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Section 1. General Information

1.1 Description
The RH4 hammer is a valve less pneumatic percussion hammer for drilling in all rock formations. It is designed for a wide range of applications including water wells, blast holes, and construction. The design incorporates one moving part, the piston, making the hammer very reliable. All external parts are hardened to resist wear while all critical internal parts are also hardened for maximum service life. The simple design also makes the hammer easy to maintain and service.

1.2 SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Metric</th>
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<tbody>
<tr>
<td>Outside Dia</td>
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<tr>
<td>Overall Length Without Bit</td>
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<tr>
<td>RH4i Models</td>
<td>41.9 in</td>
<td>1064 mm</td>
</tr>
<tr>
<td>RH4m Models</td>
<td>43.9 in</td>
<td>1115 mm</td>
</tr>
<tr>
<td>Total Weight</td>
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<td></td>
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<td>RH4i Models</td>
<td>82 lbs</td>
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<tr>
<td>RH4m Models</td>
<td>85 lbs</td>
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<td>Bore Size</td>
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<tr>
<td>Piston Weight</td>
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<td>9 kg</td>
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<td>Drillpipe Connect</td>
<td>2-3/8 Reg API Pin Up others available upon request</td>
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<tr>
<td>Wrench Flats</td>
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<tr>
<td>Hole Size Range</td>
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<td></td>
<td>4 in to 5 in</td>
<td>102 mm to 127 mm</td>
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<td></td>
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<tr>
<td>RH4m Models</td>
<td>3415/SD4</td>
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</tr>
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<td>Minimum Air Volume</td>
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<td>4.5 cmm</td>
</tr>
<tr>
<td>Required</td>
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<td></td>
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<tr>
<td>Maximum Operating</td>
<td>500 psi</td>
<td>34 bar</td>
</tr>
<tr>
<td>Pressure All Models</td>
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1.3 Air Supply
A minimum of 150 cfm should be supplied to the hammer. The hammer will function on lower supplies but the penetration rate will be very slow. For the fastest possible penetration, the hammer should be operated at the highest obtainable pressure for the given air supply. A maximum pressure of 380 psi is recommended. Operating at pressures up to 500 psi is acceptable and will increase penetration rates but will also shorten the service life of both internal and external hammer parts and also wear the bit out faster.

The charts below show the hammers operating pressure for a given air volume supply based on operation at sea level. If the compressor’s air supply is large enough to build a pressure that will exceed the compressor’s rated operating pressure, the choke will need to be opened to maintain the desired max psi. The choke adjustment is explained in section 2.4

1.4 Unpacking a New Hammer
First make note of the hammer Part Number & Serial Number found on the ID label on the outside of the hammer shipping tube and also on the wear sleeve of the hammer. Your Rock Hog representative will need these numbers if you have questions on the hammer. The 12-digit hammer serial number is the backhead & cylinder numbers put together.

Once the hammer has been unpacked, locate and remove the plastic bag attached to the backhead. This bag contains 1 optional choke. Keep this choke for possible future use.

The hammer is shipped with the backhead seated to the sleeve but not torqued tight. This is so the disc springs and centering ring stay in the correct location during shipping. **If the backhead is not seated to the sleeve, refer to Section 3.4, step 11 before the backhead is torqued tight on the rig.**
Section 2. Hammer Operation

2.1 Lubrication of Internal Parts
The hammer must have a constant and adequate supply of oil to prevent part wear, corrosion, and failure. Rock Hog recommends Mobil ALMO series, Chevron VISTAC series, or an equivalent grade. Contact your local lubricant representative for the proper grade to use for your drilling environment and temperatures.

Make sure the oil injector is filled and working properly. Always verify that there is oil coming through the drill string, DO NOT RUN THE HAMMER WITHOUT CONSTANT OIL INJECTION! THE HP HAMMERS REQUIRE MORE OIL THAN THEIR PREDECESSORS.

Set the system to inject 1.0 pints per hour for every 300 cfm of air supply. Example, if the supply is 950 cfm, inject 950/300x1.3 = 4.2 pints per hour. Again this is more oil than the older models.

<table>
<thead>
<tr>
<th>Oil Properties</th>
<th>Mobil ALMO Grade</th>
<th>525</th>
<th>529</th>
<th>532</th>
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<tr>
<td>Chevron VISTAC Grade</td>
<td>ISO46</td>
<td>ISO 150</td>
<td>ISO 320</td>
<td></td>
</tr>
<tr>
<td>When to use</td>
<td>winter</td>
<td>summer</td>
<td>summer, production drilling</td>
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<td>ISO viscosity grade</td>
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<td>150</td>
<td>320</td>
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<td>50</td>
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</tr>
<tr>
<td>Viscosity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cSt @ 40°C, ASTM D 445</td>
<td>44</td>
<td>144</td>
<td>310</td>
<td></td>
</tr>
<tr>
<td>cSt @ 100°C</td>
<td>6</td>
<td>14</td>
<td>22</td>
<td></td>
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<tr>
<td>SUS @ 100°F, ASTM D 2161</td>
<td>228</td>
<td>755</td>
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<tr>
<td>SUS @ 210°F</td>
<td>48</td>
<td>75</td>
<td>112</td>
<td></td>
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<tr>
<td>Flash Point</td>
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<tr>
<td>0°C</td>
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<tr>
<td>0°F</td>
<td>410</td>
<td>450</td>
<td>450</td>
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</tr>
</tbody>
</table>

2.2 Lubrication of Threaded Connections
All threaded connection must be coated with no-gall grease. Both the backhead and chuck are threaded into the wear sleeve. The hammer is shipped with grease on both these connections. All drill pipe connections must also be coated. When applying grease, be careful not to put grease where it will enter the air stream. The grease will not blow through the hammer but stick to the internal parts. Excessive grease in the hammer will close the airways and stop the hammer.


2.3 Hole Cleaning
For proper hole cleaning, verify that an adequate up-hole air velocity can be obtained. An annular velocity of 3000 feet-per-minute or more is required. Use this formula to check what the velocity will be:

\[
\text{Velocity (fpm)} = \frac{(183) \times \text{(supply CFM)}}{(\text{bit size})^2 - (\text{drill pipe size})^2}
\]

2.4 Setting the Choke
The choke is used to match the hammers operating pressure to the air supply. The hammer is shipped with a full choke installed. One optional open choke is shipped with the hammer.

For top performance, the operating pressure should be set at the compressor’s rated output. The maximum recommended operating pressure is 380 psi but can be run up to 500 psi. Operating over 380 will increase penetration rates but reduce service life.

An open choke creates a controlled air leak in the hammer while the full choke allows no air leak. The larger the choke opening the greater the volume of lost air, the lower the hammer operating pressure.

To determine what choke should be in the hammer, plot your air supply, cfm & psi, on the chart in Section 1.3. From this point, move straight up the chart. The 1st choke line reached is the choke that should be used. The hammer is supplied with the full choke installed. To change the choke, remove the backhead, pull out the check valve and with a hammer and punch, drive out the current choke and drive in the needed choke. On open chokes, the flat goes toward the bit.

The actual operating pressure of your hammer may vary from the chart in Section 1.3 due to elevation from sea level (see section 2.5), leaks in the air supply line, and actual compressor output compared to its rating.

It is possible to fine-tune the choke opening if needed. If the full choke is in and the operating pressure is below the compressor's rated output, the only way to increase the operating pressure is to
increase the air volume supply. If a factory supplied open choke is being used and the operating pressure is below the compressor’s rated output, it is possible to bring the operating pressure up to the rating by taking the full choke and making a flat on it that is smaller than the current open choke.

If the hammer is used on an air supply of 800 cfm or higher, it may be necessary to remove the choke completely to allow enough air to by-pass through and maintain the proper operating pressure.

2.5 Effect of Elevation
Elevation above sea level affects the compressor output. As elevation increases, the compressor’s volume output decreases. Use the table below to determine volume loss.

<table>
<thead>
<tr>
<th>Elevation in Feet</th>
<th>ECF</th>
</tr>
</thead>
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<tr>
<td>4000</td>
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<tr>
<td>5000</td>
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<tr>
<td>6000</td>
<td>0.79</td>
</tr>
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<td>10000</td>
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<td>11000</td>
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<tr>
<td>12000</td>
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<tr>
<td>13000</td>
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<td>0.59</td>
</tr>
<tr>
<td>15000</td>
<td>0.57</td>
</tr>
</tbody>
</table>

2.6 Water Injection
Injecting water into the air supply is a common practice to keep down dust and to improve hole cleaning in soft formations. **ALWAYS USE A CLEAN SUPPLY OF WATER.**

Water injection will increase the hammer operating pressure; reduce the service life of the internal parts, and cause pitting at the base of the bit blow tube. Therefore, use just enough water for the drilling conditions present.

When drilling is complete, always shut off the water and blow air and oil through the drill string to remove the water and coat internal surfaces with oil. This will help prevent surface corrosion of the steel.

2.7 Drilling Under Water
The hammer is equipped with a check valve that closes when the air supply is shut off. This maintains air pressure inside the hammer and prevents water from coming up into the hammer.

Drilling under water increases the backpressure. The higher the head of water the greater the backpressure, the slower the hammer will penetrate. A point can be reached where the up-hole velocity is insufficient to over come the water head and the piston will stop. When needed, performance can be improved by opening the choke. This diverts air from the piston to help blow the water out of the hole.

2.8 Drill Pipe/Changing Pipe
Drill pipe must be kept clean and straight. Dirt and rust blown out of the drill pipe and into the hammer will damage the hammer’s internal parts. Always cover the hole in the drill pipe when doing a pipe change. Always blow out the pipe before connecting it to the drill string.

2.9 Function of Parts
To follow is a general description of the function of each of the major components in the hammer:

**Backhead:** connects the hammer to the drill string, closes and seals top of hammer, compresses the spring pack, forms check valve seat, transfers rotational torque to sleeve.

**Breakout washer:** is clamped between the backhead/wearsleeve and chuck/wearsleeve. Reduces the torque required to breaks the backhead/chuck thread loose.

**Check valve:** pushes open when air is supplied to hammer, closes by seating on backhead when air supply to hammer is cut off, when closed prevents water from flooding up into hammer if water is present.

**Check valve spring:** helps to push check valve closed when air supply to hammer is cut off.

**Choke pin:** is pressed into cross-hole in check valve, used to adjust hammer’s air consumption to compressor’s output, see section 2.4 in manual.

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Manual No. HW-49010

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Disc Springs: prevents axial movement of the air distributor/cylinder by applying a controlled force against the air distributor, force is developed by compression of the disc springs.

Cylinder: houses check valve and spring, guides top of piston, supplies air into piston area, controls air cycle, contains blow-by valve.

Piston: the only moving part cycles up and down to hammer on bit, controls air cycle.

Wear Sleeve: houses and locates all other parts, controls air cycle, transfers rotational torque to chuck.

Bit retaining ring: keeps bit from dropping out of hammer when bit is off-bottom.

Chuck: keeps bit retainer ring inside sleeve, transfers rotational torque from sleeve to bit, keeps bit in correct axial location.

Bit: transfers piston hammer energy thru buttons to rock causing rock fracturing, controls air cycle.

Put the halves together and set the ring on the chuck. Coat the threads with no-gall grease. Thread the chuck back into the wear sleeve.

2.11 Connect the Hammer
If the hammer is new, take a clean rod and push the check valve open and pour about a pint of rock drill oil down the center hole in the backhead.

Once on the rig, shoulder and torque both the chuck and backhead (Caution, see Section 3.4 step 11) onto the wear sleeve before starting the hammer. ALWAYS USE A WRAP-AROUND WRENCH TO GRIP THE WEAR SLEEVE.

Once the hammer is connected, check the travel of the bit. In the drilling position, the bit should shoulder on the chuck and when the hammer is pulled up, the bit should drop out 0.8” (20mm) on the RH4i model and 1.1” (28mm) on the RH4m model.

2.12 Drilling
With the hammer/bit up off the bottom of the hole, supply air to the hammer. The air will blow through the hammer but the piston will not cycle. This allows for continuous blowing to clean out the hole when needed.

Start rotation of the drill string and lower the hammer/bit onto the bottom of the hole. As the bit pushes into the hammer, the piston will begin to cycle and the pressure will build to its normal operating level.

Once a consistent formation is being drilled, set the rotation speed and hold down pressure. As a starting point, use a rotation speed shown in the chart below.

Set the hold down weight on the bit. As a starting point, the weight should be 1000 lb to 2000 lb. Keep in mind that as the hole goes deeper, the weight on the bit increases. Eventually hold back is needed to keep excessive weight off the bit.

Only driller experience will determine what RPM and bit weight combination work best in a given formation. In general, too slow a RPM results in slow penetration and shortened bit life but too fast a RPM will also shorten bit life. Excessive weight on the bit will cause bit button failure. Insufficient weight causes the piston blow energy to be dissipated into the bit and piston, which will lead to steel failure of these parts.
2.1 The Drill Bit

A quality Rock Hog hammer requires a quality bit. Rock Hog recommends using the proven Rock Hog line of DTH bits. A full range of sizes and face styles are available through your Rock Hog representative.

The bit is what carries the hammer piston energy to the rock therefore the condition of the bit cutting face should be checked after the completion of each hole drilled.

As the bit accumulates drill time, the buttons and steel will start to show a wear pattern. The pattern and rate of wear will vary greatly depending on the formation being drilled.

In soft formations such as limestone where the bit wears slowly, watch the buttons for "snakeskin" on the surface. These surface cracks must be ground off to prevent button failure.

In hard formations where the bit wears quickly, watch the size of the flats on the buttons. The buttons should be sharpened when the width of the flat is no wider than ½ the diameter to help prevent bit failure.

Some formations wash the steel away quickly. In this case the buttons start to protrude excessively. The buttons need to be ground down to prevent them from breaking off.

Dull buttons are the single biggest contributor to slowed penetration and excessive stress to the bit and hammer.

If a bit must be changed before a hole is complete, make sure the gage diameter of the bit used to complete the hole is no larger than the bit just removed. Using a larger bit will result in probable lost of the gage buttons before the bit reaches the bottom of the hole. For this reason, always keep 1 or 2 worn bits that are in good condition on the drill rig.

2.14 Breaking Threads Loose

When breaking the chuck thread loose to change bits, or the backhead loose to do hammer maintenance, follow these guidelines:

- **ALWAYS USE A WRAP-AROUND WRENCH** this is to prevent pinching the sleeve out-of-round
- **KEEP SHARP JAWS IN THE WRENCH** the wear sleeve surface is very hard to give a long service life so only quality hardened or diamond-tipped jaws in good condition will grip the sleeve
- **DO NOT WELD ON THE SLEEVE** welding on the hardened sleeve will crack the sleeve and voids any warranty on the sleeve.
- **PLACE THE WRENCH AS SHOWN BELOW**

2.15 Monitoring

As the hammer accumulates drill time, these areas need to be monitored to determine when to service the hammer.

**External surfaces:** Rock Hog hammer parts are made from the best materials and hardened for long life but eventually these surfaces will wear away. The rate of wear depends on the formation being drilled,
drilling speed and airflow. Make periodic checks to know what condition the parts are in.

Normally the chuck wears out first. Check the wall thickness on the bit shoulder end. When it measures 3/8” (10mm) or less at any point, replace the chuck. The service life of the chuck also heavily depends on the condition of the drill bit.

The wear sleeve will normally wear more on the chuck end. When the outside diameter reaches 3-7/16” (87mm), flip the sleeve. Once either end has worn down to a 3-5/16” (84mm) diameter, replace the sleeve. The service life of the sleeve also heavily depends on the condition of the chuck.

Chuck splines: check the condition of the chuck splines each time the bit is removed. Do not put a chuck with badly worn splines on a new bit.

Shoulder Gap: the backhead is designed to have a gap when hand tight. Periodically check the gap between the backhead and sleeve when the backhead is hand tight only. If the gap falls below .08” (2.0mm), refer to Section 3.4-step 10.

Operating pressure: this is the best way to know what condition the internal parts are in. As internal parts wear, the operating pressure, and therefore the penetration rate, will drop. Only the operator can say when hammer performance has dropped below an acceptable level at which time the hammer must be serviced. If the pressure goes up after the hammer has been in service for some time, this would indicate the piston is sticking or the air passages inside the hammer are becoming restricted.

2.16 Storage

Overnight
When drilling is complete for the day, shut off water and any other injections except the oil and allow air and oil only to blow through the hammer for a minute or two. This will blow out most of the water and other injections and coat all the internal parts with oil. If the hammer is in a wet hole, bring the hammer above the water level before blowing it out.

Short term
If the hammer will be off the rig for no more than 3 weeks, blow air and oil only through the hammer for a minute or two before taking it off the rig. This will blow out most of the water and other injections and coat all the internal parts with oil. Store that hammer in a dry area with the ends covered. The storage area should have a steady temperature to prevent surface condensation during temperature swings.

Long term
A used hammer going into storage for a month or more should be torn down with all parts cleaned, dried, oiled and stored assembled or disassembled in a dry, steady temperature area. This is to prevent surface corrosion. Surface corrosion is a main cause of part failure in hammers.
Section 3. Maintenance

3.1 Schedule

If the need for service defined in Monitoring, section 2.14, is not reached first, follow these guidelines for servicing the hammer:

When the hammer is operated to the parameters defined in section 2 in formations up to what is considered “hard”, perform service every 25000 feet (7600 meters) of drilling.

When water injection & drilling foams are used extensively, perform service every 18000 feet (5500 meters).

When drilling in “very hard” formations or when drilling under heavy mud, perform service every 10000 feet (3000 meters).

When injecting agents that are corrosive to metal, like potash to coat the hole wall, clean the hammer at completion of the job.

Use this as a starting point. Keep a log of service done vs. footage drilled. This will help refine the service schedule to fit your operation.

3.2 Disassembly

All parts are a sliding or clearance fit inside the hammer. Some parts are held in by retaining rings. Some parts may be tight inside the hammer depending on the condition of the parts and the time period since the hammer was last serviced. Any basic tools required to disassemble and assemble the hammer are described as needed.

1. Break both the backhead and chuck threads loose. See section 2.13

2. Lay hammer on a bench, mark the sleeve ends for future reference, “backhead” and “chuck”

3. Turn out the backhead, lift out the check valve, check valve spring, (4) disk springs, and the disc spring centering ring.

4. Turn out the chuck, lift out the bit retainer ring. The bit retainer ring is a split ring with an o-ring around it to hold the 2-halves together.

5. Remove the cylinder & piston.
   a. Stand the sleeve on the backhead end on a solid surface. With a rod on the piston face, drive on the piston. The cylinder is held in by a retaining ring that will collapse out of its groove allowing the parts to come out. It will take moderate force to collapse the ring. Once collapsed, the parts will advance with less force. Caution, do not run the rod down thru the center hole in the piston. This is to prevent damage the cylinder center pin.
   b. Stop driving the parts out before the cylinder center pin has bottomed out. This is to prevent damage to the center pin.
   c. Lay the sleeve horizontal to complete the removal.
6. Remove the piston-retaining ring. Pull the cylinder off of the piston. Put the piston back into the sleeve the same way it just came out. Stand the sleeve on the chuck end on a solid surface. With a rod on the piston face, drive on the piston. The retaining ring will collapse out of its groove and push out. It will take moderate force to collapse the ring. Once collapsed, the parts will advance with less force.

Once the ring has bottomed out, lay the sleeve horizontal and push the ring and piston on out.

Disassembly is complete.

3.3 Inspection

Before cleaning any parts, observe them for oil. If the hammer is being properly lubricated, the parts should have a substantial film of oil all over but not dripping.

**None of the following should be found inside:**
- Dirt and grit
- Metal shavings
- Grease (other than at the chuck & backhead)
- Rust and corrosion

Clean all parts. Carefully look over all parts for cracks, corrosion, and pitting. Any corrosion indicates the hammer is not being oiled properly. Corrosion greatly increases the chance of cracks starting. Removed any and all corrosion using fine emery paper.

**Galling- is surface damage caused by metal-to-metal contact under high loads. Many of the parts listed will be checked for galling. Any sign of galling indicates lack of lubrication, use of the wrong type of lubricant, or parts have been damaged to the extent there is interference between parts.**

**Max Clearances:** Wear on the following part locations directly affect the hammer’s operating pressure, and therefore the penetration rate. When clearances have reached the values given below, Rock Hog considers the part or parts worn out and recommends replacement. However, the hammer will continue to operate at clearances greater than those listed but at a greatly reduced efficiency. So only the operator can say when hammer performance has dropped below an acceptable level. Some operators may choose to replace parts before these limits have been reached to keep the hammer running at top performance.

**Clearance 1:** Piston OD to Sleeve ID .008

**Clearance 2:** Piston OD to Cylinder ID .009

**Clearance 3:** Check Valve ID to Air Dist OD .010
Clearance may be checked using feeler gages or by measuring both parts with micrometers. Additional details are given under individual parts below. Again, keeping a log of when & what service was performed will help fine-tune the service schedule to fit your operation.

**Backhead:** be sure to remove all the old grease from the drill pipe connection threads. Moisture can get trapped under the grease and corrode the surface. This also allows for a visual check of wear on the threads. Compare the worn threads to a new thread. If 50% of the thread form is worn away, replace the backhead.

Check the condition of the o-ring. If it is cracked, cut, or brittle, replace it.

Check the large threads for galling. Polish out any damaged areas.

**The outside of the backhead will wear away. This wear is not detrimental to the function of the hammer but will eventually allow the drill pipe to wear away. Replace the backhead if it is no longer protecting the drill pipe.**

**Check Valve:** check the condition of the rubber top. If the surface is degraded, replace the check valve.

**Check Valve Spring:** the outside of the spring will be worn on one side about mid-length. If the wire diameter has been reduced by more than 30%, replace the spring.

**Disc Springs & Centering Ring:** Check springs for cracks. Replace any cracked springs. Never replace an individual spring, always replace the set of (4) together. Check the ring for any damage.

**Cylinder:** the cylinder is made up of (3) separate pieces. Do not remove any of the separate pieces. When purchasing a new cylinder, all (3) pieces come assembled as one part.

Check the inside bore for galling with the piston. Polish out any surface damage.

Check the inside pin for any signs of damage. Slide the cylinder down over the piston. By sense of touch, feel for any indication that the pin may be rubbing on the piston bore. Replace the cylinder if it does not slide freely over the piston. **Be aware there is a certain position where the piston traps air inside the cylinder and will hold back the free movement through that position.**

Check the retaining ring for wear on the faces. These faces may become worn and rounded. Replace the cylinder if the faces are badly worn.

Check the clearance of the bore with the top diameter of the piston. If it exceeds .012” (.30mm), replace the cylinder. Recheck the clearance with the new cylinder, if the clearance exceeds .009” (.23mm), replace the piston.

**Piston:** check the (2) outside guide diameters and top bore for galling and burning. Polish out any minor damage found on the surfaces.

Any black areas on the surface indicate the piston was rubbing and over heating. Surface heating is very detrimental to the piston. In most cases, if the surface is black, that surface will also be covered with cracks. Replace the piston if it has excessive surface cracks.

If the wear sleeve has not been previously flipped, check the clearance of the piston’s big diameter with the sleeve bore where the cylinder sits. If it exceeds .010” (.30mm), replace the piston. Check the new piston to the sleeve bore on the chuck end where the piston runs. If the clearance exceeds .010” (.25mm), flip the wear sleeve at assembly (note: normally sleeve external wear determines when the sleeve gets flipped).

If the sleeve has been previously flipped, check the clearance of the big diameter with the sleeve bore where the piston runs. If it exceeds .012” (.30mm), replace the sleeve. Check the piston to the new sleeve bore. If the clearance exceeds .009” (.23mm), replace the piston.

Check the strike face for chipping and pitting. Replace a piston with a badly damaged strike face.

**Note:** the face can be reconditioned by removing up to .04” (1mm) of material. Only a qualified machinist should do this. Reconditioned pistons are not covered under warranty.

Remove any nicks, dents, burrs with fine emery paper or a fine honing stone.

**Again look over the piston for any rust, corrosion, pitting. All these will lead to cracks and failure of the piston.**

**Wear Sleeve:** Check the outside diameter. The wear sleeve will normally wear more on the chuck end. When any location on the outside diameter has reached 3-7/16” (87mm), flip the sleeve. **Once any location has worn down to a 3-5/16” (84mm) diameter, replace the sleeve.**

Check the bore where the piston runs and the threads for galling. Polish out any surface damage.

Check the grooves where the retaining rings sit. If the corners are worn down, replace the sleeve.

**Piston Retaining Ring:** Examine the ring for cracks or damage. Replace if needed.

**Chuck:** check the large threads for galling. Polish out any damaged areas.

Check the splines. The driving side will wear away. If the form of the driving side still matches the bit, the chuck is usable. If the form no longer matches the bit or more than ½ the spline thickness is worn away, replace the chuck.

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Check the outside diameter for wear. If the wall thickness on the bit shoulder end measures 3/8” (10mm) or less at any point, replaced the chuck.

**Breakout Washers:** These copper washers are on the hammer when shipped. One between the backhead and sleeve, and one between the chuck and sleeve. The washers are optional but they do reduce the torque required to break the threads loose. These rings do disintegrate over time. During inspection there may be just a portion of the ring remaining or no ring at all.

Please note that there are assembly instructions for these washers but they are not shown in the maintenance schematics.

### 3.4 Assembly

Any basic tools needed, will be described as needed. Step 6 will require at a minimum a simple bushing to help install the cylinder or Rock Hog’s assembly tool #45402 (sold separately) is available.

1. Make sure all parts are clean. Wash and wipe off and/or blow out any dirt. Apply a light coat of oil to all internal parts as they are assembled.

2. Apply a light coating of oil into the bore of the wear sleeve. Based on the inspection, determine which end of the sleeve will be the chuck end. If the sleeve has been replaced, start on either end since the sleeve is the same on both ends.

3. Install the piston retaining ring.
   a. Stand sleeve on the beakhead end on a solid surface.
   b. Push ring into top bore in sleeve.
   c. Using the piston, drive the ring into the sleeve. The ring will stop and seat into the groove that is 5” down in the sleeve. Pull piston out.

4. Set in the bit retainer ring in on top of the piston-retaining ring. If you use them, put the breakout washer on the chuck now. Apply a thick coating of copper coat grease to the chuck thread. Thread in the chuck until hand tight. The chuck should shoulder on the sleeve. If it does not, there is a part out of location.

The bottom end is complete. Remaining parts go into the backhead end.

5. Apply film of oil to piston. Lay the sleeve horizontal and push piston, large end first, into the sleeve. The piston will hang up some as it passes the grooves but should slide free then to the piston retaining ring. If the piston does not slide free between the grooves, remove it and determine what is holding it up.

6A. Installing the cylinder without Rock Hog tool #45402. Wrap-around chain vise pliers and a simple metal bushing, 3.142/3.140 OD x 2.955/2.960 ID x 1.5 long, are needed for this procedure. During this procedure, **DO NOT** hammer on the cylinder center pin.

   a. Stand the sleeve on the chuck on a solid surface.
   b. Set the bushing into the front bore of the sleeve
   c. Set the cylinder into the sleeve so the retaining ring is resting on the bushing
   d. Pull the cylinder back up 0.2” and use the chain pliers to collapse the ring into the deepest groove in the cylinder.
   e. Tap the cylinder in so that the ring starts into the bushing. Once the bushing will keep the ring collapsed, remove the pliers.
f. The ring will only seat into the correct location so drive the cylinder in (DO NOT hammer on the center pin) until it comes to a hard stop at about 5” down.

g. Remove the bushing from the sleeve.

6B. Installing the cylinder can also be done using Rock Hog tool #45402. This kit is sold separately and comes complete with instructions. Contact your Rock Hog representative for availability.

7. Set the centering ring on top of the cylinder. Stack the disc springs as shown here and set them inside the centering ring.

8. Set the check valve spring into the cylinder center pin, set the check valve over the spring and make sure it moves up and down freely.

9. Put the o-ring and, if used, the breakout washer on the backhead. Apply a thick coating of no-gall grease the backhead thread. Thread the backhead into the wear sleeve until hand tight. Note that when the o-ring contacts the sleeve, the backhead will become hard to turn by hand due to o-ring drag.

10. With the backhead hand tight there should be a .16-.08 inch(4.1-2.0 mm) gap between the backhead shoulder & sleeve face. If the gap is greater than this, one or more parts are not in the correct location. If the gap is smaller than this, perform one of the following:
   a. Purchase and install Rock Hog part #943020 between the cylinder and bottom disc spring
   b. Obtain and install a steel washer (2.76 OD x 1.69 ID x .060 THK) between the cylinder and bottom disc spring

If the gap is less than .08 and a make-up washer is already in the hammer, then replace the disc springs, assemble the hammer without the make-up washer, and check the gap. If the gap is still less than .08, put the make-up washer back in.
11. If the backhead is not torqued to close the gap right at the time of assembly, always check the following before the backhead is torqued tight:

It is possible, due to movement of parts during transport of the hammer, for the centering ring to rise up off the cylinder and allow the bottom disc spring to slide in under the ring.

Internal parts will be damaged if the backhead is torqued with the spring out of position. Always pull the backhead and make sure the disc springs are inside the centering ring before the backhead is torqued tight.
Section 4. Parts Breakdown

Exploded View

Assembled View

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Part List
Shown at the right side of the chart is the quantity of spare parts that should be kept on hand. Level 1 is for water well drilling, Level 3 is for high production drilling.

<table>
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<th>PART No</th>
<th>QTY REQUIRED</th>
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<th>KGS</th>
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Section 5. Trouble Shooting
These are typical problems that can develop after the hammer has been in service:

**Possible Causes**

**Piston will not cycle**
1. Bit blow tube is broke
2. Piston stuck in sleeve due to
   a. Sleeve was pinched shut with wrench when threads were being loosened/tightened
   b. Foreign material entered through drill string and jammed piston
   c. Mud backed up into hammer (drilling under water), inspect the check valve
3. An internal part failed

**Slow penetration, pressure ok**
1. Dull or broken buttons on bit
2. Incorrect drill rotation or down pressure for the formation being drilled
3. Harder rock formation than the normal

**Low pressure**
1. Leak in the air line
2. Leak in the hammer (cracked or broken part)
3. Compressor output problem

**High pressure**
1. Air line is partially closed off
2. Piston is sticking
3. Foreign material clogging air passages in hammer
4. Bit blow holes are clogged