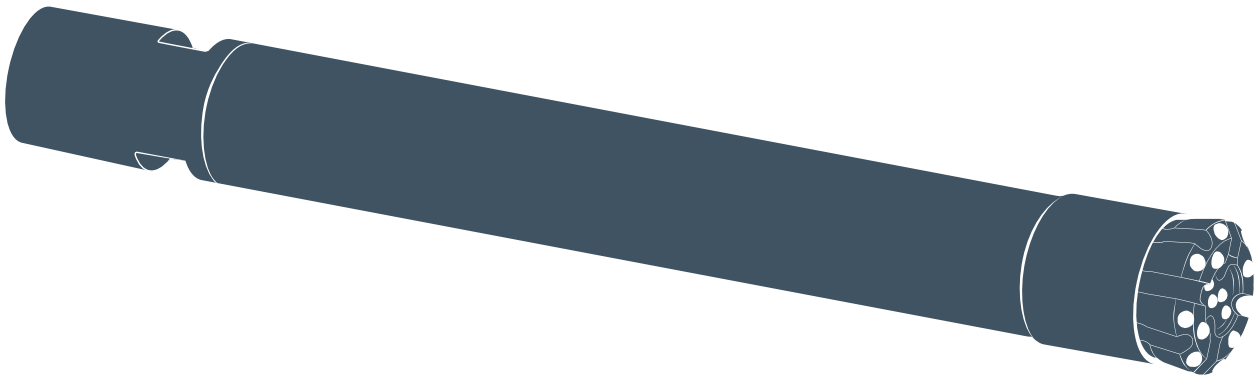
Secoroc RC 50 Reverse Circulation hammer

Operator's instructions
Spare parts lists

Epiroc



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Safety

General safety regulations

• Before starting, read these instructions carefully.

• Important safety information is given at various points in these instructions.

• Special attention must be paid to the safety information contained in frames and accompanied by a warning symbol (triangle) and a signal word, as shown below.

Warning symbols

DANGER

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

WARNING

Indicates hazards or hazardous procedures which COULD result in serious or fatal injury if the warning is not observed.

CAUTION

Indicates hazards or hazardous procedures which COULD result in injury or damage to equipment if the warning is not observed.

• Read through the operator's instructions for both the drill rig and the DTH hammer thoroughly before putting the DTH hammer into service. Always follow the advice given in the instructions.

• Use only authorized parts. Any damage or malfunction caused by the use of unauthorized parts is not covered by Warranty or Product Liability.

The following general safety rules must also be observed:

• Make sure that all warning signs on the rig remain in place and are free from dirt and easily legible.

• Make sure there are no personnel inside the working area of the drill rig during drilling, or when moving the rig.

• Always wear a helmet, goggles and ear protectors during drilling. Also observe any local regulations.

•The exhaust air from air driven hammers and grinding machines contains oil. It can be dangerous to inhale oil mist. Adjust the lubricator so that the correct rate of lubrication is obtained.

• Make sure that the place of work is well ventilated.

• Always check that hoses, hose nipples and hose clamps are properly tightened and secured, and that they are not damaged. Hoses that come loose can cause serious injury.

• Local regulations concerning air hoses and connections must always be strictly observed. This is especially the case if the DTH-hammer is to be operated at pressures above 10 bar (145 psi).

•The machine must not be used for purposes other than those prescribed by Epiroc. See “Application” on page 4.

Technical data

Dimensions and weights	
Product No.	52292273
Product code	9705-RC-00-66B-97-000
Outside diameter, mm (in)	130 (5,13)
Length without drill bit, mm (in)	1152 (45,4)
Piston weight, kg (lbs)	17 (38)
Stroke, mm (in)	64 (2,50)
Top sub thread – REMET	4½" BOX
Wrench flat on top sub, mm (in)	102 (4,0)
Weight without drill bit, kg (lbs)	72 (158)

Drilling parameters	
Recommended working pressure, bar (psi)	12–35
Rotation speed, rpm	20–70
Recommended bit size, mm (in)	140–146
Top sub thread	Remet 4½" BOX
Bit shank	RC 50

Air consumption			
(bar)	psi	(l/s)	cfm
14	450	180	380
17	250	220	460
21	300	270	580
24	350	330	700
28	400	390	820
31	450	440	930
35	500	500	1,050

Impact rate			
(bar)	psi	(strokes/min)	(Hz)
4	200	1750	29,1
17	250	1900	31,6
21	300	2100	35
24	350	2250	37,5
28	400	2350	37,1
31	450	2450	40,8
35	500	2550	42,5

Penetration rate in Swedish granite, 2200 bar, 30% SiO, mm/min (Standardized laboratory test)			
(bar)	psi	(mm/min)	m/h
16	230	475	28,5
20	290	530	31,8
24	350	710	42,6
28	31	920	55,2
35	500	1040	62,4

Performance figures are average values for new hammers at sea level. Specifications and other data subject to alteration without prior notice.

General

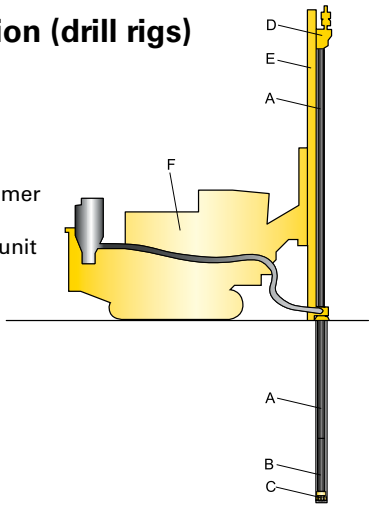
The down-the-hole hammer is a percussion hammer drill. As the name implies, the hammer works down the hole at the end of the drill string, where the impact piston strikes the drill bit directly.

Compressed air is led to the hammer via the rotation spindle and drill pipes. Exhaust air from the hammer is discharged through holes in the drill bit and used to flush clean the drill hole. Rotation is provided by a rotation unit on the feed beam and transmitted to the hammer via the drill pipes. The drill pipes are threaded so that the drill string can be extended as drilling progresses and the hole becomes deeper. Feed force is also transmitted to the hammer via the rotation unit and drill pipes. One of the main advantages of DTH hammers is that the drilling rate is not affected very much by the length or depth of the drill hole.

DTH hammers are very productive and have many applications in the mining, quarrying, civil-engineering and water-well drilling industries.

Application (drill rigs)

A = Drill pipe
B = DTH hammer
C = Drill bit
D = Rotation unit
E = Feed
F = Drill rig



Secoroc RC hammers are designed for use on RC drill rigs. They can also be used on DTH, ITH, rotary and auger type drill rigs, provided that such rigs meet the specifications for RC applications. The main demands on the drill rig are as follows:

• It should be equipped with a rotation unit that has a variable rotation speed of minimum 0–90 rpm and a rotation torque of 750–3000 Nm (75–300 kpm). Naturally, the torque demand for a recommended rotation speed will depend on the hammer size and bit diameter.

• A variable feed force of 3–43 kN (300–4300 kp) for shallow holes (less for deeper holes, bearing in mind the weight of the drill string). Obviously, the feed must be strong enough to pull the hammer and drill string out of the drill hole. This is an especially important consideration when drilling deep holes. The weight of the drill string varies between 9 and 34 kg/m, depending on the pipe- and bit diameters.

Technical description

The Secoroc RC 50 hammer and drill bit operate at the bottom of the hole as a unit.

The RC 50 hammer have a long casing 10 which houses an Adaptor tube 29, check valve 26, QL-valve 13, Inner cylinder 12, Inner cylinder stop ring 11, collector tube 20, Impact piston 8, Bit bearing 6, Bit bearing stop ring 7, chuck 2, Bit shank 1 and bit retaining rings 4.

The top end of the cylinder is closed by a threaded back head 18. The back head has a female thread for connection to the dual wall RC pipes or a dual wall digout sub. The back head is provided with wrench flats.

A chuck 2 threads in to the bottom end of the casing. The splined union between the chuck 2 and the bit shank 1 transmits rotation to the drill bit. The front end shoulder of the chuck transmits feed force to the drill bit. The retaining rings 4 limits axial movement of the drill bit. The chuck sleeve 3 is sealing off the hole and directing the exhaust air towards the front of the bit.

The check valve 26 that is mounted on the adaptor tube 29 prevents water from entering the hammer through the chuck when the compressed air supply is turned off. The adaptor tube 29 and the collector tube 20 is joined together and is going through the hammer for the collection of sample.

When feed force is applied, the drill bit is pushed into the hammer and pressed against the front of the driver chuck. The impact piston strikes the shank of the drill bit directly. The passage of compressed air through the hammer is directed by the piston and control tube, both of which have regulating ducts.

When the hammer is lifted off the bottom of the hole, the piston drops into the air blowing position. This disengages percussion and gives air blowing only, i.e. a large volume of air flows straight through the hammer. During drilling, air blowing starts if the drill bit loses contact with the bottom of the hole. The hammer starts operating again as soon as the bit is pressed back against the driver chuck. Air blowing is used when powerful flushing of the drill hole is required, and in certain difficult drilling conditions.

Preparing to drill

Hose connection

Connecting and securing the air hoses.

For a compressed air system to be efficient, reliable and economic, there must be:

• sufficient compressed-air capacity (volume and pressure);

• minimal pressure loss between the compressor and the hammer;

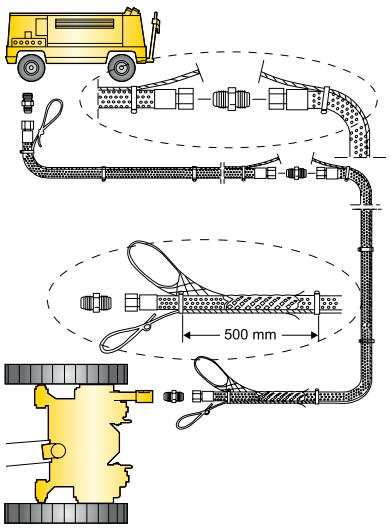
• minimal air leakage between couplings.

This can be realized by ensuring that:

• the correct size of compressor is selected;

• the correct hose size is used between the compressor and the hammer;

• there is no leakage in hose connections between the compressor and hammer.



DANGER

- Compressed air hoses between the compressor and the drill rig must be secured by means of an external or internal safety wire, which must be fastened safely to the drill rig. If the DTH hammer is to work at pressures above 10 bar (145 psi), any local regulations regarding air hoses and couplings must be strictly observed.
- Always check that hoses, hose nipples and hose clamps are not damaged, and that they are properly tightened and secured.

CAUTION

Always check the condition of drill string components. Bent or worn pipes can cause damage and excessive wear to the hammer and rig.

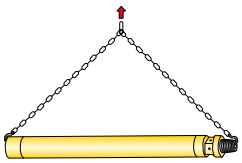
Setting-up the rig

Before drilling with the DTH hammer, the rig must be set-up correctly in order to give stability and safety. If this is not done, the effects of feed force and rotation torque can cause the rig to move. This will have a negative effect on drilling, especially when drilling deep, straight holes.

DANGER

- The rig must be set-up correctly in order to give stability and safety. If this is not done, the effects of feed force and rotation torque can cause the rig to move or even to overturn. This can incur the risk of serious or fatal injury as well as damage to the drill rig and equipment.

WARNING



- Heavy lift. Take care when handling the hammer. The hammer and its internal components are heavy and difficult to handle, especially in the case of the larger hammers.

When lifting using mechanical lifting equipment, sling the hammer as shown in the fig. Alternatively, a lifting-eye coupling can be screwed on to the top sub.

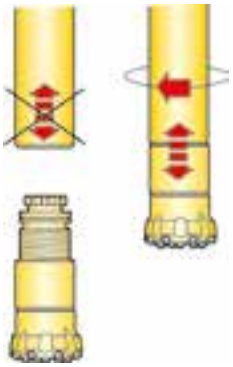
- Transportation. Do not let the hammer lie unsecured on a vehicle or drill rig. Always secure the hammer for transportation.

WARNING

- Always wear goggles during drilling!
- The exhaust air from the hammer (and also from the top sub if a unit for extra flushing is fitted) has a very high velocity. Objects such as small stones, drill cuttings, sand, earth and oil residue that are entrained in the flushing air can cause serious injury to unprotected eyes. Pay special attention to this danger during collaring, when a top sub with extra flushing is in use, and when the hammer is fed through the drill steel support or down into the hole.

Drilling

Rotation to the right



DTH hammers must be rotated to the RIGHT (clock wise) during drilling, since the driver chuck and top sub are threaded into the cylinder with **right-hand threads.**

Rotation must always be to the right when the hammer is operating. Left-hand rotation (or no rotation) will cause the driver chuck to loosen, which could mean losing the drill bit (or even the entire hammer) down the hole.

The drill string should be rotated to the right even when the hammer is not operating. For example, this should be done when cleaning the drill hole and when lifting up the drill string. It can be said that rotation to the right should be switched on as long as other operations are in progress with the hammer in the hole. The risk of the drill bit working loose should also be considered when breaking the joints between drill pipes. When adjusting the breaking wrenches, bear in mind that the drill string must not be rotated anti-clockwise any more than is absolutely necessary.

IMPORTANT

- Always switch on rotation to the right before starting the feed or hammer.
- Let the hammer rotate to the right (clockwise) even during lifting or lowering of the hammer.
- Do not switch off rotation to the right until all other functions have been switched off.

WARNING

- Take great care when jointing drill pipes. Make sure there is no danger of your fingers being pinched or clothing being entangled when the drill string is rotated.
- When a pipe wrench is used during jointing, there is a risk of the wrench flying off and causing injury when rotation is applied.

DANGER

When drilling on soft or unstable ground, great care must be taken because the flushing air from the hammer can erode the material around the drill hole, and so undermine the ground beneath the drill rig. This can pose a great danger to personnel and risk damaging the equipment.

CAUTION

- Always wear ear protectors during drilling.

Collaring

• Feed the hammer downward until the drill bit is about 5 cm from the collaring point.

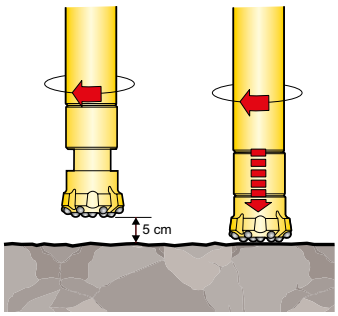
• Start rotation to the right at low speed (creeping).

• Feed the hammer on to the rock using minimal feed force, so that the bit is pressed into the hammer, and into the impact position.

• Start collaring the hole with reduced impact and feed, until the bit has entered the rock.

• Open the impact mechanism control fully and adjust the rotation and feed so that the hammer drills smoothly and steadily.

Feed and rotation



With holes of relatively shallow depth, the setting of feed and rotation is usually a simple matter in DTH drilling, since the hammers are comparatively insensitive to small variations in the "normal" flow and pressure settings. The settings can be regarded as correct when the drill string turns evenly without jerks or jamming, and a steady penetration rate is obtained.

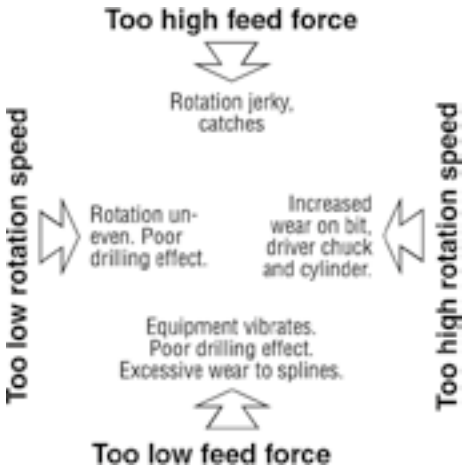
Feed force

When drilling with DTH-hammers, the feed force should be high enough to keep the shank of the drill bit pressed into the hammer during drilling.

•Too low a feed force will give easy rotation, excessive vibration and reduced penetration. The resultant reflex shock waves can damage the rotation unit and feed beam.

•Too high a feed force causes the rotation to jam (either erratically or completely), it can increases the risk of blocking the bit and can subject the drill string to severe bending stresses. It can also damage the rotation unit and feed beam. The feed force often needs to be corrected during drilling, depending on the rock formation and the weight of the drill string, which obviously varies with the hole depth.

A rough guide to drill pipe weights for different sizes of DTH-hammer are given in the table below:



Pipe dimension, mm	Approx. weight, kg/m
102	24,5
114	25,5

Bit diameter, rock formation, hole depth and available rotation torque will have a considerable influence on the setting of the feed force. What is important is that the feed force is adjusted to give steady penetration and a constant, even rotation speed with no jamming (see table).

N.B. It is important that the feed force be adapted to suit the weight of the drill string. When drilling deep holes, this requires control facilities for "negative feeding", a so-called "holdback" function.

Rotation speed

In hard rock the rotation speed for DTH hammers should be set between 20-90 r/min, depending on the hammer size and bit diameter (the larger the bit diameter, the slower the speed). The upper limit generally produces the best penetration rate. In very abrasive rock formations, however, the rotation speed should be reduced to avoid excessive wear of the drill bit. When drilling in softer rock or with high air pressure (above 18 bar) in non-abrasive formations, higher rotation speed may be used. The following should be noted:

Too high a rotation speed will cause increased wear to the drill bit, hammer and drill pipes. Stresses to the feed and rotation unit will also increase.

Too low a rotation speed results in a poor drilling output and uneven operation.

Drilling in wet holes

The inflow of water into the drill hole is expected when drilling water wells, but can also occur when drilling deep holes for other purposes. Water inflow does not normally create problems for drilling, although both "too little" and "too much" can be troublesome.

Large amounts of water in the hole can cause problems with keeping the sample dry. Auxiliary compressors and boosters are commonly used to counter back pressures and to help to keep the sample dry.

A big enough gap between the sleeve and the hole wall is needed to let some of the exhaust air pass that way and push the water away from the face of the bit.

In extreme cases no sleeve at all is used. If drilling without a sleeve make sure that the bottom shoulder of the casing is protected against excessive wear which can cause premature failure.

Drilling in very soft or broken formations

Very loose and broken formations can at times cause problems with bits getting blocked. In many cases it helps to lower the feed force and increase the rotation when drilling in these conditions. Make sure that a sleeve with a OD close to the bits is used for the best air flow to the front of the bit. In extreme situations like drilling in sand a sleeve bigger then the bit can be used, make sure that the oversize sleeve is exchanged for one smaller then the bit as son as solid rock is encountered. Otherwise it is a risk of getting stuck.

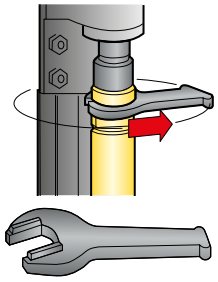
Tools

Tools for removing the drill bit and top sub from the DTH hammer

The threaded connections of the driver-chuck and top sub can become very tightly tensioned during drilling. There are special tools for removing the bit and top sub from the cylinder of the DTH hammer, and these should be used whenever possible.

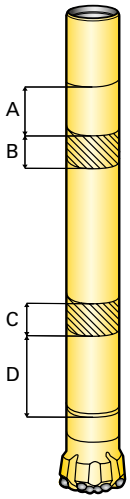
Wrench for pipe-jointing and top sub

Wrench flat	Ordering No.
55 mm	8484-0211-43
65 mm	8484-0211-00
95 mm	8484-0211-02
102 mm	8484-0214-13
120 mm	8484-0211-36
140 mm	8484-0211-44



Loosening the threads of the hammer

If special tools like chain wrenches or other types of wrench are used to break the hammer joints, then the tool must be attached around the hammer cylinder as shown in the figure. Do not attach at other points!



Positioning of wrench	mm (in)
Distance from top of casing (A)	205 (8.0)
Wrench point (B)	70 (2.8)
Wrench point (C)	70 (2.8)
Distance from bottom of casing (D)	250 (9.8)

DANGER

- Take great care when breaking the driver-chuck joint using the bit removal tool in combination with reverse rotation. If the shaft of the tool is not locked or touching the edge of the feed beam, the shaft can turn with great force when breaking the driver chuck joint.
- Keep your hands and clothing well clear of the hammer/drill string when it is rotated. Entanglement can result in serious injury.
- Blows against hammer or bit can cause fragments of metal to fly. Always wear goggles when breaking joints.

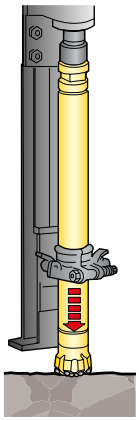
Breakout bench

It is always most convenient to break the hammer threads on the rig. For circumstances, when the threads cannot be broken or tend to get stuck, there is a breakout bench available. Ordering No. 9178.

N.B. Failure to attach the wrench as illustrated (B, C) may result in damage to the cylinder. Any such damage will not qualify for compensation.

Removing the drill bit

The drill bit can be removed in a number of different ways, depending on the tools available. The following two methods are commonly used:



A. Breaking the driver-chuck joint using percussion only

Run the hammer into the rock or a thick plank.

- Apply light feed force.
- Carefully start the impact mechanism of the hammer.
- Stop the impact mechanism as soon as the driver-chuck joint "cracks".
- Run the hammer up the feed beam to a suitable working height, and unthread the driver chuck and drill bit.

N.B. Beware of the weight of the drill bit. It could be too heavy to hold.

Disassembling the hammer

• All maintenance for the RC 50 hammer should be performed after the backhead and chuck joints have been loosened, preferably while still on the drill rig.

Removal of center collection tube

The design of the RC 50 Center Collection tube allows for the tube to be removed in one of two recommended methods.

1. Install the hammer in the breakout bench.

2. Remove driver chuck, drill bit and bit retaining ring. Chuck thread connection need to be loosened up either with breakout table on drill rig before hammer is removed or with a breakout bench.

3. Remove bit retaining rings, chuck and chuck-sleeve from drill bit.

4. Remove the inner-tube assembly.

5. Remove backhead assembly. Backhead thread connection need to be loosened up with a breakout bench. Lift out the backhead assembly, weight of the assembly is around 16,3 kg.

6. Remove the inner cylinder.

7. Remove the bit bushing and the bit bushing lock-ring.

8. Push the piston out from the back-head side with a long bar, lift the piston out. Weight of piston is 16,3 kg.

9. Remove the collector tube from the inner-tube assembly.

10. Remove the check valv assembly from the adapter tube.

11). Check and inspect all components of the hammer. Replace O-rings, worn out and/or damaged items.

12). Lubricate all parts before assembly and assemble in reverse order.

Dirt in the hammer

Stoppages and breakdowns caused by dirt in the percussion mechanism are practically inevitable with all rock drills, and DTH hammers are no exception. However, it should be remembered that, while DTH hammers are no more sensitive to dirt than tophammers, there is obviously a greater risk of dirt ingress in down-the-hole drilling, especially during pipe jointing. Any dirt that enters the drill pipes goes straight into the percussion mechanism. To ensure reliable operation of the hammer, every effort should therefore be made to prevent dirt from entering the drill pipes. The following rules should be observed:

• Always keep drill pipes clean. Always store or stack drill pipes in such a way that the risk of dirt ingress is minimized. Do not let the thread ends rest on grit or mud. Use thread covers wherever practicable.

• Always keep the open thread end of the drill pipe covered during jointing, and remove the cover just before the pipe is coupled up.

• Before coupling up, check that the drill pipe is clean around the threads and on the inside. If in doubt, blow clean the pipe. Remember to cover the pipe end that is already in the hole.

• If threads are dirty, they should be cleaned using a strong bristle brush or a cloth.

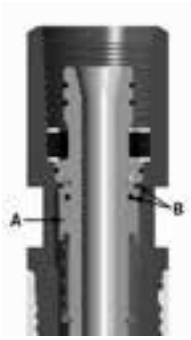
N.B. Always clean away from the hole in the pipe. Do NOT let grit fall into the hole in the pipe. After cleaning, always coat the threads with copper paste or similar. before jointing.

• Take extra care during jointing operations when drilling in abrasive rock formations, since the ingress of quartz particles into the hammer will cause heavy wear.

• When drilling holes in water-bearing rock, never leave the hammer at the hole bottom with the air supply switched off. If drilling is to be suspended temporarily, always pull up the hammer by at least two pipe lengths.

• Clean around the driver chuck before changing the drill bit. Make sure the shank of the new drill bit is clean.

• Keep the hammer clean and plug both ends when not in use. Change worn or damaged parts in good time.



All Secoroc down-the-hole hammers contain a check valve that is designed to trap a quantity of air inside the hammer when the air supply is switched off. In most conditions, this prevents the ingress of water and dirt into the hammer during jointing operations. The check valve A and rubber seals B must be fault-free when drilling in water-bearing formations. When drilling deep holes in rock with a high water inflow, however, it is possible that some seepage of water into the front of the hammer will take place during jointing. Since only very small particles of dirt would be able to penetrate the hammer in this way, the threat to the hammer is not serious.

The sealing efficiency of the check valve can be checked by pouring a small quantity of lubricant through the top sub of the hammer, with the hammer held vertical. If the lubricant passes through the checkvalve, then the valve spring and/or valve seal is worn or damaged and should be replaced immediately.

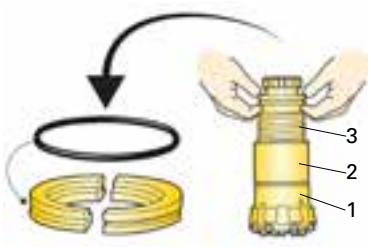
⚠ WARNING

• Take great care when jointing the drill pipes and handling the drill bit.

• Mind your fingers!

• Keep your clothing, hair etc. well clear of rotating components! Carelessness can result in serious injury.

Assembly of the drill bit and driver chuck



• Smear the splines of the bit shank with Atlas Copco thread grease.

• Smear the O-ring of the stop ring with silicone grease.

• Assemble the bit 1, driver chuck 2 and stop ring 3 as shown in figure.

• Smear the thread on the driver chuck with Atlas Copco thread grease.

• Screw in the bit assembly by hand. Note that there should be a clearance of 0.1–0.4 mm between the driver chuck and the cylinder casing. If there is no clearance, the end surface of the cylinder casing should be ground down as necessary. Tighten the driver chuck with the aid of the bit spanner.

⚠ IMPORTANT

Make sure the stop ring is located correctly, and that it faces the right direction. Incorrect fitting will result in severe damage to the hammer.

⚠ DANGER

• Before grinding, always check the flushing holes of the drill bit for traces of explosive. Contact with the grinding wheel can cause theexplosive to explode causing serious or fatal injury as well as damage to the equipment. To clean the flushing hole, use only a wooden rod, copper wire or flushing water.

⚠ CAUTION

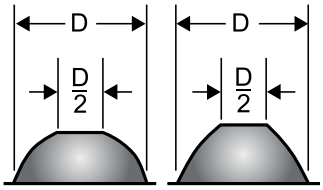
• Always wear ear protectors, protective clothing, gloves and goggles when grinding.

• Use a dust extraction system or an approved dust mask. This is of special importance when dry grinding indoors.

Regrinding the drill bit

The rate of bit wear depends on the rock formation, and is highest in rocks with a high quartz content. A suitable grinding interval should be determined according to the rate of bit wear. It is more economical to regrind too early rather than to suffer poor penetration rates and risk damaging the drill bit through overdrilling. A few hints about the care of drill bits:

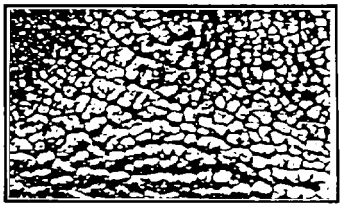
When to regrind



Button bits should be reground when the penetration rate drops, or if any of the cemented carbide buttons are damaged (fractured buttons should be ground flat). It is both practical and economical to redress the buttons when the wear flat reaches about ½ of the diameter of the button.

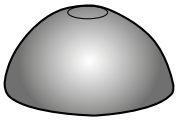
Note: This is a general recommendation.

Look out for "snake skin"



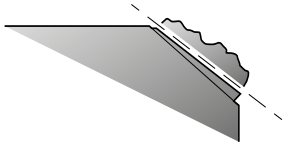
If microscopic fatigue cracks – so-called "snake skin" – begin to appear on the cemented carbide buttons, they must be ground away. In any event, bits should be reground after 300 metres of drilling at the most. This should be done even if there are no visible signs of wear and the penetration rate continues to be good. If snakeskin is not removed, the cracks will deepen and ultimately result in button fracture.

Do not grind away too much cemented carbide



Do not grind too much on the top of the buttons. Let a few millimetres of the wear flat remain on top of the button.

Always grind broken buttons flat



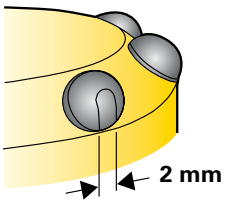
A drill bit can remain in service as long as the gauge buttons maintain the diameter of the bit. Fractured buttons must always be ground flat to prevent chips of cemented carbide from damaging the other buttons.

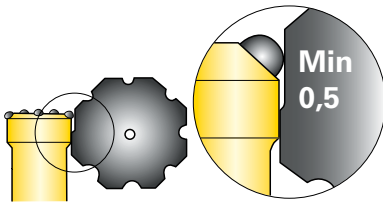
Avoid grinding the perimeter

Gauge-button anti-taper has to be removed by grinding, although excessive reduction of the bit diameter should be avoided. Leave about 2 mm of the wear flat.

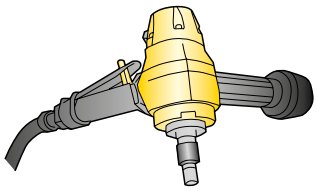
If necessary, remove some of the bit-body steel below the gauge buttons, so that a clearance (taper) of 0,5 mm is maintained.

If the flushing holes start to deform, open them up with the aid of a rotary burr or steel file.

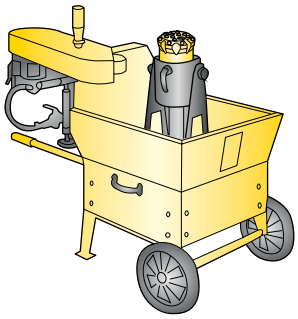




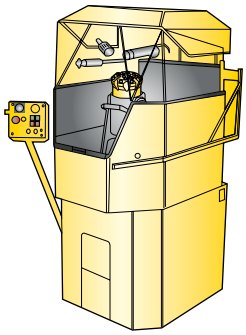
Grinding equipment



The Grind Matic HG is a portable, hand-held, air-powered grinding machine for button bits, ideal for use at the worksite. It is used with diamond-impregnated grinding cups, which can be used with or without water flushing.



The Grind Matic Manual B-DTH is a mechanized air-powered grinding machine for button bits. It is mounted in a steel box-barrow, which can be wheeled easily around the worksite. The Grind Matic Manual B-DTH uses diamond-impregnated grinding wheels.



For “permanent” grinding stations, a mechanized stationary grinding machine is available, the Grind Matic BQ3-DTH. It is equipped with automatic feeding devices and grinds both the cemented-carbide buttons and the bit-body steel in one operation. The machine uses diamond-impregnated grinding wheels.

Further information about grinding equipment can be found in the respective product leaflets.

IMPORTANT

- Always use water flushing with grinding wheels.
- Use water if possible also with grinding cups and hand-held grinders.

Care & maintenance

The service life and performance of DTH hammers depends to a large extent on good operating practice and regular maintenance.

The following recommendations should be observed:

- Make sure that the compressed air is always clean and dry.
- Always blow clean the air hoses before connecting them to the rig.
- Make sure that the drill pipes are stored properly in the pipe rack, or stacked on trestles in such a way that dirt cannot enter the pipes.
- Fit thread guards to the ends of the drill pipes whenever practicable. Keep the threads and the insides of the pipes clean.
- Always cover the “open” thread end of the drill pipe during pipe-jointing operations. The ingress of dirt into the drill string will cause blockages and/or seizure in the hammer, which can result in breakdown.
- Check regularly that the dosage of lubricating oil into the operating air is sufficient. Check that the lubricating-oil tank on the rig is filled with oil of the correct type and quality. See “Recommended lubricants”, page 12.
- Check the wear on the driver chuck and hammer cylinder regularly. The diameter of the driver chuck must never be less than that of the hammer cylinder. The service life of the hammer cylinder can be prolonged by always fitting a driver chuck with a greater outside diameter than that of the hammer cylinder. When the components are approaching their minimum permissible diameters, frequent inspection is necessary. Alternatively, change the components in good time – it makes good economic sense.

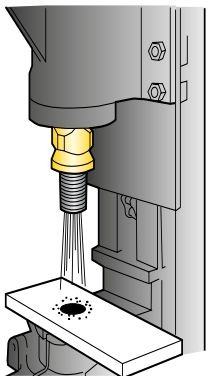
N.B. When the hammer cylinder is replaced, the driver chuck should be replaced at the same time (see “Wear limits”, page 13).

A general overhaul of the hammer should be carried out at suitable intervals, depending on the operating conditions and empirical statistics. The abrasiveness of the rock will have a considerable effect on the rate of wear, and will affect the overhauling intervals accordingly.

Overhauling

DTH hammers should be overhauled at suitable intervals depending on the drilling conditions and empirical service records. Since the abrasiveness of the rock has a considerable bearing on the rate of wear, it will affect the overhauling intervals accordingly. Before the DTH hammer is sent to an authorized Epiroc service workshop for overhauling, the joints at the top sub and driver chuck should be "cracked" on the rig.

Lubrication



Lubricating oil is vital for the satisfactory operation of DTH hammers. Apart from regular checking of the oil level in the lubricating-oil tank, always make sure that there is oil in the compressed air. This can be checked whenever the rotation unit is free, i.e. disconnected from the drill string.

Simply place a plank over the drill-steel support and blow operating air on to the plank. After a few moments, the surface of the plank should become oily, which confirms that lubricant is being carried to the hammer in the operating air.

The importance of adequate lubrication of the hammer cannot be over-emphasized. Poor lubrication will accelerate wear and ultimately result in breakdown. The effective lubrication of the DTH hammer is not always a straight-forward matter, owing to wide variations in operating conditions, e.g. extreme temperature differentials between the hammer and the lub-ricator, water or foaming concentrate added to the operating air, etc.

Different lubricants have different properties. Mineral oils have the best lubricating properties and are preferable in most cases. Mineral-base oils have good adhesion properties and are produced in different viscosity and temperature- range grades.

Since mineral oils have good resistance to water, they are suitable for use even when comparatively large volumes of water are injected into the operating air. In this case, however, the dosage must be increased.

Glycol-based lubricants, such as Atlas Copco Air Oil, are water soluble, and must not be mixed with mineral oils. They are used primarily to prevent freezing, and should be used only when there is a minimal water content in the operating air. Glycol-based lubricants are used extensively in water-well drilling for reasons of water hygiene. If there is a lot of condensation in the drill string, which is often the case in long drill strings, then lubrication may become unsatisfactory because dilution seriously affects the function of glycol-base lubricants.

Other lubricants worth mentioning are the so-called “edible” oils, which consist of vegetable oils, synthetic lubricants of the ester type, or a mixture between these two. Edible oils can be mixed with mineral oils, have good lubricating properties and are non-toxic.

Lubricators

Both plunger-pump and nozzle-type lubrication systems are available.

The plunger pump is relatively insensitive to the viscosity of the lubricant and gives a more reliable dosage compared with the nozzle-type lubricator. This is of major importance when the ambient temperature is low.

About 1 ml of oil per m^3 of operating air consumed should be the minimum dosage for bench drilling. As a rule, higher dosages are needed in water-well drilling.

Normal lubrication dosage: 0,5–1,0 l per operating hour (dependingon working pressure

In case of water injection, increase dosage by 0,1–0,2 l/hr.

N.B. The distribution of lubricating oil through the compressed air system generally takes place in the form of so-called “wall flow”.

If the air system has been shut off for a long period of time, it can take quite some time for the lubricant to reach the hammer. In such cases, a small amount of oil must be poured directly into the hammer or air hose before drilling.

Choice of lubricating oil

For COP down-the-hole hammers it is recommended to use Atlas Copco COP oil. When choosing between other types of lubricants, the oil should have:

- suitable viscosity
- good adhesion properties
- high film strength
- corrosion inhibitors
- EP additives

Ambient temp.°C(°F)	Viscosity grade
–20 to +15(–4 to +59)	ISO VG 46-100
+15 to 35(59 to 95)	ISO VG 100-150
> +35 (95)	ISO VG 150-220

For reasons of water hygiene, lubricating oils used in water-well drilling should be non-toxic.

The temperature limits given above refer to the temperature of the oil in the tank, i.e. the ambient temperature. In cases where the hammer is powered by warm compressed air at high operating pressures, e.g. when connected to a nearby portable compressor, the temperature of the operating air must be taken into consideration. In such cases it may be necessary to choose a thicker oil than what is recommended in the table.

Thicker oils have beneficial characteristics which can be exploited in stable temperature conditions, e.g. underground. In general, thicker oils have a better film strength and better adhesion properties, which leads to lower oil consumption.

Recommended lubricants	
Lubricating oil tank	Atlas Copco COP oil
Threads and splines	Copper paste or similar
O-rings and rubber parts	Silicone grease (temperature limits –20 to +120°C)

Ordering No. Atlas Copco Rock Drill Oil:	
Can 10 litres	3115 3125 00
Can pallet 48x10 litres	3115 3126 00
Drum 208 litres	3115 3127 00

Service and inspection

General information

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 the RC 50 Reverse Circulation DTH.

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 acomplete overhaul of the RC 50 Reverse Circulation DTH. 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 clearnaces at seal locations and other wear points.

Tools required for DTH service and repair

Tool	Size
Outside micrometer	101–127 mm
Feeler gauges	one set
Telescopic bore gauges	one set up to 101 mm
Vernier caliper	0–152 mm
Brass (soft) bar	25 mm OD–1200 mm (L)
Wrench	89 mm

DTH service

In most cases, a Reverse Circulation DTH will only require servicing when the collection tube wears out or when performance deteriorates due to internal parts wear. The design of the Collection Tube allows the tube to be inspected or replaced without completely disassembling the hammer. However, the hammer should be disassembled and inspected on a regular basis to maintain peak performance.

Wear limits

Component	Wear limit	Action	Comments
Drill bit (diameter)	Minimum 2 mm larger than the maximum diam. of the cylinder	Fit new bit	The bit should not be worn more than the max diam. of the cylinder
Driver chuck	If wear on the shoulder for the chuck sleeve	Replace	A worn shoulder might cause excessive wear on the chuck sleeve
Casing (diameter)	RC 50 minimum 127 mm	Replace	Measure the diameter along the full length of the cylinder, with the exception of the outermost 100 mm at each end.
Bit bearing (inside diameter)	RC50 maximum 84,8 mm Diametric clearence to the piston maximum 0,50 mm	Replace	Measure the bit bearing at its waist.
Piston / casing	Diametric clearance: maximum 0,30 mm	Replace worn parts	Outside diameter of piston should be measured at the sealing surface of the piston.
Piston / cylinder	Diametric clearance: maximum 0,30 mm	Replace worn parts	Outsdie diameter of the back gliding surface of the piston against inside diameter of the inner cylinder
Check valve	Valve seal worn or damaged	Replace worn or damaged parts	Tightness of check valve can be tested by pouring a small amount of oil into the valve with the hammer in vertical position. Also ensure that the check valve is moving correctly on the adaptor tube

Trouble shooting

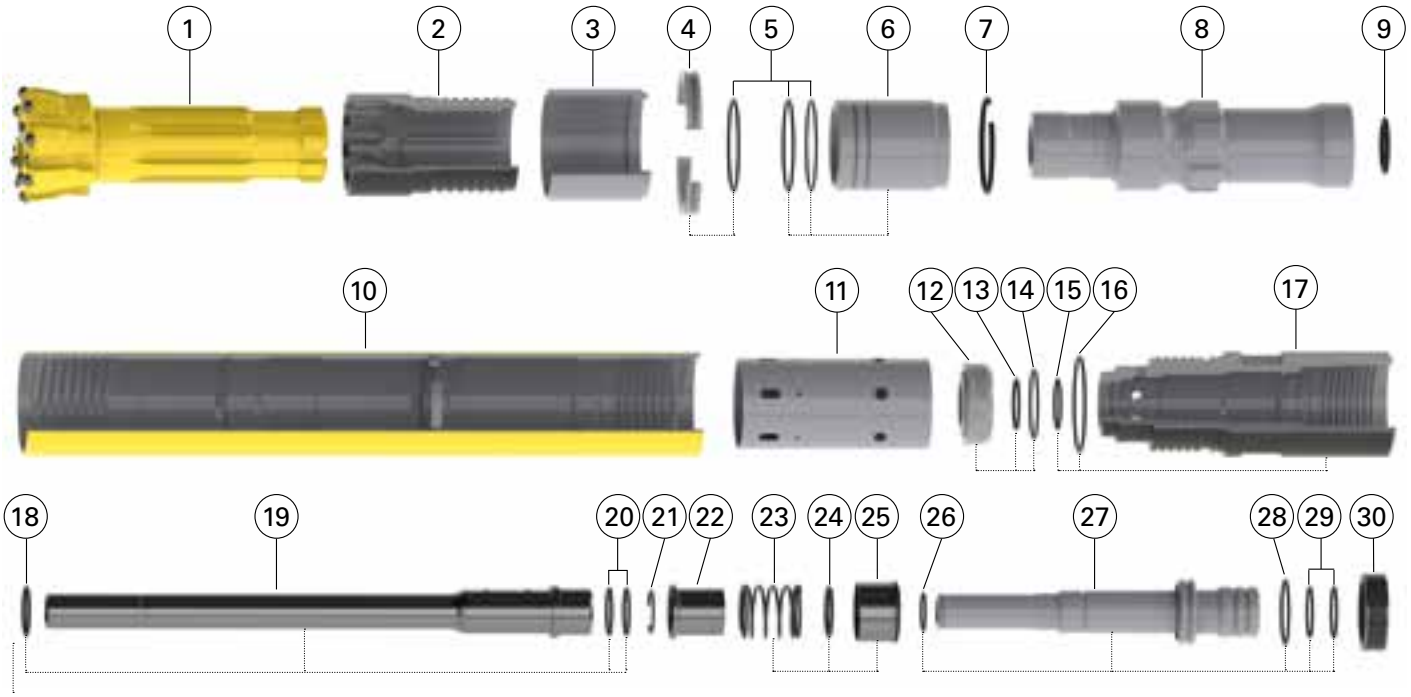
Fault	Cause	Remedy
Impact mechanism does not operate, or works with reduced effect	Air supply throttled or blocked.	Check the air pressure. Check that all air passages leading to the hammer are open
	Oil is not reaching the impact mechanism of the hammer. Poor or no lubrication, causing increased wear, scoring or seizure	Let operating air blow through rotation spindle on dry plank or similar. After a few moments, plank surface should become oily. Inspect lubricator. Top-up with oil if necessary or increase lube oil dosage.
	Too large clearance (wear) between the piston and cylinder, or between piston and control tube	Disassemble the hammer and inspect the wear (see "Wear limits"). Replace worn parts
	Hammer clogged with dirt	Disassemble the hammer and wash all components
	Cylinder stop ring is out of place	Disassemble the hammer and check if the stop ring is out of place. If so insert the cylinder in the casing and screw on the topsub until it snaps in place. If the stop ring is out of place the piston will not come out of the casing
	Worn QL-valve or worn O-rings in the QL valve	Disassemble the hammer and replace QL valve and/or O-rings
	Dirt enters the hammer when drilling in water-bearing formation	Make sure the check valve seals against the seat in the top sub (see "Dirt in hammer", (page 9). Remove the top sub and replace check valve. Make sure the check valve is moving properly
Lost drill bit and chuck	Impact mechanism has been operated without rotation to the right	Fish out the lost equipment using a fishing tool. Remember to always use right-hand rotation, both when drilling and when lifting the drill string
Excessive air consumption	Bit bearing/piston clearance is to large	Replace bit bearing and/or piston
Rough or erratic operation	Too much feed pressure	Set the feed pressure until the rotation starts to bind. Then back of the feed pressure until rotation turns smoothly
	Rotation speed too slow	Turn up the rotation speed to appropriate rpm for the hammer/bit setup used
Sudden loss of pressure	Worn/blown out inner tube	Check inner tube wear regularly, and change before it is worn out

Part failure		
Cracked Casing	Abuse of casing	Avoid welding, heating, beating or torque wrenching in the wrong place
	Worn casing	Outside diameter has worn past the discard point. Measure casing and replace if necessary
	Corrosion	If drilling in corrosive environment or foam is used wash internal and external parts regularly to avoid corrosive impact on the drill
	Bogged/stuck drill can lead to reaming and overheating distortion of the drill	Use a dig out sub
	Drill bogged can lead to chuck, casing and chuck sleeve to distort	Inspect all parts thoroughly if drill is recovered, replace parts where necessary
Piston cracked through large diameter	Lack of lubrication causes heat cracks leading to breakage	Check lubricator and ensure it is functioning. Use the correct type of lubricator. Atlas Copco ROCOIL is recommended for use with all Secoroc hammers
	Feeding hard through voids on a broken formation can cause a deformation to the casing causing heat cracks and galling on the piston	Use low feed force and ensure the hole is kept as clean and cosolidated as possible
Piston strike end breaking	Insufficient feed force	Increase the feed until rotation binds and pressure pulses and the back off until the rotation and pressure becomes smooth
	Over running inner tubes will allow ingress between the two striking faces and can cause piston nose to crack.	Replace inner tubes befor they are worn out.

Spare parts list

Secoroc RC 50

Reverse Circulation DTH-hammer



Ref.	Part	Prod. No.	Product code
1	Bit concave extra flushing		
	136 mm bit	90516434	1E0-5136-97-7217,08-20
	140 mm bit	90516432	1E0-5140-97-7217,08-20
	140 mm bit	90029025	1E0-5140-97-7217,10-20
	143 mm bit, 19 mm gauge buttons	90003638	1E0-5143-97-7215,08-20
	143 mm bit	90516472	1E0-5143-97-7217,08-20
	146 mm bit	90516433	1E0-5146-97-7217,08-20
	152 mm bit	90516558	1E0-5152-97-7217,08-20
	165 mm bit	90516435	1E0-5165-97-7217,08-20
2	Chuck	52291887	9705-RC-00-000-97-000-001
3	Chuck sleeve		
	132 mm	89001500	9705-RC-00-000-00-000-C32
	134 mm	52291606	9705-RC-00-000-00-000-C34
	137 mm	52291614	9705-RC-00-000-00-000-C37
	139 mm	89001501	9705-RC-00-000-00-000-C39
	140 mm	52348257	9705-RC-00-000-00-000-C40
	142 mm	89001502	9705-RC-00-000-00-000-C42
	144 mm	52291622	9705-RC-00-000-00-000-C44
	147 mm	52348612	9705-RC-00-000-00-000-C47
	150 mm	52348620	9705-RC-00-000-00-000-C50
	153 mm	52352374	9705-RC-00-000-00-000-C53
	157 mm	52352382	9705-RC-00-000-00-000-C57
	163 mm	52343696	9705-RC-00-000-00-000-C63
4, 5	Bit retaining ring assembly	52292331	9705-RC-00-000-97-000-002
4	Bit retaining ring (not sold separately)	-	-
5	O-ring	95086641	0663-95086641
5, 6	Bit bearing assembly	52291853	9705-RC-00-000-97-000-022
5	O-ring	95086641	0663-95086641
6	Bit bearing (not sold separately)	-	-
7	Bit bearing lock ring	52346780	9705-RC-00-000-00-000-058
8	Piston	52292018	9705-RC-00-000-97-000-005
9	Piston tail seal	52292067	9705-RC-00-000-00-000-054
10	Casing assembly	89010578	9705-RC-00-000-00-000-A04
11	Inner cylinder	52291630	9705-RC-00-000-00-000-048

Ref.	Part	Prod. No.	Product code
12, 13, 14	QL-valve assembly	52344074	9705-RC-00-000-00-000-A44
12	Valve body	-	-
13	O-ring	95137394	0663-95137394
14	O-ring	95716833	0663-95716833
15, 16, 17	Backhead assembly	52347648	9705-RC-00-66B-00-000-A20
15	O-ring	95018701	0663-95018701
16	O-ring	95086666	0663-95086666
17	Backhead	-	-
18, 19, 20	Lower inner-tube assembly	52344066	9705-RC-00-000-97-000-R95
18	Bumper ring	95136669	0663-95136669
19	Center tube	-	-
20	O-ring	95086195	0663-95086195
21	Check valve retaining ring	52346632	9705-RC-00-000-00-000-028
22	Check valve seat	52346616	9705-RC-00-000-00-000-018
23, 24, 25	Check valve assembly	52348638	9705-RC-00-000-00-000-A17
23	Spring	52346624	9705-RC-00-000-00-000-016
24	Check valve body	-	-
25	polypack seal	52346715	9705-RC-00-000-00-000-036
26, 27, 28, 29	Upper Inner-tube assembly	52348182	9705-RC-00-66B-00-000-R94
26	O-ring bottom	95086153	0663-95086153
27	Adapter tube	-	-
28	O-ring middle	95086591	0663-95086591
29	O-ring top	95018453	0663-95018453
30	Crush ring	52341898	9705-RC-00-000-00-000-014

Complete hammer and Maintenance kits	Prod. No.	Product code
RC50 Complete hammer	52292273	9705-RC-00-66B-97-000
Seal kit - Includes: 5, 9, 16, 17, 21, 27, 29, 30	52345147	0663-52345147
Service kit - Includes: QL-valve assembly (12, 13, 14), Check valve assembly (23, 24, 25) and Seal kit	52348653	9705-RC-00-000-00-000-K70
Rebuild kit - Includes: 2, 10, Backhead assembly (15, 16, 17) and Service kit	52351426	9705-RC-00-66B-97-000-K40

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