job. Note carefully that no hammering will be necessary.
2) Clean any debris from the inside of the strainer cross.
3) Slide the Strainer Tube (13) in to position.
4) Fit a fresh seal (11) into the groove in the Body (3) and coat the seal area with a good quality non-metallic grease.
5) Thoroughly coat the bore of the Body (3) with high temperature grease (Copper coat / Mollyslip etc.).
6) Clean the Inner Plug (5) and place it into position.
7) Thoroughly coat the 4 No. Piston Rod (10) threads with high temperature grease (Copper coat / Mollyslip etc.).
8) Lift the Locking Plate (1) in to position and enter it into the bore of the Body (3).
9) Screw 4 No. Retention Nuts (4) on to the 4 No. Piston Rods (10) by hand evenly so that the Locking Plate (1) is squarely butted against the Inner Plug (5).
10) Connect the Hydraulic Pump (18 or 19) hose to the Pressure fitting (14) 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.
11) When the system is energized it will be possible to observe the 4 No. Retention Nuts (4) moving away from the locking Plate (1) by approximately 5-7mm. This movement is the result of pressure being applied to the Piston Rods (10) and forcing them to compress the Springs (8).
12) The 4 No. Retention Nuts (4) should now be tightened on to the Locking Plate (1). Tighten the 4 No. nuts (4) evenly as if bedding a pipe flange. Final tighten the nuts to approx 300 lb.ft. / 400N.m.
13) 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.
14) The Cover is now correctly retained and ready to work. Disconnect the pump hose from the Body.

Operating Instructions: Opening the Strainer System

1) Removing a Cover from the pump is a one-person job. Note carefully that no hammering will be necessary.
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) Connect the Hydraulic Pump (18 or 19) hose to the Pressure fitting (14) 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 torque required to loosen the nuts will be similar to that used to pre-tension (approx 300 lb.ft. / 400N.m.).
5) Remove the Retention Nuts (4) and set aside.
6) Lift the Locking Plate (1) off and set aside.
7) Remove the Inner Plug (5) and set aside.
8) Remove the Strainer Tube (13) and set aside.
9) If it is intended that the cover be replaced directly then the pressure may be left applied to the unit.

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) **Cover Body (3)** ***Corrosion protection***: The Body (3) 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 (14) should be oiled or lightly greased and the Dust Cover (17) must be fitted to protect the threads and attachment mechanism.

3) **Cover Body (3)** ***Pressure Integrity***: The Body (3) 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 (14) 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 (9) on the Piston Rod (10). This will be confirmed when oil is seen to emit from the area of the Cylinder Cover Nut (7). If this is proved to be the case it will be necessary to carry out the following procedure. If possible this procedure should be performed in the clean environment of a workshop, however this is not essential

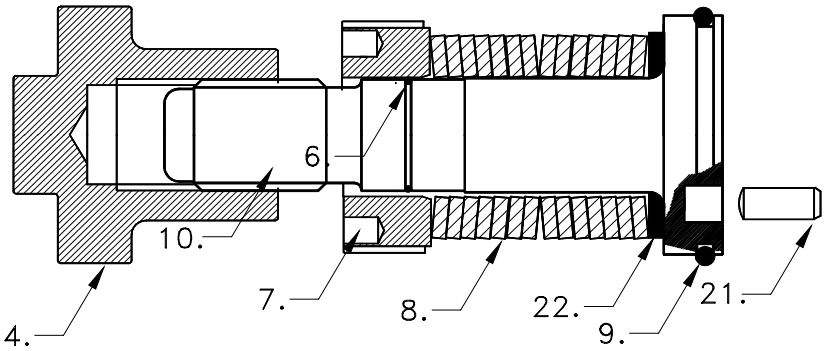
1. Confirm that there is no pressure retained within the body.
2. Remove the cylinder cover nut (7) using the pin spanner part no (16)
3. Remove the Pressure Fitting (14) to prevent a vacuum being created behind the piston as it is being removed.
4. Lay the body on its back and stand over it.
5. Grasp the Piston Rod (10) and pull until the Piston (10) 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 (21) is glued in place in the hole in the body (you will observe 2 holes in the bottom of the cylinder. The dowel (21) 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 (10) should also be checked for scores in the area around the O'ring (9)
9. Fit new O'rings (6 & 9)
10. Ensure that the threads in the Body and on the Cylinder Cover Nut (7) 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 (21).
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 (7) 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 (16). 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 (14) 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 (16)
15. Finally fit the Body back in to the pump, if it has been removed, as per *"Installation and Preparation Instructions:"*

4) **Cover Body (3)** ***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 it will be necessary to carry out the following procedure. If possible this procedure should be performed in the clean environment of a workshop, however this is not essential.

1. Confirm that there is no pressure retained within the body.
2. Remove the cylinder cover nut (7) using the pin spanner part no (16)
3. Remove the Pressure Fitting (14) 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 (10) and pull until the Piston (10) comes clear of the body.
6. Check that the anti rotation dowel (21) is glued in place in the hole in the body (you will observe 2 holes in the bottom of the cylinder. The dowel (21) 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 (10) should also be checked for scores in the area around the O'ring (9)
8. Fit new O'rings (9 & 6) and assemble new springs (8) exactly as shown in drawing herein.
9. Ensure that the threads in the Body and on the Cylinder Cover Nut (7) 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 (21).
10. Push the Piston into the bore using your own body weight. 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.
11. Coat the Cylinder Cover Nut (7) 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 (16). 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.

12. The Pressure Fitting (14) 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.**
13. 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 (16)
14. Finally fit the Body back in to the pump, if it has been removed, as per *"Installation and Preparation Instructions:"*





5) **Cover Retention Body (3)** ***Failure to release***: In the event of the hydraulic system failing while the Cover is retained, it will still be possible to remove the Cover. 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.
6) **Locking Plate (1)** : Re-paint as necessary.
7) **Cap Nuts (2):** 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 2 years use. They should be liberally coated with grease during use to limit corrosion.
9) **Pressure Fitting (14)** 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 (10)** This item is produced from stainless steel. The threads (M39x4) can generally be recovered following impact damage by hammering on the nut in order to reform them.
11) **O'rings (6 or 9)** 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 (18 or 19)** 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
4	16000700	Retention Nut	Consumable
2	16001000	Piston Assy	For Damage Spare
2	72000400	Pressure Fitting	For Damage Spare
2	60007512	Cap Nut	For Loss Spare
10	24000008	Seal	Consumable
1	24000004	Inner Plug	For Damage Spare
1	24007420	Metal Gasket	For Damage Spare

Modifications

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