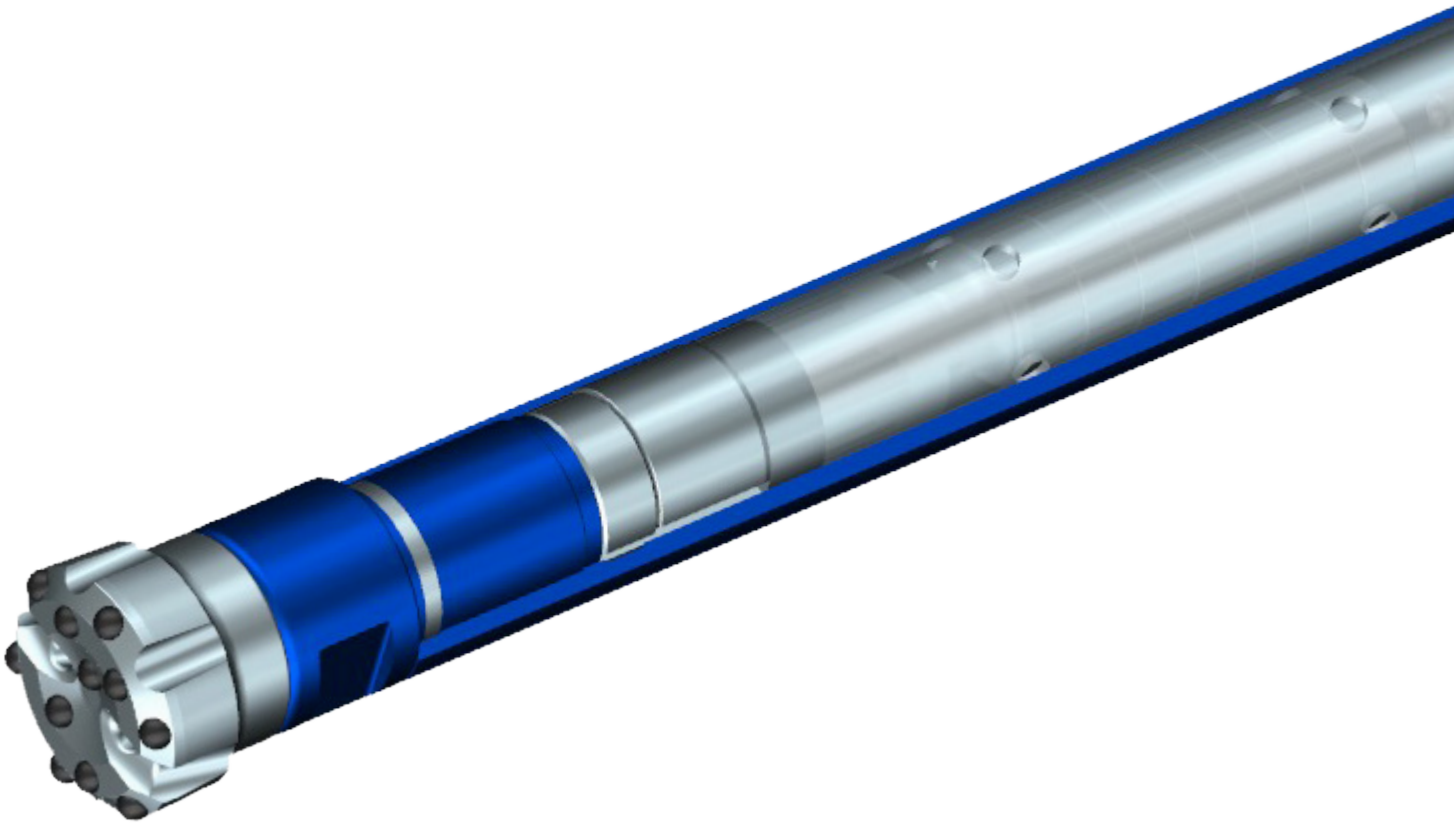
Drill King International

# DK-20 Hammer Series



## Technical Manual

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# Introduction

Drill King International was founded back in 2004 by Randy Broseh in Arlington, Texas. A year later, the business turned into a real family affair when brother Larry Broseh acquired the business. The brothers used their extensive industry knowledge to create a unique company with the best customer service in mind.

Continued growth and customer demand saw Drill King in 2008 decide to build a 60,000 sq.ft (5,575 sq.m) facility in Mansfield Texas. From this point the company has gone from strength to strength creating innovative drilling tolls and solutions for a variety of customer projects around the globe.

# DK 20 Hammer Introduction

The DK Hammer Series is designed to operate efficiently on air pressure. Compressed air is directed to the hammer via the rotation spindle and drill pipe. Exhaust air from the hammer is passsed through blowholes in the drill bit and is used to flush clean the drilled hole. Rotation is provided by a rotation unit on the drill rig and transferred to the hammer via the drill pipe.

The drill pipe is threaded so that the drill string can be extended as drilling advances and the hole becomes deeper. Feed force is also transmitted to the hammer via the hole down unit and the weight of the drill pipe.

DKI Valved D.T.H. hammers are robust tools of simple design to provide for maximum Performance with the minimum of maintenance.

DKI Valved hammers are designed to operate efficiently at air pressures, between 100 psi (7 BAR) and 250 psi (17.5 BAR), using a wide range of Button Bit diameters, from 2.75" (70mm) to 3.50" (90mm).

DKI Valved hammers are supplied with a Check Valve arrangement which maintains pressure in the hammer when the air has been shut off, and so helps prevent contaminated water entering the hammer.

DKI Valved hammers are fitted with an Air Metering Plug. This is supplied as a solid plug, but can be drilled out to a selection of hole sizes in order to increase the volume of flushing air, if excess compressed air is available. This is to suit particular drilling conditions.

# Safety Recommendation & Precautions

The safety Recommendations listed below are intended to alert the hammer operators and maintenance personnel to the possible physical dangers inherent in the various phases of operating and maintaining equipment of this kind.

We recommend that all operators and maintenance personnel read and thoroughly understand the safety precautions before attempting to operate or perform maintenance on the drilling equipment. We put "**SAFETY FIRST**" and suggest this must always be the primary consideration of all personnel while operating or maintaining the equipment.

Since the Safety Recommendations can't cover every potential situation, it is suggested that everyone exercises good judgernent and common sense while operating, servicing, or working near the equipment.

**NOTE:**
**SAFETY STATEMENTS ARE INCLUDED THROUGHOUT THE MANUAL WHERE IT MAY APPLY SPECIFICALLY TO INDIVIDUAL COMPONENTS OR ASSEMBLIES. FAILURE TO COMPLY WITH SAFETY WARNING CAN RESULT IN SERIOUS OR FATAL INJURY. IMPROPER OPERATION AND MAINTENANCE CAN CASUE SEVERE EQUIPMENT DAMAGE OR EXCESSIVE WEAR ON THE HAMMER AND HAMMER BIT.**

- ☑ Be equipped with appropriate attire, hard hat, gloves, safety shoes, eye and ear protection. Don't wear loose clothing that could get caught in the equipment.
- ☑ Safety goggles or safety glasses are required. Rocks, dust, and loose particles from drilling may be blown into the as during drilling. Also, use safety glasses when sharpening bits.
- ☑ Handle all equipment with care.
- ☑ Operating the hammer at extreme pressures or speeds may cause failure or excessive wear. Please follow the instructions in the technical manual and use the recommended procedures for operation and maintenance of the hammer.

☑ Compressed air or fluid used for cleaning purposes should be utilized with extreme caution:

- Do not apply directly to your skin
- Do not use for cleaning directly from your clothing
- Do not direct it at another person
- Be careful not to blow directly into the equipment
- Wear safety glasses **AT ALL TIMES** of the operation

☑ Check the drill rod to power head spindle joint and make sure it is securely tightened before running the rotary head in reverse rotation. If you have a loose connection, it could result in the drill rod becoming disconnected cornpletely. If the drilling rod becomes disconnected, it could strike personnel.

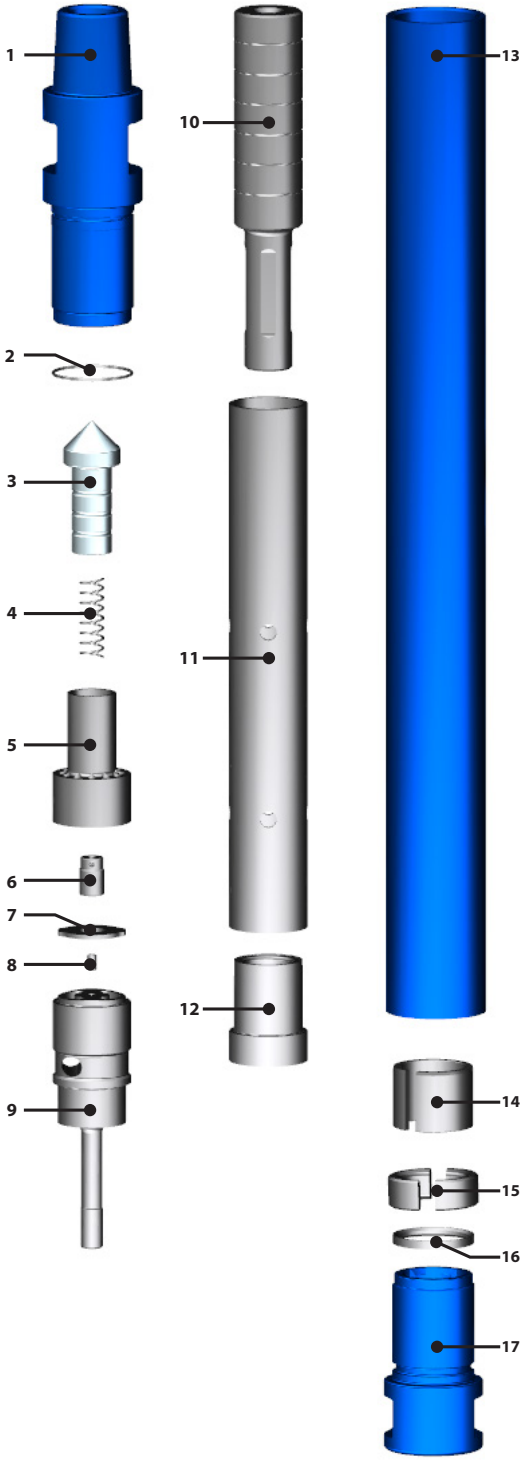
☑ Be cautious about getting under the downhole hammer for inspedion. The downhole hammer could unexpectedly cycle, forcing the piston to drop out of the downhole hammer. This could cause bodily injury to anyone under the downhole hammer.

☑ When using solvents to clean parts, make sure that they are nonflammable, and that it meets current OSHA and International Standards; be sure to use the solvent in a well-ventilated area.

☑ Be sure all downhole hammer components are properly lubricated and maintained, while in storage. Failure to follow lubrication recommendations could cause damage and wear to the downhole hammer, its components, and /or personnel injury.

☑ Never heat up any parts of the hammer or weld on it. Use extreme care when breaking loose the top and bottom connections, using either a spanner wrench or a flat wrench that properly fits the driver and top sub.

# DK 20 Hammer View and Parts List




| NO | Part Name | Qty | Part Number |
|---|---|---|---|
| 1 | Top Sub | 1 | HPDK02002 |
| 2 | Top Sub O-Ring | 1 | HPDK02003 |
| 3 | Check Valve | 1 | HPDK02007 |
| 4 | C.V. Spring | 1 | HPDK02009 |
| 5 | Guide | 1 | HPDK02004 |
| 6 | Centralizer | 1 | HPDK02006 |
| 7 | Disk Valve | 1 | HPDK02005 |
| 8 | Choke Set | 1 | HPDK02008 |
| 9 | Air Distributor | 1 | HPDK02010 |
| 10 | Piston | 1 | HPDK02014 |
| 11 | Cylinder | 1 | HPDK02012 |
| 12 | Bit Bearing | 1 | HPDK02020 |
| 13 | Wear Sleeve | 1 | HPDK02001 |
| 14 | Spacer | 1 | HPDK02023 |
| 15 | Bit Ret. Ring | 1 | HPDK02018 |
| 16 | Chuck Seal | 1 | HPDK02024 |
| 17 | Chuck | 1 | HPDK02022 |
| | Complete Hammer | | HABC20 |

| Dimensions & Weights | |
|---|---|
| Top Sub W+H Taper Pin | (Optional RD50 Box) |
| Eff. Length (in / mm) | 29.4 / 746.7 |
| OD (in / mm) | 2.44 / 62 |
| Weight w/o bit (lbs / Kg) | 28.6 / 13 |
| Piston Weight (lbs / Kg) | 4 / 1.82 |

## DK 20 Hammer Air Consumption at Different Working Pressure

| PSI | BAR | CFM | CuMtr/Min |
|---|---|---|---|
| 100 | 7 | 70 | 2.0 |
| 150 | 10.5 | 135 | 3.8 |
| 200 | 14 | 205 | 5.8 |
| 250 | 17.5 | 270 | 7.6 |

In difficult drilling conditions, extra flushing can be obtained by changing the choke in the Air Distributor. This might be desirable, e.g. when there is a large influx of water into the hole, when there is a big difference between the diameter of the drill bit and the diameter of the drill pipes, or when penetration rates are abnormally high.

Friction between the drill pipes and the hole wall can sometimes reduce the penetration rate. Increasing the air pressure to give more impact power and faster penetration can often counteract this.

## DK 20 Hammer Assembly

The DK 20 Hammer assembly process is identical to the disassembly process yet in reverse.

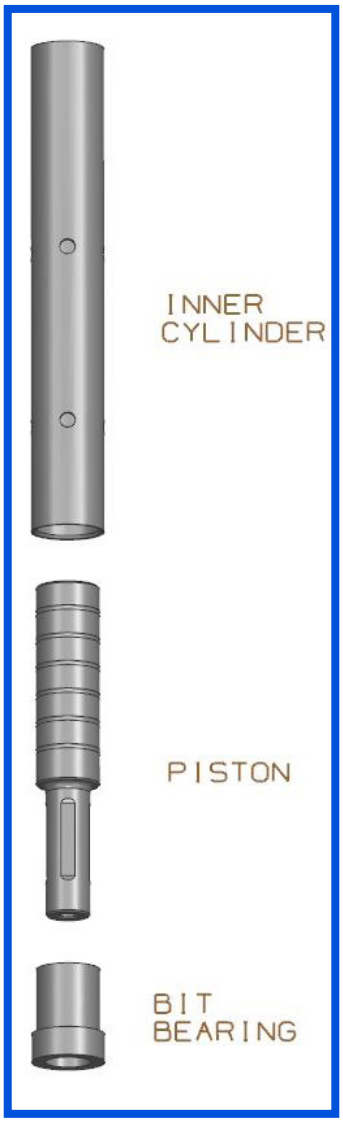
The following guideline should be used;

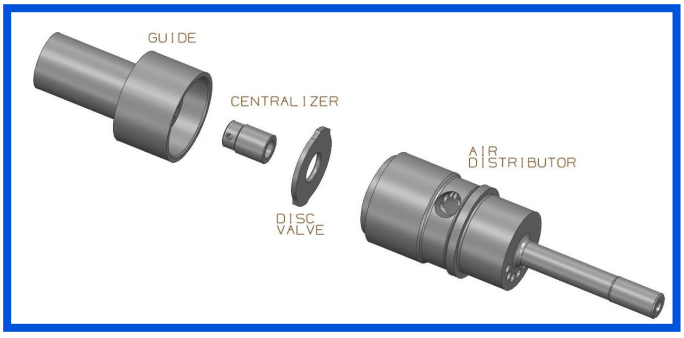
- All parts should be clean and free of grit, dirt, and other foreign material.
- All nicks and burrs on parts should be removed.
- All parts should be coated with rock drill oil & threads with thread grease and preferably the same type to be used on the drilling rig.
- All damaged O-rings' should be replaced. All seals should be oiled or greased to avoid cutting or tearing.
- Make sure the threads are clean and dry, and that sufficient drying time is allowed.

# Selective Replacement

1. Mount the Wearsleeve into the vice and nip gently.
2. Push wad of clean rags through the bore.
3. Check bore of Wearsleeve for cleanliness and identify the end of the bore with the two eccentric grooves machined internally. The Spacer will be Chuck end fitted to this, the of the Wearsleeve
4. Stand the Wearsleeve, Chuck end uppermost on a wooden block
5. Insert compression tool into the end of the Wearsleeve and place Spacer into the compression tool.
6. Drive the Spacer through the compression tool, the chamfered end goes in first.
7. When the Spacer is clear of compression tool remove tool and drive Spacer into the Wearsleeve. Distance from Wearsleeve end face is 3 1/4" (82.55mm) for DK-20
8. Mount the Wearsleeve in the vice with Chuck end to the left.
9. Clean the Bit Bearing and place wide end down on bench.
10. Oil the shank of Piston and stand the Piston inside the Bit Bearing.
11. Clean the Inner Cylinder. Identify the correct way up (i.e. radiused end to the Bit Bearing).
12. Lower the Inner Cylinder over the piston until it seats on the bearing shoulder.
13. Valve Assembly

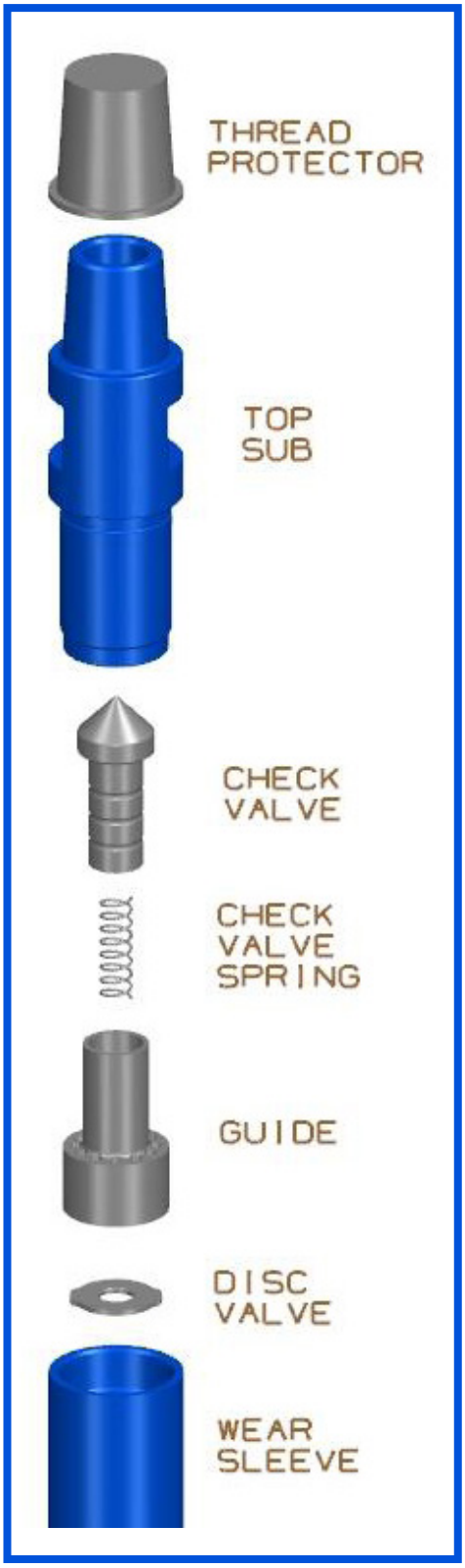
    The DK-20 model employ Disc Valves. Clean the Air Distributor, the Guide and Centralising Plug. Insert the Plug in its position in the Guide. Clean the Disc Valve and oil it with a light oil. Locate it on the Centralising Plug Join the Guide and Air Distributor with the Disc Valve in place.



# Reassembly Procedure

1. Oil the guide on the Air Distributor and the smaller diameter of the Air Distributor itself. Insert the Air Distributor into the end of the Cylinder .
2. Smear oil on all outside surfaces of Inner Cylinder, Air Distributor and Bit Bearing.
3. Introduce the assembly to the wearsleeve. The assembly DK-20, will slide comfortably home with the Bit Bearing butting upto the Spacer.
4. If a Backhead Spacer is to be fitted, it should be fitted at this stage.
5. Oil the Check Valve and fit into bore of Guide. Push the Check Valve home and check that it does not stick by rotating and fully depressing it to the bottom of the bore in the Guide.
6. Fit a seal to the groove at the base of the Top Sub threads grease the threads and screw the Top Sub fully home.
7. Fit the plastic thread protector over the Top Sub threads.
8. Insert the Bit Retaining ring halves into the Chuck end of the Wearsleeve.
9. Apply grease to threads of Chuck and screw Chuck into Wearsleeve.
10. If a bit is to be fitted slip the Chuck over the Bit splines fit Retainers over plain portion of Bit Shank. Offer the Bit assembly to the Wearsleeve and screw home.
11. Choke Set where fitted this is a steel Allen headed type plug which is screwed into the Air Distributor.



# General Maintenance

In normal dry drilling conditions, it is advisable to dismantle and check all hammer componentsevery 250 hours of operation.

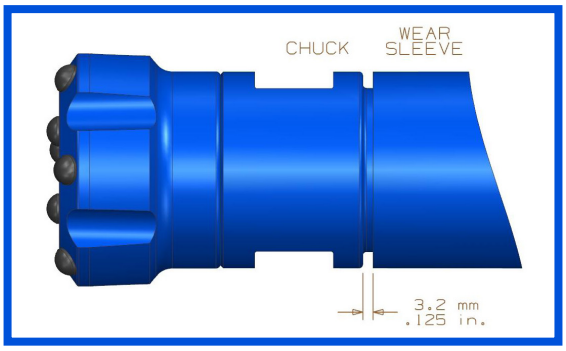
1. If a part is to be replaced because of irreparable damage or ultimate wear, then that part must be scrapped to ensure it is not put back into further use. This would seriously accelerate wear of certain other components.

   When new, all DKI Valved D.T.H. hammers will have a gap between the Chuck and the Wearsleeve. This is necessary to ensure that all the internal components are held securely in place.

   This gap will gradually reduce during drilling and it is very important to check this gap approximately every 100 hours of operation.

   When this gap reduces to 1.6mm (0.06) it is necessary to install the Backhead spacer. This is to be positioned between the Guide and the Top Sub.

   To install the Backhead spacer loosen off the Chuck then remove the Top Sub and place the Spacer on the Guide. Now torque up the Top Sub and tighten up the Chuck. You should now find that the Chuck gap has been restored to its original width




2. **Component checks on dismantled hammer**

   With the hammer dismantled into its component parts, check for lubrication starvation. The Piston especially will show heat cracks and eventually larger cracks if the hammer has been under lubricated or used with an incorrect type of lubricating oil. (See page 11. For details.)

3. **Selective replacement**

   When the tolerance between the Piston Stem and the Bit Bearing exceeds the values given in the table below, it is necessary to replace the Bearing. Similarly, when the tolerance between the Piston bore and the Air distributor probe (this is the protuberance over which the Piston head operates), exceeds the limit, the Air distributor should be replaced.

## Wear Tolerance

When the Piston and the Inner Cylinder exceed the values shown, either the Piston or the Inner Cylinder must be removed. In this case, do not scrap the replaced part as it can be returned to the hammer when the new partner is installed. In this way it is possible to double the life of both the Piston and the Inner Cylinder.

| HAMMER | PISTON INNER CYLINDER | PISTON STEM BEARING | VALVE GUIDE PISTON BORE |
|---|---|---|---|
| DK-20 | 0.009ins. (0.23mm) | 0.009ins. (0.23mm) | 0.011ins. (0.28mm) |
| | | | |

4. **Valves**

   The DK-20 hammer Disc Valves, which are of even thickness. Check the Valves for cracks or pitting marks. By placing the Disc Valve on the bevelled valve housing and holding it in front of a light (or daylight) it is possible to conduct the 'light test' .That is, if light is discernible between the Guide and Air Distributor, turn it over and test the other side. If light is still discernible scrap the Guide. (Assuming that the Air Distributor is not faulty.)

5. Check the Air Distributor for score marks. If scored, clean with fine emery cloth.

6. Check the ends of the Inner Cylinder for chipping, also the shoulder of the Bit Bearing. Chipping in these areas indicates that the hammer has been run with the Chuck or Top Sub (or both) in a loose condition. Failure to maintain the gap between the Chuck and Wearsleeve will also result in chipping and ultimate failure in the aforementioned areas.

7. Check the Check Valve located underneath the Top Sub. Depress it until it "bottoms" turning it slightly each time to ensure that it does not stick down. It is advisable to change the Check valve if its sealing capacity is in doubt. Check the Spring for breakage or weakness.

## Lubrication

In order to maintain satisfactory operation of the Drill King Hammers, you must lubricate the hammer properly. The recommended lubricant to use with Drill King Hammers is the Biodegradable and Environmentally Friendly **Rock Drill Oil (Part Number DKRDO-5G).**

- Check the oil level in the lubricating tank
- Check for oil in the compressed air.
- Mineral oils have the best lubricating properties
- Lubricating out used in water well drilling should be non-toxic.

You can make sure the lubricant is being carried to the hammer via the compressed at by placing a plank over the drill steel support and letting the operating air blow over the plank. If you see that it is oily then the oil should be getting to the hammer. It is also essential to the life of the hammer components.

Proper thread lubricants are also critical to the life of the hammer components. Thread lubrication applied to the stress relief grooves at the base pin will help fight the effects of corrosive drilling fluids.

It is a necessary procedure to reapply thread lubricant (Drill King Copper Cote Part No. 630010 1-gal) to the driver sub threads when changing bits. It is also important that the drive sub and the top sub threads be recoated with thread lubricant often in order to assure the maximum protection from corrosion pitting.

Corrosion failures in percussion hammers and hammers bits can be controlled by maintaining a protective barrier between the bit and hammer parts and the environment through proper application of readily available rock drill oils and thread lubricants.

The best method for preventing failures due to corrosion fatigue is to be sure the surface of the bits and components of the hammer is coated with rock drill oil. Threaded connections and thread run out grooves should be protected by coating with thread lubricant. When using water injection, solvable rock drill oil with a higher viscosity rating should utilized.

## Storage

When storing Drill Hammers, it is important to blow the hammer clear of all water. After disassembling the hammer, all internal parts are liberally coated with rock drill oil. Store the hammer horizontally in a clean dry place.

# Warranty

NOTICE TO CUSTOMER: READ CAREFULLY, THESE TERMS AND CONDITIONS CONTAIN DISCLAIMERS OF WARRANTIES AND STRICT LIMITATIONS OF LIABILITIES AND REMEDIES. NO WARRANTY IS TRANSFERRABLE WITHOUT THE EXPRESS PERMISSION OF DRILL KING INTERNATIONAL.

Drill King International LP warrants to the original purchaser that its products are free from defects in material and workmanship for a period of:

- ☑ Percussion Bits — One year from the date of purchase.
- ☑ DTH Hammers — Six months from the date of purchase.
- ☑ WAI Hammers — Three months from the date of purchase.

Claims of defects in material and workmanship are subject to review and physical inspection of the returned product. Failure of the purchaser to provide relevant operational details to assist in the investigation will result in the denial of the claim. Until resolution, the purchaser must retain and appropriately store the claim. part. Upon request, the claimed part must be sent to Drill King for assessment. Any part or product sent to Drill King must be accompanied with a "Return Authorization Form" issued, in advance, by the Sales Department at Drill King. All return packaging must clearly be marked with the return authorization number. Freight for the return must be pre-paid by the purchaser. Failure to abide by these instructions will result in refusal to accept the returned product at the Drill King facility.

To begin a warranty claim a 'Product Evaluation Report' must be fully completed and submitted within the above mentioned time frame or warranty life

The report must be completed and submitted within (14) days of either the time of discovery of defect or when reasonable discovery of defect should have been made.

Warranty Claims will only be accepted on products still within their warranty life.

Drill King International expressly excludes the following from the terms of this warranty:

- ☑ Incidental or consequential damages connected with the use of their products
- ☑ Claims of parts issued under concession.
- ☑ Claims of lost time
- ☑ Performance outside of the standard scope provided by Drill King International
- ☑ Effects of corrosion and/or normal wear
- ☑ Hammer seals and/or items intended to wear
- ☑ Any part that shows evidence of improper application
- ☑ Fitness for use other than the intended purposes of the product
- ☑ Proprietary design where the design control is retained by the customer, particularly when design parameters are outside Drill King Internationals recommended specifications (E.X. Oversized bits or hole openers.)
- ☑ Evidence of abuse, localized heating, welding, galling, corrosion, inadequate lubrication, physical alteration, wrench marks, lack of proper maintenance, operating outside recommended specifications, bending or otherwise distorting, excessive wear, improper storage or transportation, and chipped or crushed carbides must result in denial of claims
- ☑ Damage caused as a result of using incorrect servicing tools or procedures
- ☑ Evidence from wear shows the product has achieved at least 7596 of its expected life.
- ☑ Any part that is described as "No Warranty" in the quote, order acknowledgement, order, packing list, or invoice
- ☑ Special warranties described in the quote, order acknowledgement, order, packing list, or invoice

## Troubleshooting

| Fault | Cause | Remedy |
|---|---|---|
| Inoperative Drill | Drill bit blow holes blocked | Unblock Holes |
| | Dirt inside drill | Strip and clean drill |
| | Worn or damaged parts | Replace damaged parts |
| | Insufficient lubrication | Check oil level, Adjust lube needle valve |
| | Excessive lubrication | Adjust lube valve needle |
| | Hanging piston | Piston stuck, Polish out the score marks |
| | Insufficient air pressure | Check compressor, discharge and increase to, operational valve |

| Fault | Cause | Remedy |
|---|---|---|
| Slow Penetration | Insufficient air pressure | Increase discharge pressure |
| | Dull drilling bit | Regrind or change bit |
| | Worn drill parts | Replace worn parts |
| | Too much or to little lubrication | Check oil level and if necessary adjust lube needle valve |
| | Dirt in drill | Strip and clean |
| Low Return Air Velocity | Low air pressure | Increase air pressure |
| | Insufficient hole clearing air passing through metering plug | Insert metering plug with larger orifice or remove plug altogether |
| | Drill bit exhaust holes blocked | Clean out blockage |
| Spasmodic Operation | Flapper valve inserted, wrong way | Turnover Valve |
| | Failed or damaged parts | Overhaul drill |
| | Lack of oil | Check lubricator |
| | Drill bit broken | Replace bit |
| | Dirt in drill | Strip and clean |

## Conclusion

In the event of finding a defective product, a full or pro-rated credit will be issued provided that the end user has demonstrated that the product has been stored, installed, maintained and operated in an acceptable manner.

Drill King International will not accept any remedies to the user other than those set out under the provisions of the warranty above. **Drill King international will only ever be liable for damages that are liquidated and set at the original purchase price for any said item or part in dispute**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