Secoroc Down-the-hole Equipment

Quantum Leap® Technical Manual

QL40
QL45
QL50
QL55
QL60
QL65
QL70
QL80
QL120
QL200

Technical Manual
Read this instruction manual before operating this equipment.

ENGLISH

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CONTENTS

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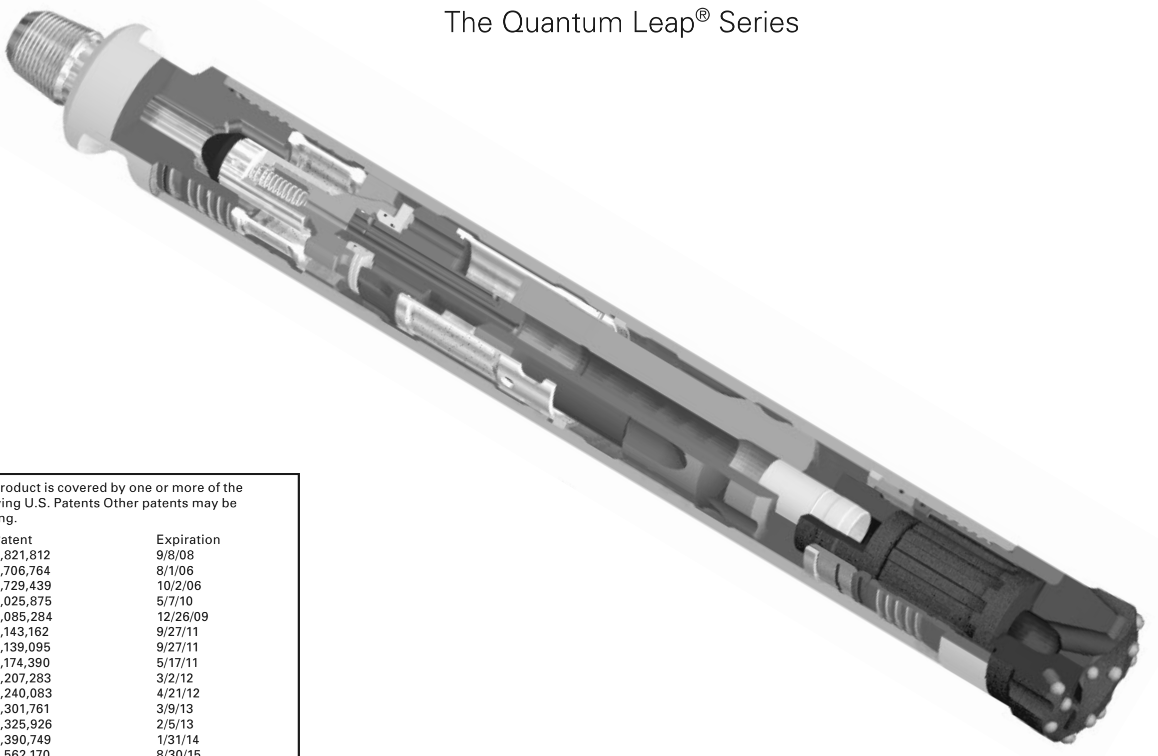
INTRODUCTION

The Quantum Leap® Series



This product is covered by one or more of the following U.S. Patents Other patents may be pending.

Patent	Expiration
4,821,812	9/8/08
4,706,764	8/1/06
4,729,439	10/2/06
5,025,875	5/7/10
5,085,284	12/26/09
5,143,162	9/27/11
5,139,095	9/27/11
5,174,390	5/17/11
5,207,283	3/2/12
5,240,083	4/21/12
5,301,761	3/9/13
5,325,926	2/5/13
5,390,749	1/31/14
5,562,170	8/30/15
5,566,771	8/30/15
5,647,447	6/10/16
5,682,957	12/21/15
5,699,867	7/31/16
5,711,205	10/30/16
5,735,358	6/6/16

READ THIS MANUAL CAREFULLY to learn how to operate and service your DTH correctly. Failure to do so could result in personal injury or equipment damage.
Consult your Atlas Copco Secoroc Dealer if you do not understand the instructions in this manual or need additional information.

THIS MANUAL should be considered a permanent part of the DTH , and should remain with the DTH and available for reference at all times.

WARRANTY is provided as part of Atlas Copco Secoroc support program for customers who operate and maintain their equipment as described in this manual.

MEASUREMENTS in this manual are given in both English and metric units, and are used to provide additional worldwide understanding. Metric units are shown between parentheses ‘‘( )’’. Use only correct replacement parts and fasteners.

The instructions, illustrations, and specifications in this manual are based on the latest information available at time of publication. Your DTH may have improvements and options not yet contained in this manual.

ABBREVIATIONS used throughout this manual.

acfm	Actual Cubic Feet per Minute
API	American Petroleum Institute
C	Centigrade
dia.	Diameter
deg.	Degree
F	Fahrenheit
ft.	Feet
ft.-lb	Foot Pounds
gpm	Gallons per Minute
in.	Inches
kg	kilogram
l	Liter
lbs.	Pounds
lpm	Liters per Minute
m	Meter
mm	Millimeter
mm Hg	Millimeters of Mercury
m3/min	Cubic Meters per Minute
psi	Pounds per Square Inch
psig	Pounds per Square Inch Gauge Pressure
rpm	Revolutions per Minute
scfm	Standard Cubic Feet per Minute
⚠	Safety Alert Symbol

SAFETY REGULATIONS
BE AWARE OF SAFETY INFORMATION

UNDERSTAND SIGNAL WORDS

A signal word - DANGER, WARNING, or CAUTION - is used with the safety-alert symbol.

DANGER identifies the most serious hazards.

⚠ DANGER
Indicates immediate hazards which will result in serious or fatal injury if the warning is not observed.

⚠ WARNING
Warning is used to indicate the presence of a hazard which can cause severe injury or death if the warning is ignored.

⚠ CAUTION
Caution is used to indicate the presence of a hazard which will or can cause personal injury, or property damage if the warning is ignored.

SAFETY

Follow instructions
Carefully read all safety messages in this manual and on your machine´s safety labels. Keep safety labels in good condition. Replace all missing or damaged safety labels.

Replacement safety labels can be obtained at no cost from your local Atlas Copco dealer or representative or by contacting the factory.

Learn how to operate the DTH and how to use the controls on the machine properly. Do not let anyone operate this DTH without proper instruction.

If you do not understand any part of this manual and need assistance, contact your local Atlas Copco dealer.

Keep DTH in good working condition
Keep your DTH in proper working condition.

Unauthorized modifications to the DTH may impair the function and/or safety and effect DTH life.

Make sure all safety devices, including shields are installed and functioning properly.

Visually inspect the DTH daily before using. Do not operate the DTH with loose, worn, or broken parts.

Wear protective clothing
Wear APPROVED safety equipment (safety shoes, safety glasses, hearing protection, hard hat, gloves, respirator, etc.) when operating or maintaining the DTH .

Wear close fitting clothing and confine long hair.

Operating equipment requires the full attention of the operator. Do not wear radio or music headphones while operating the DTH .

Check for underground utility lines
Before starting work, remember that contact with buried utilities may cause serious injury or death. Electric line contact may cause electric shock or electrocution. Gas line contact may rupture pipe causing explosion or fire. Fiber optic cables can blind you if you look into the laser light in them. Water line rupture may cause a flood and possible ground collapse. Before drilling, check with qualified sources to properly locate all buried utilities in and around drill path. Select a drill path that will not intersect buried utilities. Never launch a drill bit on a path toward electric, gas, or water lines until their location is known. If there is any doubt as to the location of the underground placement, have the utility company shut it off before starting any underground work and excavate to confirm its exact location.

Avoid electrocution. Stay away
Electrocution possible. Serious injury or death may result if the machine strikes an energized powerline. Take the following precautions to prevent electrocution. Also refer to the operating instructions.

- Always contact your local utility company when working in the vicinity of utilities.
- Locate underground utilities by qualified persons.
- Do not raise, lower, or move drill guide or boom near power lines.
- Always wear proper electrically insulated linemanís gloves and boots.
- Never touch metal parts on machine while standing on bare ground if machine comes in contact with a powerline.
- Always stay in cab during all drilling operations.
- Never step onto or off of a machine if an electric strike occurs.

Loose parts
Make sure the drill rod to rotary head spindle joint is securely tightened before running the rotary head in reverse rotation. A loose connection could result in the drill rod unscrewing completely; a falling drill rod could strike personnel.

Live air
Never get under a downhole drill to examine the exhaust air; live air is dangerous. Also, part failure could cause the bit to fall out of the downhole drill which could result in bodily injury. A piece of cardboard can be inserted under the bit to check for the lubrication being carried through the downhole drill.

Air pressure
Make certain that the air line lubricator (or lubrication system) is capable of handling the higher air pressures associated with the downhole drill (up to 350 psi (24.13 bar) air pressure). When pressurized, an unsuitable lubricator could burst and possibly cause injury to personnel in the area.

Do not work in trench
Do not work in trench with unstable sides which could cave in. Specific requirements for shoring or sloping trench walls are available from several sources including Federal and State O.S.H.A. offices, and appropriate governing agency. Be sure to contact suitable authorities for these requirements before working in a trench. Federal O.S.H.A. regulations can be obtained by contacting the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. State O.S.H.A. regulations are available at your local state O.S.H.A. office, and appropriate governing agency.

Check laws and regulations
Know and obey all Federal, State, and Local, and appropriate governing agency laws and regulations that apply to your work situation.

Place warning barriers around work site
Set up orange cones around the work area with warning signs facing outward.

Place pedestrian and traffic barriers around the job site in accordance with Federal, State, and Local, and appropriate governing agency laws and regulations.

Observe environmental Protection regulations
Be mindful of the environment and ecology.

Before draining any fluids, find the correct way of disposing them.

Observe the relevant environmental protection regulations when disposing of oil, fuel, coolant, brake fluid, filters and batteries.

When using any solvent to clean parts, make sure that it is nonflammable, that it will not harm the skin, that it meets current O.S.H.A. standards, and appropriate governing agency, and that it is used in an area that is adequately ventilated.

⚠ WARNING

- **Failure to follow any of the above safety instructions or those that follow within this manual, could result in serious injury or death. This DTH is to be used only for those purposes for which it was intended as explained in this instruction manual.**

INSTALLATION AND OPERATION

General information

Follow instructions

Before operating this down-the-hole drill (DTH) for the first time, become familiar with the operation of the machine and the DTH .

Learn how to operate the machine and how to use the controls properly. Do not let anyone operate this machine without proper instruction.

If you do not understand any part of this manual and need assistance, contact your local Atlas Copco dealer.

Description

The Quantum Leap® line of (DTH ´s) are designed for use on drilling machines in conjunction with a top head or kelly drive mounting. The mounting must be capable of supplying sufficient hold down, hold back, rpm, torque, hammer lubrication, air pressure, and air volume.

DTH ´s achieve high productivity in hard rock applications by adding percussion to the drilling process. Rotary drilling methods use the combination of raw weight and rotation to chip and carve rock from a hole. The rotary method works fine in soft formations where adequate weight and stress can be applied to the rock to initiate fracture and chipping. However, in harder rock the rotary method cannot supply sufficient load on the bit inserts to crack the rock and produce a chip. Percussion drills overcome the rotary bit load limitation by producing a very high load during impact of the hammer. This load is sufficient to drive the cutting inserts into the rock to produce chips.

Quantum Leap® DTH ´s are recommended for practically any hard rock application. Depending on the size downhole drill being used, they are suitable for drilling water wells, primary blast holes in quarries, open pit mining, coal stripping operations, oil and gas exploration, and construction jobs where large volume rock excavation is required.

Common DTH ´s operate by using the position of a piston to direct supply and exhaust air to and from drive and return volumes. The drive volume ''drives'' the piston toward impact and the return volume ''returns'' the piston in preparation for another impact stroke. In order to maximize impact energy it is desirable to deliver supply pressure to the drive volume while the piston is at the top of its stroke, and, turn off the supply pressure when the piston is nearly at its impacting position. However, conventional DTH ´s which use position dependent fixed porting are not able to alter the position at which supply pressure is delivered and shut off from the drive chamber. As a result, maximum efficiency and power are limited.

The Atlas Copco Quantum Leap® DTH cycle overcomes this inherent limitation by using a poppet valve to maximize efficiency. The poppet valve opens and directs supply air to the drive chamber at the top of the piston stroke and cuts off supply air just before impact. Variable drive volume supply timing is the key difference between the Quantum Leap® cycle and common DTH cycles.

DTH Setup

Before the DTH is used to drill it should be set up for proper air consumption and the joints should be tightened. The selection of choke size and/or valve lift will be dependent on the hole cleaning requirements and the capacity (pressure and flow) of the compressor being used. Hammer air consumption should be set up for the best balance of power and hole cleaning. Other factors which need to be considered are depth of hole, water to be encountered and water to be injected. In some cases, where such factors are unpredictable, the proper choke size can only be selected after experience is developed.

Valve, Choke selection and Hydrocyclone® Setup

The best performance of any DTH will be achieved when a maximum volume of air can be passed through the drill with a solid choke. Under ideal conditions the pressure required to drive this volume through the drill will be within the capabilities of the compressor. All Quantum Leap® DTH ´s have a choke plug which can be changed for additional hole cleaning capacity if additional hole cleaning air is needed and compressor capacity is sufficient.

Bailing velocity requirements

The need for adequate hole cleaning cannot be emphasized enough. A hole that is not cleaned properly can result in poor performance, rapid wear of bits and accessories and in some cases loss of the drill and pipe down the hole. Hole cleaning is usually directly related to what is called bailing velocity or the speed of the air which is lifting cuttings from the hole.

Bailing velocity is defined as the velocity of the air in the hole annulus at atmospheric pressure. In other words, the effect of bottom hole pressure is not taken into account when computing bailing velocity. For conventional hole cleaning (no soaps or foams) bailing velocity should exceed 3000 ft./min. (914.4 m/min.). However, if possible, bailing velocity should not exceed 7000 ft./min. (2133 m/min.). Bailing velocity can be computed by dividing the air consumption of the DTH in scfm by the annulus area in square feet. The equation following may be used:

$$\textbf{Velocity [ft./min.] (m/min.)} = \frac{\textbf{Air consumption [scfm] (m}^3\textbf{/min.)}}{\textbf{Annulus area [sq. ft.] (sq. m)}}$$

where:

- Air consumption is the rated delivery of the compressor or the air consumption of the drill at maximum pressure, whichever is less.

- Annulus area is the area between the hole bore and the drill rod. It can be computed as follows:

- Annulus area

[sq. ft.] =.0055 x (hole dia. [inches]^2 - rod dia. [inches]^2)
(sq. m) =.785 x (hole dia. [m]^2 - rod dia. [m]^2)

The sections following explain how to adjust the choke or valve to increase air consumption.

Valve selection (QL40, QL60/65, QL80HF, QL 120 only)

The QL60 and QL65 can use two valves. The lift of these valves differs by .030 in. (7.62 mm). The higher lift valve allows more air and power to be delivered to the drive chamber. QL60´s and QL65QM´s come factory equipped with the low lift valve installed. The high lift valve is supplied as an accessory

for the QL65QM and sold separately for the QL60.
The low lift valve is suggested for use on 900 scfm (25.5 m^3/min.) and lower air compressors. The high lift valve is suggested for use on compressors larger than 900 scfm (25.5 m^3/min.). However, it is suggested that in deep holes greater than 500 ft. (152.4 m) the low lift valve be used all the time regardless of compressor capacity.The two valves can be identified by the presence of a groove on the outer diameter of the high lift valve. Conversely, the low lift valve has a smooth outer diameter.

The QL50, QL50HF, QL55QM and QL55QM-HF can also use two valves. The lift of these valves differs by .015. The higher lift valve allows more air and power to be delivered to the drive chamber. The higher lift valve is an optional item and recommended for 900 scfm (25.5 m^3/min.) and higher capacity compressors.

The QL40, QL80HF and QL120 use stainless steel shims to adjust air flow by limiting valve lift. QL120´s ship with the shim installed. QL40´s and QL80HF´s ship without the shim installed. Refer to the air consumption curve to determine if the shim should be removed. **It is highly recommended that the proper valve setup be used for adjusting air consumption before choke adjustments are made.**

Shim addition or removal on the QL40, QL80HF, and QL120 may be useful for certain applications. For example,

- Installing the shim on the QL40 maybe useful in applications where casing wear is excessive. Bear in mind that a reduction in air consumption will reduce penetration rate. If fuel consumption must be minimized, at the expense of the penetration rate, it may useful to install the valve shim.

- Installing the shim on the QL80 will be useful on any 1050 scfm (30.7 m^3/min.) compressor. It will also be beneficial on larger volume compressors operating at altitudes greater than 4000 ft. (1219 m).

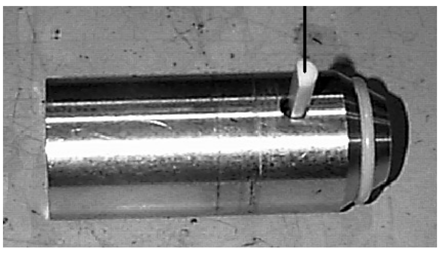
- Removing the shim on the QL120 is generally suggested for deep-hole applications where air consumption must be increased for hole cleaning.

Choke sizing

All Quantum Leap® DTH ´s other then the QL40 have a choke plug which is press-fit into the check valve. The QL40 choke plug is installed in the air distributor. Different plugs can be inserted in place of the factory installed ''solid'' choke to increase air consumption of the drill. The choke may need to be opened to bypass more air to reduce pressure and/or increase bailing velocity. It should be noted that opening the choke plug does create a back-pressure on the DTH which reduces performance. Additionally, excess air which is not needed for hole cleaning increases the erosive wear of the DTH .

Therefore, for cases where additional air is not required for hole cleaning, consideration should be given to reducing compressor output by lowering engine RPM or restricting the compressor inlet.

CHOKE PLUG



The QL50, QL55QM, QL60, QL65QM, QL80, QL120 and QL200 are all shipped with spare choke plugs which are matched to common hole sizes.

Figure on page 31 shows a graph of the relationship between flat size and equivalent orifice diameter. The curve is useful for determining what flat size is needed to obtain a required increase in flow.

In addition to using a conventional choke for increasing air consumption, DTH ´s equipped with Hydrocyclones® bypass air through the water metering orifices in the separator body. While the primary purpose of these metering holes is to bypass fluids, they can also be adjusted to bypass air. In most cases it will be more efficient to bypass air through the Hydrocyclone® than through the choke because less back-pressure will be created against the DTH .

Hydrocyclone® Setup

The Hydrocyclones® are shipped with metering orifices which regulate the amount of water which can be removed from the air stream. The highest efficiency occurs when all the water and very little air passes through the metering orifice. The following lists the standard and optional metering orifice sizes which can be used on the Hydrocyclones®.

	Maxium fluid removal capacity (gallons per minute = gpm)									
Separator metering orifice size (inch)	0.125 (1/8")		0.156 (3/32")		0.188 (3/16")		0.25 (1/4")		0.312 (5/16")	
Quantity of metering ports	1	2	1	2	1	2	1	2	1	2
Operating pressure (psig)	QL50/QL60				QL80		QL120			
100	3.3	6.5	5.1	10.2	7.4	14.8	13.1	26.1	20.3	40.7
125	3.6	7.3	5.7	11.4	8.3	16.5	14.6	29.2	22.7	45.5
150	4.0	8.0	6.2	12.5	9.0	29.5	17.3	34.5	26.9	53.8
175	4.3	8.6	6.7	13.5	9.8	19.5	17.3	34.5	26.9	53.8
200	4.6	9.2	7.2	14.4	10.4	20.9	18.5	36.9	28.8	57.5
225	4.9	9.8	7.6	15.3	11.1	22.2	19.6	39.2	30.5	61.0
250	5.2	10.3	8.4	16.9	12.2	24.5	21.7	43.3	33.7	67.5
275	5.4	10.8	8.4	16.9	12.2	24.5	21.7	43.3	33.7	67.5
300	5.7	11.3	8.8	17.6	12.8	25.6	22.6	45.2	35.2	70.4
325	5.9	11.8	9.2	18.3	13.3	26.6	23.5	47.1	36.7	73.3
350	6.1	12.2	9.5	19.0	13.8	27.6	24.4	48.9	38.0	76.1
375	6.3	12.6	9.8	19.7	14.3	28.6	25.3	50.6	39.4	78.8
400	6.5	13.1	10.2	20.3	14.8	29.5	26.1	52.2	40.7	81.3

Note: Bypass orifice in Hydrocylcone must be able to pas quantity of water injected at operaing pressure. Failure to adjust orifice to correct size will result in loss of power and poor DTH performance.

Bit installation

Bits splines should be well lubricated with rock drill oil or thread grease before the chuck is installed over the splines. Additionally, the threads on the chuck should also be well coated with thread grease before threading the chuck into the DTH . Remember to install the bit retaining ring halves before threading the chuck into the DTH .

New bit and chuck

All QL drills (except the QL200) use tapered retaining rings which are locked in place axially and radially when the chuck is tightened. This patented feature insures lower end drill parts are held securely in place to prevent vibration and movement. Be careful not to get flat retainers from earlier model DTH ís mixed with the tapered rings. The QL120 and QL200 use plastic drive pins which insure a non-metallic chuck to bit interface. These pins must be installed properly with the pin end labeled ''TOP'' (QL200 only) being visible after installation. The QL120 and QL200 pin drive systems have been designed so that if the pins are omitted, or fail, the chuck bit and spline drive surfaces can operate reliably for a short period of time.

Used bit and chuck
Caution must be used when installing a new bit on a used chuck or visa-versa. Some applications, usually soft rock where there is excessive bit travel within the splines, can develop uneven wear on the bit and chuck splines. When a new bit is installed within a used chuck there is likely to be poor mating surfaces. Check the condition of the chuck or bit splines when using a new bit or chuck if your application is prone to this form of spline wear.

It is also suggested that the chuck be rotated relative to the bit splines from time to time to even out the gouging and grooving which takes place due to erosive wear. This practice will extend your chuck and casing life.

Makeup torque and backhead closure
The Quantum Leap® drills have two forms of locking means for internal components; the QL4, QL120 and QL200 use relatively low-load belleville springs, all others use ''solid clamping'' arrangement whereby parts are held in place under very high load.

Rotary head torque is usually sufficient to close the QL4 backhead. The QL200 uses a special wrench to close the backhead. However, because of the high load used to clamp the parts in place in the QL40, QL50, QL60, QL80, and QL120; a high level of torque is needed to close the backhead gap. Rotary head torque is not sufficient to close the backhead gap. A supplementary wrench is needed to properly tighten the joint. It is extremely important that the backhead gap be closed in these drills.

The presence of a gap between the casing and the backhead while drilling will increase the chances for loosening the backhead in the hole and possibly losing the drill.

In addition to at least closing the backhead gap, it is also recommended that the backhead and chuck be torqued to approximately 750 - 1000 ft.-lb per inch (40.5 - 54 N-m per mm) of hammer diameter. For example a 5 in. (127mm) class DTH (QL50) should be torqued to 3750 - 5000 ft.-lb (5143.5 - 6858 N-m). This makeup torque insures against loosening joints in the hole and also preloads the threads sufficiently.

Drill lubrication

Lubrication guidelines and specifications
All DTH ´s require oil lubrication to resist wear, galling and corrosion. Additionally, the film of oil coating all internal parts seals internal clearance paths to reduce power-robbing leakage across sealing clearances. As a general rule of thumb the oil required is proportional to the volume of air being used.

Oil also needs to be of sufficiently high quality. It is recommended that Atlas Copco Supertac rock drill oil be used. If another type of oil is used it must comply with the oil specifications shown in table on page 32.

For dry drilling (less than 2 gpm (7.6 lpm) of water injection) it is generally recommended that oil be injected into the drill air stream at the rate of 1/3 pint (.16 l) of oil per hour for every 100 scfm (2.8 m^3/min.) of air. For example a 900 scfm (25.5 m^3/min.) compressor delivering full flow to a DTH would require 900 ÷ 100 x 1/3 = 3 pints per hour (25.5 ÷ 2.8 x .16 = 1.6 l per hour).

For wet drilling (more than 2 gpm (7.6 lpm)), and in particular when using a Hydrocyclone® water separator, it is suggested that the lubrication rate be doubled to 2/3 pint (.32 l) of oil per hour for every 100 scfm (2.8 m^3/min.) of air.

The additional oil compensates for the wash-out caused by water and the oil losses caused by the Hydrocyclone®.

Lubricators
There are two primary types of lubricators; a plunger oiler and a venturi oiler:

A plunger oiler normally operates from a timed plunger system which delivers a fixed ''slug'' of oil into the line in timed intervals. These systems are beneficial in that the oil reservoir does not need to contain a high pressure. Plunger lubricators are also insensitive to oil viscosity and temperature. However, because of their complexity, the reliability of plunger lubricators is not as good as the venturi type. Also, because oil is delivered as ''slugs'' it is not atomized and delivered to the drill internals as evenly as a venturi.

Venturi type lubricators (sometimes referred to as pig oilers) operate in a similar fashion to a gasoline carburetor. A necked down area in the venturi creates a pressure drop which draws oil into the air stream. The oil is atomized and mixed very efficiently with the air providing maximum coverage and cohesion to internal drill components. A needle valve is usually used to adjust the oil volume delivered. Disadvantages of the venturi oiler are that it requires a pressurized volume, which is generally small in volume. Also, the lubrication rate is dependent on oil viscosity which varies with temperature.

Lubrication check
When oil is injected into an air stream with dry piping or hoses it takes a considerable amount of time to coat the walls of the piping so that the oil is actually delivered to the DTH . Until these surfaces are coated with an oil film very little is actually delivered to the DTH . It´s important to insure that an oil film is established before starting the DTH . It´s recommended that the drill be allowed to blow until a visible film of oil is developed on the bit blow holes.

Placing a piece of cardboard or wood beneath the blow holes gives a good indication when oil is passing through the drill. The cardboard or wood will become wet with oil when an adequate film of oil has been developed. If a drill string has not been used for some time and the oil has dried out it is suggested that a cup of oil be poured into each rod to assist in developing an oil film. After drilling with high levels of water injection it is important to note that any oil film has probably been washed off. For operators that switch from wet to dry drilling (i.e. waterwell and quarry) its important to redevelop the oil film.

Water injection
Water injection can cause a DTH to either consume more air (hold a lower pressure) or less air (hold a higher pressure) depending on the volume of fluids injected. For example, if a DTH is lubricated with oil and water is then injected at a low rate (less than 1 gpm (3.8 lpm)), the oil film which is sealing the internal leak paths is washed out and air consumption will increase (pressure will fall).

Conversely, if water is injected at a high rate (more than 3 gpm (11.4 lpm)) the fluid level will be sufficient to seal the leak paths and restrict the flow of air through the DTH . In this case the air consumption will decrease (pressure will increase).

The pressure rise associated with water injection can sometimes exceed the maximum pressure rating of a compressor. In these cases the choke or Hydrocyclone bypass hole must be increased to reduce pressure.

The use of water, while required in most cases, does reduce component life. The following lists some of the problems that water injection can cause:

■ Poor quality water can either be corrosive or can carry contamination into the drill. Premature wear or corrosion related failures can result. All water injected into a DTH should be neutral in pH and free from particulate contamination.

■ Water injection reduces drill performance considerably. Water restricts the flow and resultant pressure in working chambers of the drill and reduces face cleaning which causes regrinding of cuttings.

■ Water present at the impact face causes cavitation of the bit and piston and jetting or cutting of the exhaust tube. In both cases component life is reduced.

A DTH that has been operated with water injection and will be idle for more than a few days should be dried out and lubricated with oil. This can be accomplished by blowing lubricated air through the tool when drilling is finished.

QL60 Non-lube instructions
The QL60 non-lube does not require injected oil or other lubricants. However, the use of oil will not harm the DTH . The following operational considerations are required.

■ A minimum of 1/4 gpm (1 lpm) of water is needed to lubricate and cool the internal seals. It is suggested that at least a ''mist'' of water be used even while driving casing.

■ Use of the QL60 non-lube for quarry applications is not recommended unless; The minimum water injection rate is observed, and,

■ The chances of getting stuck and overheating the drill are minimal. The addition of frictional heat can be sufficient to melt the piston seals and bearings.

■ A Hydrocyclone can be used on the QL60 non-lube. Sufficient water bypasses the Hydrocyclone to permit adequate cooling of the seals and bearings.

QL60 Non-lube instructions
■ Because there is usually no oil present in the QL60 non-lube to prevent corrosion, it is important to oil the DTH if it will be idle for more than two days. The following process is suggested.

■ While the cylinder and casing have been specially heat treated to resist corrosion, other internal parts need the protection of oil when not being used.

■ Fill the backhead bore, or last joint, with approximately 1 pint (0.5 Liter) of oil (motor oil is fine),

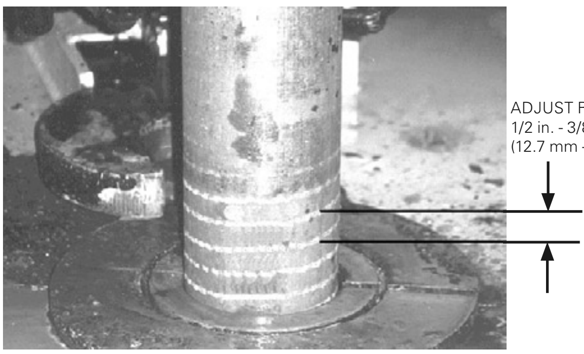
■ Re-connect and cycle the drill on a block of wood at low pressure (50-100 psi) for approx. 15 seconds.

Drill operation

Rotation speed
Rotation speed directly affects the amount of angular index the bit inserts go through from one impact to the next. The optimum amount of index is dependent on variables such as blow energy (pressure), rock hardness, bit diameter, etc. The ideal rotation speed produces the best overall balance of penetration rate, bit life and smoothness of operation. It generally occurs when cuttings are their largest.

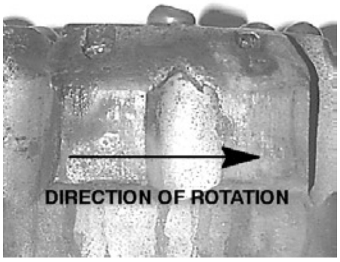
Determining the optimum rotation speed needs to be carried out in the actual application. A good rule-of-thumb is to divide 300 by the bit diameter in inches to determine RPM. This will get the rotation speed in the ''ballpark''. However, a fine-tuned rotation speed also needs to be correlated with penetration rate. It has been found that a proper rotation speed usually results in a 3/8 in.- 5/8 in. (9.525 mm - 15.875 mm) advance of the bit per revolution of the DTH . This measurement can normally be taken by using chalk or soapstone to scribe a spiral on the drill pipe while the drill is operating. The distance between the spirals (thread pitch) can be measured to determine if rotation speed should be increased or decreased. Obviously, if the pitch is less than 3/8 in. (9.525 mm) the drill RPM should be decreased, if it is more than 5/8 in. (15.875 mm) the drill RPM should be increased.

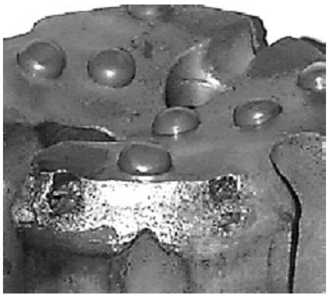
The picture following shows an example of the marks left on a drill pipe when using chalk to mark the advance of the drill.



Another method for setting rotation speed involves witnessing the wear flat developed on the carbide. The wear flat on the should be directly on the top of the inserts. A flat which is on the leading edge of carbide (side facing the direction of rotation) indicates rotation speed is too slow. Conversely, rotating too fast will cause rapid wear of the bit and the wear flat will be on the trailing edge of the carbide.

Note that due to the higher penetration rate of Quantum Leap® drills over conventional valveless drills, rotation speed will normally need to be increased in proportion to the increase in drilling speed.





View showing wear flat on leading edge - indicates rotation too slow. note that carbide failure was caused by the leading edge wear flat.

Rotation Torque
As a general rule of thumb, you should apply roughly 500 foot/ pounds (27 newton/meter) of torque for
each inch of bit diameter.

Example: 6 inch diameter bit X 500 ft/ pounds = 3000 ft/pounds of rotation torque

Collaring
Collaring a drilled hole is a critical stage of the drilling process. In blast holes it can determine the quality of the top of the hole and the ability to load a charge. In foundation and well drilling it can determine the overall straightness of the completed hole. It is suggested that a drill be collared with low pressure and feed until the hole has stabilized. Just as a twist drill needs to be controlled carefully when drilling with an electric hand drill, a DTH needs to be started with care.

Feed force (hold down and hold back)
The force required to feed a percussive tool properly is directly proportional to the level of output power.

As a rule of thumb, DTH ´s need to be fed with a force of roughly 500 lb per inch (9 kg per mm) of hammer diameter when operating at maximum power.

In many cases operators will simply adjust the feed pressure until rotation pressure starts to pulse and then back off slightly until rotation pressure becomes smooth. When a hole is first started, if the weight of the starter rod or collars is not sufficient to feed the drill then pull down will be needed. As the hole is advanced and more weight is added to the drill string, the level of pull down will need to be decreased. Eventually, the weight of the string may exceed the proper feed force and the feed system will need to be shifted to a pull-back mode.

When drilling through varying conditions such as hard and soft or voided material, every effort should be made to keep the drill fed properly. A loose running DTH can cause damage to the tool and bit in a short period of time. The feed system of a drilling rig should have a sufficiently fast response so the DTH can ‘‘catch up’’ with the bit when a void or soft seam is encountered.

As with rotation speed, Quantum Leap® drills will typically need to be fed harder due to their higher output power level over valveless drills.

It´s equally important to avoid feeding too hard through voided and fractured material. The piston in a DTH operates within the casing with a clearance of about .003 in. (.076 mm) on each side. While the casing appears very strong and stiff, it does not take much sideways pressure to distort the casing enough to cause interference with the piston as it reciprocates. If the casing is overfed through voided ground it is likely that deflection of the casing will occur. Frictional cracks will develop on the surface of the piston if the piston rubs hard enough against the wall of the casing while being distorted. These small frictional cracks can eventually grow and break the piston.

Feed force should be reduced when drilling through voided, unconsolidated or fractured ground to avoid twisting or distorting the hammer casing.

Hole cleaning, flushing and dust suppression
As stated previously, the importance of good hole cleaning cannot be over emphasized. A hole which is not cleaned effectively will cause reduced production (penetration rate), decreased bit and accessory life and could ultimately increase the risk of losing the drill & string in the hole.

Dry drilling
The most effective means for hole cleaning is drilling dry. Cuttings are normally lifted and cleaned from the hole very efficiently. Imagine blowing, or sweeping, dust or dirt from a floor when the floor is dry and wet....which is more effective? The same principle holds true for cleaning cuttings from a hole.

Wet drilling
Water injection is required in many applications for dust suppression or hole cleaning. Water injection rates for dust suppression only are usually less than 1 gpm (3.785 lpm) and just sufficient to moisten fine dust. It is usually common to use minimal water injection for dust suppression in shallow blasthole applications where water intrusion into the hole is not a problem.

Heavier volumes of water injection are usually required in water well and deep-hole applications where
a number of factors come into play;

- Water intrusion into the hole can develop mud rings where dry cuttings meet a seam of water entering the hole. Mud rings develop where dry cuttings stick to the wall of the hole when they hit the moist area. Water injection is needed to keep the hole wet enough to prevent these mud rings from developing. Fluid injection rates can vary from 2 - 15 gpm (7.57 - 56.775 lpm) depending of the hole size, rate of penetration and the type of material being drilled.

- Some materials such as those which drill fast or contain clay can sometimes require very heavy levels of water injection. These applications are unique in that they can either be drilled totally dry or totally wet....not in between. Marginal fluid injection results in making a tacky mud which sticks to the drill rods and hole wall and hinders hole cleaning. The correct level of fluid injection thins the paste so it will be cleared from the hole.

Wet drilling with Hydrocyclone®
Many of the compromises associated with water injection are eliminated when using a Hydrocyclone® water separator. With the Hydrocyclone®, as much water as needed can be injected without a significant loss in performance. The Hydrocyclone® will typically remove approximately 98% of the fluids injected until the bypass orifice becomes saturated and cannot pass any more water.

If the Hydrocyclone® bypass orifice is not large enough to pass all the fluid being injected, the remainder of fluid will pass through the drill as if the Hydrocyclone® was not present. However, a portion of the benefits associated with using the Hydrocyclone® will be lost. If this does occur it is suggested that the bypass orifice within the Hydrocyclone be enlarged to pass the additional volume of fluid. See previous paragraphs and table on page 8 involving Hydrocyclone® setup.

Because the Hydrocyclone® removes matter that´s heavier than air, it removes rust scale, small rocks and other debris in addition to fluids. As a result, the Hydrocyclone® can become clogged with debris. It is suggested that after every hole, the ports in the Hydrocyclone® backhead are checked to be open. This can be determined simply by witnessing the passage of air or fluid through the ports while blowing air. If they are clogged refer to the service and maintenance section for repair instructions.

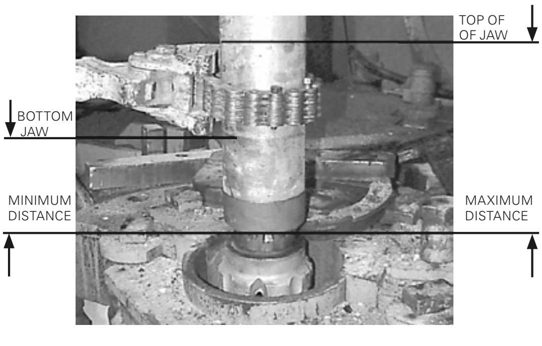
Insure Hydrocyclone® backhead ports are passing air at the end of each hole.

Bit changing

Removing the drill bit
Bit removal can be one of the most dangerous and frustrating tasks associated with the drilling operation. However, with the proper tools and techniques it should require no more than a few minutes and few expletives to remove a bit. The following lists pointers which will be beneficial in helping you remove a bit quickly, safely and with reduced risk to damaging DTH parts and components:

1. Use sharp tong jaws. Worn or rolled over tong jaws increase the jaw pressure and make the wrench more prone to damaging the hammer case. Many Atlas Copco Secoroc hammer cases are case hardened which means sharp jaws are needed to grip through the hardened case.

2. Grip the casing in the proper location. Gripping over the threads can make thread loosening extremely difficult. Example; as the wrench tightens it exerts an inward force which can pinch the threads if they are under the wrench jaw. This only increases the torque needed to uncouple the thread. Also, do not grip the casing in an area where the bore is not supported by either the piston or bearing. Gripping over an unsupported area can distort the bore. The figure and table below shows the recommended locations for wrenches.



Chain Wrench Positions

DTH Model	Minimum distance from chuck to lower jaw	Maximum distance from chuck to upper jaw
QL4/QL40	6.6 in. (167.64 mm)	17 in. (431.8 mm)
QL50/QL55QM	6.5 in. (165.1 mm)	15 in. (381 mm)
QL60/QL65QM	6.5 in. (165.1 mm)	17 in. (431.8 mm)
QL80	8 in. (203.2 mm)	22 in. (558.8 mm)
QL120	12 in. (304.8 mm)	30 in. (762 mm)
QL200	Special Wrench	Special Wrench

3. Insure the bit fits properly within the bit basket. An improper fit may result in the bit slipping from the basket.

4. Never weld or hammer on the casing to loosen it. All casings except the QL200 are case hardened for extended service life. The hard casing surface can be cracked by welding or impacting with a sledge hammer.

WARNING

- **Insure chain wrenches or tongs are rated for the torque applied. The flying parts of** chain wrenches can cause injury or death when they break!

Removing the bit with percussion only
If a chuck is difficult to loosen itís sometimes helpful to use low-pressure percussion assisted with reverse rotation to free the thread. The following lists the process and cautionary notes:

Process instructions
1. Place a piece of relatively hard polyurethane or conveyor belting in the bit break-out basket to absorb shock.

2. Remove all drill pipe so only the DTH and required adapters are attached to the rotary head.

3. Bring the drill in contact with the bit basket with a relatively light feed.

4. Bring the hammer pressure up to roughly 150 psig (10.3 bar).

5. See if the joint has loosened on its own after about 10 seconds of cycling.

6. If the joint has not loosened, ‘‘Bump’’ the rotation in reverse at a slow speed while the drill cycles until the joint has loosened.

7. Stop as soon as the chuck loosens, grease and air will be noticed coming from the loosened joint at the time of loosening.

CAUTION

- **Wear eye protection as the hammer will be cycling above ground. insure that all drill string joints are tight watch other string joints to insure they do not loosen before the chuck. if they do loosen, stop the process.**

ENGLISH

MAINTENANCE AND REPAIR

General information

Follow instructions
Along with correct operational technique; proper and timely service and repair of a DTH can extent component life and reduce operational expenses considerably. The sections following describe how to disassemble, inspect, repair and reassemble all Quantum Leap® DTH ´s.

Depending on the degree to which you plan on servicing a DTH , a number of tools are required. The following lists the tools needed for a complete overhaul of all Quantum Leap® DTH ´s. Obviously a stand is required for holding the DTH and it is presumed that backhead and chuck threads have been loosened. Complete overhaul includes measuring and inspecting all clearances at seal locations and other wear points.

Tools required for DTH service and repair

Tool	QL4 QL40	QL50 QL55QM	QL60 QL65QM
Outside Micrometer	3-4'', 2-3'', 1-2''	4-5'', 3-4'',	1-2'' 5-6'', 4-5'', 3-4''
Feeler Gauges	set	set	set
Telescopic Bore Gauges	set up to 3''	set up to 4''	set up to 5''
Vernier Caliper	0-6''	0-6''	0-6''
Brass (soft) Bar	3/4'' dia. by 48''	1'' dia. by 48''	1-1/4'' dia. by 48''
''J'' Wrench	2-1/2''	3-1/2''	4''
Threaded Rod	none	none	none
Bar Stock	none	none	none
Lifting Eye	none	none	none
Tool	**QL80**	**QL120**	**QL200**
Outside Micrometer	7-8'', 5-6'', 4-5'' 2-3'', 1-2''	9-10'', 8-9'' 7-8'', 2-3''	12-13'', 10-11'' 2-3'', 3-4''
Feeler Gauges	set	set	set
Telescopic Bore Gauges	set up to 6''	set up to 10''	set up to 13''
Vernier Caliper	0-6''	0-6''	0-6''
Brass (soft) Bar	1-3/4'' dia. by 48''	2''dia. by 48''	2-1/2'' dia. by 48''
''J'' Wrench	6''	9 1/4''	none
Threaded Rod	none	none	3/4'' -8 by 60''
Bar Stock	none	none	1-1/2'' dia. by 18'' long bar or tube
Lifting Eye	none	included	1 ea. 3/4'' -8 female, 2 ea. 5/8'' -11 male

DTH Service
In most cases a DTH will only require servicing when the casing wears out or when performance deteriorates due to internal parts wear. The level of inspection can obviously be much less if the casing only needs replacement. If the DTH has lost performance a more detailed inspection will be required.

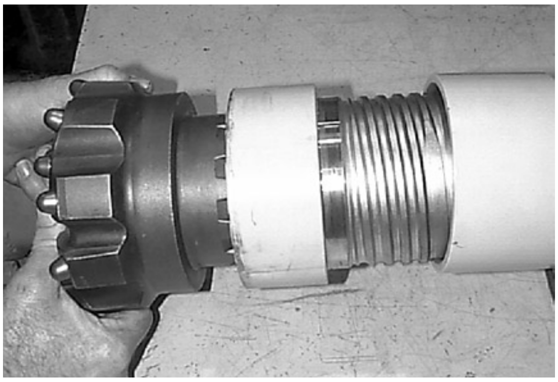
DTH Disassembly

Disassembly
The following disassembly procedure starts with the resumption that the chuck and backhead threads have been loosened. While the disassembly process is similar for all Quantum Leap® hammers there are slight distinctions from one model to another that will be noted. In general the QL50, QL55QM, QL60, QL65QM and QL80 are identical in the way they are serviced.

It´s important to note that the Quantum Leap® piston can only be removed from the chuck end of the drill.

1. **Mark the casing** so you can note which end is the backhead side and which is the chuck end. Once the hammer has been disassembled itís hard to tell which end is which.

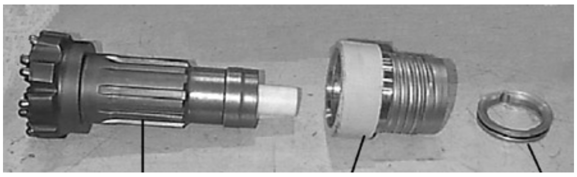
2. **Loosen the chuck** along with bit and retaining rings and remove from casing.



■ This can be accomplished with all of the DTH ´s laying horizontal, except for the QL200. It may be preferable to hang the QL200 vertically from a hoist, use a wrench and break lose the joint, and spin the casing while slowly lifting the DTH .

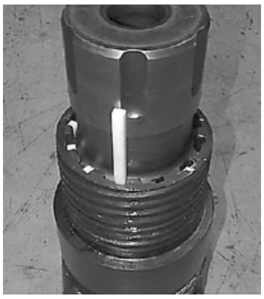
QL200

3. **Remove retaining rings** and o-ring from bit shank.

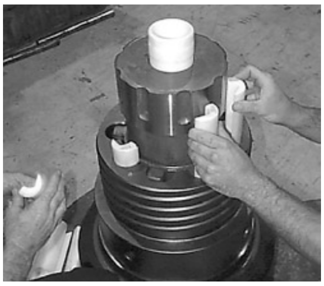


4. **Remove the chuck** from the bit.

■ Remove the drive pins from the QL120.



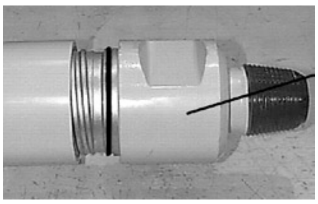
■ Remove the drive pins from the QL200.



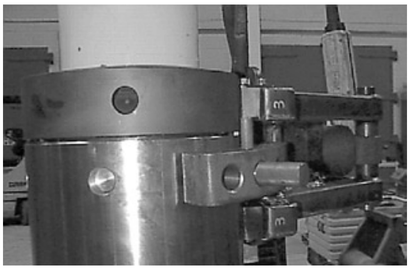
QL200 - Removing drive pins

QL200 - Removing chuck from bit

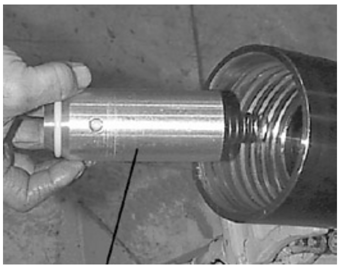
5. **Remove the backhead** from the other end of the casing.

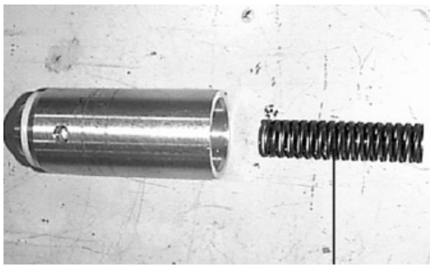


■ As with the chuck, it may be preferable to hold the QL200 vertically from a hoist, use a wrench and break loose the joint and spin the backhead off while slowly lifting.



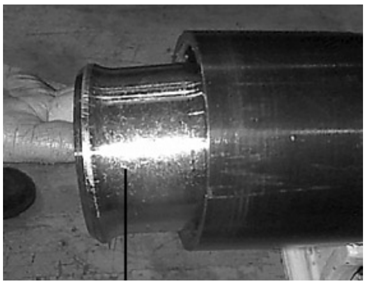
6. **Remove the check valve, and check valve spring.**





QL200

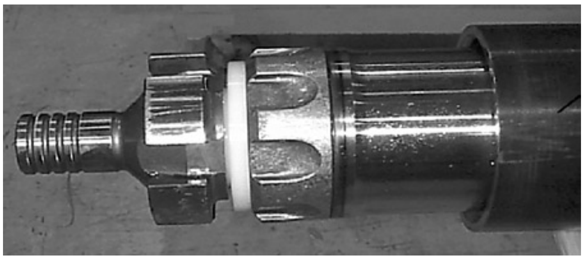
6a. **Remove the make up spacer, or on the QL200 bellville springs and make up spacer.**



MAKE UP SPACER

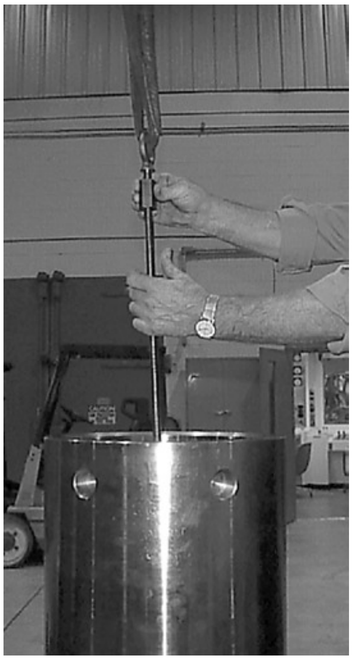
- On the QL4, the belleville springs are attached to the backhead with a cassette. These parts are removed with the backhead.
- On the QL200, the belleville springs will be removed with the air distributor.

7. **Grip the valve cap** (which is attached to the air distributor and cylinder as an assembly), and pull the group of parts from the casing. Clamping the valve cap stem with a pair of vice grips can help. Depending on the level of corrosion or dryness in the tool, it may be difficult to move the parts. If the parts are tight use the brass bar to tap the assembly by inserting it through the piston bore on the other end. Sometimes tapping the casing in the center with a soft bar or hammer can free the parts and allow them to move.

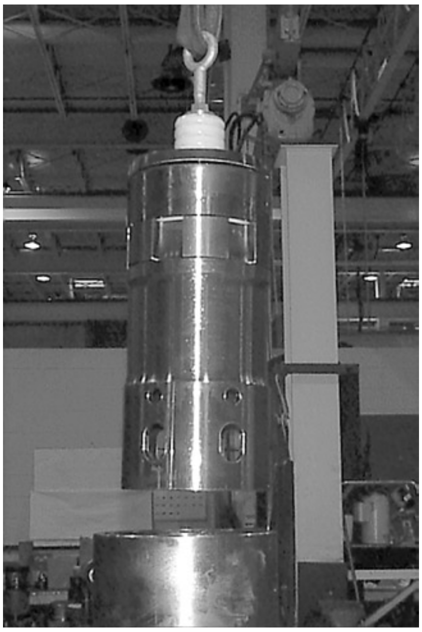


CASING

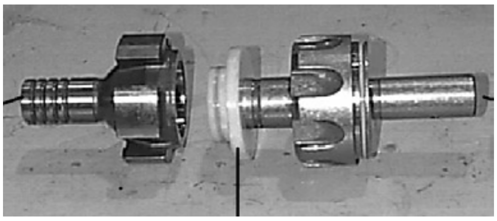
- Alternatively, a 3/4 in. (19.05 mm) threaded rod with an appropriately sized washer and nut can be inserted into the guide and a female lifting eye can be attached to the opposite end. The casing can be hoisted vertically and the internal stack of parts can be lifted from the casing.



- Attach lifting eyes to the valve cap on the QL200 with a lifting strap and hoist the valve cap, distributor and cylinder assembly (along with belleville springs) from the casing.
- Alternatively, with the casing on its side, a brass bar can be used to drive the valve cap, distributor and cylinder assembly (along with belleville springs) from the casing. Do not hit the guide too hard as it is made of plastic and can be damaged.
- The QL120 ships with a lifting plug which threads into the air distributor.



8. **Disassemble the cylinder assembly** by prying the valve cap from this air distributor. An old set of belleville springs are sometimes useful for prying the valve cap from the distributor. Be careful not to damage the valve when prying the cap off.



VALVE CAP

AIR DISTRIBUTOR

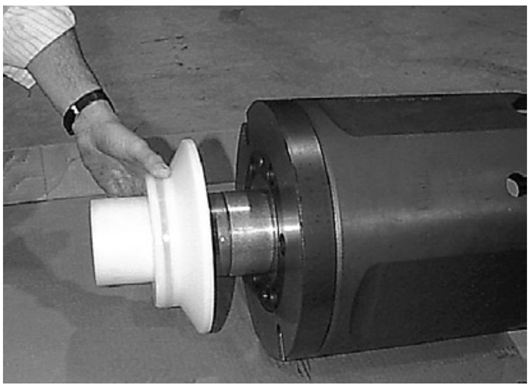
VALVE

- The QL200 has two slots machined in the air distributor for inserting prying bars.

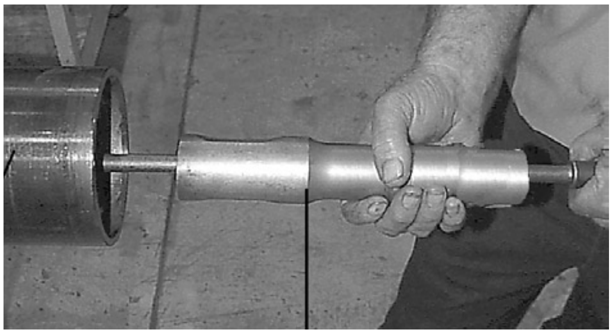
QL200

9. Remove the **valve** from the air distributor.

QL200

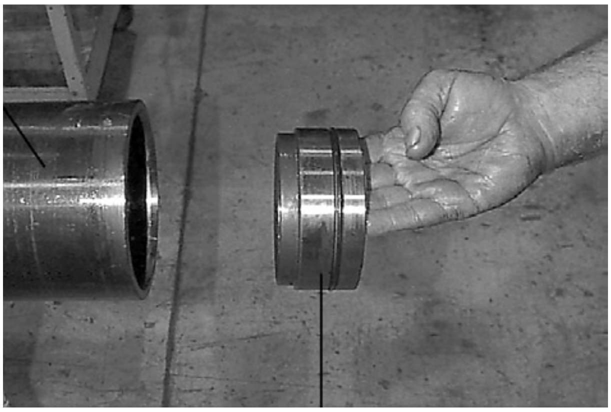


10. Moving back to the chuck end, **pull the bit bearing** from the hammer casing. Depending on the degree of rust or dryness of this area, a bearing puller may be needed to remove the bearing. When using a puller, be careful not to catch the bearing retaining ring. Sometimes lifting and dropping the casing on a block of hardwood can jar the bearing loose.



CASING

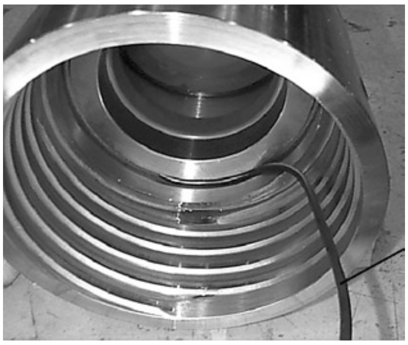
BEARING PULLER



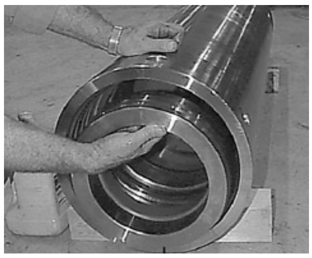
CASING

BIT BEARING

- Remove the o-ring cord holding the bearing in place on the QL120/QL200 before attempting to remove the bearing. Remove the polyurethane bearing stop ring from the QL120/ QL200 casing bore.



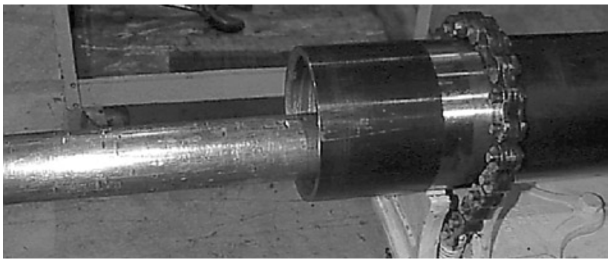
O-RING CORD

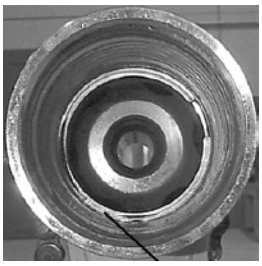


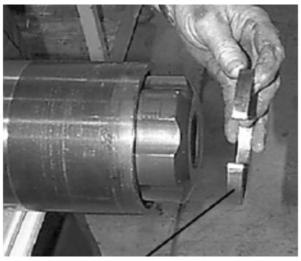
BEARING STOP RING

BEARING

11. With the casing standing vertically (the backhead end up and the chuck end down), the **piston can be used to drive the bearing retaining ring from the casing**. A brass bar may be useful for impacting and driving the piston. The plastic non-lube bearing retaining ring can be removed by hand. This may make field replacement of seals easier.

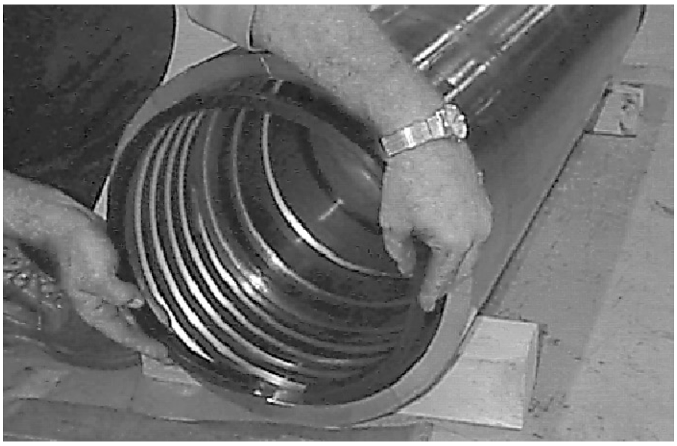






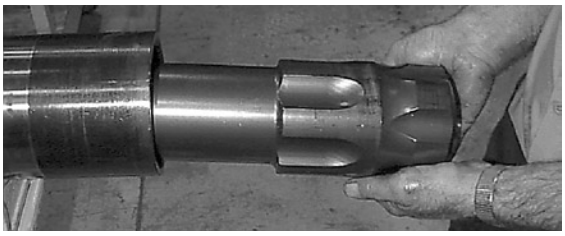
BEARING RETAINING RING

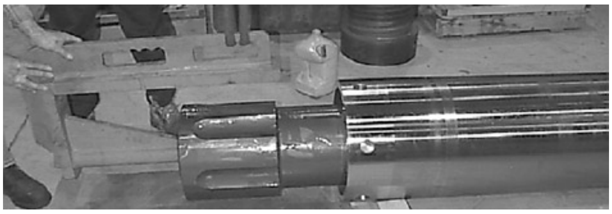
- On the QL120/QL200 remove the flexible polyurethane bearing stop ring. The piston will be able to slide out of the drill.



QL200

12. **Slide the piston out** of the drill being careful to carry its weight when it´s no longer supported by the casing. While the QL4, QL50/QL55QM, QL60/QL65QM pistons weigh less than 50 lbs (22.68 kg) and can be lifted easily, the QL80 (112 lb. (50.8 kg)), QL120 (360 lb. (164 kg)), and QL200 (610 lb. (276.7 kg)) pistons will require a sling to carry their weight.





13. **Remove the cylinder from the air distributor.** A preferred method is to take the cylinder and distributor assembly and fit it over the small diameter end of the piston. By raising the assembly up and impacting it down onto the piston the cylinder can be freed. **Be careful not to get fingers caught in the cross holes in the cylinder while driving it up and down.** Disassembly of the QL40, QL50/QL55QM, QL60/QL65QM and QL80 is now complete. The cylinder stop rings on the QL4, QL120, and QL200 can be removed.

- Remove the QL4 cylinder stop ring by using the piston to drive the ring out using the brass bar for impacting the piston. The QL4 stop ring can only be driven out the backhead end.

NOTE: The cylinder stop ring in the ql50/ql55qm, ql60/ql65qm and ql80 is permanently installed in the casing and cannot be removed.

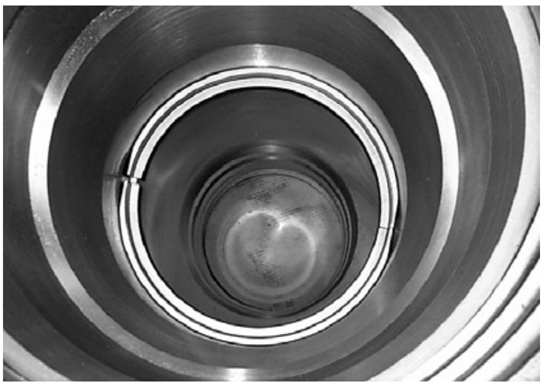
AIR DISTRIBUTOR

CYLINDER

CYLINDER

PISTON

- The QL200 has two-piece cylinder stop rings which can be removed by reaching in the the casing bore, turning the rings sideways and retracting them through the casing end.

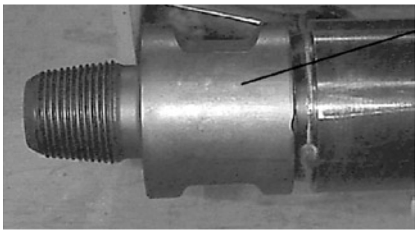


Hydrocyclone®
Disassembly and service

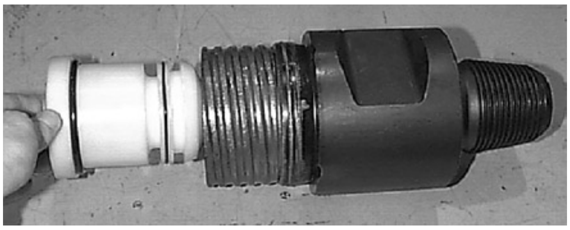
There are no moving parts in the cyclone. Service will only be required if the unit becomes clogged or if the rubber check seal becomes eroded. Note that if the Hydrocyclone® becomes clogged, the drill will continue to operate, but without separation.

Service as follows:

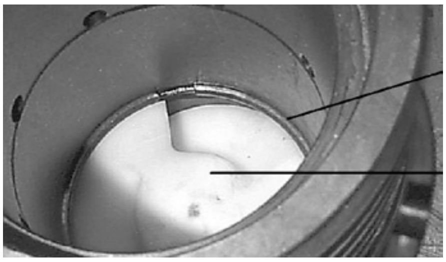
1. **Remove backhead.**



2. **Pull the plastic separator out.** A puller or tool which can reach into the separator bore may be needed. The separator can be difficult to remove if it becomes lodged with dirt.



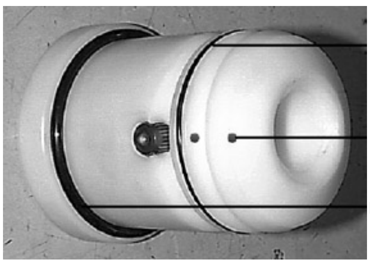
3. There is no need to remove **the inducer** unless damage is visible. **(Only inducers with snap rings can be removed).**



4. If the **inducer** has to be removed, press out the old one and press in the new one.

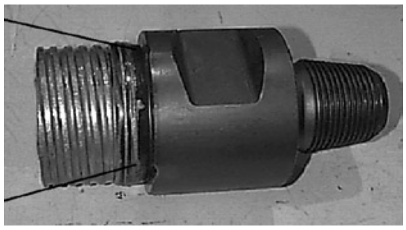
NOTE: Inducers can be removed only in hydrocyclones that use a snap ring to hold the inducer in place. Inducers are permanently installed at the factory on all other models they are not to be removed.

5. Insure the the **metering hole(s)** are clear in the separator.



6. Inspect the separator o-ring for damage. Replace if necessary.

7. Clean out the dirt trap ring and the inside of the backhead.



8. Inspect the check seal for erosion or damage, replace if necessary.

9. Insure the cross holes in the backhead are clear.

10. Reassemble the unit and grease the check seal.

11. Install the Hydrocyclone® in the DTH .

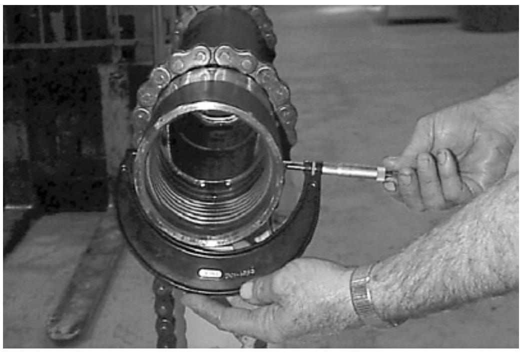
DTH inspection

The following lists critical measurements which are required to determine what parts, if any, require replacement, repair of reversal. Refer to the specifications for finding the appropriate discard point clearances. Bear in mind that discard point clearances represent an increase in clearance of 50% over the maximum as-new clearance. In some applications this clearance increase may represent too much performance loss and in other applications the opposite may be true.

Note that deterioration in drill performance is caused by the increase in clearance between two parts. It is obviously more cost effective to replace the part which decreases clearance the most at the lowest cost.

1. **Casing** outside diameter should be measured roughly 2 - 3 in. (50.8 - 76.2 mm) from the end of the chuck end. Refer to the casing reverse and discard dimensions to determine if the casing should be replaced or reversed.

- It´s suggested that if the casing is replaced the chuck and backhead should also be replaced.

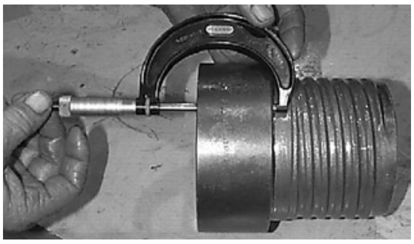


ENGLISH

2. The **chuck** should be inspected from a few perspectives:

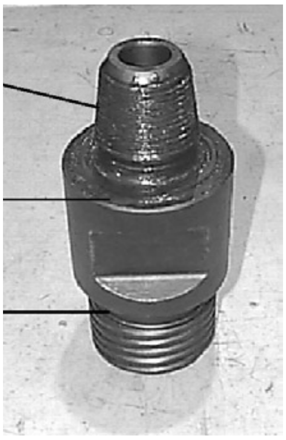
■ The overall length of the chuck should be checked against specification. A short chuck can cause cycling problems, difficulty handling water and a rough drill operation.

■ The chuck should be replaced if spline wear is heavy or uneven.. The chuck should be replaced if its minimum outside diameter is less than the casing discard point.



3.The **backhead** should be inspected from a few perspectives:

■ The condition of the connection thread should be checked. A backhead should be replaced if the threads are torn, galled or damaged. The condition of the connection shoulder should also be inspected for a depression which means the thread will not make-up properly.

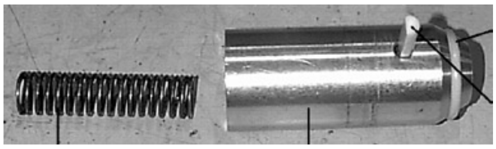


4. The **backhead o-ring or check seal** should be replaced if damaged in any way.

5. Check the **belleville springs** (QL4 & QL200 only) for damage by bouncing them with a drop of a few inches on a hard surface and listening for a ring. A dull sound will indicate a crack may exist. Springs which have been flattened or deformed will need replacement.

6. The **check valve spring** should be checked for cracks and obviously replaced if it is broken. In addition to visual inspection, compress the spring by hand and listen for a faint cracking sound to determine if cracks exist.

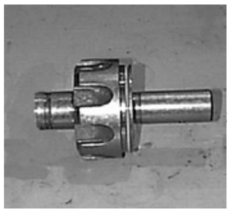
7. Inspect the check valve rubber or o-ring for damage on its sealing surface. Replace a damaged check valve. **Remember to replace the check valve choke if a new check valve is required.**



8. Inspect the **valve cap** seal bore for grooving or severe corrosion where the valve assembly contacts. Clean this area as required with emery paper to remove rust, scale or nicks and burrs. A valve cap with a deep groove should be replaced.

9. Inspect the **air distributor stem** (valve cap side) for grooving or severe corrosion where the valve seal contacts. Clean this area as required with emery paper to remove rust, scale or nicks and burrs. A distributor with a deep groove should be replaced.

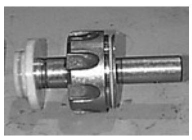
■ The QL200 has a distributor sleeve which can be replaced if it becomes worn or damaged.



10. Inspect the **valve** for seal interference and damage. The valve seals should have interference with the valve cap bore and distributor guide. The valve sealing surfaces should be free of nicks and burrs.

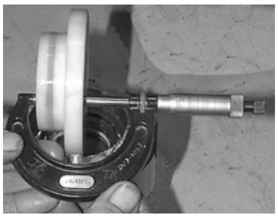
■ Insert the valve into the valve cap and check for interference. Replace the valve if there is no interference.

■ Place the valve over the distributor guide and check for interference. Replace the valve if there is no interference.



■ Measure the height of the valve with calipers and check against the discard specification. Replace the valve if itís below discard point. A shortened valve may cause a loss in operating pressure.

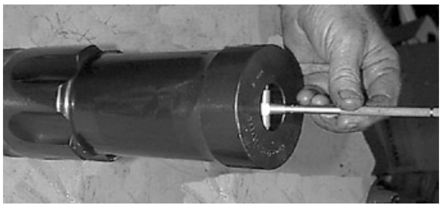
- Check to see that the outside diameter seal has not worn its groove in the valve by more than .060 in. (1.52 mm) axially. Replace the valve if the seal groove has worn.



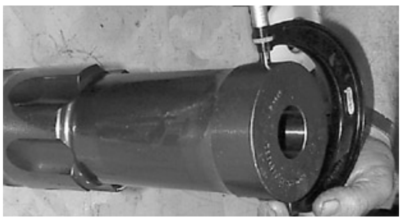
11. Inspect the **bearing bore** just above the internal flutes for wear using a telescopic bore gage and a micrometer. Replace the bearing if the net clearance with a new bit has worn beyond the discard point. Replace the bearing o-ring if it has been damaged or torn.

12. Inspect the **piston** for wear using micrometers in the four locations noted below. The piston usually wears more than its mating parts so itís likely that it will affect clearance the most. Record the dimensions for comparison to mating parts (cylinder, distributor and casing) to determine which part offers the most economical replacement cost. See special notes for non-lube seal and bearing inspection on page 3-23.

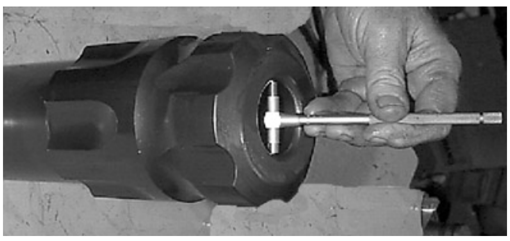
- Measure the tail bore in the location shown.



- Measure the tail outside diameter in the location shown.



- Measure the piston exhaust tube bore in the location shown.



- Measure the piston large diameter in the location shown.

NOTE: This is the most critical wear point on the drill as it influences performance the most.

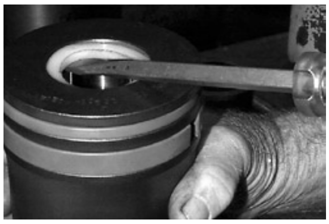
12a Non-lube piston, seals and bearing inspection
(Replacement seals and bearings are available as a kit only)

When should seals and bearings be replaced or serviced?

- If the DTH loses performance, operates erratically or exhibits other behavior that cannot be traced to a faulty part (pay attention to the bearing and valve), then a seal kit should be installed.

- Seals may last longer than 250 hours but it is wise to replace at this time period as preventive maintenance.

Remove tail seal by prying out with a screwdriver.

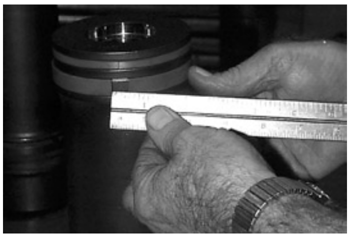


Install new tail seal by working it into the groove as much as possible.

Snap tail seal into bore by lightly tapping into groove.

- Check the gap in the bearings to insure they are at least 1/4'' wide. Proper seal function will be lost if this gap closes too much. To increase the gap simply cut or grind away what is required to achieve a 3/8'' to 1/4'' wide gap.

Precision is not required!

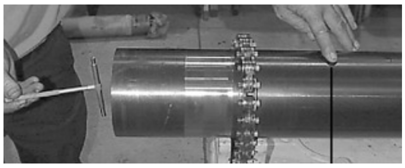


It is useful to pre-stress the seals slightly so they don´t get caught in casing grooves when installing piston.

Install bearings and seals by spreading over groove and allowing them to snap back into undercuts.

13. Carefully remove any sharp edges, burrs or nicks which have developed on the piston using a hand grinder. **Do not overheat the piston...it will crack if overheated!** If the piston face is heavily cavitated or pitted either use a ceramic facing tool to dress the face of the piston or use a well cooled grinder. In either case, a maximum of .060 in. (1.52 mm) can be removed from the piston face.

14. If the **casing** did not require replacement due to wear on itís outside diameter, measure and record the bore diameter for later reference. Use a telescopic bore gage and micrometers while measuring in the location shown.

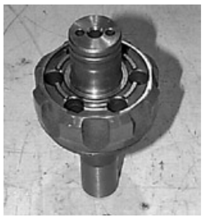


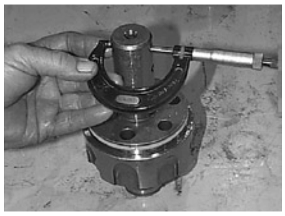
MEASURE AT THIS LOCATION
(1/2'' past long undercut)

15. Inspect the **cylinder** for cracks or damage. Measure and record the cylinder bore for later reference.

16. Inspect the **air distributor** for excessive wear on the valve seat, replace if wear is deeper than .005 in. (.127 mm). Measure and record the guide diameter for later reference.

■ Note that the QL200 guide and distributor are two different parts and can be replaced individually.





17. Referring to the chart inSection 6, which contains replace clearances and worst case as-new dimensions, determine the following from the measurements recorded:

■ If any of the four clearances have exceeded the discard point.
■ Bit to bit bearing.
■ Piston to casing.
■ Piston to cylinder.
■ Piston to guide.

18. Determine which parts have suffered the most wear by referring to the as-new dimensions in Section 5. Replace the part(s) needed to bring the clearance back to specification. The chart below may be useful for recording and determining which clearances require service.

DTH Clearance worksheet

Dimensions		**Measured Dimension**	**As new diameter from table**	**Actual wear**	**Measured clearance**	**Discard clearance from table**
	ID	**A**	**B**	**C**	**D**	**E**
Piston to Casing					2A-1A	
Large piston OD	1			1B-1A		
Casing ID	2			2A-2B		
Piston to cylinder					4A-3A	
Small piston OD	3			3B-3A		
Cylinder ID	4			4A-4B		
Piston to guide					5A-6A	
Piston tail ID	5			5A-5B		
Guide OD	6			5B-5A		
Bit to bearing					7A-8A	
Bit bearing ID	7			7A-7B		
New bit tail OD	8			8B-8A		

DTH assembly

The DTH assembly process is identical to the disassembly process yet in reverse.
The following guidelines should be used:

- All parts should be clean and free of grit dirt and other foreign material.

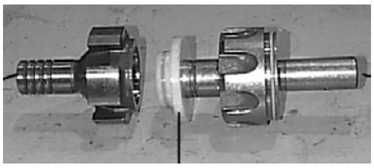
- All nicks and burrs on parts should have been removed.

- All parts should be coated with rockdrill oil and preferably the same type to be used on the drilling rig

- All damaged o-rings should have been replaced if. All seals should be oiled or greased to avoid cutting or tearing.

- If corrosion is common it may be useful to spray the threads on the casing with a corrosion protector such as LPS Hardcoat or an equivalent. Make sure the threads are clean and dry and sufficient drying time is allowed.

1. Reassemble the air distributor, valve and valve cap assembly. Remember that the air distributor and valve cap o-rings ''lock'' the parts together for ease of assembly and disassembly:

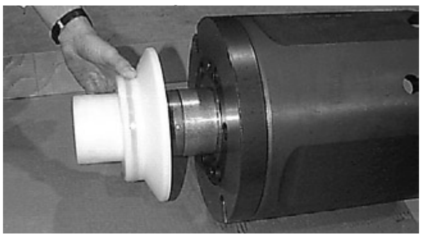


- With the cylinder resting on a piece of wood or hard rubber, place the air distributor (insure o-ring is installed) on the cylinder and drive it into the cylinder bore. Use a mallet or brass bar to overcome the o-ring pressure.

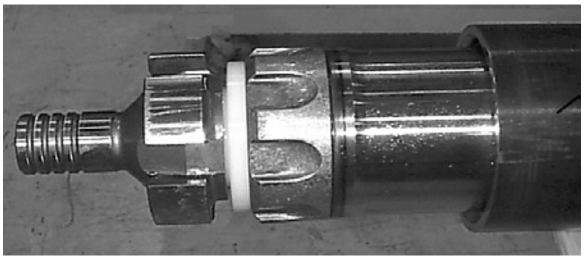
- Insure the valve cap o-ring is installed in the valve cap and that itís in good condition.

- Install the valve into the valve cap being careful not to fold or tear the valve seal.

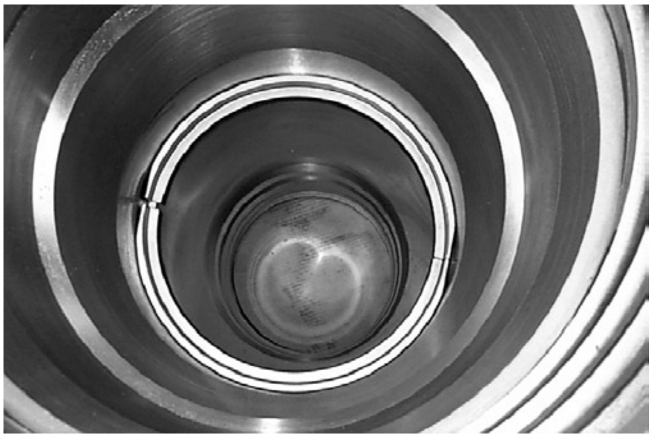
- Slide the valve and valve cap onto the distributor stem, again being careful not to damage the valve seal. Tap the top of the valve cap with a mallet to seat the o-ring and lock the parts together.



2. If the casing needs to be reversed, slide the cylinder, distributor and valve cap assembly into what was the chuck end. Otherwise slide the assembly into the backhead end. Note that even though the casing may not require reversal due to OD wear, it may be worthwhile to reverse the casing to renew the end of the bore the piston slides in. On the QL50/QL55QM, QL60/QL65QM and QL80 the cylinder stop ring in the casing does not need to be moved.

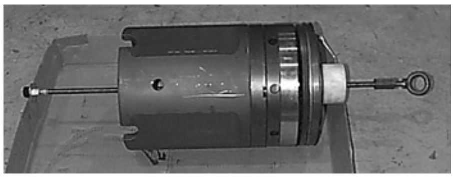


- The QL200 casing is not reversible so the cylinder stop rings halves must be reinstalled in the same direction they were removed.



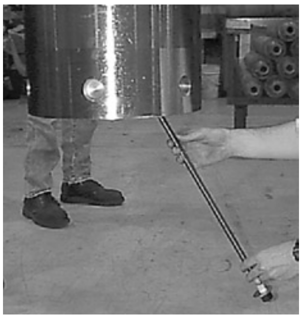
3. On the QL200 special handling is needed to install the cylinder assembly:

- Insert the 3/4 in. (19.05 mm) threaded rod with washer and locknut attached into the guide and attach the female lifting eye to the other end.



- With the casing standing straight up and the cylinder retaining rings spread outwards, lift the cylinder assembly up and into the casing bore.

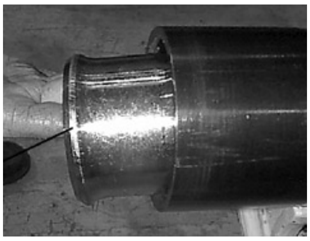
- Unthread the lifting eye and let the threaded rod drop out through the bottom. When the casing is placed on its side the rod can be retrieved.

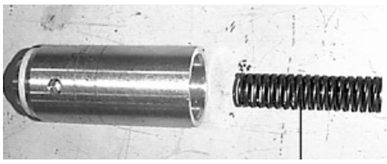


- The QL120 ships with a lifting plug which threads into the air distributor.

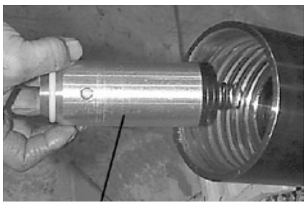
4. Install the solid spacer, check valve spring and check valve.

MAKEUP SPACER



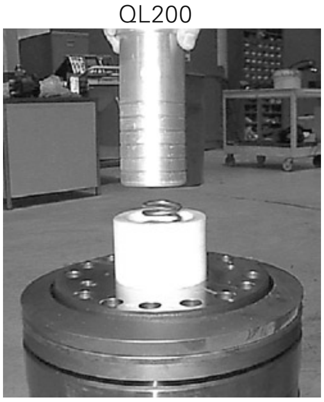


CHECK VALVE SPRING



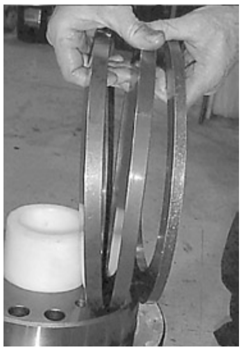
CHECK VALVE

QL200



- On the QL200, install the belleville springs and spacer. **Be careful to install the springs in their proper orientation. This is extremely important.**

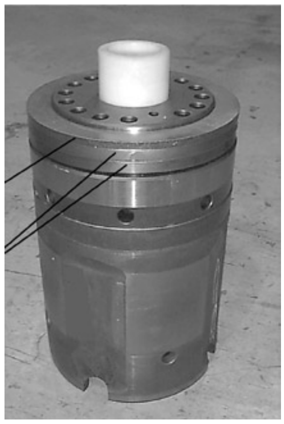
QL200



BELLVILLE SPRINGS AND MAKE UP SPACER

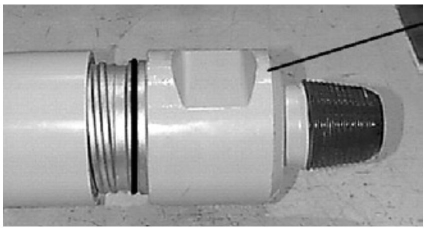
SPACER

BELLVILLE SPRINGS (BEVEL DOWN)



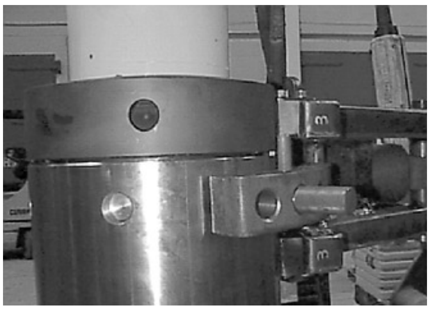
5. Make sure the backhead o-ring is in place on the backhead. Coat the backhead thread with a copper or zinc based thread compound and thread the backhead into the casing. All should close to create a gap between the casing when snug ''refer to technical specifications'' section. If there is no gap or the gap is too great the assembly must be rechecked.

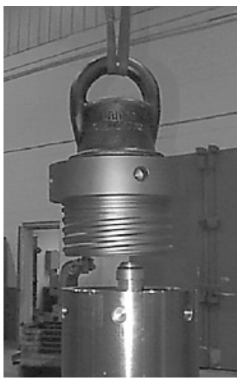
- The QL200 backhead should close to within 1/8 in. (3.18mm) when snug. A wear shim must be installed if the gap is less than 1/16 in. (1.59 mm).



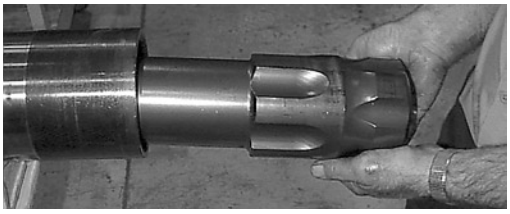
BACKHEAD

6. Torque all backheads until the backhead to casing gap is closed. This will require roughly 1500 ft-lb per inch (.86 kN-m per mm) of hammer for the QL50/QL55QM, QL60/QL65QM and QL80. For example, the QL80 is an 8 in. (203.2 mm) class DTH so it will need 8 (203.2) x 1500 (.86) or 12,000 ft-lb (174 kN-m) to close the backhead.

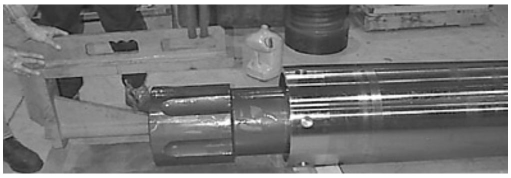




7. Install the piston through the chuck end of the casing.



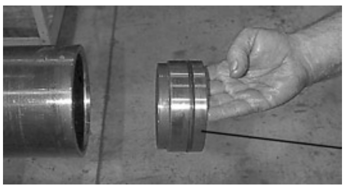
- A lifting cradle may be useful for the QL200 piston.



8. Install the bearing stop ring into the casing by starting it sideways and when itís near the undercut turn into the proper orientation until it snaps into the groove. A brass rod may be useful to driving and turning the ring. **Be sure to wear safety glasses as oil and grease in the groove may be expelled when the ring snaps.**

- On the QL120/QL200 install the polyurethane bearing stop ring in the groove by hand.

9. Insure the o-ring on the bearing is in good shape as it holds the bearing in place when the chuck is removed. Slide the bearing into the casing until it seats against the bearing stop ring. The bearing may need to be tapped from side to side to prevent it from getting stuck in the bore.



- Install the bit bearing o-ring on the Ql120 and QL200 by seating it into the gland. Improper installation could allow the piston to fall out.

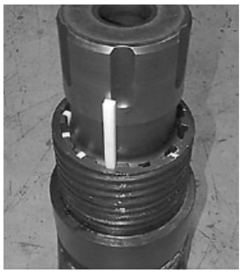
10. Coat the bit splines liberally with copper or zinc based thread compound and install the chuck on the bit.

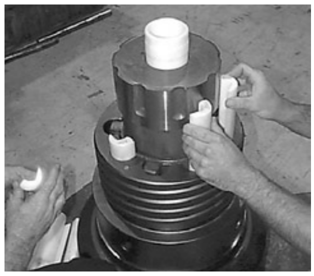
- On the QL200 install the drive pins in the proper direction so as the chuck turns clockwise it drives into the drive pins. Pins are marked ''TOP'' on one end.

- On the QL120, the drive pins do not have any particular direction. But they must all be assembled in the same orientation. Torque drives through the thin section.

(VIEWED FROM TOP END)

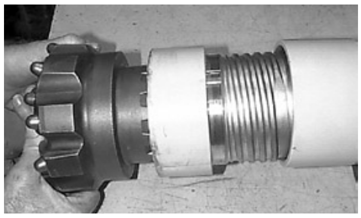
QL120 QL200





11. Install the bit retaining rings and bit retaining ring o-ring on to the bit and chuck.

12. Coat the chuck threads liberally with copper or zinc based thread compound and thread the bit, chuck and retaining rings into the casing.



- On the QL200 use a lifting bail on the backhead thread to lift the assembly and thread it onto the chuck.

13. **Be sure to torque the chuck to specification before drilling!**

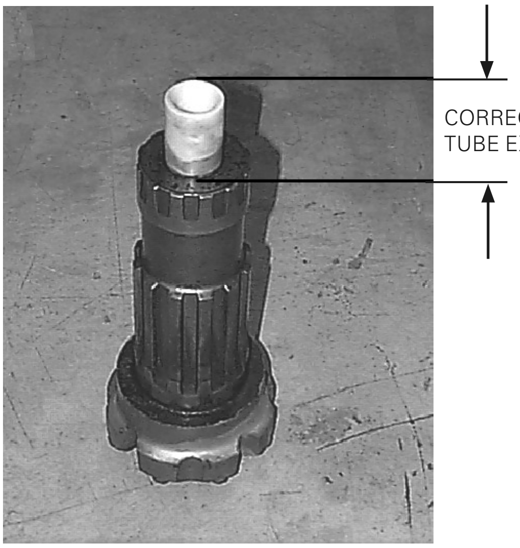
Exhaust tube replacement and installation

Exhaust tubes (footvalves) can become damaged during handling or physically eroded while in service, the net result is that they need to be serviced from time to time.

Tube failures will generally occur due to erosion caused by the jetting of water, oil and grit which is displaced as the piston strikes the bit. This form of failure is common in waterwell applications where injection rates are high. This high velocity jet of material actually erodes away the base of the tube and can eventually cause the tube to fail. Tube erosion can be reduced by insuring water is clean and free from particulate matter and that excessive fluid injection is avoided. It´s a good idea to monitor tube erosion and make replacements as needed before a hole is started to avoid a costly trip out of the hole.

Exhaust tubes can be removed by cutting off the remaining portion of the tube and prying the remaining piece out with a screwdriver. It may be useful to use a small rotary file to relieve the bore of the tube which remains in the bit. **However, be careful not to touch the bit tube bore with the rotary file or a heat check followed by bit failure may result.** The tube can also be heated slightly to soften the plastic. **Avoid breathing fumes which may come from the heated plastic and also be careful not to overheat the bit.**

A new exhaust tube can be installed by driving the tube into the bit with a rubber faced mallet or with a block of wood between the hammer and tube. Do not hit the tube directly with a metal hammer or the tube may be damaged. Alternatively, the tube can be pressed into the bore using a press or even the table and feed on a drilling rig. Be careful not to over-press the tube.



CORRECT EXHAUST TUBE EXTENSION

Bits

Atlas Copco Secoroc manufactures a complete product line of DTH bits in a design specifically for your drilling conditions. Contact your local Atlas Copco Secoroc representative for a complete catalogue.

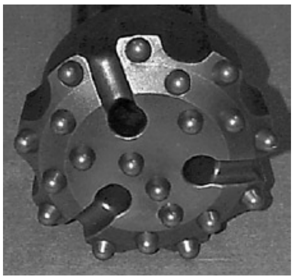
Selection

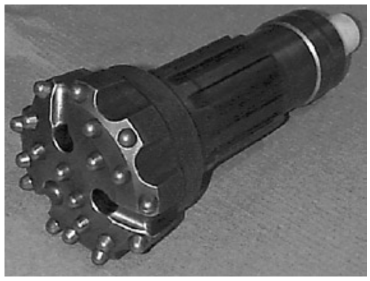
Proper selection of the correct bit type along with good service practice can reduce operating costs and improve production considerably. The sections following will assist you with the bit selection process and provide instruction for service practice.

Convex head concial tipped

Soft materials which are less than 15,000 psi (1033.5 bar) compressive strength. The material should also be consolidated and homogeneous with a low abrasiveness.

- Soft limestone
- Shale
- Slate

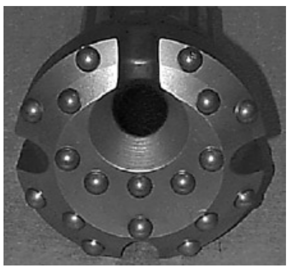


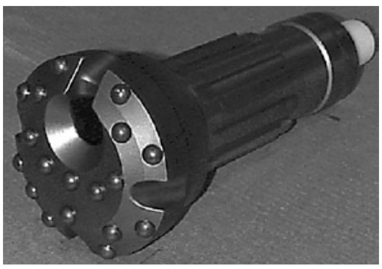


Convex head spherical tipped

Medium soft materials which are 15,000 - 25,000 psi (1033.5 - 1722.5 bar) compressive strength.
The material should be consolidated and homogenous.

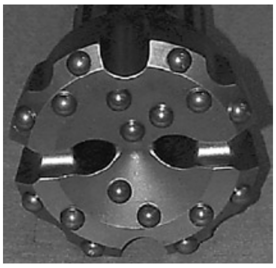
- Hard limestone
- Granite
- Sandstone
- Diorite
- Schist
- Marble

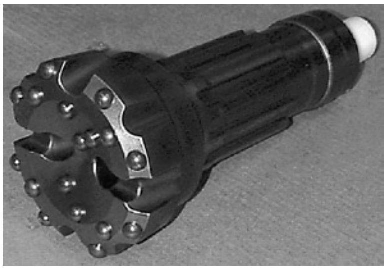




Concave face
Medium-soft to medium-hard materials which are 15,000 - 30,000 psi (1033.5 - 2067 bar) compressive strength. Material can be voided, fractured, unconsolidated and faulted. Face slots provide good hole cleaning in fast drilling applications.

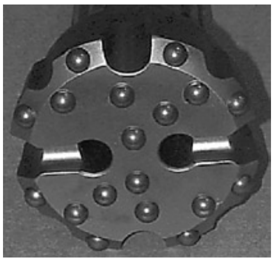
- Hard limestone
- Granite
- Sandstone
- Diorite
- Schist
- Marble

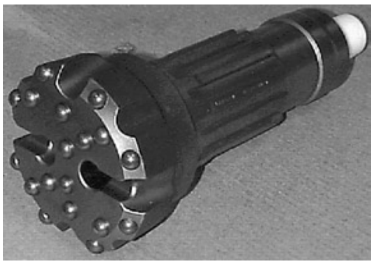




Flat face
Medium-hard to hard materials which are greater than 30,000 psi (2067 bar). Materials should be consolidated but a certain level of voids and fractures are acceptable. The flat face design has the strongest head.

- Granite
- Gabbro





Service
Bits need to be sharpened and serviced just like any other cutting tool would. The following provides tips and suggestions for proper bit maintenance.

Bit sharpening
The sharper a bit insert is the faster you will penetrate and the longer your bit will last. The objective is to penetrate the insert into the rock so that chips can be created. A sharper insert will penetrate deeper and generate larger cuttings. Also, the stresses on a sharp insert are lower those on a dull insert. Lower stresses mean longer insert life and reduced risk of socket bottom failures. The bottom line is

Keep those inserts sharp!!!

Atlas Copco Secoroc offers a complete assortment of bit sharpening tools and equipment. Contact your local Atlas Copco Secoroc sales location for a complete catalogue and sharpening instructions.

TROUBLESHOOTING GUIDE

The majority of DTH operating problems can be traced to improper operation. These troubleshooting charts will help you by suggesting a probable cause and a recommended remedy.

Problem	Cause(s)	Remedy(s)
Rough-erratic operation	1. Too much water injection.	1. Reduce level of water injection. Consider installing a Hydrocyclone®.
	2. Chuck has worn too much.	2. Inspect chuck length for correct body length. A short chuck will restrict air needed to return piston. Note that body length is the distance from the shoulder which contacts the casing to the shoulder that contacts the bit.
	3. Rotation speed too slow.	3. Increase rotation speed to get at no more than 1/2 in. (12.7 mm) advance per revolution. Watch flat on carbide; if it´s on the leading edge of the insert rotation´s too slow.
	4. Feed too hard.	4. Set feed pressure (decrease holddown or increase holdback) just until pulsation in rotation pressure falls and pressure is steady.
	5. Valve lift too large.	5. Inspect valve lift and replace valve assembly if needed. Valve lift should be .045 - .055 in. (1.14 - 1.9 mm) or, .075 - .085 in. (1.9 - 2.16 mm) for high flow QL60/QL65QM valve.
	6. Worn/leaking valve seal.	6. Check for axial wear of outside valve seal groove. Replace valve assembly if groove has worn more than .06’’ (1.5 mm).
	7. Worn bit bearing.	7. Replace bit bearing. Leakage past bit bearing may cause piston to lack upstroke force making cycle erratic.
	8. Worn piston exhaust tube	8. Inspect piston bore and exhaust tube vs. bore or exhaust tube. specification. Replace if needed. Leakage past this clearance can reduce piston upstroke force making cycle erratic.
	9. Worn non-lube seals	9. Replace seals and bearings.
Low penetration/high pressure	1. Worn/leaking valve seal.	1 Check for axial wear of outside valve seal groove. Replace valve assembly if groove has worn more than .06 in. (1.524 mm).
	2. Chuck has worn too much.	2. Inspect chuck length for correct body length. A short chuck will restrict air needed to return piston.
	3. Too much water injection.	3. Reduce level of water injection. Consider installing a Hydrocyclone®.
	4. Contamination (rubber hose, etc.) jammed hammer.	4. Remove obstruction which may be holding the in valve closed or restricting the air flow.
	5. Exhaust tube projection too long.	5. Check projection vs. specifications repair tube.
	6. Valve lift too small.	6. Measure valve lift. Replace parts as needed to correct. This problem usually means that standoff has been lost and internal parts are loose. Check standoff of backhead.

Problem	Cause(s)	Remedy(s)
Low penetration/low pressure	1. Lack of oil. 2. Worn drill clearances. 3. Large valve gap. 4. Damaged valve seat. 5. Worn non-lube seals.	1. Insure lubricator is working and hammer is getting coated with oil. Check bit blow ports for oil film. 2a. Inspect piston for wear particularly on large diameter just beneath scallops. This is the most sensitive diameter. Check other diameters; tail bore and tail diameter for wear. Compare all to specification. 2b. Inspect guide diameter for wear. Compare with specification and replace if necessary. 2c. Check cylinder bore for wear. Compare to specification and replace if necessary. 2d. Check casing bore for wear. Compare to specification and reverse or replace if necessary. 2e. Check bearing bore for wear. Compare to specification and replace if necessary. 3. Inspect valve lift and replace valve assembly if needed. Valve lift should be .045 - .055 in. (1.14 - 1.9 mm) or, .075 - .085 in. (1.9 - 2.16 mm) for high flow QL60/QL65QM valve. 4. Inspect valve seat surface for damage or wear which could cause leakage. Replace valve is suspect. 5. Replace seals.
Drill running off bottom	1. Worn piston. 2. Excessive water injection.	1. Inspect large diameter of piston for wear. Leakage past the large diameter can cause the piston to cycle when off bottom. 2. Try reducing water injection level. Water inhibits the air venting process which is needed to shut the hammer off.
Component failures	1. Piston cracked through large diameter. 2. Piston struck end cupping or breaking. 3. Cracked casing.	1a. Lack of lubrication could cause frictional cracks. Check lubricator and insure oil film is developed on bit blow holes. 1b. Wrenching over wrong location distorts casing and causes frictional rubbing with piston. Apply tong wrench pressure in correct location. 1c. Fighting or getting stuck in hole heats and distorts casing bore causing frictional heat and cracks on piston. Flood tool with water when stuck. 1d. Collaring on an angle or feeding hard through voided, faulted or broken ground can cause casing to distort and rub piston causing cracks. Use light feed when going through tough conditions. 2a. Usually a sign of underfeeding. Increase feed until rotation pressure pulses and then back down till smooth. 2b. Cavitation from excess water injection can cause small pits in piston face. These pits turn into cracks. Avoid excessive water injection. 3a. Hammering, welding and wrenching in wrong location can fail casings; avoid these practices & use sharp tong jaws to loosen connections. 3b. Corrosion from internal undercuts and threads; use good quality (neutral pH) water and flush with oil when finished drilling. If possible, coat threaded areas undercuts and bore of casing with corrosion protector such as LPS Hardcoat. 3c. Look for beat in chuck which could allow the piston to stroke far enough to contact air distributor and overstress the casing. Replace chuck if worn more than specification. 3d. Look for leaking or loose fitting large dia valve

Problem	Cause(s)	Remedy(s)
		seal which could make piston stroke too far and contact distributor. Replace the valve assembly. 3e. Casing has worn beyond discard point. Measure casing OD about 2 in. (50.8 mm) from chuck end. Compare to specification and replace if needed.
	4. Rolled over chuck.	4. Underfeeding can cause the bit to rebound into shoulder. the chuck and generate a rolled up edge. Increase feed force.
	5. Cracked backhead-body.	5. Fighting from hole and pulling backhead through caved-in materials creates frictional heat. Rotate slowly and/or flood with water when stuck.
	6. Cracked backhead threaded connection.	6. Look for evidence of connection moving on contact shoulder. Connection shoulder may be worn allowing movement. Replace/repair adapter sub or rod.
Breaking exhaust tubes	1. Erosion.	1a. Water jetting erodes base of bit tube at striking surface. Reduce level of water injection. 1b. Contaminants in water mix and cause abrasive blast at base of exhaust tube. Use clean water.
	2. Damage.	2a. Damaging tubes when changing bits. Be careful to thread casing onto chuck while vertical and in alignment. 2b. Use care when transporting bits to avoid damage to tube. Keep bit in box until needed.
	3. Bit tube bore small.	3. The tube bore of a bit can become deformed and pinch the tube. Look for a rolled over edge or deformation at the top of the bit bore. Remove by grinding away lip.
Chuck loosening in hole	1. Running loose.	1a. Refer to proper feed settings 1b. Avoid feathering feed in loose ground or at end of rod.
	2. Improper make up torque.	2a. Tong chuck tight before drilling.
Chuck hard to loosen	1. Gripping poor.	1a. Don´t grip over threads. 1b. Insure tong jaws are sharp.
	2. Conditions	2a. Try using breakout washer.

SPECIFICATIONS

DTH Requirements
Minimum guidelines for mounting specifications

Torque:
Roughly 500 ft-lb per inch (27 N-m per mm) maximum of bit.

Speed:
10 to 90 rpm

Hold down force:
500 lb per inch (9 kg per mm) of hammer maximum
(i.e. QL60 needs 3000lb (1360.8 kg)

Hold back force:
Dependent on hole depth and string weight. Must be capable of maintaining 500 lb per inch (226.8 kg per mm) at depth.

Operating pressure:
350 psig (24.1 bar) maximum

Volume:
150 - 200 scfm per inch (.165 - .22 m3/min per mm) of hammer diameter.

Lubrication:
1/3 pint (.16 l) per hour per 100 scfm (2.8 m3/min)

Minimum requirements for compressor capacity and pressure

The pressure and production developed by a DTH will be related to the air flow passing through the drill. The pressure and performance of a DTH is related to the SCFM delivered by the compressor. To determine what pressure a DTH will carry (without fluid injection and well oiled) you need to take into account the actual SCFM (or mass flow) of air delivered by the compressor. Compressors are rated in ACFM which only equals SCFM at standard conditions of sea level and 60°F (16° C) inlet temperature. As the inlet air density either increases or decreases due to temperature and altitude changes, the SCFM delivery of a compressor will change. The pressure and performance of a DTH are related to the SCFM delivered by the compressor.

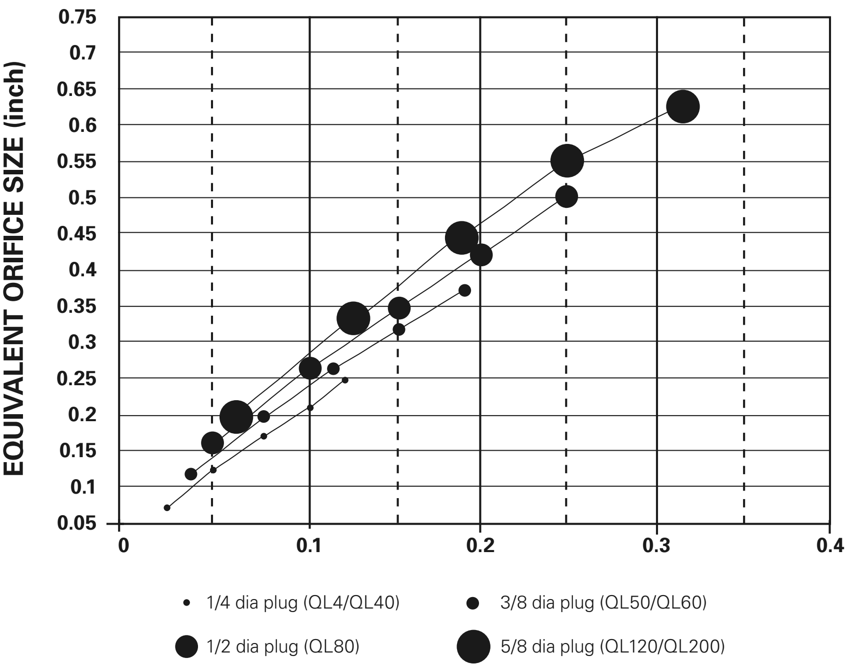
Figures below show the relationship of pressure and flow for all Quantum Leapr DTH ´s running oiled with no water injection in a shallow hole.

The Figure 1 shows compressor correction factors for typical oil flooded screw compressors. The rated delivery of a compressor must be multiplied by the correction factor to determine delivery in SCFM. The flow in SCFM should be used for determining the pressure the drill will hold referring to Figure 1.

Figure 1. Altitude Correction Multipliers

Altitude - feet (meters)	sea level 0 (0)	2,000 (609.6)	4,000 (1219.2)	6,000 (1828)	8,000 (2438.4)	10,000 (3048)
Atmospheric pressure PSIA (mm Hg)	14.70 (760.2)	13.66 (706.4)	12.68 (655.7)	11.77 (608.7)	10.91 (564.2)	10.10 (522.3)
Temperature °F (°C)						
0 (-18)	1.07	0.99	0.92	0.86	0.79	0.74
20 (-7)	1.05	0.97	0.90	0.84	0.78	0.72
40 (4)	1.02	0.95	0.88	0.82	0.76	0.70
60 (16)	1.00	0.93	0.86	0.80	0.74	0.69
80 (27)	0.98	0.91	0.85	0.78	0.73	0.67
100 (38)	0.96	0.89	0.83	0.77	0.71	0.66
120 (49)	0.94	0.88	0.81	0.76	0.70	0.65

DIAMETER EQUIVALENT TO FLAT SIZE

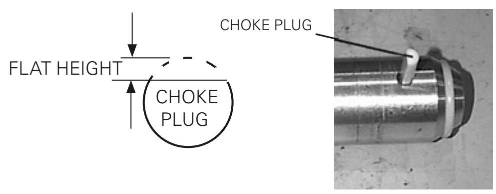


1. Diameter is based on flow enetering from both sides of the flat (ie. two flats make up hole equivalent).
2. Flat height is thickness removed from round choke plug.
3. Flow can be determined from the expression following where:

D is equivalent hole diameter
Q is flow in scfm
P is pressure in psig

Q = 9.71 x D^2 x P

Assumptions:
flow coefficient is 0.7 temperture is 120F gas is air.



Rock drill oil specifications

Characteristic	Test Procedure	Below 20°F (-7°C)	20°F to 90°F (-7°C to 32°C)	Above 90°F (32°C)
Viscosity:				
SUS at 100°F (38°C)	ASTM-D2161	175 min.	450 min.	750 min.
SUS at 210°F (99°C)	ASTM-D2161	46 min.	65 min.	85 min.
cST at 104°F (40°C)	ASTM-D445	37 min.	105 min.	160 min.
cST at 212°F (100°C)	ASTM-D445	6 min.	11 min.	16 min.
Pour Point, °F (°C) max.	ASTM-D97	-10°F (-23°C)	-10°F (-23°C)	0°F (-18°C)
Flash Point, °F (°C) min.	ASTM-D92	370°F (188°C)	400°F (204°C)	450°F (232°C)
Viscosity Index, min.	ASTM-D2270	90	90	90
Steam Emulsion No. min.	ASTM-1935-65	1200	1200	1200
Consistency	. . . .	Stringy	Stringy	Stringy
Falex Load Test lbs (kg) [min]	ASTM-D2670	2000 lbs (907 kg)	2000 lbs (907 kg)	2000 lbs (907 kg)
Timken E.P. Test lbs (kg) [min]	ASTM-D2782	30 lbs (14 kg)	30 lbs (14 kg)	30 lbs (14 kg)

Super-tac rock drill oil part numbers

Grade	1 Gallon 3,8 Lit	5 Gallon 18,9 Lit	55 Gallon 207 Lit	300 Gallon 1136 Lit	ISO Grade (reference)	Viscosity (Cst @ 40°C)	Viscosity Index (typ)	Pour Point Max °F (°C)	Flash point Min °F (°C)	Emulsion Min t 35 ml.
Test reference-ASTM						D2270	D97	D92	D1401	
Test reference - ISO						2909	3104	2592	3488	
Light	52334174	52333192	52333200	52343225	100	90-110	124	-16 (-26)	460 (237)	>60
Medium	52334182	52333218	52333226	52343233	220	198-242	121	0 (17)	457 (236)	>60
Heavy	52334190	52333234	52333242	52323241	460	380-430	94	10 (-12)	455 (235)	>60
Extra heavy	52334208	52333259	52333267	52343258	1000	1078	95	34 (1)	480 (249)	>60

LUBRICANTS (Furnished only when specially ordered)

	Not intended for EU-markets	
51781607	LUBRICANT, ANTI-SEIZE	8 OZ.
51857407	LUBRICANT, DRILL PIPE	1 GAL
51857415	LUBRICANT, DRILL PIPE	2-1/2 GAL
51857423	LUBRICANT, DRILL PIPE	5 GAL
52334174	SUPER-TAC ROCK DRILL OIL (LIGHT)	1 GAL
52333192	SUPER-TAC ROCK DRILL OIL (LIGHT)	5 GAL
52333200	SUPER-TAC ROCK DRILL OIL (LIGHT)	55 GAL
52334182	SUPER-TAC ROCK DRILL OIL (MEDIUM)	1 GAL
52333218	SUPER-TAC ROCK DRILL OIL (MEDIUM)	5 GAL
52333226	SUPER-TAC ROCK DRILL OIL (MEDIUM)	55 GAL
52334190	SUPER-TAC ROCK DRILL OIL (HEAVY)	1 GAL
52333234	SUPER-TAC ROCK DRILL OIL (HEAVY)	5 GAL
52333242	SUPER-TAC ROCK DRILL OIL (X-HEAVY)	55 GAL
52334208	SUPER-TAC ROCK DRILL OIL (X-HEAVY)	1 GAL
52333259	SUPER-TAC ROCK DRILL OIL (X-HEAVY)	5 GAL
52333267	SUPER-TAC ROCK DRILL OIL (X-HEAVY)	55 GAL

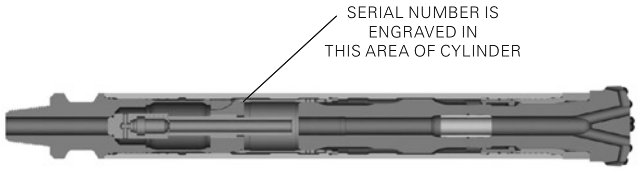
ORDERING INSTRUCTIONS

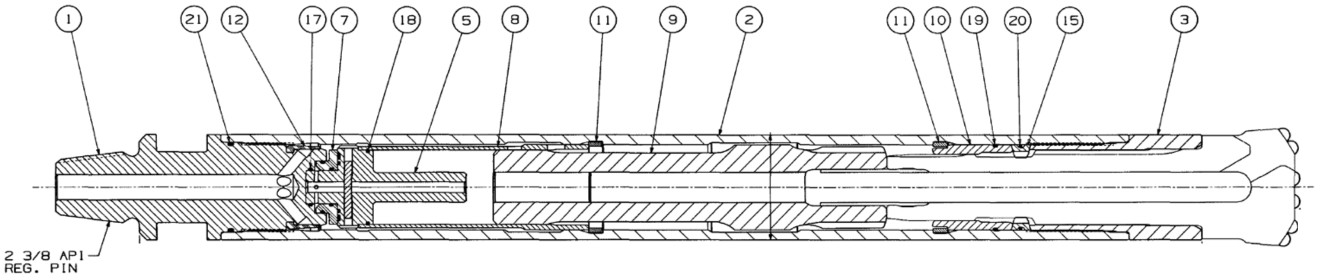
When ordering service parts, please specify:

1. The **NAME** of each part as listed.
2. The **PART NUMBER** as listed or stamped on the part.
3. The **SERIAL NUMBER** of the equipment.

DO NOT use illustration numbers when ordering service parts.

To save time, send all orders for parts to the nearest branch office or agent. IF IT IS NECESSARY TO SEND ANY PART OF THIS EQUIPMENT TO THE FACTORY, INQUIRE AT OUR NEAREST BRANCH OFFICE OR AGENT FOR SPECIAL INSTRUCTIONS.





NOTICE

- The QL50, QL50HC, QL55QM, QL60, QL60HC, QL65QM, QL80 and QL80HC ''out of the box'' will have a gap between the casing and backhead. This gap must be closed with rotary head torque or with wrenches before the drill is used. No *shimming* is ever required because stackup height never changes.

Model:	DHDQL40-STD		DHDQL45P-STD		DHDQL4		DHDQL50		DHDQL55QM	
CPN:	**52133519**		**52307873**		**51954808**		**51983120**		**51997591**	
Description:	**Standard QL40 with 2-3/8" API PIN connection.**		**Large OD QL40 with 2-3/8" API PIN connection.**		**Standard QL4 with 2-3/8" API PIN connection.**		**Standard QL50 with 3-1/2 API reg pin connection.**		**Thicker case Quarry & Mining QL50 with 3-1/2 API reg pin connection and cutting backhead.**	
General specifications:	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**
Connection:	2-3/8 API reg pin		2-3/8 API reg pin		2-3/8 API reg pin		3-1/2 API reg pin		3-1/2 API reg pin	
Outside diameter (in & mm)	3,69	93,7	3,86	98,0	3,69	93,7	4,60	116,8	4,88	124,0
Length w/o bit shoulder to shoulder (in &mm)	37,3	946,7	37,3	946,7	38,1	967,7	42,0	1066,8	42,0	1066,8
Length with bit extended (in & mm)	41,8	1061,2	41,8	1061,2	42,6	1081,5	46,3	1176,3	46,3	1176,3
Length with bit retracted (in & mm)	40,4	1026,2	40,4	1026,2	41,2	1046,5	45,3	1149,4	45,3	1149,4
Weight w/o bit (lb & kg)	71	32,3	81	36,8	71	32,3	132	60,0	162	73,6
Backhead across flats (in)	1-3/4 X 2-1/2 AF		1-3/4 X 2-1/2 AF		1-3/4 X 2-1/2 AF		2 X 3-1/2 AF		2 X 3-1/2 AF	
Minimum bit size (in & mm)	4,13	104,9	4,25	108,0	4,13	104,9	5,13	130,3	5,50	139,7
Maximum bit size (in & mm)	5,00	127,0	5,00	127,0	5,00	127,0	6,00	152,4	6,00	152,4
Bore (in & mm)	3,000	76,20	3,000	76,20	3,000	76,20	3,742	95,05	3,742	95,05
Piston weight (lb & kg)	17,1	7,8	17,1	7,8	17,1	7,8	31	14,1	31	14,1
Stroke (in &mm)	4,00	101,6	4,00	101,6	4,00	101,6	3,75	95,3	3,75	95,3
Maximum pressure differential (psig & bar)	350,0	24,1	350,0	24,1	350,0	24,1	350,0	24,1	350,0	24,1
Maximum choke diameter (in & mm)	0,38	9,65	0,38	9,65	0,38	9,65	0,38	9,65	0,38	9,65
Make-up torque (ft-lb & N-m)	4000	5416	4000	5416	4000	5416	5000	6770	5000	6770
Air consumption:	**QL40 (.050 lift-std) (4")**		**QL40 (.050 lift-std) (4")**		**QL4 OBS (.050 lift-std) (4")**		**QL50 (5")**		**QL55QM (5")**	
100 psi/ 6,9 bar (scfm & m^3/min)	158	4,5	158	4,5	154	4,3	202	5,7	202	5,7
100 psi (bpm)	1 354	1 354	1 354	1 354	1 354	1 354	1 116	1 116	1 116	1 116
150 psi/ 10,3 bar (scfm & m^3/min)	267	7,6	267	7,6	245	6,9	310	8,8	310	8,8
150 psi (bpm)	1 459	1 459	1 459	1 459	1 459	1 459	1 266	1 266	1 266	1 266
200 psi/ 13,8 bar (scfm & m^3/min)	377	10,6	377	10,6	339	9,6	422	11,9	422	11,9
200 psi (bpm)	1 580	1 580	1 580	1 580	1 580	1 580	1 401	1 401	1 401	1 401
250 psi/ 17,2 bar (scfm & m^3/min)	485	13,7	485	13,7	436	12,3	538	15,2	538	15,2
250 psi (bpm)	1 717	1 717	1 717	1 717	1 717	1 717	1 521	1 521	1 521	1 521
300 psi/ 20,7 bar (scfm & m^3/min)	594	16,8	594	16,8	536	15,1	658	18,6	658	18,6
300 psi (bpm)	1 869	1 869	1 869	1 869	1 869	1 869	1 626	1 626	1 626	1 626
350 psi/ 24,1 bar (scfm & m^3/min)	702	19,8	702	19,8	638	18,0	783	22,1	783	22,1
350 psi (bpm)	2 036	2 036	2 036	2 036	2 036	2 036	1 716	1 716	1 716	1 716
Operational specifications:										
Feed force (lbs)	1500-2000		1500-2000		1500-2000		1500-2500		1500-2500	
Rotation speed (rpm)	50-70		50-70		50-70		40-60		40-60	
Service specifications:										
Casing discard diameter (in & mm)	3,39	86,1	3,39	86,1	3,39	86,1	4,19	106,4	4,19	106,4
Casing reverse diameter (in & mm)	n/a	n/a	n/a	n/a	3,46	87,9	4,25	108,0	4,38	111,3
Minimum chuck length (in & mm)	2,49	63,2	2,49	63,2	1,90	48,3	1,83	46,5	1,83	46,5
Max. worn piston to casing clearance (in & mm)	0,011	0,27	0,011	0,27	0,011	0,27	0,011	0,27	0,011	0,27
Min new piston large OD:	2,991	75,97	2,991	75,97	2,991	75,97	3,741	95,02	3,741	95,02
Max new casing ID:	2,998	76,15	2,998	76,15	2,998	76,15	3,748	95,20	3,748	95,20
Max. worn piston to cylinder clearance (in & mm)	0,011	0,27	0,011	0,27	0,011	0,27	0,009	0,23	0,009	0,23
Min new piston tail OD:	2,601	66,07	2,601	66,07	2,601	66,07	3,319	84,30	3,319	84,30
Max new cylinder ID:	2,608	66,24	2,608	66,24	2,608	66,24	3,325	84,46	3,325	84,46
Max. worn piston to guide clearance (in & mm)	0,011	0,27	0,011	0,27	0,011	0,27	0,013	0,34	0,013	0,34
Max new piston tail/sealID:	1,050	26,67	1,050	26,67	1,050	26,67	1,251	31,78	1,251	31,78
Min new guide OD:	1,043	26,49	1,043	26,49	1,043	26,49	1,242	31,55	1,242	31,55
Max. worn bit to bearing clearance (in & mm)	0,015	0,38	0,015	0,38	0,015	0,38	0,020	0,50	0,020	0,50
Max new bearing ID:	2,334	59,28	2,334	59,28	2,334	59,28	3,019	76,68	3,019	76,68
Min new bit shank OD:	2,324	59,03	2,324	59,03	2,324	59,03	3,006	76,35	3,006	76,35
Max. worn bit to chuck clearance (in & mm)	0,019	0,50	0,019	0,50	0,019	0,50	0,017	0,42	0,017	0,42
Max new chuck ID:	2,686	68,22	2,686	68,22	2,686	68,22	3,490	88,65	3,490	88,65
Min new bit shank OD:	2,673	67,89	2,673	67,89	2,673	67,89	3,479	88,37	3,479	88,37
Exhaust tube extension (in & mm):	2,25	57,15	2,25	57,15	2,25	57,15	2,07	52,58	2,07	52,58
Min. new valve height, low lift valve (in & mm):	0,733	18,62	0,733	18,62	0,693	17,60	0,978	24,84	0,978	24,84
Min. new valve height, high lift valve (in & mm):	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Valve lift new, low lift valve or w/shim (in & mm):	.020-.030	0,51-0,76	.020-.030	0,51-0,76	.045-.055	1,14-1,40	.045-.055	1,14-1,40	.045-.055	1,14-1,40
Valve lift new, high lift valve or w/o shim (in & mm):	.045-.055	1,14-1,40	.045-.055	1,14-1,40	.045-.055	1,14-1,40	n/a	n/a	n/a	n/a
Maximum backhead standoff:	0,034	0,86	0,034	0,86	0,060	1,52	0,041	1,04	0,041	1,04
Minimum backhead standoff:	0,016	0,41	0,016	0,41	0,090	2,29	0,017	0,43	0,017	0,43

Model:	**DHDQL50HF**		**DHDQL55QMHF**		**DHDQL60+ STD**		**DHDQL60NL**		**DHDQL60HF-STD**	
CPN:	**52284882**		**52284890**		**52314820**		**51903326**		**52310604**	
Description:	**Standard QL50 high frequency with 3-1/2 API reg pin connection.**		**Thicker case Quarry & Mining QL50 high frequency with 3-1/2 API reg pin connection and cutting backhead.**		**Standard QL60+ with 3-1/2 API reg pin connection.**		**Non-Lube QL60 with 3-1/2 API reg pin connection.**		**Standard QL60HF with 3-1/2 API reg pin connection. "W" style piston, high blow pressure cylinder.**	
General specifications:	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**
Connection:	3-1/2 API reg pin		3-1/2 API reg pin		3-1/2 API reg pin		3-1/2 API reg pin		3-1/2 API reg pin	
Outside diameter (in & mm)	4,60	116,8	4,88	124,0	5,44	138,2	5,44	138,2	5,44	138,2
Length w/o bit shoulder to shoulder (in &mm)	42,0	1066,8	42,0	1066,8	44,6	1131,8	44,6	1131,8	44,6	1131,8
Length with bit extended (in & mm)	46,3	1176,3	46,3	1176,3	49,5	1256,3	49,5	1256,3	49,5	1256,3
Length with bit retracted (in & mm)	45,3	1149,4	45,3	1149,4	48,1	1220,7	48,1	1220,7	48,1	1220,7
Weight w/o bit (lb & kg)	132	60,0	162	73,6	200	90,9	200	90,9	200	90,9
Backhead across flats (in)	2 X 3-1/2 AF		2 X 3-1/2 AF		2 X 4 AF		2 X 4 AF		2 X 4 AF	
Minimum bit size (in & mm)	5,13	130,3	5,50	139,7	6,00	152,4	6,00	152,4	6,00	152,4
Maximum bit size (in & mm)	6,00	152,4	6,00	152,4	8,50	215,9	8,50	215,9	8,50	215,9
Bore (in & mm)	3,742	95,05	3,742	95,05	4,500	114,30	4,500	114,30	4,500	114,30
Piston weight (lb & kg)	33	15,0	31	14,1	42,6	19,4	42,6	19,4	42,6	19,4
Stroke (in &mm)	2,75	69,9	3,75	95,3	3,75	95,3	3,75	95,3	3,75	95,3
Maximum pressure differential (psig & bar)	350,0	24,1	350,0	24,1	350,0	24,1	350,0	24,1	350,0	24,1
Maximum choke diameter (in & mm)	0,38	9,65	0,38	9,65	0,38	9,65	0,38	9,65	0,38	9,65
Make-up torque (ft-lb & N-m)	5000	6770	5000	6770	6000	8124	6000	8124	6000	8124
Air consumption:	**QL50HF (5")**		**QL50HF (5")**		**QL60+ (.050 lift) (6")**		**QL60 NON-LUBE (.050 lift) (6")**		**QL60HF-HIGH BLOW (.050 lift) (6")**	
100 psi/ 6,9 bar (scfm & m^3/min)	232	6,5	232	6,5	305	8,6	305	8,6	314	8,9
100 psi (bpm)	1 445	1 445	1 445	1 445	1 270	1 270	1 270	1 270	1 330	1 330
150 psi/ 10,3 bar (scfm & m^3/min)	356	10,0	356	10,0	431	12,2	431	12,2	448	12,6
150 psi (bpm)	1 588	1 588	1 588	1 588	1 370	1 370	1 370	1 370	1 449	1 449
200 psi/ 13,8 bar (scfm & m^3/min)	475	13,4	475	13,4	561	15,8	561	15,8	581	16,4
200 psi (bpm)	1 711	1 711	1 711	1 711	1 470	1 470	1 470	1 470	1 569	1 569
250 psi/ 17,2 bar (scfm & m^3/min)	589	16,6	589	16,6	695	19,6	695	19,6	714	20,2
250 psi (bpm)	1 816	1 816	1 816	1 816	1 570	1 570	1 570	1 570	1 689	1 689
300 psi/ 20,7 bar (scfm & m^3/min)	698	19,7	698	19,7	832	23,5	832	23,5	848	24,0
300 psi (bpm)	1 901	1 901	1 901	1 901	1 670	1 670	1 670	1 670	1 809	1 809
350 psi/ 24,1 bar (scfm & m^3/min)	803	22,7	803	22,7	973	27,5	973	27,5	981	27,7
350 psi (bpm)	1 966	1 966	1 966	1 966	1 770	1 770	1 770	1 770	1 928	1 928
Operational specifications:										
Feed force (lbs)	1500-2500		1500-2500		2000-3000		2000-3000		2000-3000	
Rotation speed (rpm)	40-60		40-60		30-50		30-50		30-50	
Service specifications:										
Casing discard diameter (in & mm)	4,19	106,4	4,19	106,4	5,06	128,5	5,06	128,5	5,06	128,5
Casing reverse diameter (in & mm)	4,25	108,0	4,25	108,0	5,25	133,4	5,25	133,4	5,25	133,4
Minimum chuck length (in & mm)	1,83	46,5	1,83	46,5	2,15	54,6	2,15	54,6	2,15	54,6
Max. worn piston to casing clearance (in & mm)	0,011	0,27	0,011	0,27	0,009	0,23	[redacted]		0,009	0,23
Min new piston large OD:	3,741	95,02	3,741	95,02	4,492	114,10	[redacted]		4,492	114,10
Max new casing ID:	3,748	95,20	3,748	95,20	4,498	114,25	[redacted]		4,498	114,25
Max. worn piston to cylinder clearance (in & mm)	0,009	0,23	0,009	0,23	0,009	0,23	[redacted]		0,009	0,23
Min new piston tail OD:	3,319	84,30	3,319	84,30	3,985	101,22	[redacted]		3,985	101,22
Max new cylinder ID:	3,325	84,46	3,325	84,46	3,991	101,37	[redacted]		3,991	101,37
Max. worn piston to guide clearance (in & mm)	0,013	0,34	0,013	0,34	0,016	0,42	[redacted]		0,016	0,42
Max new piston tail/sealID:	1,251	31,78	1,251	31,78	1,502	38,15	[redacted]		1,502	38,15
Min new guide OD:	1,242	31,55	1,242	31,55	1,491	37,87	[redacted]		1,491	37,87
Max. worn bit to bearing clearance (in & mm)	0,020	0,50	0,020	0,50	0,015	0,38	0,015	0,38	0,015	0,38
Max new bearing ID:	3,019	76,68	3,019	76,68	3,623	92,02	3,623	92,02	3,623	92,02
Min new bit shank OD:	3,006	76,35	3,006	76,35	3,613	91,77	3,613	91,77	3,613	91,77
Max. worn bit to chuck clearance (in & mm)	0,017	0,42	0,017	0,42	0,018	0,46	0,018	0,46	0,018	0,46
Max new chuck ID:	3,490	88,65	3,490	88,65	4,187	106,35	4,187	106,35	4,187	106,35
Min new bit shank OD:	3,479	88,37	3,479	88,37	4,175	106,05	4,175	106,05	4,175	106,05
Exhaust tube extension (in & mm):	2,07	52,58	2,07	52,58	2,31	58,67	2,31	58,67	2,31	58,67
Min. new valve height, low lift valve (in & mm):	0,978	24,84	0,978	24,84	1,174	29,82	1,174	29,82	1,174	29,82
Min. new valve height, high lift valve (in & mm):	n/a	n/a	n/a	n/a	1,144	29,06	1,144	29,06	1,144	29,06
Valve lift new, low lift valve or w/shim (in & mm):	.045-.055	1,14-1,40	.045-.055	1,14-1,40	.045-.055	1,14-1,40	.045-.055	1,14-1,40	.045-.055	1,14-1,40
Valve lift new, high lift valve or w/o shim (in & mm):	n/a	n/a	n/a	n/a	.075-.085	1,90-2,16	.075-.085	1,90-2,16	.075-.085	1,90-2,16
Maximum backhead standoff:	0,041	1,04	0,041	1,04	0,034	0,86	0,034	0,86	0,034	0,86
Minimum backhead standoff:	0,017	0,43	0,017	0,43	0,013	0,33	0,013	0,33	0,013	0,33

Model:	DHDQL65+ STD		DHDQL65QM		DHDQL70+ STD		DHDQL80		DHDQL80HF	
CPN:	52315132		51991297		52315231		52083623		52313426	
Description:	Thicker-case Quarry-Mining QL65 with 3-1/2 API reg pin connection and cutting backhead.		Thicker-case Quarry-Mining QL60 with 3-1/2 API reg pin connection and cutting backhead.		Extra thick Quarry-Mining QL65QM (QL70) with 4-1/2 API reg pin connection and cutting backhead.		Standard QL80 with 4-1/2" API reg pin connection.		Standard QL80HF with 4-1/2" API reg pin connection.	
General specifications:	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**
Connection:	3-1/2 API reg pin		3-1/2 API reg pin		4-1/2 API reg pin		4-1/2 API reg pin		4-1/2 API reg pin	
Outside diameter (in & mm)	5,75	146,1	5,75	146,1	6,00	152,4	7,13	181,1	7,13	181,1
Length w/o bit shoulder to shoulder (in &mm)	44,6	1131,8	44,6	1131,8	44,6	1131,8	57,5	1460,5	57,5	1460,5
Length with bit extended (in & mm)	49,5	1256,3	49,5	1256,3	49,5	1256,3	63,5	1611,6	63,5	1611,6
Length with bit retracted (in & mm)	48,1	1220,7	48,1	1220,7	48,1	1220,7	61,7	1567,2	61,7	1567,2
Weight w/o bit (lb & kg)	244	110,9	244	110,9	272	123,6	446	202,7	446	202,7
Backhead across flats (in)	2 X 4 AF		2 X 4 AF		2 X 4 AF		2 X 5-7/8 AF		2 X 5-7/8 AF	
Minimum bit size (in & mm)	6,50	165,1	6,50	165,1	6,50	165,1	7,88	200,2	7,88	200,2
Maximum bit size (in & mm)	8,50	215,9	8,50	215,9	8,50	215,9	12,00	304,8	12,00	304,8
Bore (in & mm)	4,500	114,30	4,500	114,30	4,500	114,30	5,873	149,17	5,873	149,17
Piston weight (lb & kg)	42,6	19,4	42,6	19,4	42,6	19,4	112	50,9	117	53,2
Stroke (in &mm)	3,75	95,3	3,75	95,3	3,75	95,3	3,75	95,3	2,75	69,9
Maximum pressure differential (psig & bar)	350,0	24,1	350,0	24,1	350,0	24,1	350,0	24,1	350,0	24,1
Maximum choke diameter (in & mm)	0,38	9,65	0,38	9,65	0,38	9,65	0,50	12,70	0,50	12,70
Make-up torque (ft-lb & N-m)	6000	8124	6000	8124	6000	8124	8000	10832	8000	10832
Air consumption:	**QL65QM+ (.050 lift) (6")**		**QL65QM+ (.050 lift) (6")**		**QL65QM+ (.050 lift) (6")**		**QL80 (8")**		**QL80HF (8")**	
100 psi/ 6,9 bar (scfm & m^3/min)	305	8,6	305	8,6	305	8,6	166	4,7	331	9,4
100 psi (bpm)	1 270	1 270	1 270	1 270	1 270	1 270	968	968	1 242	1 242
150 psi/ 10,3 bar (scfm & m^3/min)	431	12,2	431	12,2	431	12,2	437	12,3	559	15,8
150 psi (bpm)	1 370	1 370	1 370	1 370	1 370	1 370	1 050	1 050	1 282	1 282
200 psi/ 13,8 bar (scfm & m^3/min)	561	15,8	561	15,8	561	15,8	707	20,0	784	22,1
200 psi (bpm)	1 470	1 470	1 470	1 470	1 470	1 470	1 132	1 132	1 333	1 333
250 psi/ 17,2 bar (scfm & m^3/min)	695	19,6	695	19,6	695	19,6	977	27,6	1 006	28,4
250 psi (bpm)	1 570	1 570	1 570	1 570	1 570	1 570	1 215	1 215	1 396	1 396
300 psi/ 20,7 bar (scfm & m^3/min)	832	23,5	832	23,5	832	23,5	1 248	35,3	1 225	34,6
300 psi (bpm)	1 670	1 670	1 670	1 670	1 670	1 670	1 297	1 297	1 469	1 469
350 psi/ 24,1 bar (scfm & m^3/min)	973	27,5	973	27,5	973	27,5	1 518	42,9	1 441	40,7
350 psi (bpm)	1 770	1 770	1 770	1 770	1 770	1 770	1 379	1 379	1 552	1 552
Operational specifications:										
Feed force (lbs)	2000-3000		2000-3000		2000-3000		3000-4000		3000-4000	
Rotation speed (rpm)	30-50		30-50		30-50		20-40		20-40	
Service specifications:										
Casing discard diameter (in & mm)	5,06	128,5	5,06	128,5	5,06	128,5	6,67	169,4	6,67	169,4
Casing reverse diameter (in & mm)	5,44	138,2	5,44	138,2	5,63	143,0	6,80	172,7	6,80	172,7
Minimum chuck length (in & mm)	2,15	54,6	2,15	54,6	2,15	54,6	2,83	71,8	2,83	71,8
Max. worn piston to casing clearance (in & mm)	0,009	0,23	0,009	0,23	0,009	0,23	0,014	0,34	0,014	0,34
Min new piston large OD:	4,492	114,10	4,492	114,10	4,492	114,10	5,872	149,15	5,872	149,15
Max new casing ID:	4,498	114,25	4,498	114,25	4,498	114,25	5,881	149,38	5,881	149,38
Max. worn piston to cylinder clearance (in & mm)	0,009	0,23	0,009	0,23	0,009	0,23	0,012	0,30	0,012	0,30
Min new piston tail OD:	3,985	101,22	3,985	101,22	3,985	101,22	5,332	135,43	5,332	135,43
Max new cylinder ID:	3,991	101,37	3,991	101,37	3,991	101,37	5,340	135,64	5,340	135,64
Max. worn piston to guide clearance (in & mm)	0,016	0,42	0,016	0,42	0,016	0,42	0,014	0,34	0,014	0,34
Max new piston tail/sealID:	1,502	38,15	1,502	38,15	1,502	38,15	1,941	49,30	1,941	49,30
Min new guide OD:	1,491	37,87	1,491	37,87	1,491	37,87	1,932	49,07	1,932	49,07
Max. worn bit to bearing clearance (in & mm)	0,015	0,38	0,015	0,38	0,015	0,38	0,021	0,53	0,021	0,53
Max new bearing ID:	3,623	92,02	3,623	92,02	3,623	92,02	4,652	118,16	4,652	118,16
Min new bit shank OD:	3,613	91,77	3,613	91,77	3,613	91,77	4,638	117,81	4,638	117,81
Max. worn bit to chuck clearance (in & mm)	0,018	0,46	0,018	0,46	0,018	0,46	0,023	0,57	0,023	0,57
Max new chuck ID:	4,187	106,35	4,187	106,35	4,187	106,35	5,365	136,27	5,365	136,27
Min new bit shank OD:	4,175	106,05	4,175	106,05	4,175	106,05	5,350	135,89	5,350	135,89
Exhaust tube extension (in & mm):	2,31	58,67	2,31	58,67	2,31	58,67	2,13	54,10	2,13	54,10
Min. new valve height, low lift valve (in & mm):	1,174	29,82	1,174	29,82	1,174	29,82	1,538	39,07	1,538	39,07
Min. new valve height, high lift valve (in & mm):	1,144	29,06	1,144	29,06	1,144	29,06	n/a	n/a	n/a	n/a
Valve lift new, low lift valve or w/shim (in & mm):	.045-.055	1,14-1,40	.045-.055	1,14-1,40	.045-.055	1,14-1,40	.025-.035	0,64-0,89	.025-.035	0,64-0,89
Valve lift new, high lift valve or w/o shim (in & mm):	.075-.085	1,90-2,16	.075-.085	1,90-2,16	.075-.085	1,90-2,16	.045-.055	1,14-1,40	.045-.055	1,14-1,40
Maximum backhead standoff:	0,034	0,86	0,034	0,86	0,034	0,86	0,045	1,14	0,045	1,14
Minimum backhead standoff:	0,013	0,33	0,013	0,33	0,013	0,33	0,019	0,48	0,019	0,48

Model:	DHDQL120		DHDQL120-OPT-B		QL200		QL200S	
CPN:	**52107448**		**52138385**		**52286523**		**52286531**	
Description:	**Standard QL120. 6-5/8" API reg pin connection.**		**QL120 with 10-3/4" outside diameter. 6-5/8" API reg pin connection.**		**Standard QL200 with 8-5/8 API reg pin connection.**		**Standard QL200 with "SUPER chuck to allow use with up to 36" bits, 8-5/8 API reg pin connection.**	
General specifications:	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**	**English**	**Metric**
Connection:	6-5/8 API reg pin		6-5/8 API reg pin		8-5/8 API reg pin		8-5/8 API reg pin	
Outside diameter (in & mm)	11,21	284,7	10,75	273,1	15,60	396,2	15,60	396,2
Length w/o bit shoulder to shoulder (in &mm)	72,3	1837,2	72,3	1837,2	65,8	1670,1	72,1	1830,8
Length with bit extended (in & mm)	82,0	2082,8	82,0	2082,8	75,3	1911,4	83,5	2120,1
Length with bit retracted (in & mm)	80,0	2032,0	80,0	2032,0	73,3	1860,6	81,5	2069,3
Weight w/o bit (lb & kg)	1430	650,0	1257	571,4	2579	1172,3	2983	1355,9
Backhead across flats (in)	4 X 1" holes		4 X 1" holes		special wrench/tongs		special wrench/tongs	
Minimum bit size (in & mm)	12,25	311,2	12,25	311,2	17,50	444,5	28,00	711,2
Maximum bit size (in & mm)	22,00	558,8	22,00	558,8	26,00	660,4	36,00	914,4
Bore (in & mm)	9,250	234,95	9,250	234,95	12,250	311,15	12,250	311,15
Piston weight (lb & kg)	350	159,1	350	159,1	610	277,3	610	277,3
Stroke (in &mm)	5,00	127,0	5,00	127,0	4,00	101,6	4,00	101,6
Maximum pressure differential (psig & bar)	250,0	17,2	250,0	17,2	250,0	17,2	250,0	17,2
Maximum choke diameter (in & mm)	0,75	19,05	0,75	19,05	0,88	22,35	0,88	22,35
Make-up torque (ft-lb & N-m)	12000	16248	12000	16248	18000	24372	18000	24372
Air consumption:	**QL120 (.050) (12")**		**QL120 (.050) (12")**		**QL200 (18")**		**QL200S (30")**	
100 psi/ 6,9 bar (scfm & m^3/min)	804	22,7	804	22,7	1 584	44,7	1 584	44,7
100 psi (bpm)	585	585	585	585	701	701	701	701
150 psi/ 10,3 bar (scfm & m^3/min)	1 248	35,3	1 248	35,3	2 470	69,8	2 470	69,8
150 psi (bpm)	695	695	695	695	807	807	807	807
200 psi/ 13,8 bar (scfm & m^3/min)	1 680	47,5	1 680	47,5	3 389	95,7	3 389	95,7
200 psi (bpm)	805	805	805	805	923	923	923	923
250 psi/ 17,2 bar (scfm & m^3/min)	2 100	59,3	2 100	59,3	4 341	122,6	4 341	122,6
250 psi (bpm)	915	915	915	915	1 049	1 049	1 049	1 049
300 psi/ 20,7 bar (scfm & m^3/min)	2 508	70,8	2 508	70,8	5 324	150,4	5 324	150,4
300 psi (bpm)	1 025	1 025	1 025	1 025	1 185	1 185	1 185	1 185
350 psi/ 24,1 bar (scfm & m^3/min)	2 904	82,0	2 904	82,0	6 340	179,1	6 340	179,1
350 psi (bpm)	1 135	1 135	1 135	1 135	1 331	1 331	1 331	1 331
Operational specifications:								
Feed force (lbs)	4500-6000		4500-6000		10,000-12,000		10,000-12,000	
Rotation speed (rpm)	15-25		15-25		10-15		10-15	
Service specifications:								
Casing discard diameter (in & mm)	10,50	266,7	10,50	266,7	15,00	381,0	15,00	381,0
Casing reverse diameter (in & mm)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Minimum chuck length (in & mm)	4,25	108,0	4,25	108,0	4,87	123,7	11,30	287,0
Max. worn piston to casing clearance (in & mm)	0,013	0,34	0,013	0,34	0,019	0,50	0,019	0,50
Min new piston large OD:	9,242	234,75	9,242	234,75	12,239	310,87	12,239	310,87
Max new casing ID:	9,251	234,98	9,251	234,98	12,252	311,20	12,252	311,20
Max. worn piston to cylinder clearance (in & mm)	0,014	0,34	0,014	0,34	0,019	0,50	0,019	0,50
Min new piston tail OD:	8,302	210,87	8,302	210,87	10,739	272,77	10,739	272,77
Max new cylinder ID:	8,311	211,10	8,311	211,10	10,752	273,10	10,752	273,10
Max. worn piston to guide clearance (in & mm)	0,019	0,50	0,019	0,50	0,039	0,99	0,039	0,99
Max new piston tail/sealID:	2,352	59,74	2,352	59,74	2,875	73,03	2,875	73,03
Min new guide OD:	2,339	59,41	2,339	59,41	2,849	72,36	2,849	72,36
Max. worn bit to bearing clearance (in & mm)	0,031	0,80	0,031	0,80	0,034	0,88	0,034	0,88
Max new bearing ID:	7,396	187,86	7,396	187,86	8,770	222,76	8,770	222,76
Min new bit shank OD:	7,375	187,33	7,375	187,33	8,747	222,17	8,747	222,17
Max. worn bit to chuck clearance (in & mm)								
Max new chuck ID:								
Min new bit shank OD:								
Exhaust tube extension (in & mm):	2,72	69,09	2,72	69,09	2,59	65,79	2,59	65,79
Min. new valve height, low lift valve (in & mm):	2,211	56,16	2,211	56,16	2,236	56,79	2,236	56,79
Min. new valve height, high lift valve (in & mm):	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Valve lift new, low lift valve or w/shim (in & mm):	.045-.055	1,14-1,40	.045-.055	1,14-1,40	.061-.069	1,50-1,75	.061-.069	1,50-1,75
Valve lift new, high lift valve or w/o shim (in & mm):	.075-.085	1,90-2,16	.075-.085	1,90-2,16	n/a	n/a	n/a	n/a
Maximum backhead standoff:	0,105	2,67	0,105	2,67	0,188	4,78	0,188	4,78
Minimum backhead standoff:	0,053	1,35	0,053	1,35	0,125	3,18	0,125	3,18

PARTS LISTS

NAME OF PART Parts indented under an item are included with that item	REF	QTY	QL40- STD 52133519	QL40P- STD 52315389	QL40LH- STD 52310398	QL50- STD 51983120	QL50- OPT-A 52100310	QL50HC- STD 52100344	QL50HC OPT-A 52101359	QL55QM- STD 51997591	QL50HF STD 52284882	QL55QMHF- STD 52284890
BACKHEAD	1	1	52127727 (2-3/8 API PIN)	←	52310430 (2-3/8 API PIN)	51991487 (3-1/2 API PIN)	52100328 (2-3/8 API REGPIN)	52100385 (3-1/2 API PIN)	52101367 (2-3/8 API PIN)	51955771 (3-1/2 API PIN)	51991487 (3-1/2 API PIN)	51955771 (3-1/2 API PIN)
HAMMER CASING	2	1	52131802 (3.69 O.D.)	←	52310414 (3.69 O.D.)	51991479 (4.60 O.D.)	←	←	←	51955805 (4.88 O.D.)	52284809 (4.60 O.D.)	52284932 (4.88 O.D.)
CHUCK, ONE PIECE	3	1	52131786	←	52310422	51991495	←	←	←	51955748	51991495	51955748
CHUCK BEARING	3A	-	-	-	-	-	-	-	-	-	-	-
CHUCK-IT CHUCK	4	1	-	-	-	-	-	-	-	-	-	-
CHUCK-IT SLEEVE	4A	1	-	-	-	-	-	-	-	-	-	-
AIR DISTRIBUTOR / GUIDE ASSY.	5	1	52131752	←	←	51793693	←	←	←	←	←	←
VALVE CAP	6	1	-	-	-	51793685	←	←	←	←	←	←
VALVE ASSY LOW FLOW	7	1	-	-	-	52082989	←	←	←	←	←	←
VALVE ASSY HIGH FLOW	7A	1	52133535	←	-	52297678	←	←	←	←	←	←
VALVE SHIM	7B	1	52138286	←	←	-	-	-	-	-	-	-
CYLINDER	8	1	51716371	←	←	51997088	←	←	←	←	←	←
PISTON	9	1	52131760	←	←	51996551	←	←	←	←	52123502	←
BIT BEARING	10	1	52131778	←	←	51996569	←	←	←	←	←	←
BEARING RETAINING RING	11	1	52131810	←	←	51987014	←	←	←	←	←	←
CHECK VALVE ASSEMBLY (with o-ring)	12	1	52127735	←	←	52115664	←	←	←	←	←	←
CHECK VALVE O-RING	12A	1	-	-	-	95962742	←	←	←	←	←	←
CHECK VALVE CHOKE PLG SOLID	13	1	52131828	←	←	50899137	←	←	←	←	←	←
CHECK VALVE CHOKE PLG 1/8'' (3/8'' - QL120 & QL200)	13A	1	-	-	-	50899129	←	←	←	←	←	←
CHECK VALVE CHOKE PLG 1/4'' (9/16'' - QL120 & QL200)	13B	1	-	-	-	50899111	←	←	←	←	←	←
CHECK VALVE SPRING	14	1	-	-	-	51857274	←	←	←	←	←	←
BIT RETAINING RING ASSEMBLY	15	1	51988947	←	←	51987006	←	←	←	←	←	←
MAKEUP SPACER	16	1	-	-	-	51997245	←	←	←	←	←	←
VALVE CAP O-RING	17	1	95136412	←	←	95136438	←	←	←	←	←	←
AIR DISTRIBUTOR O-RING	18	1	95136552	←	←	95137212	←	←	←	←	←	←
BIT BEARING O-RING	19	1	95086310	←	←	95086351	←	←	←	←	←	←
BIT RETAINING O-RING	20	1	95086310	←	←	95086351	←	←	←	←	←	←
BACKHEAD O-RING	21	1	95018719	←	←	95028452	←	←	←	←	←	←
BELLVILLE SPRINGS	23	v	-	-	-	-	-	-	-	-	-	-
BELLVILLE CASSETTE (QL4 ONLY)	24	1	-	-	-	-	-	-	-	-	-	-
CYLINDER RETAINING RING	25	1	52131810	←	←	-	-	-	-	-	-	-
INDUCER	27	1	-	-	-	-	-	52100369	←	-	-	-
PRELOAD O-RING	28	1	-	-	-	-	-	95087060	←	-	-	-
WATER SEPERATOR	29	1	-	-	-	-	-	52100377	←	-	-	-
SEPERATOR O-RING	30	1	-	-	-	-	-	95086252	←	-	-	-
CHECK SEAL	31	1	-	-	-	-	-	52100393	←	-	-	-
v SEE FIGURE FOR QUANITY.												

NAME OF PART Parts indented under an item are included with that item	REF	QTY	QL60HF- STD 52310604	QL60NL- STD 51903326	QL60NL- HC-STD 52296845	QL60+ STD 52314820	QL60H+ STD 2324258	QL60P+ STD 52324167	QL60H+ OPT-A 52315124	QL60H+ OPT-B 52315116	QL60H+ OPT-C 52315108	QL60H+ OPT-D 52315090	QL60H+ OPT-E 52321619
BACKHEAD	1	1	52324183 (3-1/2 API PIN)	52324183 (3-1/2 API PIN)	51994713 (3-1/2 API PIN)	51998748 (3-1/2 API PIN)	52324183 (3-1/2 API PIN)	52324183 (3-1/2 API PIN)	51998763 (2-7/8 API IFBOX)	51998771 (2-7/8 API IF PIN)	51998789 (3-1/2 API BOX)	51998797 BLANK BACKHEAD	NO BACKHEAD
HAMMER CASING	2	1	52324209	52297025	←	52135043	52324209	←	←	←	←	←	←
			(5.44 O.D.)	(5.44 O.D.)		(5.44 O.D.)	(5.44 O.D.)						
CHUCK, ONE PIECE	3	1	52324191	←	←	51998755	52324191	←	←	←	←	←	←
CHUCK BEARING	3A	1	-	-	-	-	-	-	-	-	-	-	-
CHUCK-IT CHUCK	4	1	-	-	-	-	-	-	-	-	-	-	-
CHUCK-IT SLEEVE	4A	1	-	-	-	-	-	-	-	-	-	-	-
AIR DISTRIBUTOR / GUIDE ASSEMBLY	5	1	52082567	51994614	←	52082567	←	←	←	←	←	←	←
VALVE CAP 6 1 52126299 z z z z z z z z z z													
VALVE ASSY LOW FLOW	7	1	52126265	←	←	←	←	←	←	←	←	←	←
VALVE ASSY HIGH FLOW	7A	1	52126794	←	-	-	-	-	-	-	-	←	←
VALVE SHIM	7B	1	-	-	-	-	-	-	-	-	-	-	-
CYLINDER	8	1	52310612	51903557	←	51994663	←	←	←	←	←	←	←
PISTON	9	1	52285228	51903532	←	52313558	52324217	←	←	←	←	←	←
BIT BEARING	10	1	51984607	←	←	←	←	←	←	←	←	←	←
BIT BEARING INSERT	10A	1	-	-	-	-	-	-	-	-	-	-	-
BEARING RETAINING RING	11	1	51999068	52284643	←	51999068	←	←	←	←	←	←	←
CHECK VALVE ASSEMBLY (with o-ring)	12	1	52099561	←	←	←	←	←	←	←	←	←	←
CHECK VALVE O-RING	12A	1	95962668	←	←	←	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG SOLID	13	1	50899137	←	←	←	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG 1/8'' (3/8'' - QL120 & QL200)	13A	1	50899129	←	←	←	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG 1/4'' (9/16'' - QL120 & QL200)	13B	1	50899111	←	←	←	←	←	←	←	←	←	←
CHECK VALVE SPRING	14	1	51600773	←	←	←	←	←	←	←	←	←	←
BIT RETAINING RING ASSEMBLY	15	1	51996031	←	←	←	←	←	←	←	←	←	←
MAKEUP SPACER / OR BELLEVILLE SPACER	16	1	51997328	←	←	←	←	←	←	←	←	←	←
VALVE CAP O-RING	17	1	95136479	←	←	←	←	←	←	←	←	←	←
AIR DISTRIBUTOR O-RING	18	1	95325353	←	←	←	←	←	←	←	←	←	←
BIT BEARING O-RING	19	1	95086641	95939435	←	95086641	←	←	←	←	←	←	←
BIT RETAINING O-RING	20	1	95086641	95939435	←	95086641	←	←	←	←	←	←	←
BACKHEAD O-RING	21	1	95018727	←	←	←	←	←	←	←	←	←	-
BELLVILLE SPRINGS	23	v	-	-	-	-	-	-	-	-	-	-	-
CYLINDER RETAINING / STOP RING	25	1	-	-	-	-	-	-	-	-	-	-	-
WEAR SPACER / WEAR SHIM	26	2	-	-	-	-	-	-	-	-	-	-	-
INDUCER (INCLUDED WITH BACKHEAD)	27	1	-	-	51988806	-	-	-	-	-	-	-	-
PRELOAD O-RING	28	1	-	-	95087094	-	-	-	-	-	-	-	-
WATER SEPERATOR	29	1	-	-	51994267	-	-	-	-	-	-	-	-
SEPERATOR O-RING	30	1	-	-	95086435	-	-	-	-	-	-	-	-
CHECK SEAL	31	1	-	-	51994259	-	-	-	-	-	-	-	-
NON-LUBE PISTON SEALS AND BEARINGS KIT	33	1	-	52287752	←	-	-	-	-	-	-	-	-
TAIL SEAL	37	1	52282233	-	-	-	-	-	-	-	-	-	-

v SEE FIGURE FOR QUANITY.

NAME OF PART Parts indented under an item are included with that item	REF	QTY	QL60+ HC-STD 52314838	QL65+QM STD 52315132	QL65H+QM STD 52324266	QL65P+QM STD 52324175	QL65+QM OPT-A 52315199	QL65H+QM OPT-A 52329083	QL65H+QM OPT-B 52315207	QL65H+QM OPT-C 52315215
BACKHEAD	1	1	51994713 (3-1/2 API PIN)	51991248 (3-1/2 API REG PIN)	52324241 (3-1/2 API REG PIN)	52324241 (3-1/2 API REG PIN)	51991248 2-7/8 API IF BOX)	52324241 2-7/8 API IF BOX)	NO BACKHEAD	51998821 (3-1/2 BECO PIN)
HAMMER CASING	2	1	52135043	52291663	52324225	←	52291663	52291663	←	←
CHUCK, ONE PIECE	3	1	51998755	51991222	52324233	←	-	52324225	52324233	←
CHUCK BEARING	3A	1	-	-	-	-	-	-	-	-
CHUCK-IT CHUCK	4	1	-	←	←	←	51997419	←	-	-
CHUCK-IT SLEEVE	4A	1	-	←	←	←	51985554	←	-	-
AIR DISTRIBUTOR / GUIDE ASSEMBLY	5	1	52082567	←	←	←	←	←	←	←
VALVE CAP	6	1	52126299	←	←	←	←	←	←	←
VALVE ASSY LOW FLOW	7	1	52126265	←	←	←	←	←	←	←
VALVE ASSY HIGH FLOW	7A	1	52126794	←	←	←	←	←	←	←
VALVE SHIM	7B	1	-	-	-	-	←	-	-	-
CYLINDER	8	1	51994663	←	←	←	←	←	←	←
PISTON	9	1	52313558	52313558	52324217	←	52313558	52324217	←	←
BIT BEARING	10	1	51984607	←	←	←	←	←	←	←
BEARING RETAINING RING	11	1	51999068	←	←	←	←	←	←	←
CHECK VALVE ASSEMBLY (with o-ring)	12	1	52099561	←	←	←	←	←	←	←
CHECK VALVE O-RING	12A	1	95962668	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG SOLID	13	1	50899137	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG 1/8'' (3/8'' - QL120 & QL200)	13A	1	50899129	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG 1/4'' (9/16'' - QL120 & QL200)	13B	1	50899111	←	←	←	←	←	←	←
CHECK VALVE SPRING	14	1	51600773	←	←	←	←	←	←	←
BIT RETAINING RING ASSEMBLY	15	1	51996031	←	←	←	←	←	←	←
MAKEUP SPACER / OR BELLEVILLE SPACER	16	1	51997328	←	←	←	←	←	←	←
VALVE CAP O-RING	17	1	95136479	←	←	←	←	←	←	←
AIR DISTRIBUTOR O-RING	18	1	95325353	←	←	←	←	←	←	←
BIT BEARING O-RING	19	1	95086641	←	←	←	←	←	←	←
BIT RETAINING O-RING	20	1	95086641	←	←	←	←	←	←	←
BACKHEAD O-RING	21	1	95018727	←	←	←	←	←	←	←
BELLVILLE SPRINGS	23	v	-	-	-	-	-	-	-	-
CYLINDER RETAINING / STOP RING	25	1	-	-	-	-	-	-	-	-
WEAR SPACER / WEAR SHIM (QL4 & QL200 ONLY)	26	2	-	-	-	-	-	-	-	-
INDUCER (INCLUDED WITH BACKHEAD)	27	1	51988806	-	-	-	-	-	-	-
PRELOAD O-RING	28	1	95087094	-	-	-	-	-	-	-
WATER SEPERATOR	29	1	51994267	-	-	-	-	-	-	-
SEPERATOR O-RING	30	1	95086435	-	-	-	-	-	-	-
CHECK SEAL	31	1	51994259	-	-	-	-	-	-	-
NON-LUBE PISTON SEALS AND BEARINGS KIT	33	1	-	-	-	-	-	-	-	-

v SEE FIGURE FOR QUANITY.

NAME OF PART Parts indented under an item are included with that item	REF	QTY	QL65H+QM OPT-D 52315223	QL65H+QM OPT-E 52324142	QL65H+QM OPT-F 52339900	QL70+ STD 52315231	QL80- STD 52083623	QL80- OPT-A 52083631	QL80- OPT-B 52083649	QL80- OPT-C 52106770	QL80- OPT-D 52298973	QL80- OPT-E 52329075	QL80HC- STD 52083656	QL80HC- OPT-A 52120292	QL80HC- OPT-B 52138328
BACKHEAD	1	1	52093275 (3-1/2 API IF PIN)	51998821 (3-1/2 BECO PIN CUTTING)	52093275 (3-1/2 API IF PIN)	52291747 (4-1/2 REG PIN)	52313400 (4-1/2 API PIN)	52083870 (4-1/2 BECO PIN)	52084597 (4'' BECO PIN)	521106788 (BLANK BACKHEAD)	52313400 (4-1/2 API PIN)	52313400 (4-1/2 API PIN)	51987071 (4-1/2 API PIN)	52105475 (BLANK BACKHEAD)	52138310 (BLANK BACKHEAD)
HAMMER CASING	2	1	52324225	52324225	52324225	52315264	51910396 (7.12 O.D.)	←	←	←	←	←	←	←	←
CHUCK, ONE PIECE	3	1	52324233	-	-	52291762	52313418	←	←	←	-	-	52313418	←	←
CHUCK, RETRIEVAL	3	1	-	51997419	←	-	-	-	-	-	52102894	52102894	-	-	-
CHUCK BEARING	3A	1	-	-	-	-	-	-	-	-	-	-	-	-	-
RETRIEVAL SLEEVE/THRUST WASHER (QL200S ONLY)	3B	1	-	-	-	-	-	-	-	-	52086501	-	-	-	-
RETRIEVAL RETAINER	3C	1	-	-	-	-	-	-	-	-	52086519	-	-	-	-
DOWEL PIN (NOT SHOWN)	3D	1	-	-	-	-	-	-	-	-	95651493	-	-	-	-
CHUCK-IT SLEEVE	4A	1	-	51985554	←	-	-	-	-	-	-	52292091	-	-	-
AIR DISTRIBUTOR / GUIDE ASSY	5	1	52082567	52082567	52082567	←	51910271	←	←	←	←	←	←	←	←
VALVE CAP	6	1	52126299	52126299	52126299	←	51910297	←	←	←	←	←	←	←	←
VALVE ASSY LOW FLOW	7	1	-	-	-	-	52084670	←	←	←	←	←	←	←	←
VALVE ASSY HIGH FLOW	7A	1	52126265	52126265	52126265	←	-	-	-	-	-	-	-	-	-
VALVE SHIM	7B	1	52126794	52126794	52126794	←	52282092	←	←	←	←	←	←	←	←
CYLINDER	8	1	51994663	51994663	51994663	←	51986834	←	←	←	←	←	←	←	←
PISTON	9	1	52324217	52324217	52324217	52313558	51910354	←	←	←	←	←	←	←	←
BIT BEARING	10	1	51984607	51984607	51984607	←	51910362	←	←	←	←	←	←	←	←
BEARING RETAINING RING	11	1	51999068	51999068	51999068	←	51987063	←	←	←	←	←	←	←	←
CHECK VALVE ASSEMBLY (with o-ring)	12	1	52099561	52099561	52099561	←	52115680	←	←	←	←	←	←	←	←
CHECK VALVE O-RING	12A	1	95962668	95962668	95962668	←	95136644	←	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG SOLID	13	1	50899137	50899137	50899137	←	50899137	←	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG 1/8'' (3/8'' - QL120 & QL200)	13A	1	50899129	50899129	50899129	←	50899129	←	←	←	←	←	←	←	←
CHECK VALVE CHOKE PLG 1/4'' (9/16'' - QL120 & QL200)	13B	1	50899111	50899111	50899111	←	50899111	←	←	←	←	←	←	←	←
CHECK VALVE SPRING	14	1	51600773	51600773	51600773	←	51910446	←	←	←	←	←	←	←	←
BIT RETAINING RING ASSEMBLY	15	1	51996031	51996031	51996031	←	52084688	←	←	←	←	←	←	←	←
MAKEUP SPACER / OR BELLEVILLE SPACER	16	1	51997328	51997328	51997328	←	52084928	←	←	←	←	←	←	←	←
VALVE CAP O-RING	17	1	95136479	95136479	95136479	←	95495776	←	←	←	←	←	←	←	←
AIR DISTRIBUTOR O-RING	18	1	95325353	95325353	95325353	←	95045324	←	←	←	←	←	←	←	←
BIT BEARING O-RING	19	1	95086641	95086641	95086641	←	95045324	←	←	←	←	←	←	←	←
BIT RETAINING O-RING	20	1	95086641	95086641	95086641	←	95045324	←	←	←	←	←	←	←	←
BACKHEAD O-RING	21	1	95048727	95048727	95048727	←	95027249	←	←	←	←	←	-	-	-
BELLVILLE SPRINGS	23	v	-	-	-	-	-	-	-	-	-	-	-	-	-
CYLINDER RETAINING / STOP RING	25	1	-	-	-	-	-	-	-	-	-	-	-	-	-
WEAR SPACER / WEAR SHIM	26	2	-	-	-	-	-	-	-	-	-	-	-	-	-
INDUCER (INCLUDED WITH BACKHEAD)	27	1	-	-	-	-	-	-	-	-	-	-	51987089	←	←
PRELOAD O-RING	28	1	-	-	-	-	-	-	-	-	-	-	51987121	←	←
WATER SEPERATOR	29	1	-	-	-	-	-	-	-	-	-	-	51987097	←	←
SEPERATOR O-RING	30	1	-	-	-	-	-	-	-	-	-	-	95086385	←	←
CHECK SEAL	31	1	-	-	-	-	-	-	-	-	-	-	51987105	←	←
LIFTING BAIL	34	1	-	-	-	-	-	-	-	-	-	-	-	-	-

v SEE FIGURE FOR QUANITY.

ENGLISH

NAME OF PART Parts indented under an item are included with that item	REF	QTY	QL80HF STD 52313426	QL80HF-OPT-A 52308350	QL80HF-HC-STD 52307881	QL120-STD 52107448	QL120-OPT-A 52107620	QL120-OPT-B 52138385	QL120HC-STD 52107455	QL200-STD 52286523	QL200S-STD 52286531
BACKHEAD	1	1	52313400 (4-1/2 API PIN)	52313400 (4-1/2 API PIN)	51987071 (4-1/2 API PIN)	52105624 (6-5/8 API Reg Pin)	52105624 (6-5/8 API Reg Pin)	52138393 (6-5/8 API Reg Pin)	52105715 (6-5/8 HC Bare Reg Pin)	51989218 (8-5/8 API PIN)	←
HAMMER CASING	2	1	52313392			52105616		52131984	52105616	52286507	
			(7.12 O.D.)	←	←	(11.2 O.D.)	←	(10.75 O.D.)	(11.2 O.D.)	(15.6 O.D.)	←
CHUCK, ONE PIECE	3	1	52313418	←	52313418	52105632	-	52131992	52105632	51989390	52124864
CHUCK, RETRIEVAL	3	1	-	52102894	-	-	52107281	-	-	-	-
CHUCK BEARING	3A	1	-	-	-	52105699	←	←	←	51989416	52124880
RETRIEVAL SLEEVE/THRUST WASHER (QL200S ONLY)	3B	1	-	52086501	-	-	52107299	-	-	-	52124872
RETRIEVAL RETAINER	3C	1	-	52086519	-	-	52107307	-	-	-	-
DOWEL PIN (NOT SHOWN)	3D	1	-	95651493	-	-	95365839	-	-	-	-
CHUCK-IT SLEEVE	4A	1	-	-	-	-	-	-	-	-	-
AIR DISTRIBUTOR / GUIDE ASSY	5	1	51910271	←	←	52116191	←	←	←	52098761	←
DISTRIBUTOR BODY	5A	1	-	-	-	52105525	-	-	-	52097045	-
GUIDE	5B	1	-	-	-	52105558	-	-	-	52097029	-
GUIDE LINER	5C	1	-	-	-	52105566	-	-	-	-	-
SLEEVE			-	-	-	52105608	-	-	-	52097037	-
VALVE CAP	6	1	52327640	←	←	52105533	←	←	←	52097052	←
VALVE ASSY LOW FLOW	7	1	52327665	←	←	52116209	←	←	←	52098753	←
VALVE ASSY HIGH FLOW	7A	1	-	-	-	-	-	-	-	-	-
VALVE SHIM	7B	1	52282092	←	←	52127594	←	←	←	-	-
CYLINDER	8	1	52285251	←	←	52105541	←	←	←	51989457	←
PISTON	9	1	52138526	←	←	52105509	←	←	←	52286515	←
BIT BEARING	10	1	51910362	←	←	52287562	←	←	←	52133543	←
BEARING RETAINING RING	11	1	51987063	←	←	52105657	←	←	←	51989374	←
CHECK VALVE ASSEMBLY (with o-ring)	12	1	52115680	←	←	52116217	←	←	←	51989739	←
CHECK VALVE O-RING	12A	1	95136644	←	←	52097896	←	←	←	52097896	-
CHECK VALVE CHOKE PLG SOLID	13	1	50899137	←	←	51991305	←	←	←	51991305	-
CHECK VALVE CHOKE PLG 1/8'' (3/8'' - QL120 & QL200)	13A	1	50899129	←	←	51991313	←	←	←	51991313	←
CHECK VALVE CHOKE PLG 1/4'' (9/16'' - QL120 & QL200)	13B	1	50899111	←	←	51991321	←	←	←	51991321	←
CHECK VALVE SPRING	14	1	51910446	←	←	51989259	←	←	←	51989259	←
BIT RETAINING RING ASSEMBLY	15	1	52084688	←	←	52105640	←	←	←	51989382	←
MAKEUP SPACER / OR BELLEVILLE SPACER	16	1	52084928	←	←	-	-	-	-	52098860	-
VALVE CAP O-RING	17	1	95495776	←	←	95087086	←	←	←	95136818	←
AIR DISTRIBUTOR O-RING	18	1	95045324	←	←	95379350	←	←	←	95451233	←
BIT BEARING O-RING	19	1	95045324	←	←	52107422	←	←	←	51989481	←
BIT RETAINING O-RING	20	1	95045324	←	←	95379350	-	-	-	95451233	-
BACKHEAD O-RING	21	1	95027249	←	←	95402913	←	←	←	95018347	←
BELLVILLE SPRINGS	23	noted	-	-	-	52105590 (1)	←	←	←	51989283 (2)	←
CYLINDER RETAINING / STOP RING	25	1	-	-	-	52105681	←	←	←	51989333	←
WEAR SPACER / WEAR SHIM	26	2	-	-	-	-	-	-	-	51989275	←
INDUCER	27	1	-	-	51987089	-	-	-	52107265	-	-
PRELOAD O-RING	28	1	-	-	51987121	-	-	-	95087250	-	-
WATER SEPERATOR	29	1	-	-	51987097	-	-	-	52105731	-	-
SEPERATOR O-RING	30	1	-	-	95086385	-	-	-	95086781	-	-
CHECK SEAL	31	1	-	-	51987105	-	-	-	52107257	-	-
LIFTING BAIL	34	1	-	-	-	-	-	-	-	50780170	←

ACCESSORIES FOR ''QUANTUM LEAP'' DOWNHOLE DRILLS

NAME OF PART	QL40	QL45	QL50	QL55QM	QL60+	QL65+QM	QL60NL	QL70+	QL80	QL80HF	QL120	QL200
REBUILD KIT (BACKHEAD, CHUCK, CASING, VALVE, CHECK VALVE, O-RINGS)	52336807	52336815	52336823	52336831	52336849	52336856	-	-	-	-	-	-
ECONOMY REBUILD KIT (CASING, CHUCK, VALVE, O-RINGS)	-	-	-	-	-	-	-	-	-	-	-	-
HYDROCYCLONE KIT	-	-	52101375 (2-3/8 REG PIN)	-	52082732 (3-1/2 REG. PIN)	-	52082732 (3-1/2 REG. PIN)	-	52088465 (4-1/2 REG. PIN)	←	-	-
HYDROCYCLONE KIT	-	-	52101383 (3-1/2 REG PIN)	-	52115136 (BLANK)	-	-	-	52105467 (BLANK)	-	-	-
CHUCK , DUCTILE IRON	-	-	52336559	-	-	-	-	-	-	-	-	-
CHUCK ASSEMBLY (CHUCK, BEARING, WASHER)	-	-	-	-	-	-	-	-	-	-	-	52127529
CHUCK-IT KIT	-	-	-	-	-	51997401	-	-	-	-	-	-
CASING WEAR GAGE	-	-	51293033	←	52291416	←	←	←	-	-	-	-
BREAKOUT WASHER	-	-	52329133	←	52308012	←	←	←	52329141	←	-	-
SEAL KIT							52287752			-	-	-
BIT RETRIEVAL SYSTEM	-	-	-	-	-	-	-	-	52103538	←	52116159 (16-1/4'' & SMALLER BITS)	52122694
BIT RETRIEVAL SYSTEM	-	-	-	-	-	-	-	-	-	-	52328598 (17-1/2'' & LARGER BITS)	-
SWIVEL KIT	-	-	-	-	-	-	-	-	-	-	-	52133568
SHIM, SOLID STACK	-	-	-	-	52335676	←	←	←	-	-	-	-
REMOVAL TOOL	-	-	-	-	-	-	-	-	-	-	52127586	-
JET SUB ASSEMBLY	52340312	-	-	-	-	-	-	-	-	-	-	-

9852 1864 01 - QL 2006.07 Relatera

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