Original instructions

996 2 en 2012-12-31

Rock Hammer RH550

Operation, maintenance and parts manual

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1. INTRODUCTION

1.1. The purpose of these instructions

⚠ WARNING	
	**IGNORING INSTRUCTIONS HAZARD** **Faulty handling practice could cause death or severe injury.** **READ, UNDERSTAND and FOLLOW the instructions of the MANUALS and safety LABELS!**

Information for use are this manual, the drill rig's manual and other information for proper and safe use of this machinery.

Keep all information for use clean and in good condition. If necessary, ask for a translation of information for use.

The purpose of these instructions is to promote intended safe, proper and economical use of the hammer. These instructions should assist the user in identifying, avoiding and preventing hazardous situations and related consequences.

These instructions must be followed along with any instructions given in local laws and regulations, any orders given by local authorities and all protective measures specific for the site (e.g.: safe working procedures).

Read and understand the complete information for use. All sections of this manual contain information which is vital for your safety.

The operator's manual must be replaced immediately if lost, damaged or unreadable. For replacement copies, please take contact with your local representative.

The instructions set forth in the operator and other manuals shall be used as a part of the training material during orientation.

By following these instructions, maintenance cost and downtime are minimized while reliability and life of the equipment are optimized.

If there is anything you don't understand, ask your employer or your local representative to explain it.

1.2. Identification of the product

Check that the hammer model corresponds to the one given on the cover of this manual.

1.2.1. EC Declaration of conformity

This hammer complies with the essential health and safety regulations of the European Union (= CE machinery directive) when leaving the factory.

Keep the EC Declaration of Conformity in a proper place and make sure to forward it to future owners of this hammer.

Text contents of the EC declaration of conformity

EC DECLARATION OF CONFORMITY

(2006/42/EC, Annex II. 1. A)

Manufacturer: Sandvik Mining and Construction Oy, Drills Tampere

Address: Pihtisulunkatu 9, 33330 TAMPERE, Finland

Herewith declares that the Sandvik DTH-hammer

Model:

Type:

is in conformity with all the relevant provisions of the Machinery Directive (2006/42/EC)

The procedure applied for the conformity assessment is "Assessment of conformity with internal checks on the manufacture of machinery" (Annex VIII).

Technical file: Product Development Manager, Rock Drills, DTH Hammers, is authorized to compile the technical file and confirms the product design to conform with the essential health and safety requirements.

The declaration relates exclusively to the machinery in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.

Date of issue:

Place of issue: Pihtisulunkatu 9, 33330 TAMPERE, Finland

on behalf of Sandvik Mining and Construction Oy, Drills Tampere

Signed:

Product Development Manager, Rock Drills, DTH Hammers

Signed:

Production Unit Manager

1.2.2. Product manufacturer

This hammer has been manufactured by:

Sandvik Mining and Construction Oy, Pihtisulunkatu 9, FI-33310 TAMPERE, Finland.

Maintenance:

For maintenance of this hammer contact your nearest Sandvik dealer or representative. Dealer/ distributor information may be found at www.sandvik.com.

1.2.3. Validity of the manuals

This manual contains safety information, operation instructions, storage information, lubrication information and maintenance information in accordance with the hammer design at the time it was delivered from factory.

This manual, and especially its safety information as well as the EC declaration of conformity and statement of compliance, are valid only, if no unauthorized changes to the product are made.

This manual, and especially its safety information, is valid only, if no unauthorized changes to the product are made.

Some illustrations in this publication show details that can be different from your hammer.

Continuing improvement and advancement of product design may have caused changes to your hammer, which are not included in this publication.

Whenever a question arises regarding your hammer, or this manual, please consult your representative for the latest available information.

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1.3. Copyright notice

1.4. Definitions

Hammer	the product described in this manual.
Bit	the wear part which is in direct contact with the rock.
Drill rig	the base machine, onto which the hammer is mounted, and which supplies the operating power and controls, with which the hammer is operated.
Information for Use	the information in this manual, the safety labels on hammer and other information on e.g. the delivery package. This provides protective measures and advice on proper methods for transportation, installation, operation and maintenance of the hammer.
Intended Use	use of this hammer in accordance with the instructions provided in information for use.
Prohibited Use	any use of this hammer, which is not intended use. Especially the use which is specifically prohibited in information for use.
User	any person handling the hammer, whether it be transportation, installation, operation, scheduled maintenance, scrapping or other.
Hazard	potential source of harm.
Risk	the combination of the probability of occurrence of harm and the severity of that harm.
Protective Measure	the measure intended to achieve risk reduction. The protective measures are implemented by the designer where possible, and by the user, where design measures are not sufficient for safe operation. Protective measures for the user are given in the information for use.
Harm	physical injury or damage to health. This is always in relationship to people, not to equipment or property.
User Obligations	protective measures, which must be taken by the user based on the information for use.
Bystander	any person, which is not handling the hammer.
Hazard Zone	any space around the hammer or the drill rig, in which a person can be exposed to a hazard.
Real Time Hazard Analysis (RTHA)	review of site before starting to work, in order to identify potential hazards that could impact users, bystanders or environment.

2. SAFETY

2.1. Warning and information symbols used in this manual

The warnings in this manual have been divided into the following three categories.

DANGER The term "DANGER" Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING The term “WARNING” Indicates a hazardous situation which, if not avoided, could result in death or injury.

NOTICE The term "NOTICE" Indicates a situation which, if not avoided, could result in damage to property.

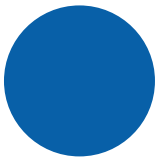
2.1.1. Safety Symbols

The safety symbols found in this manual may also be posted on the machine. All personnel who operate, repair, or service the machine MUST be familiar with and observe all safety symbols, labels, and instructions!

- Keep safety instructions and safety labels clean and visible at all times.
- Replace any illegible or missing safety instructions and safety labels before operating the machine.

Hazard
The black symbol inside a yellow triangle with a black border describes the hazard.

Prohibition
The black symbol inside a red ring with a diagonal red bar describes the action that should not be taken.



Mandatory action
The white symbol inside a blue circle describes the action that must be taken to avoid a hazardous situation.

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Hazard symbols

These symbols are used in warnings to indicate a hazardous situation or action.
Hazard symbols are divided into seven categories according to their nature:

- Mechanical hazards
- Electrical hazards
- Noise hazards
- Radiation hazards
- Material/substance hazards
- Ergonomic hazards
- General hazard

The hazard symbols related to each hazardous situation are presented below.

Mechanical Hazard Symbols


Falling load hazard


Squashing hazard


Flying material hazard


Crushing hazard - feet


Crushing hazard - hands


Cutting hazard


Entanglement hazard


Entanglement hazard


Entanglement hazard

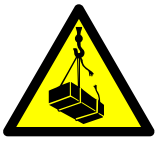

Entanglement hazard - rotating drill


Falling hazard


Trip hazard


Skin injection hazard


High pressure injection hazard


Hanging load hazard


Run over hazard


Slipping hazard


Sideways tipping hazard


Forward/backward tipping hazard


Sideways tipping hazard


Forward/backward tipping hazard

Electrical Hazard Symbols


Electrical hazard


Dangerous electrical voltage


Electrical shock/ Electrocution hazard

Noise Hazard Symbols


Noise hazard

Radiation Hazard Symbols


Radioactive hazard


Laser hazard

Material / Substance Hazard Symbols


Hot surface hazard


Explosion hazard


Flammable hazard


Hazardous/poisonous material hazard


Chemical burn hazard


Silica/dust hazard


Hot coolant splashing hazard


Environment pollution hazard

Ergonomic Hazard Symbols

Lifting hazard

General Hazard Symbol


General hazard

Prohibited action symbols

These symbols are used in warnings and notifications to indicate the action that should not be taken. The prohibition symbols are presented in the following table.

No climbing

No smoking

No open flames

Do not touch

Limit or restrict access

Do not weld

Do not remove safety guard

Do not modify

General symbol for prohibited action

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Mandatory action symbols

These symbols are used in warnings and notifications to indicate the action that must be taken to avoid a hazardous situation.
The mandatory action symbols are presented in the following table.


Wear safety gloves


Wear eye protection


Wear safety helmet


Wear safety harness

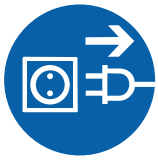

Wear ear protection


Wear steel toed safety boots


Wear close fitting overalls


Wear high visibility vest


Wear respirator


Disconnect from power source


Switch off and lockout equipment


Read the manual or instructions


Use cardboard for locating leaks in hoses


Use lap belt


General symbol for mandatory action

2.2. Common safety instructions

The safe use of a hammer depends on, among other things, a combination of design and construction measures taken by the manufacturer, skills of operators and protective measures taken by the user.

Instructions are an essential and integral part of the product and they must be always available for users.

This manual must be stored for easy user access at any time.

It is important to pass the manual on to any subsequent holder or user of this hammer.

Sandvik declines all responsibility for injury or damage resulting from non-compliance with the instructions in this manual.

This equipment must be used or maintained only by a person who has received proper training and has demonstrated that he or she has the skills needed for safe and proper operation and maintenance.

Sandvik prohibits in connection with the access and proximity to our product the consumption, the possession and the distribution of:

- intoxicants and narcotics
- any kind of legal or illegal drugs
- items which are in conjunction with any of these
- unapproved explosives

Safety and life cycle information covers transport, installation, use, settings, operation, cleaning, maintenance and disposal of machinery. Safe working procedures are needed for each phase.

In case you need more detailed instructions, do not hesitate to contact your local Sandvik representative.

2.3. Proper operating practice

Only operate the controls while the engine is running. Protective glasses must be worn while you operate the drill rig and while you operate the hammer.

While you operate the hammer slowly in an open area, check for proper operation of all controls and all protective devices.

Before you move the drill rig with the hammer, ensure that no one will be endangered.

Do not go close to the edge of a cliff, an excavation or an overhang.

Maintain control of the drill rig while you operate the hammer. Operating the equipment beyond its design limits can cause damage to people or equipment.

Know the maximum operating dimensions of your drill rig when the hammer is installed.

Ensure that there is adequate clearance between the drill rig and any stationary objects when you are maneuvering the machine.

Know the appropriate work site hand signals and the personnel that are authorized to give the hand signals. Accept hand signals from one person only.

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2.4. User obligations

Protective measures, which must be taken by the user, based on the information for use:

- Use of personal protective equipment (PPE)
- Provision and use of additional safeguards
- Regular training on site safety and safe working procedures.

Other particular issues which should be known to the user are:

- Site organization and supervision
- Workplace safety, including safe working procedures.
- Permit-to-work systems.

The following safety guidelines apply for each person working with the hammer or in the vicinity of the hammer:

- Every single person is responsible for the own safety and for the safety of her or his colleagues
- In case of violation of any safety guidelines or regulations, every single person is responsible to warn the others and the responsible supervisor.

2.4.1. Managing work-related hazards

This hammer is for professional use only.

This hammer may be used or maintained only by a person who has received proper training and has demonstrated that he or she has the skills needed for safe and proper operation or maintenance. Read the instructions before using or servicing the hammer.

Safety is not just a matter of responding to the warnings. All the time you are working with your equipment you must pay attention to what hazards there might be and how to avoid them.

All mechanical equipment can be hazardous if handled without due care or correct maintenance. Most accidents involving equipment handling are caused by failure to observe basic safety rules or precautions.

Because it is impossible to anticipate every possible circumstance that might involve a potential hazard, the warnings in this manual and on the equipment are not all inclusive.

The user must always perform a local risk assessment before starting a task. This assessment (also known as a Real Time Hazard Analysis, RTHA), ensures that the user stops and thinks about what she or he is going to do before starting to work:

- Make sure that the equipment will not be made unsafe or damaged by the method of operation or maintenance you choose
- Identify potential hazards that could impact yourself, your colleagues, the environment, your product and/or work method while you are performing the task
- Assess the risks to determine what scale of control is required and then apply proper controls to manage the risk.

Training **must ensure** that **only** competent personnel handles the equipment. Management should:

- provide training and orientation
- verify training methods
- verify knowledge and skills
- monitor and evaluate performance.

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2.4.2. Personal protective equipment (PPE)

Lack of personal protective equipment (PPE) could cause severe injury or death.

Operators and anyone in the vicinity of the hammer MUST wear approved personal protective equipment (PPE) (respirator, hard hat, ear protection, safety boots, safety gloves, safety glasses).

Proper PPE includes (but is not restricted to):

- ear protection
- respirative protection
- eye protection
- safety boots
- hard hat
- protective gloves
- high visibility vest

Special conditions may make the use of additional PPE necessary.
Do not wear loose clothing or jewelry that can snag on controls or on other parts of the equipment.

2.5. Product limitations

2.5.1. Intended use

This hammer is to be used as an attachment on a drill rig in the hole drilling applications.

Properties of materials to be processed

ENVIRONMENT HAZARD!

Special conditions, such as e.g. radioactive, asbestos or poisonous hazard environment require unconditional use of hazard specific methods and protective measures.

DANGER	
	**FIRE HAZARD!** **Fire will cause death or severe injury.** **During operation, the tip of the bit may get extremely hot. The bit in contact with the material to be broken will create sparks.** **Do not operate the hammer near flammable substances.**

EXPLOSION HAZARD!

Use of hammer in explosive atmosphere (gasoline fumes, coal dust etc.) is strictly prohibited. The bit in contact with the material to be broken will create sparks, which could ignite an explosive atmosphere.

WARNING	
	**ELECTRICAL HAZARD!** **If the machine comes in contact with high voltage power lines, electrocution could cause death or severe injury.** **Be aware of high voltage power lines and power cables that are buried.**

Do not start any job until you are sure that you and those around you will be safe.

This hammer drills holes in rock and has been designed exclusively for this application.

This hammer is designed to operate in standard environmental conditions.

Clear all obstacles that are in the path of the machine. Beware of hazards such as wires, ditches, etc.

Know the width of your equipment in order to maintain proper clearance when you operate the equipment near fences or near boundary obstacles.

Under special conditions, the methods and precautions must be reviewed in cooperation with the local and national authorities. Operation may only commence when approval has been granted.

If you are unsure of anything, ask someone who knows. Do not assume anything! Find out!

2.5.2. Prohibited use of machinery

Any use of this hammer not permitted as intended use, outside the designed environmental conditions or on unsuitable materials to be processed, is prohibited.

Use of this hammer is specifically prohibited in the following cases:

- Operator has not read and understood this manual
- Operator has not read and understood operator's manual for the host machine
- Defeating any safety feature of the equipment, for whatever reason, is strictly prohibited
- Operator has not performed Real Time Hazard Analysis (RTHA) of the site and is not aware of escape route for emergency situation
- Operation without proper and approved personal protective equipment is strictly prohibited
- Hammer must not be used with people in hazard zone
- Hammer must not be used outside the technical limits as described in the technical specification.

2.5.3. Modifications

⚠ WARNING

MODIFICATION HAZARD

Unauthorized modifications could lead to death, severe injury or property damage.

Always contact a Sandvik representative in order to get advanced written approval for any modification.

All modifications and corrections not authorized in the information for use or which may affect the maintenance, operation, safety, and availability of the product need to be approved in writing by the manufacturer before implementation. Approval requires a careful risk assessment, taking into consideration the known risks and any new risks that the modifications may cause.

Changes and modifications without proper risk assessment, elimination or reduction of risk and without appropriate safety measures may lead to death or serious injury or damage to property.

If modifications and corrections that affect the maintenance, operation, safety and usability of the product are made without the written permission of the manufacturer, the manufacturer is not responsible for any incidents resulting in death, injury, or property damage brought about by such modifications and corrections.

Should you consider a modification or correction necessary, please contact the manufacturing and design team of the equipment.

If a modification or correction as described above has been implemented without the manufacturing factory's permission, its effect on warranty liability will be considered case-by-case. Thus, a warranty application may be rejected altogether.

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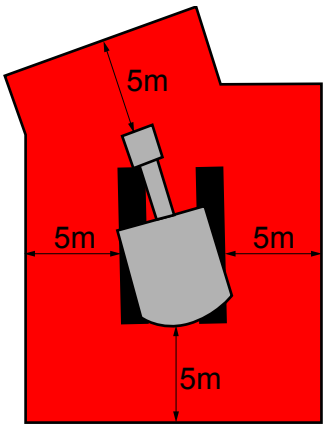
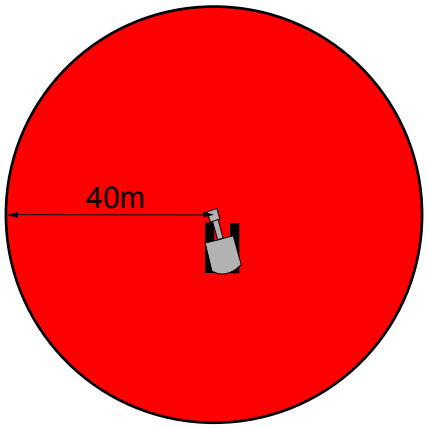
2.5.4. Hazard zones

⚠ WARNING	
	**FLYING OBJECTS HAZARD!** **Flying rocks could cause death or severe injury.** **Ensure there is nobody in the hazard zone I during operation.** **The hammer must be stopped immediately, when people without proper personal protective equipment (PPE) come into hazard zone II.** **Make sure that the drill rig is equipped with a flying object guard.**

There are several different hazard zone levels for this equipment.

Hazard zone I The risks for bystanders in hazard zone I are related to crushing by hammer, drill rig, boom or other heavy equipment. This hazard zone is within 5 m (15 ft) of the machinery. Nobody is allowed in hazard zone I. It is operator obligation to stop hammer operation immediately, when people come into hazard zone.	
Hazard zone II The risks to bystanders in hazard zone II are related to noise, dust and flying fragments of rock or others. This hazard zone is 40 m (130 ft) from hammer for each single one of these hazards. hazard zone II determines the requirements of legibility for safety labels. Nobody is allowed in hazard zone II during hammer operation, unless they utilize proper and approved PPE, including respirator, safety glasses, ear protection, high visibility vest etc. It is user obligation to stop hammer operation immediately, when people without proper PPE come into hazard zone II. This is the case for both bystanders as well as the operator of remote controlled equipment.	

2.6. Noise

⚠ WARNING

NOISE HAZARD

High noise level during operation may damage your hearing.

Always wear approved ear protection to prevent personal injury.

2.7. Airborne pollution

⚠ DANGER

DUST HAZARD

Breathing dust particles will cause death or severe injury!

Always wear approved respirator!

Protect yourself and bystanders from airborne pollution.

Always work with a respirator approved by the respirator manufacturer for the job you are doing. It is essential that the respirator that you use protects you from the tiny dust particles which cause silicosis and which may cause other serious lung diseases. You should not use the equipment until you are sure your respirator is working properly. This means the respirator must be checked to make sure that it is clean, that its filter has been changed, and to otherwise make sure the respirator will protect you in the way it is meant to.

Make sure the dust suppression system in your equipment is working properly. If the dust suppression system is not working properly, stop working immediately.

Always make sure dust has been cleaned off your boots and clothes when you leave your shift.

The smallest particles of dust are the most harmful. They may be so fine that you can not see them.

Remember, you must protect yourself from the danger of breathing or inhaling dust.

Do not inhale oil fogs which may be generated by the compressor, drill rig or hammer during operation. Use approved respirator to protect against oil fog.

Failure to comply will result in serious injury or death.

2.8. National safety regulations

It is the responsibility of the user to follow national safety regulations at all time. Special care should be given to dust, noise and vibration related regulation.

Ignorance is no excuse for not following national law. Familiarize yourself with the national safety legislation.

2.9. Site-specific safety regulations

Site specific regulations must not contradict national safety regulations, and would rather cover other topics, than dust, noise and vibration.
Site specific regulations will frequently address issues like transportation of product or equipment, access to places, PPE, working hours etc.
Site specific regulations should also cover the case of an incident occurring: what to do, who to contact and other questions.
Site specific regulations must be followed at all time in the same way as national safety regulations.

2.10. Periodic maintenance

The maintenance section is a guide to equipment care. Follow the instructions for maintenance and checking the equipment.
Poor quality of compressed air, lack of lubrication, poor quality of lubrication oil or too much wear in hammer parts may destroy the hammer.

2.11. Warranty notice

If the RH hammer is operated at pressures above 24 bar (350 psi), greatly increased productivity can be achieved, but Sandvik will not be held responsible for component failure or premature wear. The warranty against faulty workmanship and materials on the RH hammer and bits is only valid for operating pressures up to 24 bar (350 psi).

2.12. Preventing crushing and cutting

Make sure that the drill rig is able to properly support the load of the hammer in all directions and in all working situations.
Do not depend on the hydraulic cylinders in order to support the hammer. A hammer can fall if a control lever is moved or if a hydraulic line breaks. Also, a hammer can fall if a hydraulic cylinder drifts.
Stay clear of all rotating parts and all moving parts. Unless you are instructed otherwise, never attempt adjustments while the machine is moving or while the engine is running.
During storage and transportation make sure, that the load is secured in a proper way. Use proper pallets and make sure the ground is able to support the load.

2.13. High pressure air hose breakage

⚠ WARNING	
	**SKIN INJECTION HAZARD** **Fine jets of compressed air at high pressure can penetrate the skin, causing serious injury.** **To avoid hose breakages, check air hoses and connections regularly. If a hose breaks unexpectedly, keep out of hazard zone and disconnect power from compressor in a safe way. Keep people away from the air hoses during hammer operation. Stop the air compressor before disconnecting or connecting air hoses.**

2.14. High pressure pinhole leakage in drill rig

⚠ WARNING	
	**HYDRAULIC FLUID INJECTION HAZARD!** **High-pressure hydraulic fluid sprays can penetrate the skin and could cause death or severe injury.** **Search for leaks with a piece of cardboard or wood. Never try to locate a leak by feeling with your hand. Seek immediate medical attention if you are hit by a hydraulic fluid spray.**

ENVIRONMENTAL POLLUTION HAZARD

Improperly disposing of fluids can threaten the environment.

Always use leakproof containers when you drain fluids. Do not pour waste onto the ground, down a drain or into any source of water. Potentially harmful fluids should be disposed of according to local regulations.

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2.15. Trapped pressure in a hydraulic or pneumatic system

Before disconnecting or connecting hydraulic or pneumatic hoses, stop drill rig engine and operate controls to release pressure trapped in the hoses.

Wait at least 10 minutes to ensure that pressure has been relieved from the system before disconnecting any hoses, pipes or other components.

⚠ WARNING

CRUSHING HAZARD!

Sudden machine or attachment movement could cause death or severe injury.

Never carry out maintenance or repair work on a pressurized system.

Always make sure the parts are not pressurized during service. Use a bleeder screw to relieve the pressure behind the valves or cartridges, or wait until the unit is depressurized, before starting any maintenance work.

⚠ WARNING

HIGH-PRESSURE HAZARD!

Whipping oil or air hose or spraying fluid could cause death or severe injury.

Relieve pressure before opening fittings, plugs, or hydraulic valve cartridges.

Always make sure the parts are not pressurized. Use a bleeder screw to relieve the pressure behind the valves or cartridges, or wait until the unit is depressurized, before removing the components.

⚠ WARNING

HIGH-PRESSURE HAZARD!

Unblocking clogged bit without detaching the bit from the hammer, could cause death or severe injury.

Relieve pressure and detach the bit from the hammer, before maintenance work.

⚠ WARNING

BURN HAZARD!

Hot oil could cause severe burns to the skin.

The oil circulating in the hydraulic system is hot. Let the oil cool down before starting any maintenance work.

2.16. Maintenance

Make sure that the engine is shut down and can not be started while maintenance is performed. Attach a "**DANGER — Do Not Start**" warning tag or a similar warning tag to the start switch or to the controls before you service the equipment or before you repair the equipment.

Unless you are instructed otherwise, never attempt adjustments while the machine is moving or while the engine is running. Stay clear of all rotating parts and all moving parts.

2.17. Containing fluid spillage

ENVIRONMENT POLLUTION HAZARD!

Improper disposal of waste can threaten the environment.

Always use leakproof containers when you drain fluids. Do not pour waste onto the ground, down a drain, or into any source of water.

Use all cleaning solutions with care. Never put maintenance fluids into glass containers. Drain all liquids into a suitable container.

Care must be taken in order to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the equipment. Prepare to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Use tools and equipment, which are suitable for containing and collecting fluids.

Obey all local regulations for the disposal of liquids.

2.18. Hot substances

THERMAL HAZARD!

Hot fluid or hot surfaces could cause severe injury.

Always wear protective clothing, protective shoes, and eye protection when working near hot fluids or surfaces.

Hot oil and hot components can cause personal injury. Do not allow hot oil to contact the skin. Also, do not allow hot components to contact the skin.

Relieve all pressure in the air system, in the hydraulic system or in the lubrication system before any lines, fittings or related items are disconnected

The working end of the bit may get extremely hot during operation. Make sure the bit has had time to cool down before starting to handle it.

2.19. Flammable liquids

⚠ WARNING	
	**FIRE HAZARD!** **Fire could cause death or severe injury.** **Wipe spilled fluid off before starting the rig. Do not use the rig if there is a leak. Flammable fluids that are leaking or spilled onto hot surfaces or onto electrical components could cause a fire.**

⚠ WARNING	
	**FIRE HAZARD!** **Fire could cause death or severe injury.** **Do not smoke in areas that are used for storing flammable materials.** **Do not weld on lines or on tanks that contain flammable fluids.** **Do not flame cut lines or tanks that contain flammable fluid.**

All fuels, most lubricants, and some coolant mixtures are flammable.

Clean any lines or tanks thoroughly with a nonflammable solvent prior to welding or flame cutting.

Store fuels and lubricants in properly marked containers away from unauthorized persons. Store oily rags and any flammable materials in protective containers.

2.20. Lifting

⚠ WARNING	
	**LIFTING HAZARD** **Faulty lifting practice could cause death or severe injury.** **Keep yourself and bystanders out of hazard area during lifting.** **Never place load over people.** **Never ride a load.** **Make sure that lifting equipment is in good condition.** **Use the hoist plug when lifting the hammer.**

Always use a hoist wherever possible, and especially when lifting components which weight 23 kg or more.

Hammer weight is shown in specifications.

Make sure all chains, hooks, slings etc., are in good condition, are in the correct capacity and comply with all local regulations. Make sure that lifting equipment is strong enough for the job and you know how to use it.

Make sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation. Clean lifting eye holes and lifting eye threads before applying the lifting eye.

Lift the hammer using the hoist plug (see special tools list).

Safety instructions for lifting

Below are some common safety instructions concerning lifting operations. In addition to this, the national standards for machines and lifting-tackles must always be strictly observed. Please note that the list below is not all inclusive. You must always ensure, that the procedure you choose is safe for yourself and bystanders.

- Inspect all lifting equipment before use. Do not use twisted or damaged lifting equipment. Protect lifting equipment from sharp corners.
- Do not lift load over people. No one shall be under a hoisted load.
- Do not lift people and never ride a hoisted load.
- Keep people clear from lift area.
- Avoid side pull of the load. Make sure you take up the slack slowly. Start and stop carefully.
- Lift load a few centimeters and verify proper lifting procedure. Make sure the load is well balanced. Check for any loose items.
- Never leave the suspended load unattended. Maintain load control at all times.
- Never lift a load over a rated capacity.
- Obey all local safety instructions.

2.21. Recycling

ENVIRONMENT POLLUTION HAZARD!

Improper disposal of waste can threaten the environment.

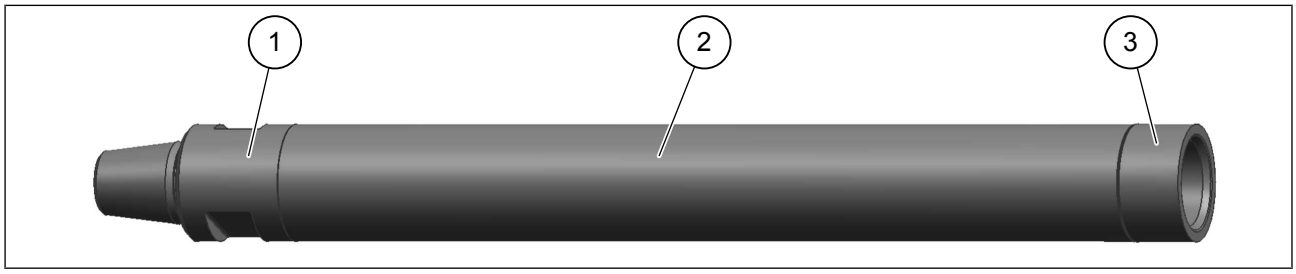
Always use leakproof containers when you drain fluids. Do not pour waste onto the ground, down a drain, or into any source of water.

Obey all local regulations for the disposal of liquids.

All metal parts of the hammer may be recycled as standard scrap recycling.

All plastic parts (seals, buffers, plugs) of the hammer should be deposited on a standard waste deposit. Plastic parts must not be burned.

3. MAIN COMPONENTS



1 Top sub
2 Piston case
3 Driver sub

4. OPERATION

4.1. General

The Operation section is functions as a reference for the new operator, and as a checklist for the experienced operator.

This section outlines only the basic operating techniques. With more knowledge of the hammer and its capabilities, the operator will be able to improve the skills and operating techniques.

4.2. Setting up

When handling the hammer and drill pipe, always keep the inside diameter of the hammer covered to prevent dirt, rust, scale or other objects from entering the hammer.

Each new hammer is assembled with all joints hand tight. If applicable, the correct size choke must be selected from specification table and installed before joints are tightened to the specified torque and hammer is operated. Remove feed tube from top sub. Set feed tube, with top end facing down, on wooden block. Using a blunt nose drift punch, drive choke towards the top end of feed tube. The choke will dislodge from its seat after it has moved approximately 6 mm (1/4 inch) and will fall out the rest of the way. Select choke and install it. Be sure the bottom end is resting on a wooden block prevent to damage.

The hammer has a large contact surface between the piston and the inside of the piston case. It requires attention during start-up of new hammer and cold hammer. Before starting a brand new hammer or a used hammer which has not been used for more than 2 days, flush hammer thoroughly with clean lubricated air from the compressor before attempting to drill. This will remove any oil buildup that has migrated down from the drill pipe. This procedure is essential in tight hammer clearance and thick oil.

4.2.1. Attaching the hammer to the drill rig

⚠ DANGER	
	**CRUSHING HAZARD!** **Unexpected rig movement will cause death or severe injury.** **Keep an eye on the movements of the drilling rig when working close to the rig.**

⚠ DANGER	
	**ENTANGLEMENT HAZARD!** **Rotating drill steel will cause death or severe injury.** **Do not touch the rotating pipe or hammer.** **Make sure that no body parts get caught while connecting hammer to the drill rig.**

Make sure that the pipe thread connection is the same as at the hammer. Check that the drill rig has enough feed force.

NOTE! Do not exceed the maximum air pressure when operating the hammer. Check the maximum air pressure from the specifications.

Make sure that drill rig has parked on a steady and level surface. Ensure that the drill rig cannot move by itself.

1. Remove all old thread compound.
   Clean the threads thoroughly with solvent and wire brush.
2. Inspect the threads and mating shoulders for damage.
   Repair if necessary.
3. Coat the threads and mating shoulders with new thread compound.
   NOTE! Do not allow any thread compound to fall into the hammer.
   Do not use too much of thread compound, this may prevent proper shouldering.
4. Lift the hammer with a proper lifting tool to the feed of the drill rig.
5. Use PITO (only available at the Sandvik drill rigs) to hold the hammer.
   If there is no PITO available, lower the hammer to the ground. **NOTE!** Make sure that the hammer does not fall.
   NOTE! Never hold the hammer by hand.
6. Remove the lifting tool.
7. Attach the drill pipe to the hammer.
   Use the drilling controls of the drill rig to attach the hammer.
8. Use rotation to tighten the joints.
   The joints must be tightened before starting to drill.

4.3. Feed weight on the bit

A minimum amount of feed weight must be maintained on the bit throughout the drilling operation. As the hole gets deeper and the drill pipe is added, the push-down force must be reduced to compensate for the added weight of the drill pipes. Hold-back force may be needed, depending on the hole depth. See the operation techniques section for more information on feed weight.

4.4. Back Pressure

When a pneumatic hammer is operating at the surface, it is exhausting directly into the atmosphere, and is producing maximum obtainable horsepower for a given inlet pressure. Conversely, any positive pressure above the atmospheric (back pressure) which is encountered at the exhaust of the hammer is detrimental to the hammer‘s efficiency.

As the hole is drilled deeper, the back pressure is constantly increasing. With high back pressure, the hammer will run, but energy per blow of the piston and the number of strokes of the piston are less than that developed at zero back pressure. To compensate for the efficiency lost to back pressure, it is necessary to increase the air pressure at the inlet. To increase the inlet pressure, more compressed air volume is required, and the increase must be substantially more than the back pressure. Increase the inlet pressure until optimum drilling rate is obtained.

4.5. Rotation speed

⚠ DANGER	
	**ENTANGLEMENT HAZARD!** **Getting entangled in rotation parts will cause death or severe injury.** **Do not enter the hazard zone I when rotation is on.**

Proper rotation speed is important for long bit life and good peneration. Recommended speeds range 20 to 100 RPM, with the slower rotation used in hard, abrasive formations and faster rotation in soft, nonabrasive formations. Adjust rotation to obtain the best drilling rate and to minimize the bit wear. See the specifications.

4.6. Water or Foam Injection

During drilling operations, water or foam injection may be necessary in some applications. Water injection is used for collaring and dust suppression. Foam injection is used to help clean the hole when the formation is producing water or is broken. Use the following procedures during water or foam injection to avoid hammer corrosion, unnecessary maintenance costs and to save downtime.

- Ensure that the water being used is free from solids contamination.
- Any time a hammer is not used for one or more hours, clean the hammer and drill pipe by blowing lubricated air though the system.
- Water or foam injection causes hammers to corrode if it is not properly maintained.

4.7. Underwater use

Never allow a hammer to remain overnight in a hole that contains water or mud. The corrosive action caused by these conditions may seriously damage the hammer.

4.8. Operation techniques

Only use the hammer to drill rocks. Before you start drilling operation, place the machine on a level, stable surface. If the machine must be placed on a slope or on a rough surface, be careful during operation.

For efficient drilling it is important that the buttons on the face of the bit are in close contact with the rock at all times. Drilling feed weight on bit must be sufficient to keep the bit closed against the driver sub allowing the maximum amount of piston energy to be transferred to the rock.

If drilling feed weight is insufficient, the rock breaking energy stays within the hammer and will cause premature component failure.

Several problems can occur if drilling feed weight is excessive. Rotation torque will increase, flushing will be reduced in softer ground and in some conditions, hole deviation could occur.

The optimum weight on bit will vary according to many conditions, such as the type of rock, bit type and rotation speed. The optimum weight on bit is best determined by the driller but below is the guide for weights at various operating pressures.

Hammer	10 Bar	18 Bar	24 Bar	150 psi	250 psi	350 psi
RH550 3”	2650 N	4400 N	6150 N	580 lb	970 lb	1350 lb
RH550 4”	4600 N	7500 N	10500 N	1000 lb	1650 lb	2300 lb
RH550 5”	6800 N	11400 N	15900 N	1500 lb	2500 lb	3500 lb
RH550 6”	10900 N	18200 N	25500 N	2400 lb	4000 lb	5600 lb
RH550 8”	16800 N	27800 N	39100 N	3700 lb	6100 lb	8600 lb

- Lower the hammer into the hole slowly until the bit contacts the bottom of the hole and the piston starts operating. If lowering the hammer into a hole with casing installed, make sure the bit does not strike the casing.
- Always apply the air and start rotation before putting weight on the bit to avoid damaging the bit.
- Maintain good push-down force on the hammer and ensure the hole is being cleaned.
- If the hammer enters soft soil or the void, the rig‘s pull down system may not be capable of maintaining recommended weight on the bit. The oscillating piston strikes the bit when it is not against the rock face. Every effort should be made to prevent or decrease this condition because it can cause bit shanking.
- If there is a drop-off in the size and volume of cuttings or an air pressure build-up while the hammer is operating at a normal rate, raise hammer without turning off rotation and work hammer up and down to assure that the hammer and pipe are free and the hole is clean before continuing to drill.
- Cracks in the formation may cause the hammer to bind in the hole. Raise the hammer, clear the hole with air and work the hammer up and down to assure that the hammer and pipe are free before continuing to drill. Rotate slowly and feed the hammer down the hole slowly to resume drilling.
- If the top of the hole craters, and cutting and debris fall into the hole from the surface, install a short length of casing in the hole. Allow the casing to extend 150 mm to 200 mm above the surface.
- When rotation stops, the hammer will continue to impact unless it is raised off the bottom. If the hammer is not raised off the bottom, the bit carbides will penetrated to the formation. Severe damage to the bit can occur if rotation is resumed without first raising the hammer and bit.
- Very rough rotation can be caused by a dull bit or certain rock formation.
- Before stopping the drilling operation clean the hammer and pipes by blowing lubricated air through the system.

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4.9. Bit wear

⚠ WARNING

FALLING LOAD HAZARD!

Falling bit could result death or severe injury.

Do not put body parts under the bit, when removing it from the hammer.

Wear safety footwear.

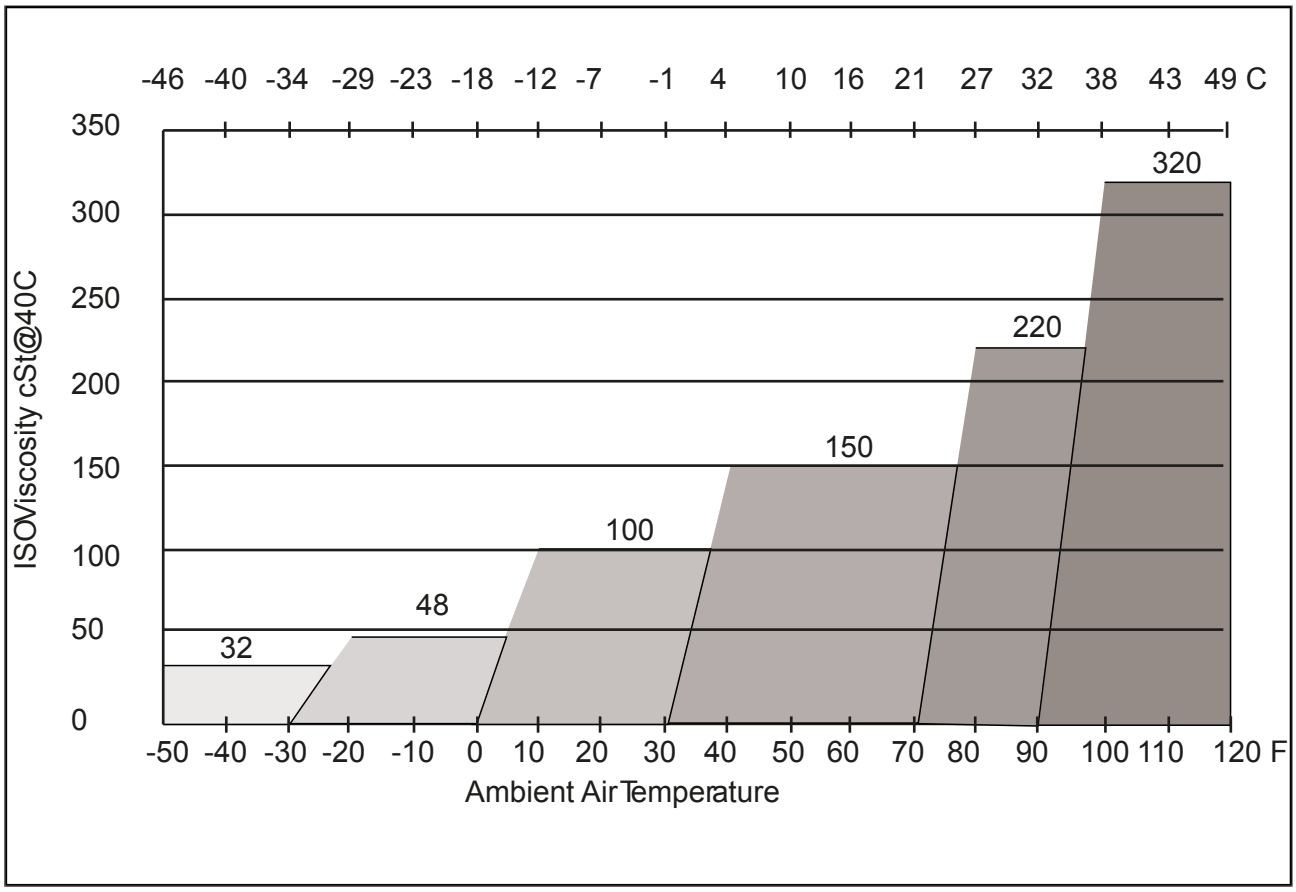
For the most efficient drilling, it is important to determine how many meters can be drilled in a given formation before the bit needs to be resharpened. Dull bits reduce the rate of penetration and increase the potential for bit damage. Excessively dull bits take longer to resharpen and waste carbide and grinding stone material.

1. A dull bit is indicated by any of the following conditions:
   - A slower penetration rate.
   - A decrease in cuttings amount / size.
   - Squealing / other signs of binding.
   - Chattering and rough rotation.
2. Broken outside diameter carbides. Possible causes of this damage:
   - Bit used was too long before resharpening.
   - Excessive weight on the bit.
   - Improper rotation speed.
3. Uneven carbide wear. Excessive wear on the edges of the carbides is caused by improper rotation:
   - Too slow rotation causes excessive wear on the leading edges of the carbides causing the carbides to break.
   - Too fast rotation causes excessive wear on the center of the carbides.
4. Excessive bit wear. Possible causes of excessive bit wear are:
   - Improper hole cleaning.
   - Bit used too long before resharpening.
   - Excessive weight on the bit.
   - Excessive rotation speed.
5. Broken carbides. Possible causes of broken carbides are:
   - Outside diameter of the bit larger than the hole diameter. Do not use the bit as a hole reamer.
   - Bit body wear is faster than the carbide wear.
   - Improper rotation speed.
   - Drilling on junk or foreign matter in the hole.

4.10. Lubrication of the hammer

Correct lubrication during drilling operations is extremely important. Inadequate lubrication is a major cause of hammer wear and failure.

- Use rock drill oil only. Use the chart on below to select the correct grade of rock drill oil.
- Lubrication oil acts as a seal between the hammer parts for air. Too small amount of lubrication oil increases air consumption.
- The recommended amount of rock drill oil for reliable operation is in the specification.
- When using the hammer in cold weather, mix some antifreeze to the compressed air to bind the condensed water in the line system.
  Sandvik recommends the use of alcohol-based antifreeze as an environmental-friendly solution.
- Rule of thumb: 1 liter/hour per 14 m^3/min (1 quart/hour per 500 CFM).



4.11. Preheating the oil and compressor

Especially during the winter, preheat the hydraulic oil of the drill rig to 30 °C ... 40 °C (80 °F ... 105 °F) before hammer operation. Warm also the compressor.

4.12. Stopping operation

Before leaving the drill rig, always lower the boom, so that the drill rig is stable. Never leave the drill rig with the engine running.

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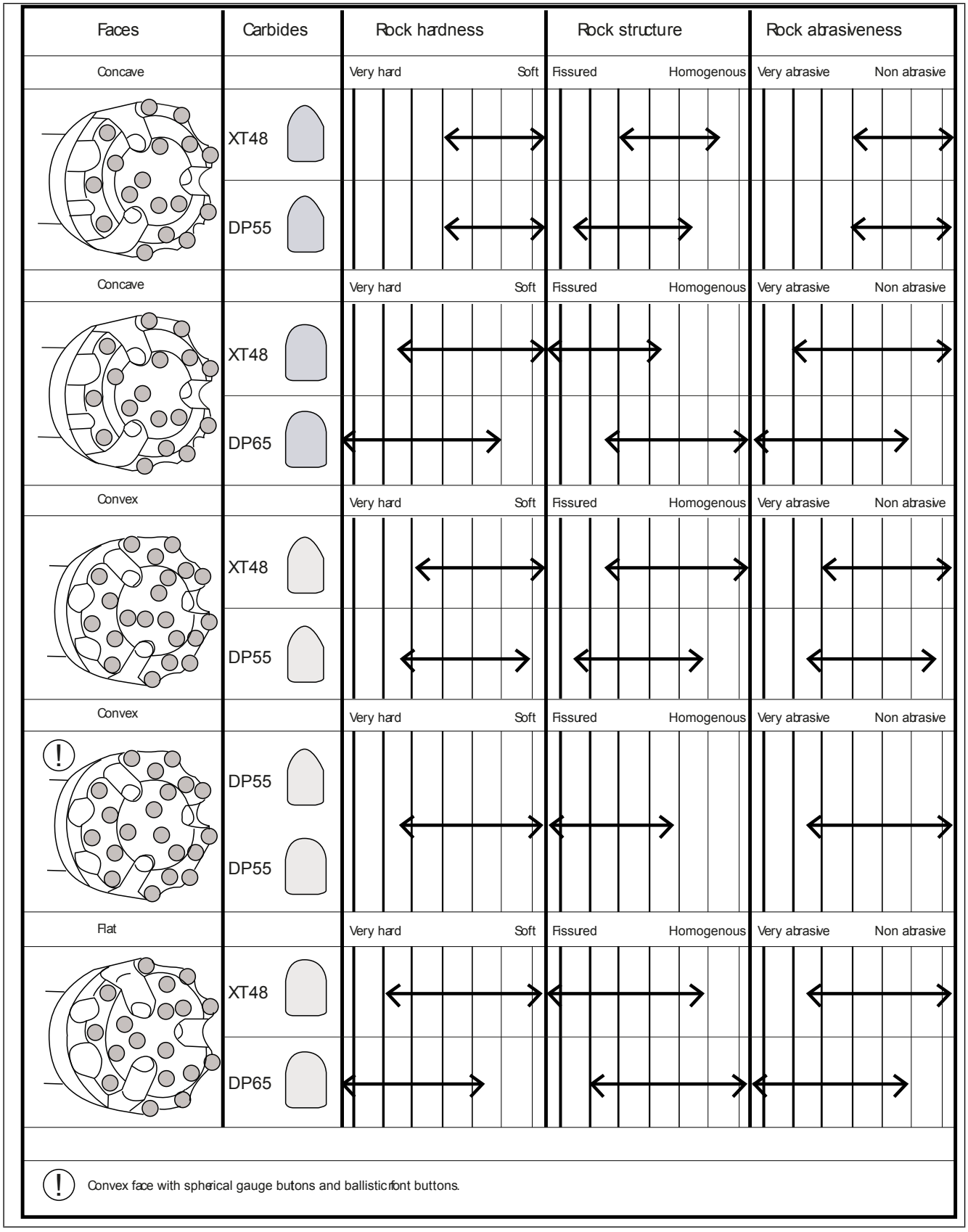
4.13. Sandvik DTH drilling tools

Sandvik offers three basic bit face designs: concave, convex and flat. Two types of carbides are available: Spherical and ballistic.

This bit selection guide shows in what rock conditions our different bit designs will have its best performance. It serves many times as a guide to make a first choice. Test drilling in actual rock conditions will then verify the selection.

Note: Cemented carbide grades DP55 and DP65 are available on several but not all bit diameters and shank designs.

Bit selection guide:



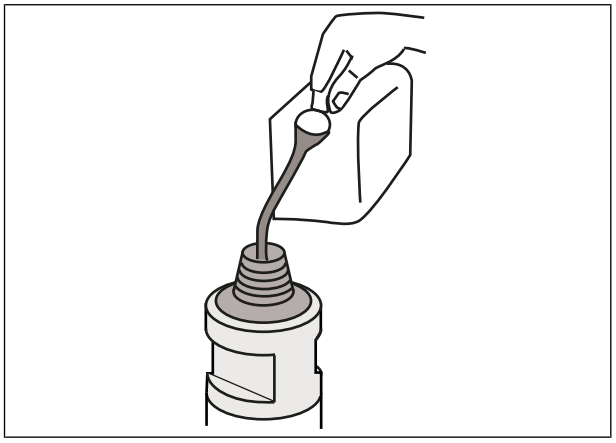
4.14. Storage

Never allow a hammer to remain overnight in a hole that contains water or mud. The corrosive action caused by these conditions may seriously damage the hammer.

Observe the following points when the hammer is stored. In this way the vital parts of the hammer are protected from rust and the machine is ready to be used whenever necessary..

- Disassemble the hammer completely.
- Thoroughly clean and repair all components.
- Reassemble hammer immediately, keep joints loose.
- Coat the entire hammer inside diameter with a light film of rock drill oil. Coat all the threads with thread grease.
- Install the thread protectors.
- Seal each end of the hammer to keep dirt and dust out of the hammer.
- Always store the hammer in a suitable protective container in a dry location.
- Grease the bit shank.
- Place a protective cover on top of the bit to prevent foot valve breakage.
- Always store the bit in a dry location.

- Before storing the hammer overnights or weekends, clean the hammer by blowing lubricated air through the system and insert rock drill oil into the top sub.
- Push the check valve dart open with rounded-end drift pin to ensure the oil inlet to the hammer.



5. MAINTENANCE

This Sandvik hammer is built to last, and will provide troublefree operation, provided it is properly used and maintained.

Your DTH hammer should be routinely disassembled, inspected, repaired and cleaned. The frequency of periodic maintenance depends upon the drilling conditions and hammer use.

1. Always check condition of the impact surface of the piston visually when changing the bit. Replace the piston if necessary.
2. Disassemble the hammer always, if you suspect that solid impurities have entered the hammer.
3. Inspect and service a new hammer after 8 hours of operation.
4. Service interval is 100 hours, if the hammer is used in hard, abrasive drilling.
5. Service interval is 200 hours, if the hammer is used in dry drilling.
6. If the hammer is used with water/foam injection in wet holes where mud is encountered, clean the hammer as soon as possible after each use with compressed air blasts and coat with rock drill oil. Inspect and service every 100 hours.

5.1. Safety

⚠ WARNING

HIGH PRESSURE PINHOLE LEAK HAZARD

A high pressure jet of hydraulic fluid may penetrate your skin and cause severe injury!

Do not touch fine jets of hydraulic fluid at high pressure. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to the suspected leaks. If fluid is injected into your skin, it must be treated immediately by a doctor familiar with this type of injury.

- Never apply compressed air directly to the skin.
- Never use compressed air for cleaning dirt from clothing.
- Never direct compressed air at another person.
- Make sure, that flying dirt does no harm to people or equipment.
- Always wear safety glasses.

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5.2. Tools and materials needed for service

- Tongs with cylindrical jaws.
- Bit breaker.
- Solvent or chemical cleaning compound.
- Flat file, medium to fine.
- Three-cornered file, medium to fine.
- Slip-joint pliers.
- Wire brush.
- Rock drill oil.
- Thread lubricant.
- Hammer breakout bench.

5.3. Checking the condition of the hammer

⚠ WARNING

GENERAL HAZARD

Faulty or worn hammer in use could cause injury.

Do not use hammer which is defective.

Make sure the maintenance procedures in this manual are completed before using the hammer. Keep track of all repairs done to the hammer.

Always make a visual inspection of the hammer **before** daily operation. Report all necessary repairs.

1. Check the hammer for cracks. Replace worn parts.
2. Check threads on the top sub and pipes. Replace worn parts.
3. Check the drill bit. Resharpen bit or replace worn parts.

5.4. Cleaning the hammer after use of the water/foam injection

If the hammer is used with water/foam injection in wet holes where mud is encountered, clean the hammer as soon as possible after each use with compressed air blasts and coat with rock drill oil. Inspect and service every 100 hours.

5.5. Disassembling the hammer

⚠ WARNING

CRUSHING HAZARD

A falling hammer could cause death or severe injury.

Secure the hammer from falling down when handling it.

Check that the lifting capacity of the hoist you are using is sufficient for the job. Use approved personal protective equipment.

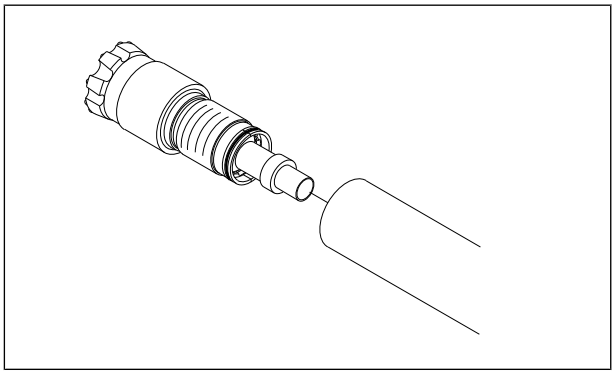
Worn parts may have sharp edges. Always wear approved safety gloves to avoid injury.

During disassembly, heavy parts may fall out from the hammer. Always keep the hammer in proper position to avoid falling parts.

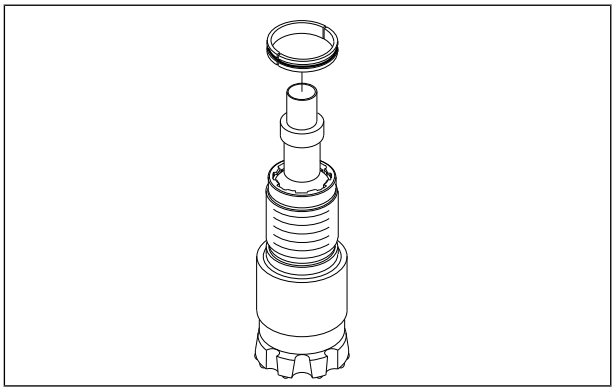
Use a proper assembly stand to avoid fall over or roll over of the hammer or parts of it.

Always use tongs with jaws that place a uniform load on the outside diameter of the hammer. Never grip the hammer with pipe wrenches or wrenches that can deform and damage the hammer. Always place tongs on the body of the bit, not on the carbides. Do not apply heat of any type to the piston case to remove the driver sub or the top sub.

1. Unscrew the driver sub from piston case using hammer breakout bench.
   Never use tongs directly on the threads or damage will result.



2. Remove bit retainer ring with O-ring keeping the two halves together.



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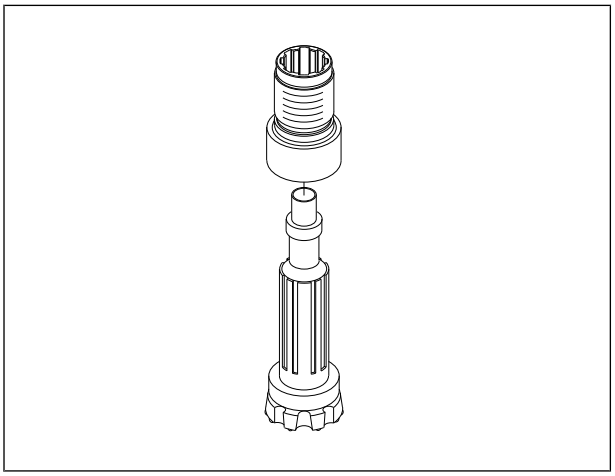
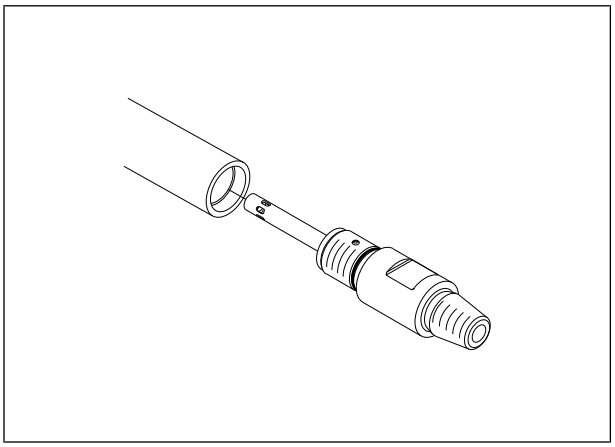
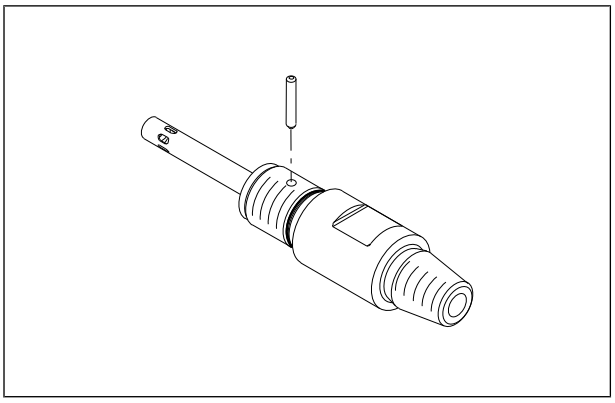
3. Remove the driver sub from the bit.



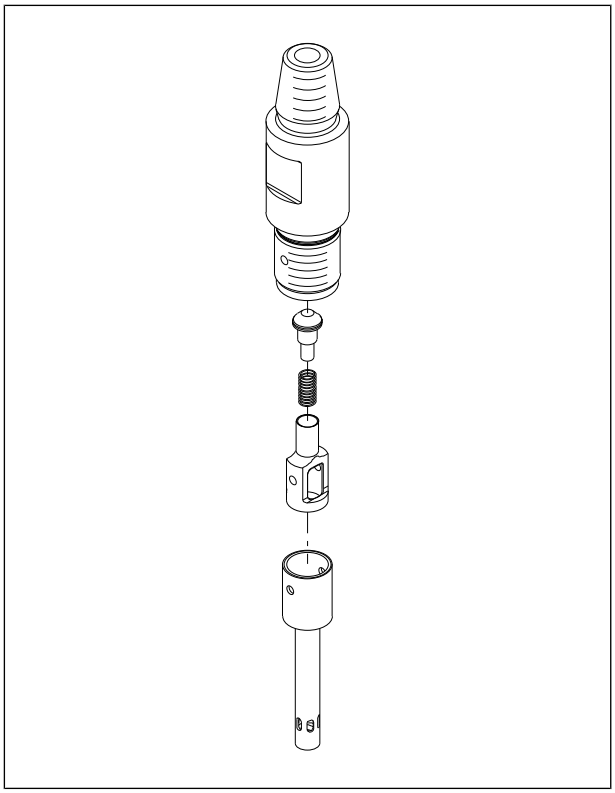
4. Unscrew the top sub from piston case using hammer breakout bench.
   Never use tongs directly on the threads or damage will result.



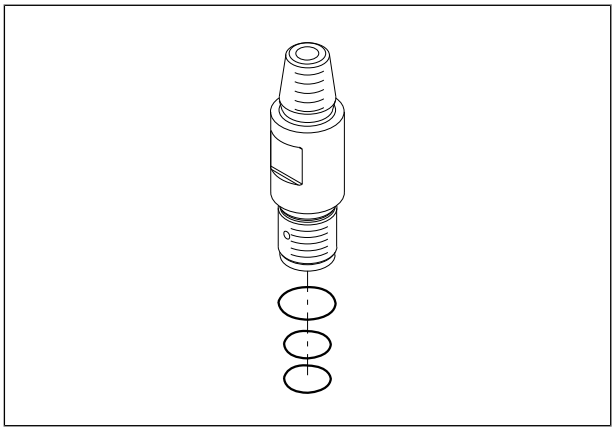
5. Remove the feed tube retainer pin.



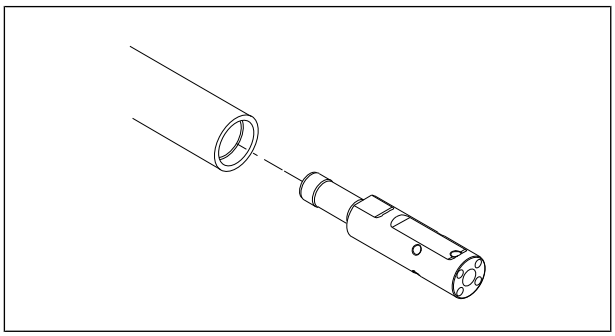
6. Remove the feed tube, check valve guide, spring and check valve dart.



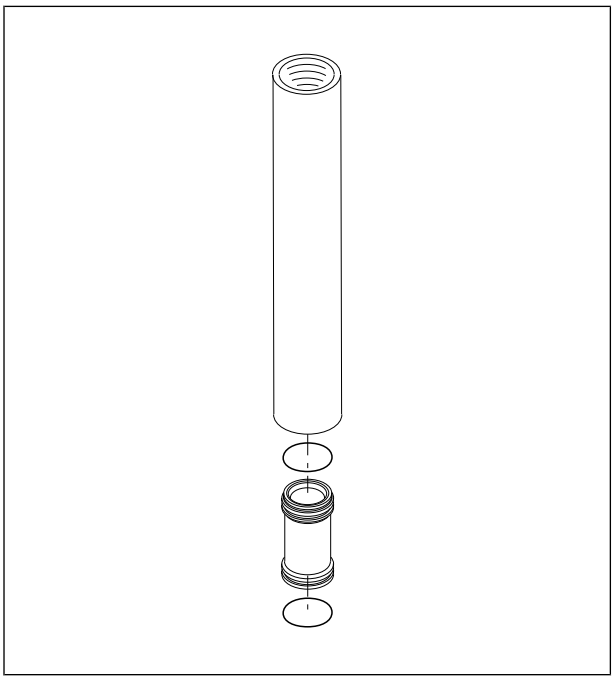
7. Remove O-rings from the top sub.



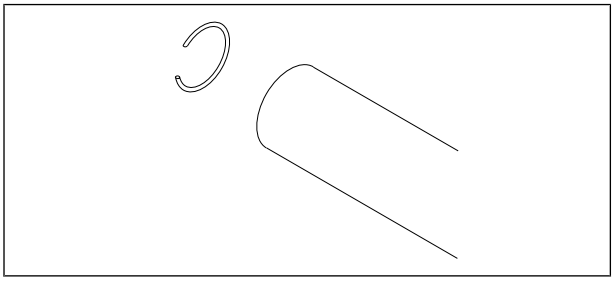
8. Remove the piston from top sub end.



9. Remove the guide sleeve with O-rings from driver sub end.
   a. From the top sub end, insert an aluminium bar which is the same length as the piston case and 6 mm (1/4 inch) smaller in diameter than the piston and tap against the guide sleeve until it can be removed.
   b. Remove the O-rings from guide sleeve.



10. Remove the piston retainer ring.
    a. Place the curved side of the extractor tool against the wall of the piston case, in line with the split in the ring and push forward until the ring lifts out of the groove.
    b. Continue pushing until the ring turns sideways inside the piston case and then pull it out with the ring puller on the back of the extractor tool.



5.6. Checking the condition of the parts

1. Measure piston case
   Measure outside diameter regularly, and compare to the specified wear limits.
2. Inspect parts
   Regularly inspect all parts carefully for burrs, galling or cracks. If the piston is galled it should be replaced and careful inspection is required inside the piston case. It is strongly recommended that you hone or polish the inside of the piston case to smooth the galled surfaces.
   Look for causes of galling such as poor lubrication or contamination and take corrective measures to avoid future damage. Neglecting to hone the galled piston case before installing a new piston will lead to early and repeated piston failures.
3. Service
   Replace any parts which are cracked. Use a file or emery paper to remove any burrs.

⚠ WARNING

FLYING MATERIAL HAZARD!

Deburring could cause severe injury.

Always use approved safety glasses and approved safety gloves. Always apply proper cleaning and machining procedures.

5.7. Assembling the hammer

5.7.1. Assembling the piston retainer ring

Where applicable, when reversing the piston case, it is strongly recommended to replace the piston retainer ring to ensure the gap in maintained between the driver sub and piston case.

1. Insert the piston retainer ring into piston case. Retainer ring is installed at the same end as the driver sub.
2. Push the piston retainer ring at place.

5.7.2. Assembling the guide sleeve

1. Inspect the guide sleeve inside.
   Polish if surface is galled. Replace if cracked or otherwise damaged.
2. Install two O-rings on guide sleeve.
   These O-rings are critical for proper sleeve alignment and for holding guide sleeve in place when changing bits.
3. Coat the guide sleeve with oil.
4. Push the guide sleeve into piston case.
   The guide sleeve will install correctly into the piston case only in one direction. Insert with the shoulder that fits against the piston retainer ring.
   Use the plastic or aluminium bar to push the guide sleeve into piston case. Continue to push the guide sleeve until it will go no further. It is in the correct position.

5.7.3. Assembling the piston

1. Inspect faces of used pistons for galling against piston case, guide sleeve or feed tube inside the center air hole. Polish as necessary. Reinstall used pistons with the piston case horizontal to avoid knocking guide sleeve out of place.
2. Regularly inspect the piston striking face and remove any burrs (peening) with a fine buffing or flap wheel. Do not use any type of grinding wheel as the resulting rough surface will propagate cracks and lead to premature piston failure.
3. Lightly coat the piston with rock drill oil. Install the piston into the piston case through top sub end striking end first.

5.7.4. Assembling the top sub

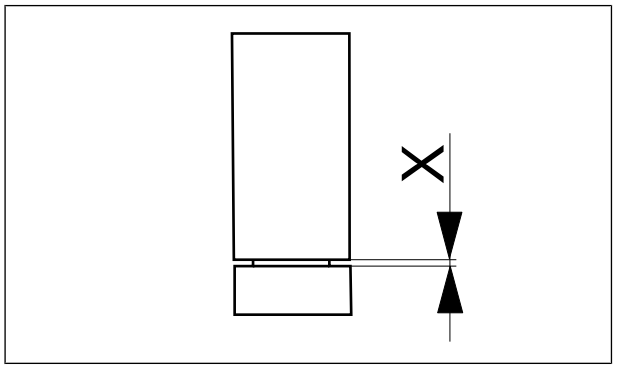
1. Oil parts before assembly.
2. Install top sub O-ring outside the top sub.
3. Install feed tube O-rings into the grooves inside top sub.
4. Insert check valve dart, spring and check valve guide into the feed tube.
5. Carefully line up retainer pin holes.
6. Insert the feed tube assembly into the top sub.
7. Line up retainer pin holes and install feed tube retainer pin.
   Make sure the pin does not protrude into threads either side.
8. Apply copper-based thread grease on threads, install the top sub assembly into the piston case.
9. Guide the feed tube into the piston center hole.
   Never force assembly.
10. Turn clockwise to tighten.
11. After hand tightening the top sub assembly, lay hammer down flat on a clean surface and lift driver sub end of hammer up until the piston is heard sliding smoothly towards the top sub end.

5.7.5. Assembling the driver sub

1. Inspect used driver sub for nicks or burrs in the thread.
   Polish if needed.
2. Inspect interior spline for wear.
   Replace driver sub if spline is at one third or less of original width.
3. Check the driver sub‘s remaining outside diameter.
   Most of the time the driver sub will wear more rapidly than other hammer components; two spare driver subs are typically used per piston case.
   Never install a used driver sub on a new piston case.
   Replace the driver sub if necessary.
4. Check driver sub for erosion.
   Sometimes vertical channels are eroded adjacent to drill bit flushing groves.
   When replacing the bit, always index the driver sub to alleviate this problem.
   Some operators rebuild driver sub by adding weld material. This is not recommended as it may cause warping or cracking. Welding, as described herein, cancels any remaining driver sub or piston case thread warranty.
5. Install driver sub.
   Apply copper-based thread grease on its thread.
   During storage, the bit retainer ring made up of two half rings plus an O-ring, may be inserted without a drill bit installed.
   When assembling the hammer without a drill bit, use a cover over the open driver sub to prevent contamination from entering hammer.

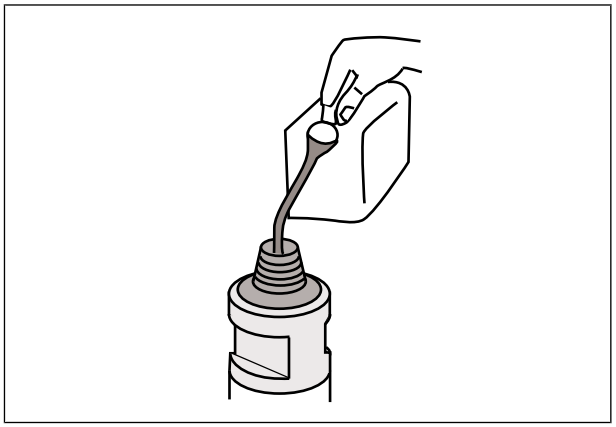
5.7.6. Measuring the gap between the piston case and the driver sub

- When the driver sub has been screwed into the piston case with the bit and bit retainer ring installed, a gap (X) must be visible between the piston case and the driver sub..
- The dimension of this gap is not critical, but it should not be less than 0.5 mm (0.020 inch) and not more than 1.50 mm (0.060 inch).
- When this gap is no longer visible, the piston retainer ring should be replaced. If hammer operation continues with no visible gap, there is high risk of component failure. Broken parts are not covered by warranty in this situation.



5.8. After assembling the hammer

- Insert rock drill oil into the top sub.
- Push the check valve dart open with a rounded-end drift pin to ensure the oil inlet to the hammer.
- Place the protective cover on thread of the top sub.



5.9. Resharpening the bit

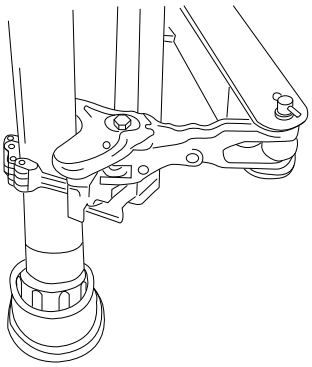
⚠ WARNING

FLYING OBJECTS HAZARD

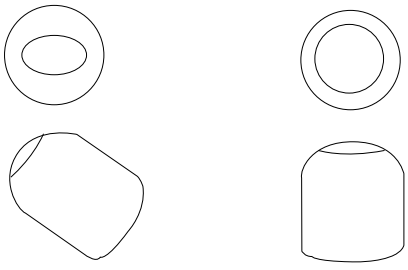
Flying debris could cause death or severe injury.

Always use approved safety goggles and approved protective clothing. Inspect the grinder and grinding cap for defects before starting.

1. Remove the bit from hammer using a bit breaker on the rig or hammer breakout bench.
2. Remove the driver sub and retaining ring.



3. Bit has spherical- or ballistic-ended cemented carbides. As drilling proceeds, the carbides develop a "flat" that becomes progressively wider. Carbides should be resharpened when the flat is 1/3 of the original carbide diameter. Shape of the flat at gauge carbides (A) and at face carbides (B).



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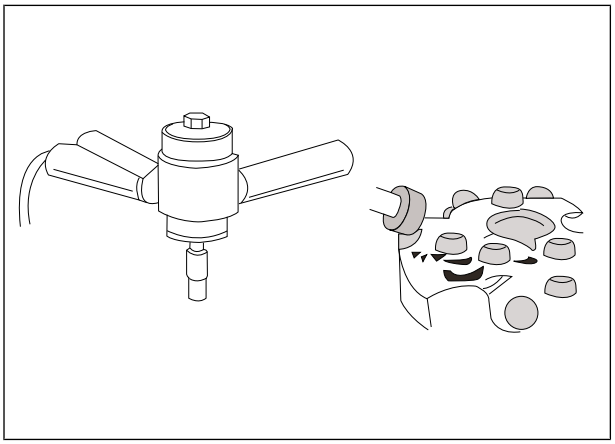
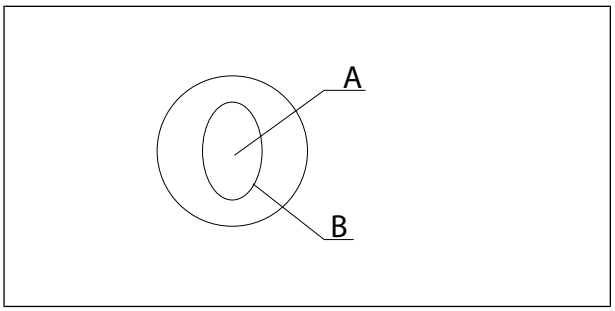
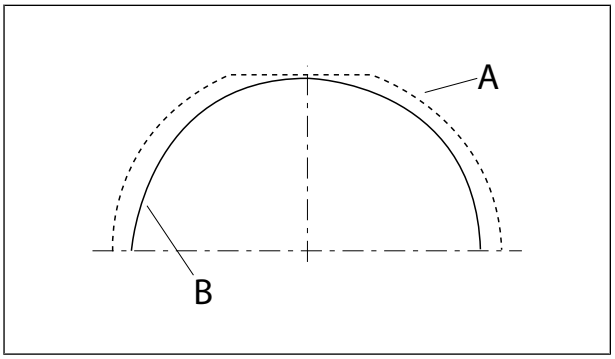
4. Use stationary or hand-held bit button grinder with diamond impregnated grinding cups.
5. Place the bit securely in a grinding stand or suitable fixture.



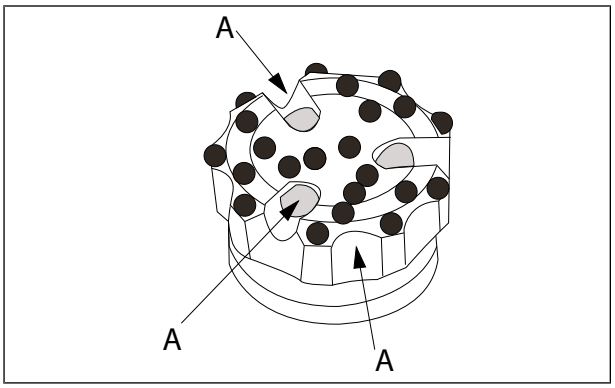
6. On gauge carbide only, mark a point on the center (A) of the flat (B).
7. Using the point marked, grind the carbide to its original shape, leaving the point untouched. This point assures concentricity of the gauge carbide surface.



8. Shape of the worn face carbide (A). Sharpen the face carbides to their original shape (B).



9. Reshape the outer diameter and face air passages (A) to allow free flow of cutting.
10. Grind off any carbides that are broken and can not be resharpened.



6. TROUBLESHOOTING

The hammer does not start

Hammer components are broken	Disassemble and check for broken components.
Hammer is clogged	Disassemble and clean.
Hammer is filled with thick oil	Run air through hammer.
Blockage before hammer	Check all hoses on rig for kinks or other blockages.

Rough or erratic operation

Insufficient or too much weight on bit	Adjust weight until hammer smoothes out. This is usually accompanied with rpm adjustment.
Too slow or too fast RPM	Adjust rpm until hammer smoothes out. This is usually accompanied with weight on bit adjustment.
Dull bit	Re-sharpen bit.
Worn critical hammer components	Check critical diameters/lengths for specification. See wear limits.
Too much water injection	Back off water injection rate.
Inadequate or too much oil, too high viscosity	Adjust lubrication rate and proper viscosity oil.

Low penetration rate with high pressure

Driver sub length worn	Replace driver sub.
Too much water injection	Back off water injection amount.
Hammer partially blocked	Remove obstruction.
Too much back pressure	Use larger choke and/or add booster compressor.

Low operating pressure

Inadequate lubrication	Use correct injection rate and viscosity of oil.
Worn hammer clearances	Check wear limits on critical dimensions. See wear limits.
Wrong or missing choke	Check to see if choke is in place, use correct choke.
Improper match between hammer and compressor	Check air consumption charts against compressor rating.

Hammer running off bottom

Soft formation	Increase choke size to keep hole open.
Too much or too high viscosity oil	Adjust lubrication for proper type and quantity.
Too much water injection	Reduce water injection.

Driver sub loosening in hole

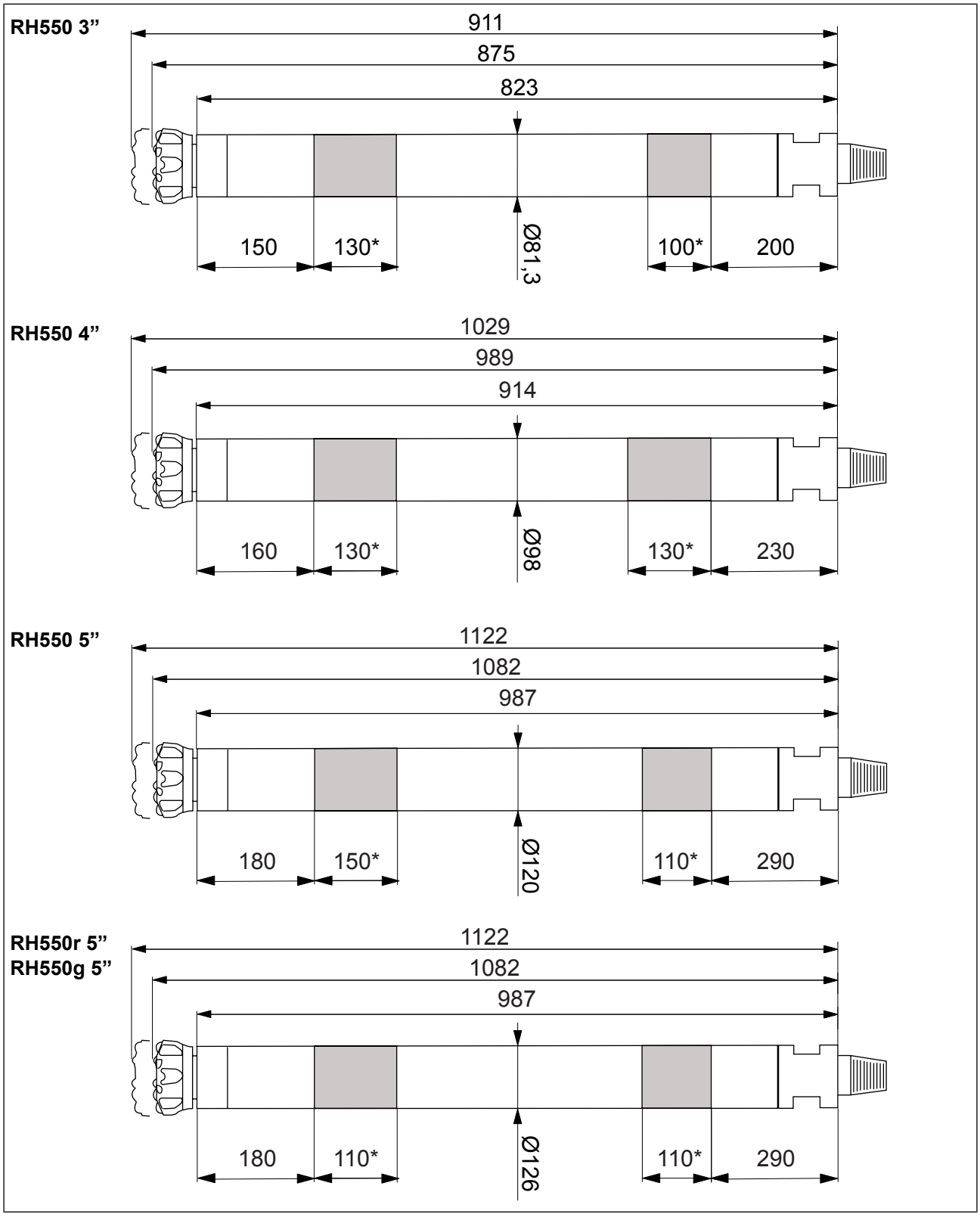
Inadequate weight on bit	Adjust feed pressure.
Improper make up torque	Use tong to torque threads prior to operation.
Soft or broken formation	Use lower air pressure (increase choke size or adjust at compressor. This will depend on rig manufacturer).

Driver sub hard to loosen

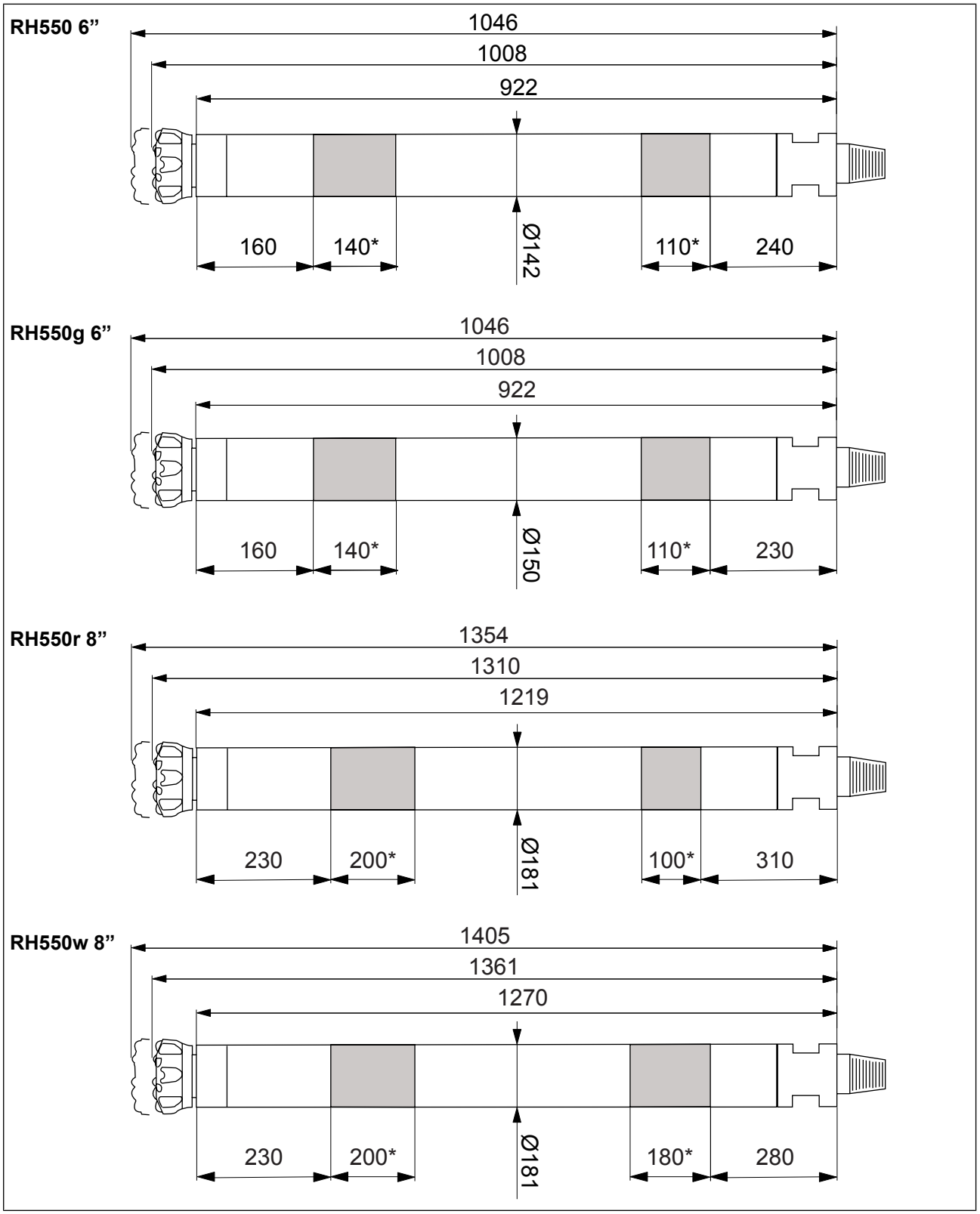
Improper gripping	Do not grip directly over threads. Make sure tong dies are sharp. Make sure that tong placement is right.
Improper make up torque	Use tong to torque threads prior to operation.

7. SPECIFICATIONS

7.1. Main dimensions



* Dimension for tong placement



* Dimension for tong placement

7.2. Technical specifications RH550 3"

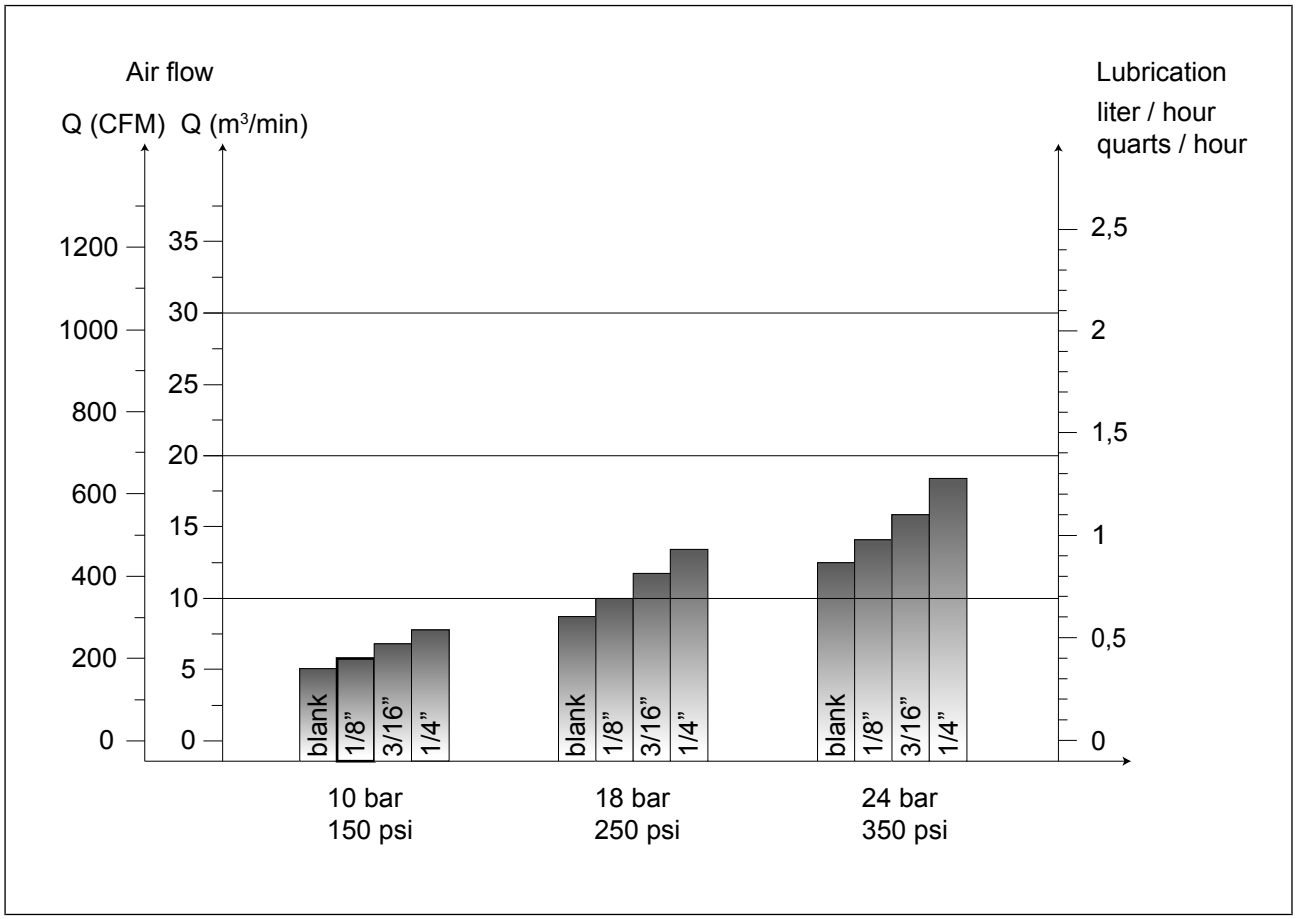
Description	Specifications*
Net weight	25 kg (60 lb)
Hammer outside diameter	81,3 mm (3,20 in)
Hammer length	823 mm (32,40 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	81,3 mm (3,20 in)
Piston case outside diameter (Recommended time to reverse)	75,7 mm (2,98 in)
Piston case outside diameter (Time to replace)	70,4 mm (2,77 in)
Piston case inside diameter (Time to replace)	61,443 mm (2,42 in)
Piston diameter (Time to replace)	61,138 mm (2,41 in)
Maximum piston case/piston clearance	0,30 mm (0,01 in)
Driver sub length (Recommended time to replace)	85,0 mm (3,35 in)

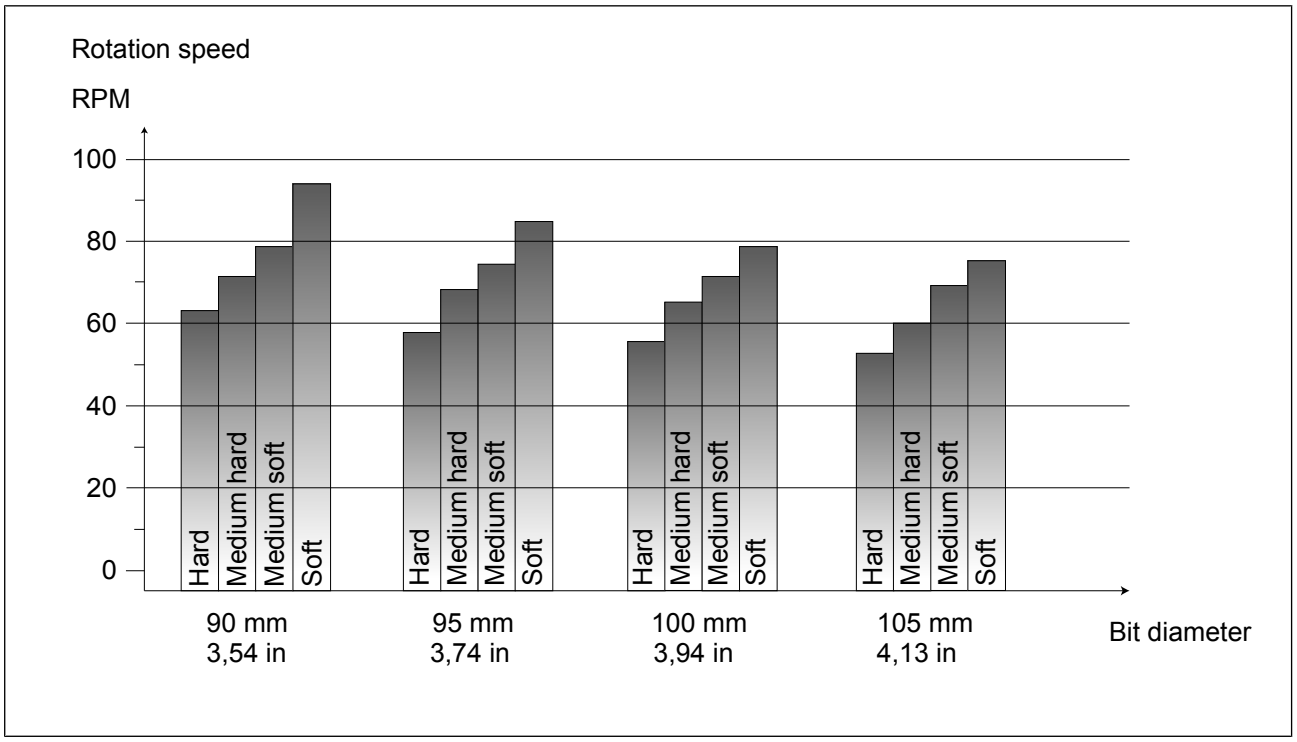
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550 3"

Correct lubrication during drilling!



ROTATION SPEED WITH VARIOUS BIT SIZES: RH550 3"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.3. Technical specifications RH550 4"

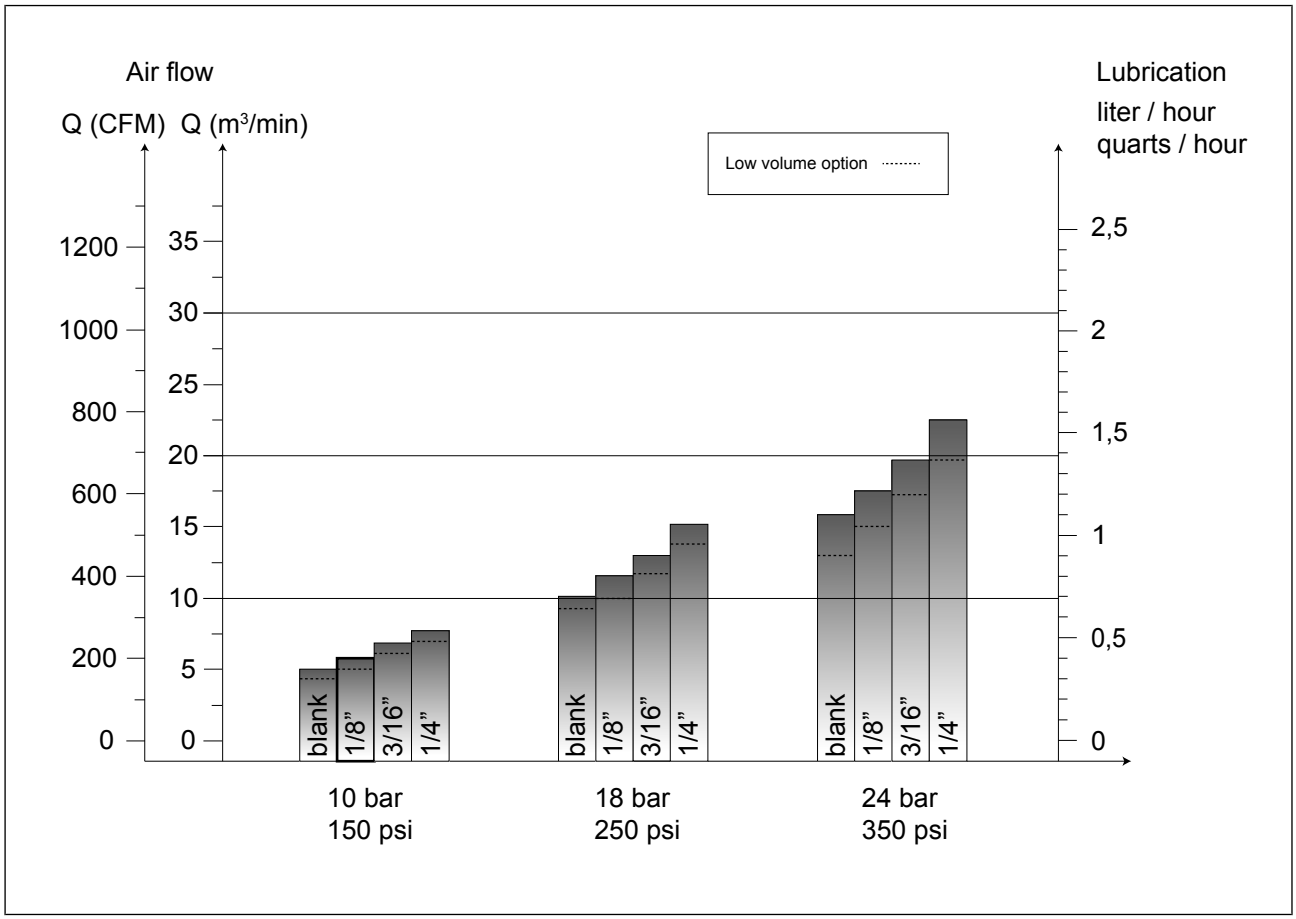
Description	Specifications*
Net weight	38 kg (80 lb)
Hammer outside diameter	98 mm (3,86 in)
Hammer length	914 mm (35,98 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	98,0 mm (3,86 in)
Piston case outside diameter (Recommended time to reverse)	93,0 mm (3,66 in)
Piston case outside diameter (Time to replace)	88,0 mm (3,46 in)
Piston case inside diameter (Time to replace)	77,711 mm (3,06 in)
Piston diameter (Time to replace)	77,381 mm (3,05 in)
Maximum piston case/piston clearance	0,33 mm (0,01 in)
Driver sub length (Recommended time to replace)	60,4 mm (2,38 in)

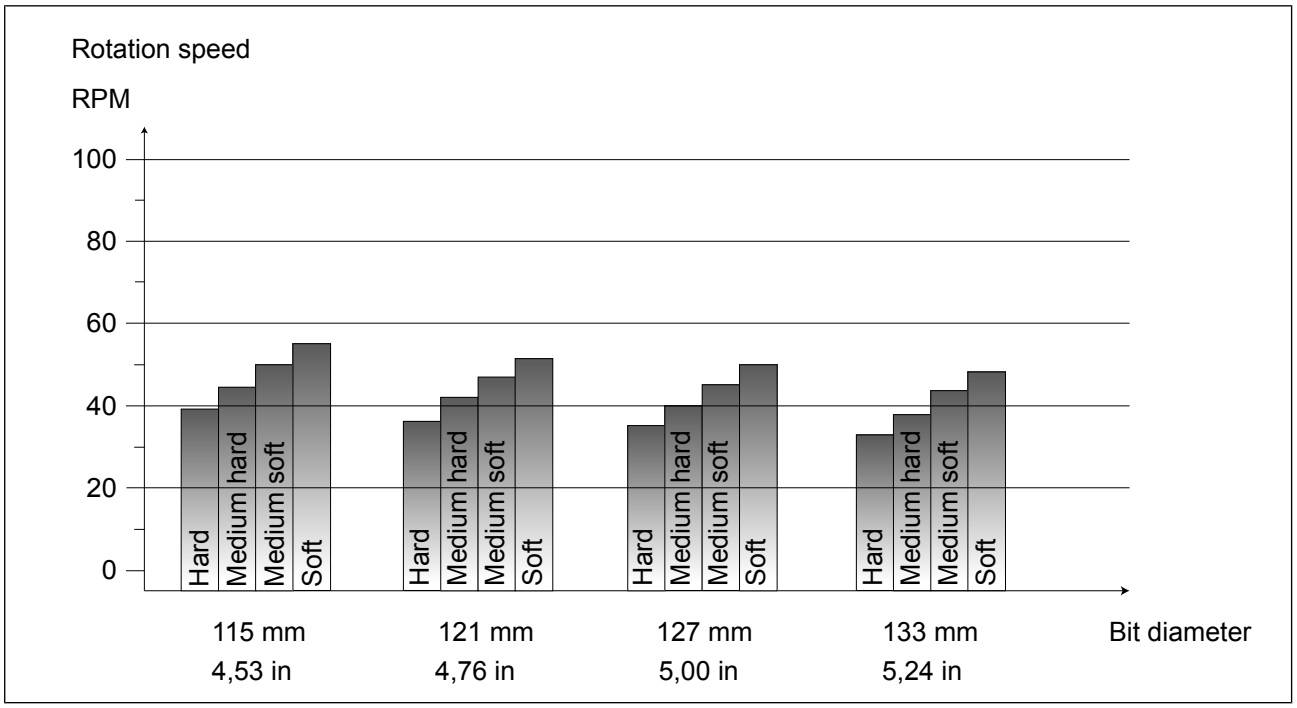
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550 4"

Correct lubrication during drilling!



ROTATION SPEED WITH VARIOUS BIT SIZES: RH550 4"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.4. Technical specifications RH550 5"

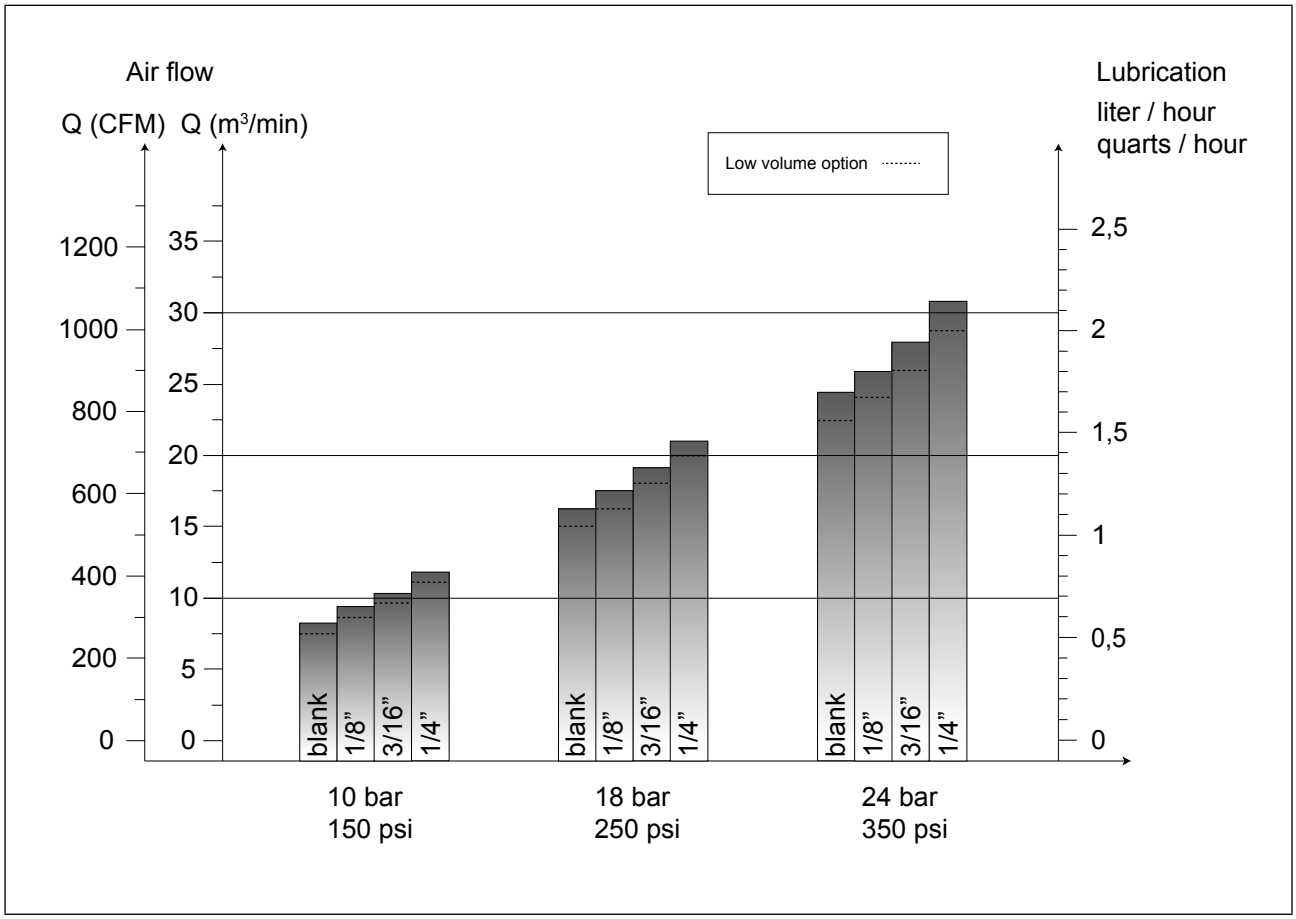
Description	Specifications*
Net weight	68 kg (150 lb)
Hammer outside diameter	120 mm (4,72 in)
Hammer length	987 mm (38,86 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	120,0 mm (4,72 in)
Piston case outside diameter (Time to replace)	108,0 mm (4,25 in)
Piston case inside diameter (Time to replace)	98,76 mm (3,89 in)
Piston diameter (Time to replace)	96,43 mm (3,80 in)
Maximum piston case/piston clearance	0,33 mm (0,01 in)
Driver sub length (Recommended time to replace)	81,28 mm (3,20 in)

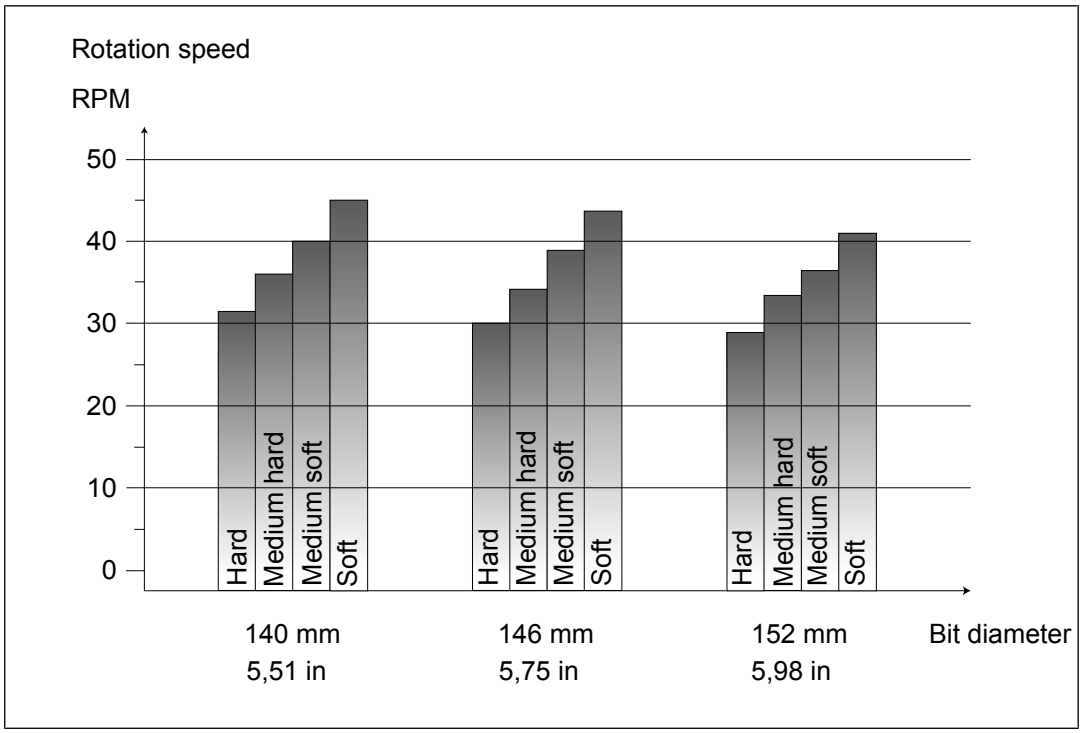
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550 5"

Correct lubrication during drilling!



ROTATION SPEED WITH VARIOUS BIT SIZES: RH550 5"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.5. Technical specifications RH550r 5"

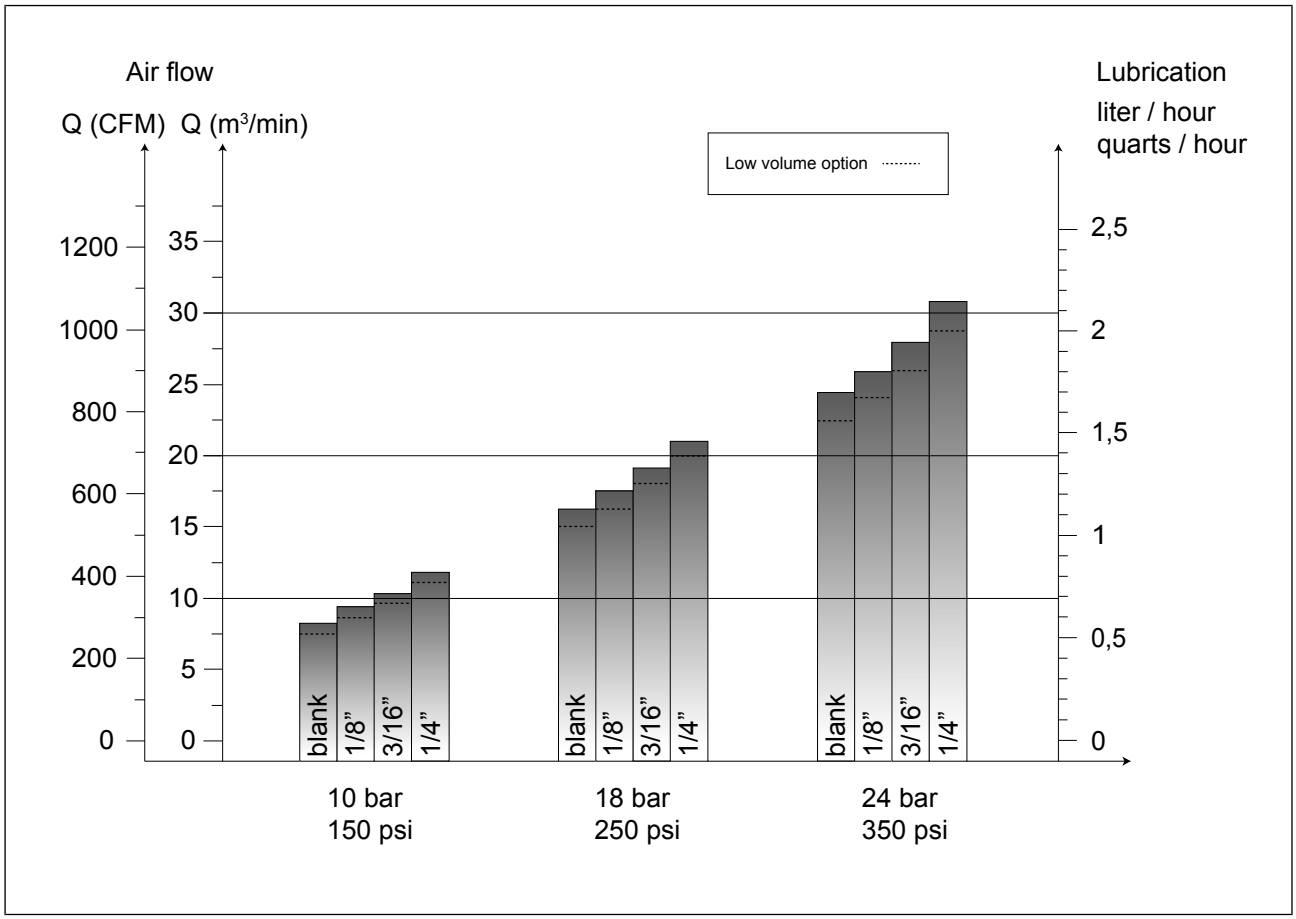
Description	Specifications*
Net weight	73 kg (160 lb)
Hammer outside diameter	126 mm (4,96 in)
Hammer length	987 mm (38,86 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	126,0 mm (4,72 in)
Piston case outside diameter (Recommended time to reverse)	117,0 mm (4,49 in)
Piston case outside diameter (Time to replace)	108,0 mm (4,25 in)
Piston case inside diameter (Time to replace)	98,76 mm (3,89 in)
Piston diameter (Time to replace)	96,43 mm (3,80 in)
Maximum piston case/piston clearance	0,33 mm (0,01 in)
Driver sub length (Recommended time to replace)	81,28 mm (3,20 in)

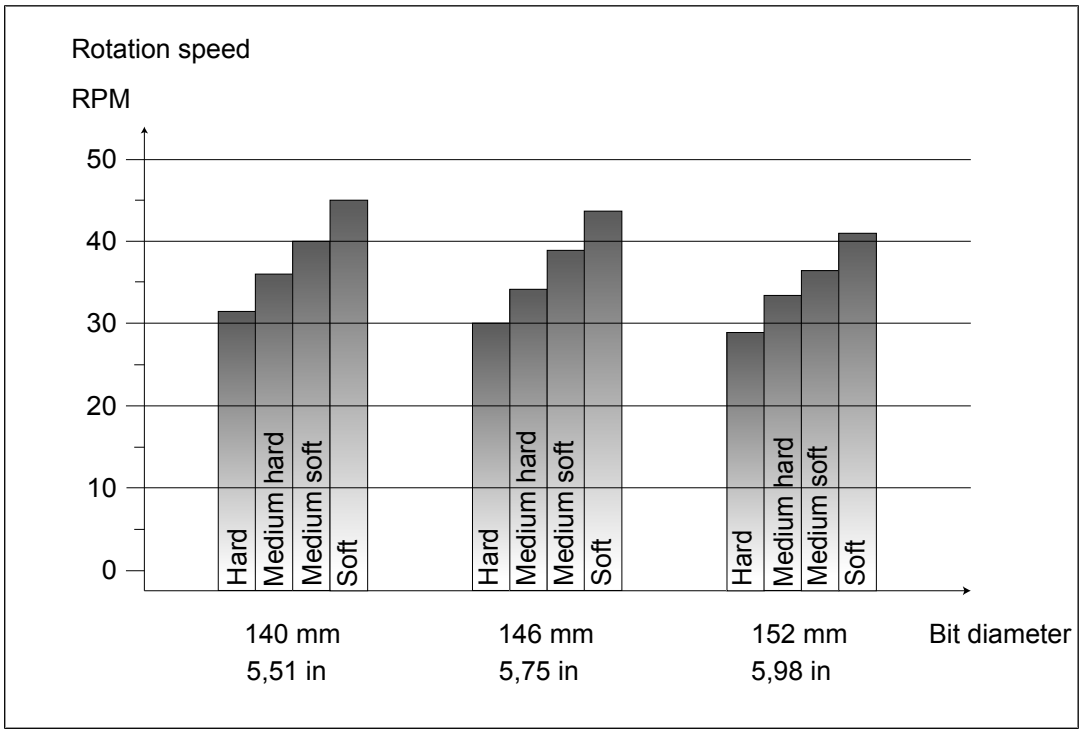
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550r 5"

Correct lubrication during drilling!



ROTATION SPEED WITH VARIOUS BIT SIZES: RH550r 5"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.6. Technical specifications RH550g 5"

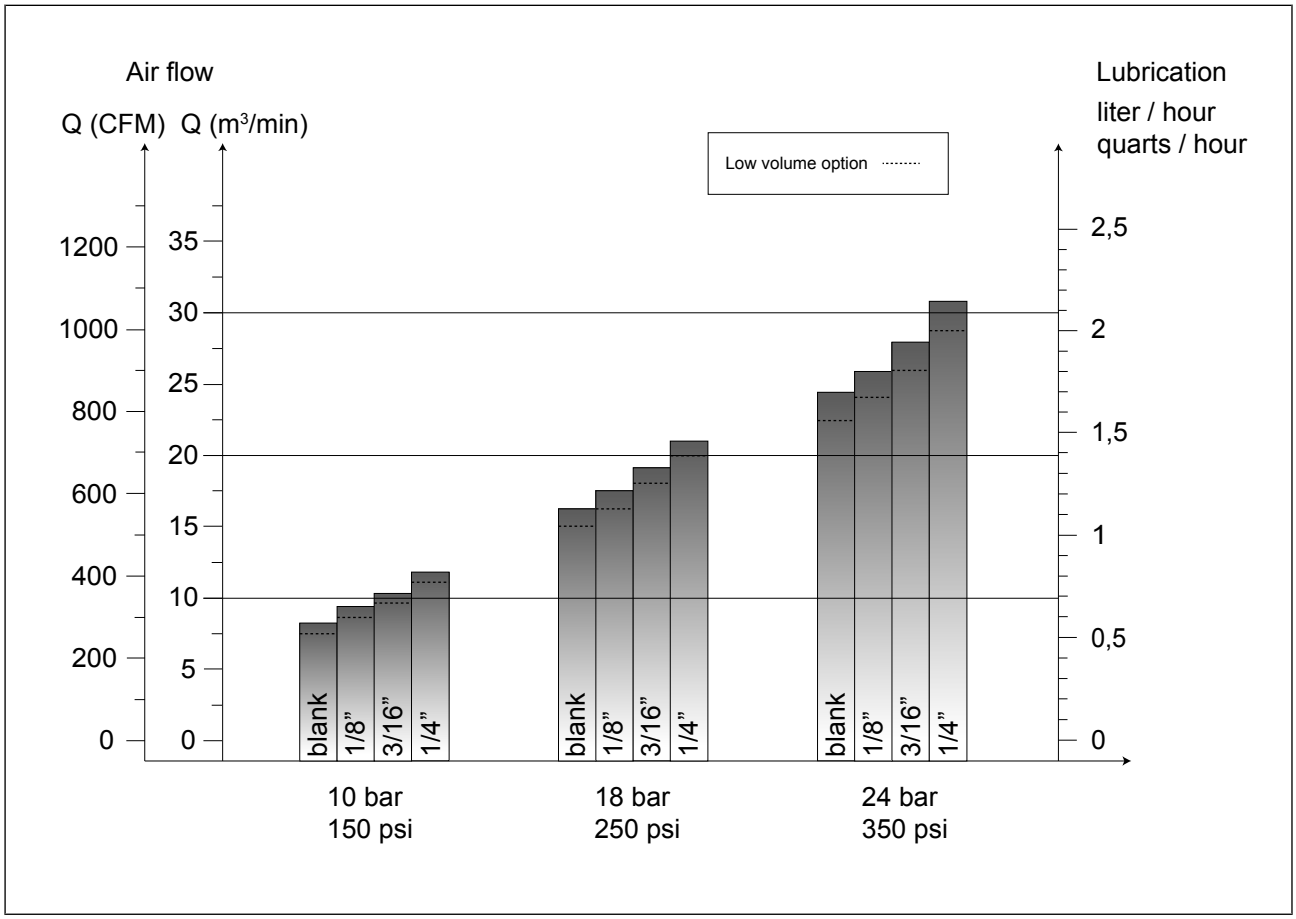
Description	Specifications*
Net weight	73 kg (160 lb)
Hammer outside diameter	126 mm (4,96 in)
Hammer length	987 mm (38,86 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	126,0 mm (4,96 in)
Piston case outside diameter (Time to replace)	108,0 mm (4,25 in)
Piston case inside diameter (Time to replace)	98,76 mm (3,89 in)
Piston diameter (Time to replace)	96,43 mm (3,80 in)
Maximum piston case/piston clearance	0,33 mm (0,01 in)
Driver sub length (Recommended time to replace)	81,28 mm (3,20 in)

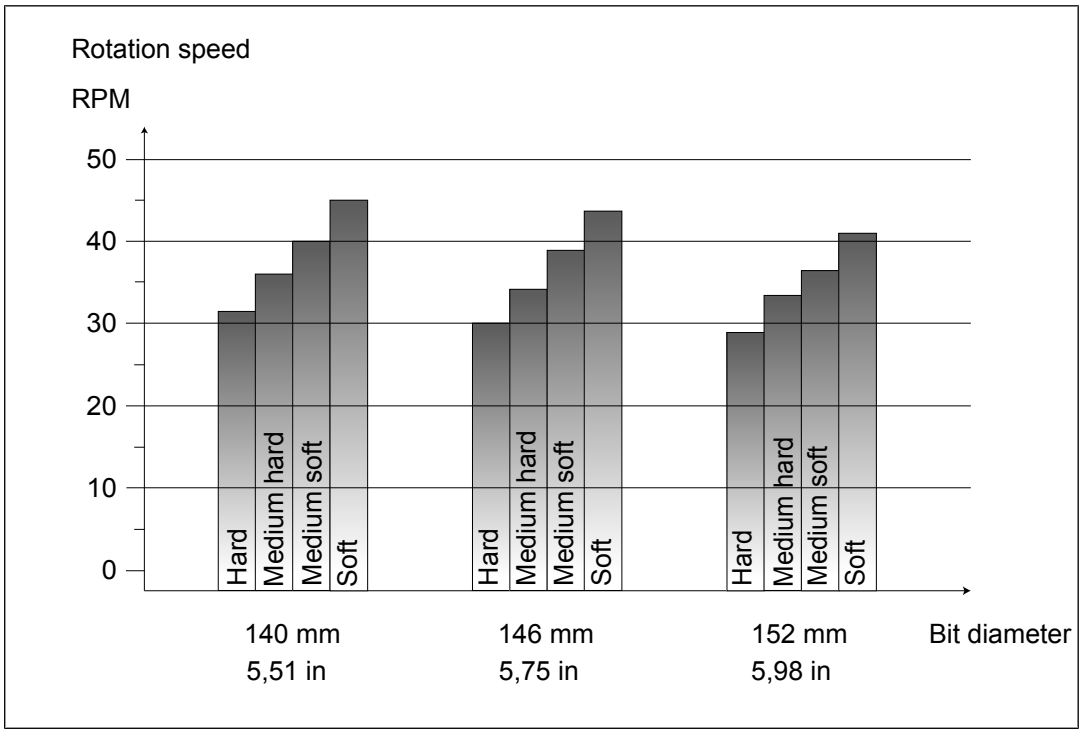
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550g 5"

Correct lubrication during drilling!



ROTATION SPEED WITH VARIOUS BIT SIZES: RH550g 5"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.7. Technical specifications RH550 6" and RH550w 6"

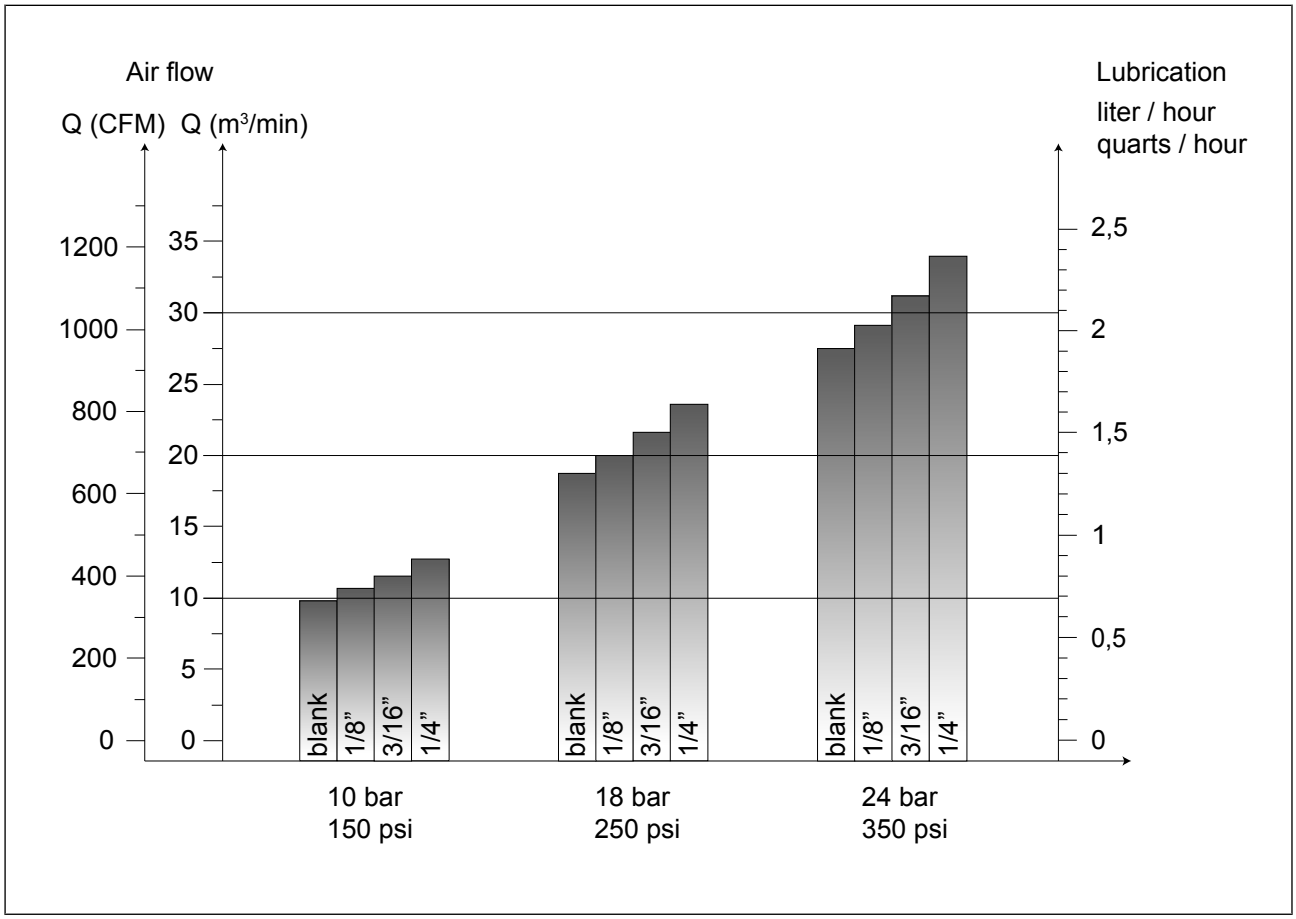
Description	Specifications*
Net weight	72 kg (160 lb)
Hammer outside diameter	142 mm (5,59 in)
Hammer length	922 mm (36,30 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	142,0 mm (5,59 in)
Piston case outside diameter (Time to replace)	132,0 mm (5,20 in)
Piston case inside diameter (Time to replace)	120,63 mm (4,75 in)
Piston diameter (Time to replace)	120,3 mm (7,74 in)
Maximum piston case/piston clearance	0,33 mm (0,01 in)
Driver sub length (Recommended time to replace)	61,0 mm (2,40 in)

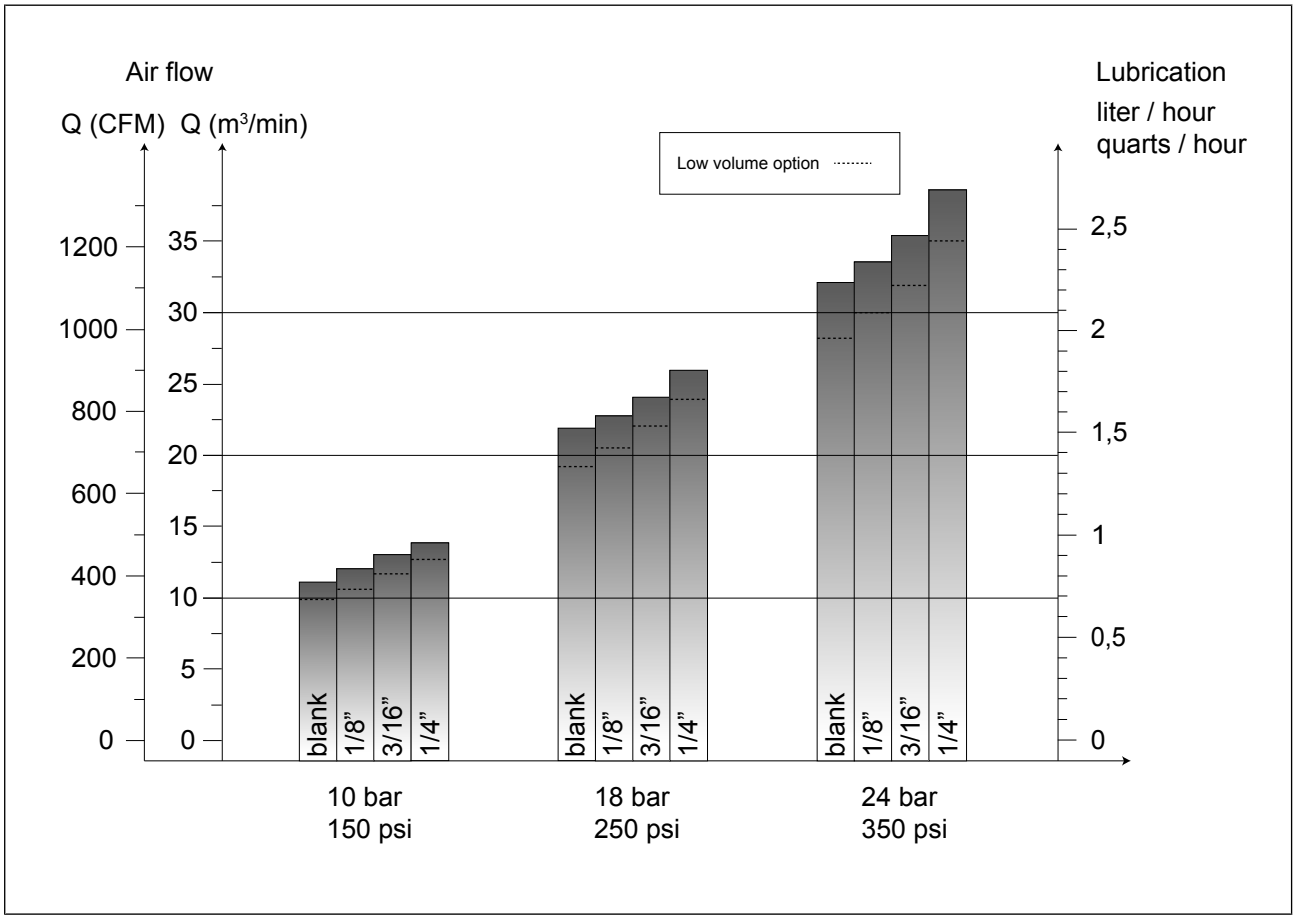
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550 6"

Correct lubrication during drilling!



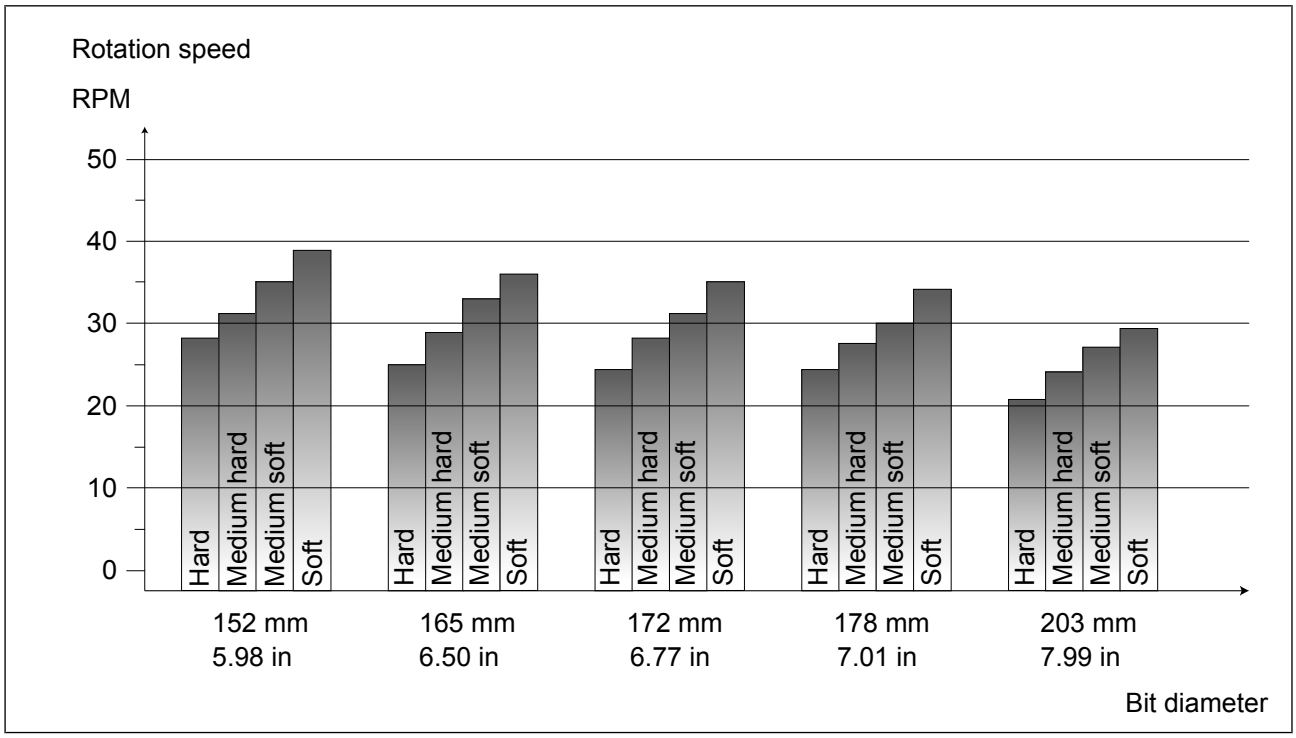
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550w 6"

Correct lubrication during drilling!



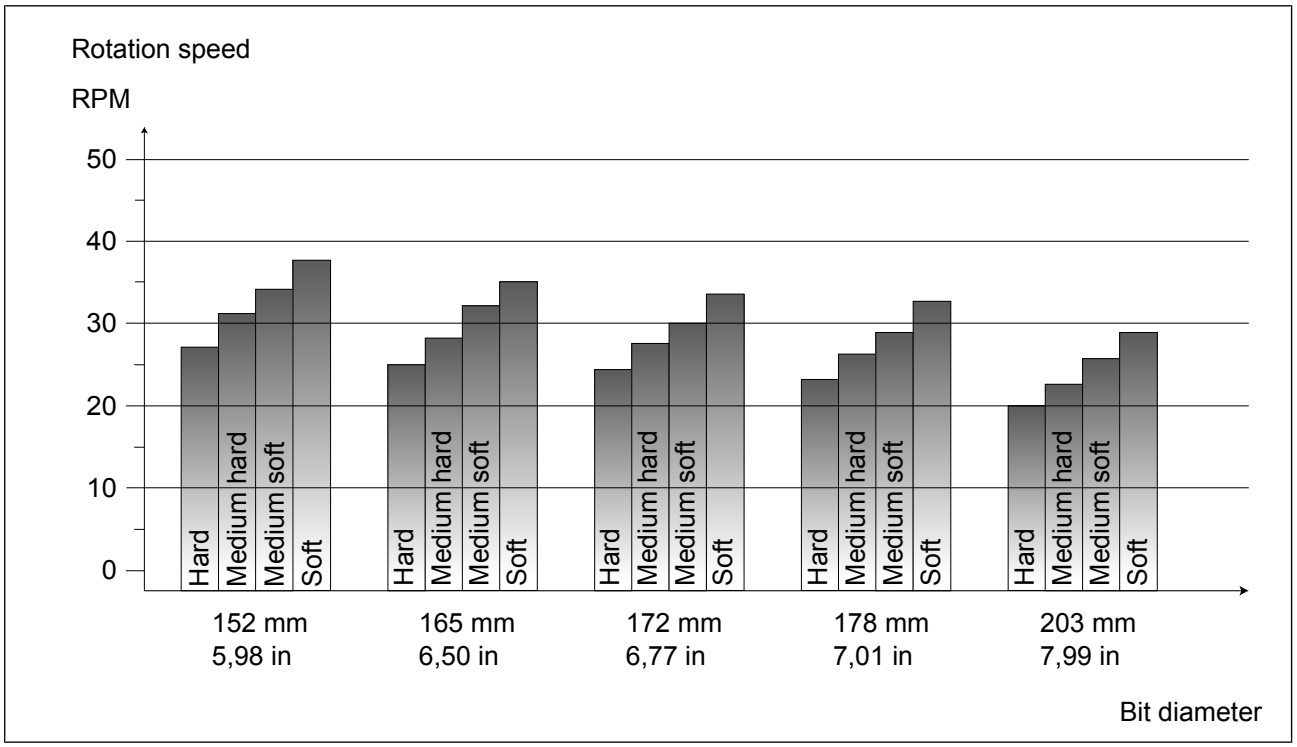
ROTATION SPEED WITH VARIOUS BIT SIZES: RH550 6"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



ROTATION SPEED WITH VARIOUS BIT SIZES: RH550w 6"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.8. Technical specifications RH550g 6"

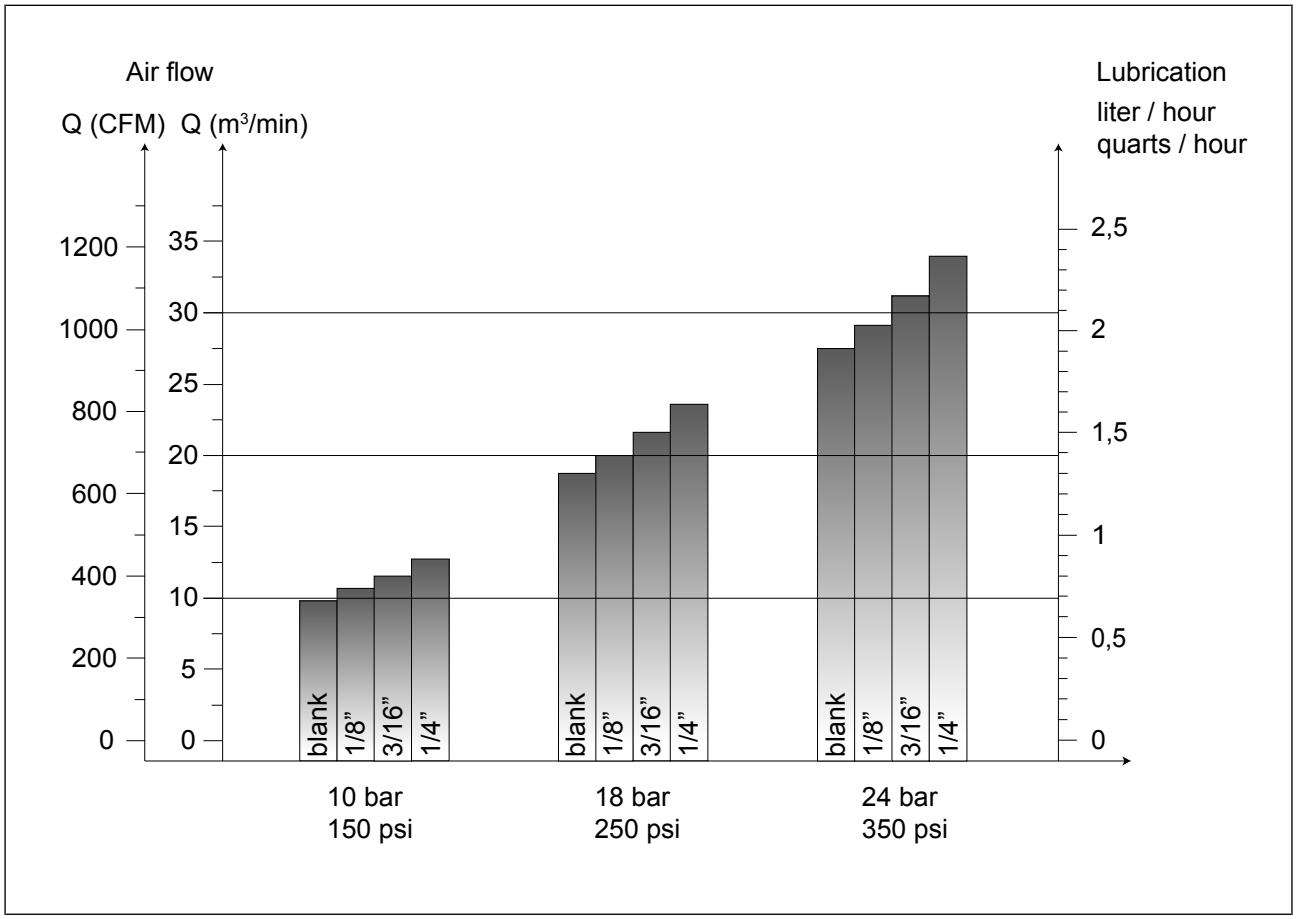
Description	Specifications*
Net weight	82 kg (180 lb)
Hammer outside diameter	150 mm (5,91 in)
Hammer length	922 mm (36,30 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	150,0 mm (5,91 in)
Piston case outside diameter (Time to replace)	132,0 mm (5,20 in)
Piston case inside diameter (Time to replace)	120,63 mm (4,75 in)
Piston diameter (Time to replace)	120,3 mm (7,74 in)
Maximum piston case/piston clearance	0,33 mm (0,01 in)
Driver sub length (Recommended time to replace)	61,0 mm (2,40 in)

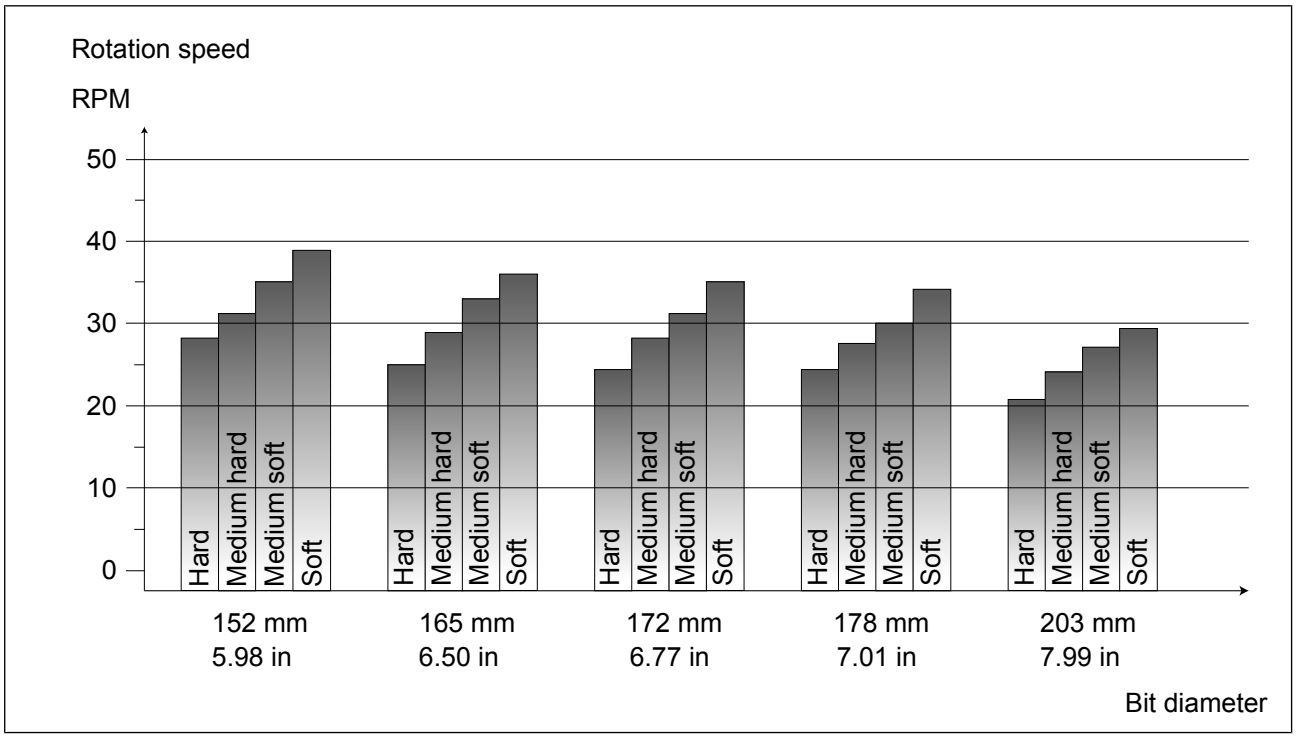
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550g 6"

Correct lubrication during drilling!



ROTATION SPEED WITH VARIOUS BIT SIZES: RH550g 6"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.9. Technical specifications RH550r 6"

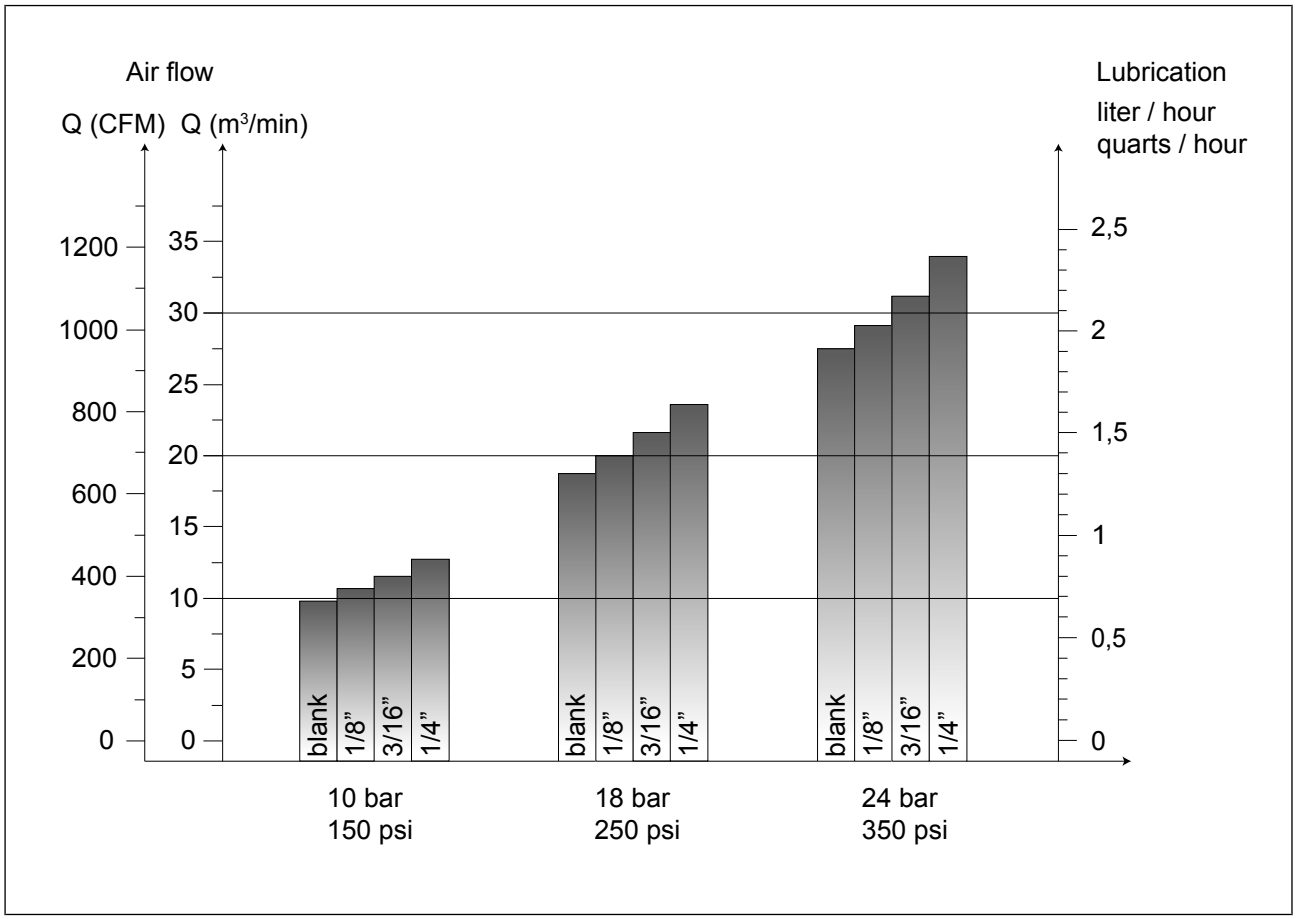
Description	Specifications*
Net weight	82 kg (180 lb)
Hammer outside diameter	150 mm (5,9 in)
Hammer length	922 mm (36,30 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	150,0 mm (5,9 in)
Piston case outside diameter (Recommended time to reverse)	141,0 mm (5,55 in)
Piston case outside diameter (Time to replace)	132,0 mm (5,20 in)
Piston case inside diameter (Time to replace)	120,63 mm (4,75 in)
Piston diameter (Time to replace)	120,3 mm (4,74 in)
Maximum piston case/piston clearance	0,33 mm (0,01 in)
Driver sub length (Recommended time to replace)	61,0 mm (2,40 in)

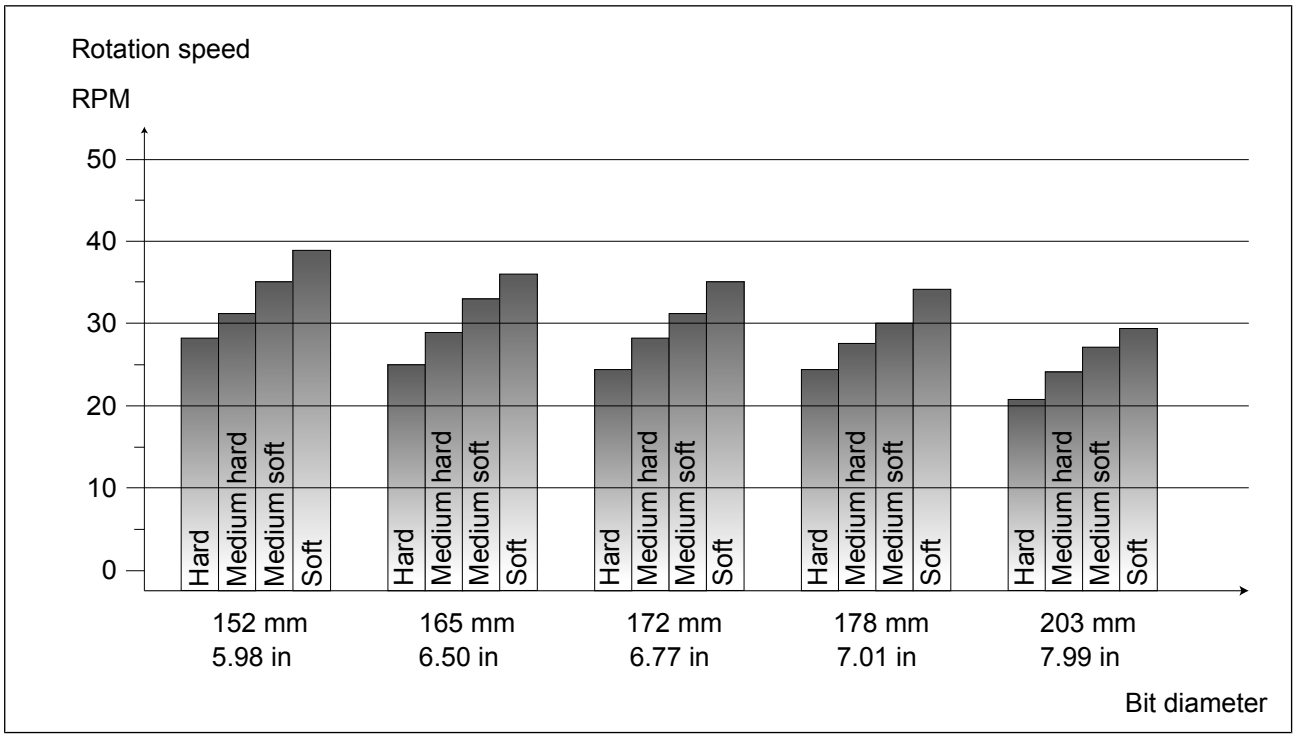
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550r 6"

Correct lubrication during drilling!



ROTATION SPEED WITH VARIOUS BIT SIZES: RH550r 6"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.10. Technical specifications RH550r 8"

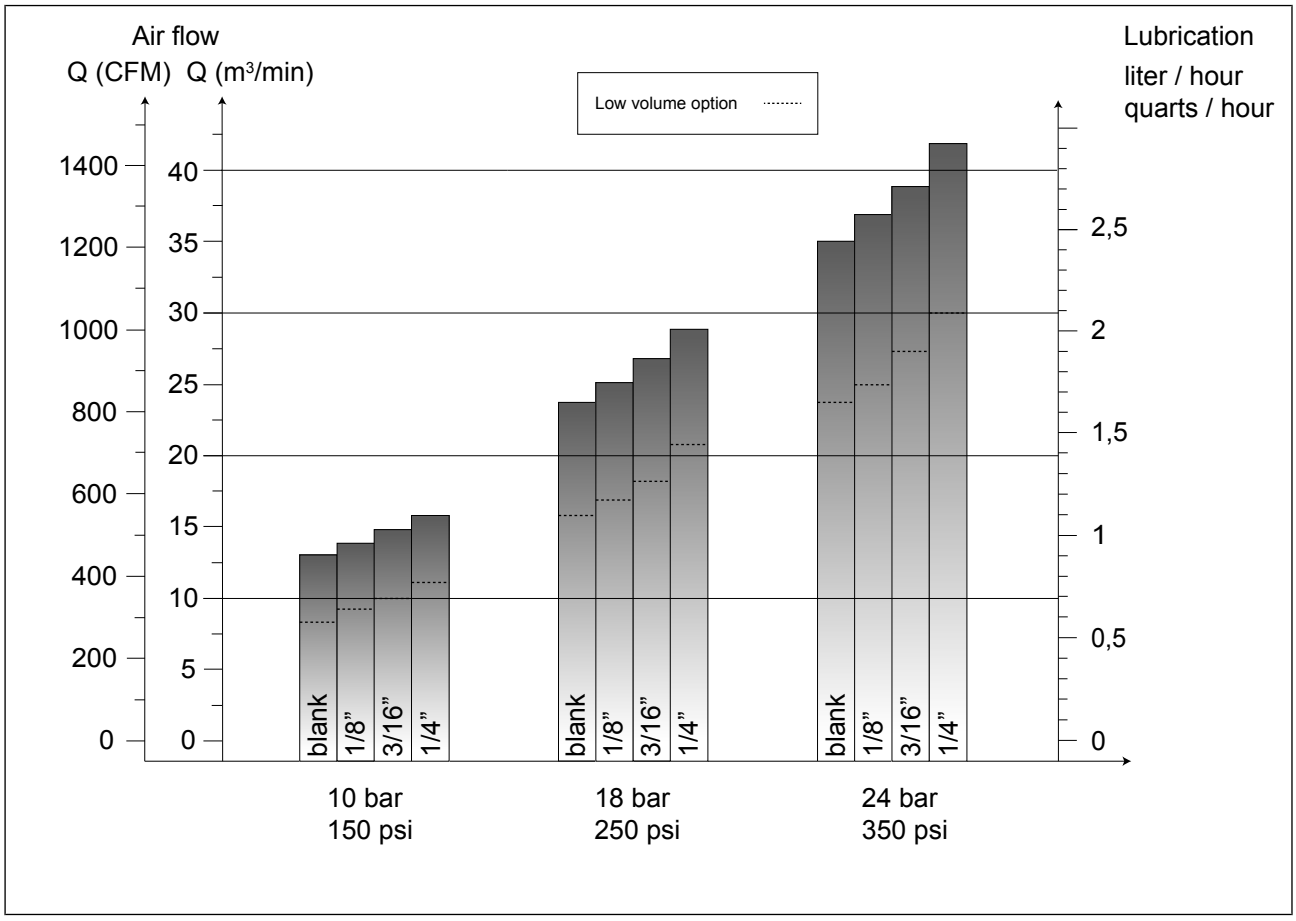
Description	Specifications*
Net weight	173 kg (380 lb)
Hammer outside diameter	181 mm (7,13 in)
Hammer length	1219 mm (47,99 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	181,0 mm (7,13 in)
Piston case outside diameter (Recommended time to reverse)	172,0 mm (6,77 in)
Piston case outside diameter (Time to replace)	164,0 mm (6,46 in)
Piston case inside diameter (Time to replace)	149,492 mm (5,89 in)
Piston diameter (Time to replace)	149,136 mm (5,87 in)
Maximum piston case/piston clearance	0,36 mm (0,01 in)
Driver sub length (Recommended time to replace)	99,0 mm (3,90 in)

FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550r 8"

Correct lubrication during drilling!



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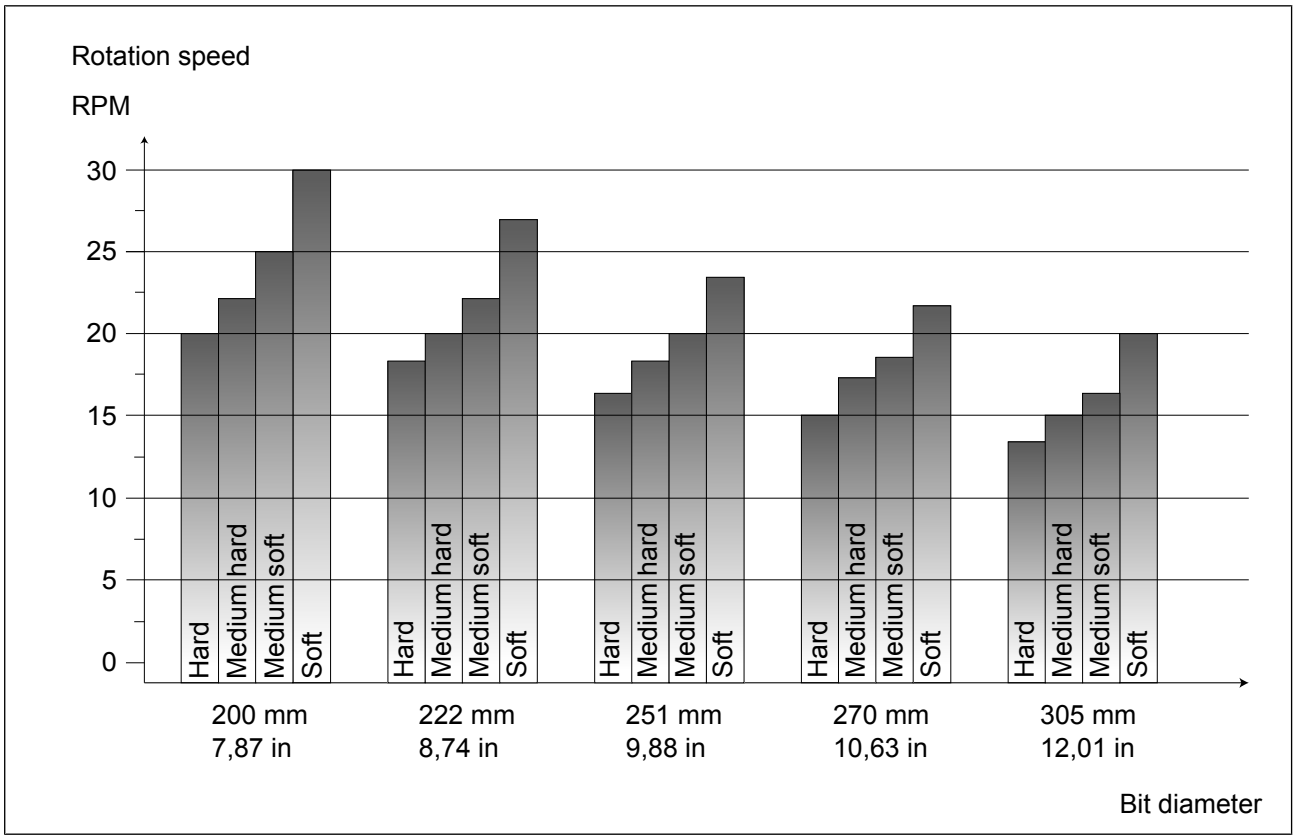
ROTATION SPEED WITH VARIOUS BIT SIZES: RH550r 8"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



7.11. Technical specifications RH550w 8"

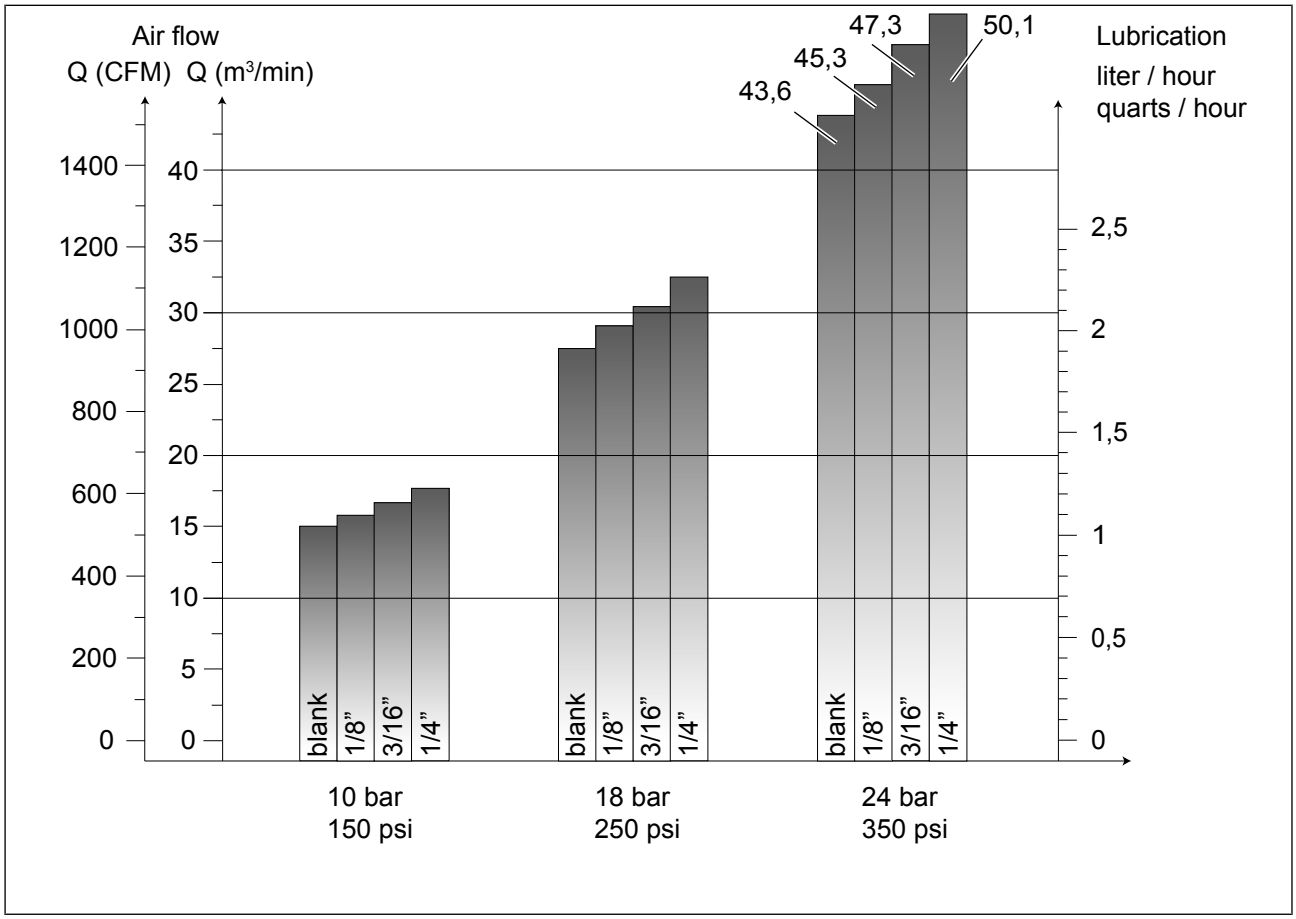
Description	Specifications*
Net weight	173 kg (380 lb)
Hammer outside diameter	181 mm (7,13 in)
Hammer length	1270 mm (50,0 in)
Maximum air pressure	24 bar (350 psi)

***Specifications are subject to change without prior notice.**

WEAR LIMITS:	
Description	**Specifications**
Piston case outside diameter (New)	181,0 mm (7,13 in)
Piston case outside diameter (Time to replace)	164,0 mm (6,46 in)
Piston case inside diameter (Time to replace)	149,492 mm (5,89 in)
Piston diameter (Time to replace)	149,136 mm (5,87 in)
Maximum piston case/piston clearance	0,36 mm (0,01 in)
Driver sub length (Recommended time to replace)	99,0 mm (3,90 in)

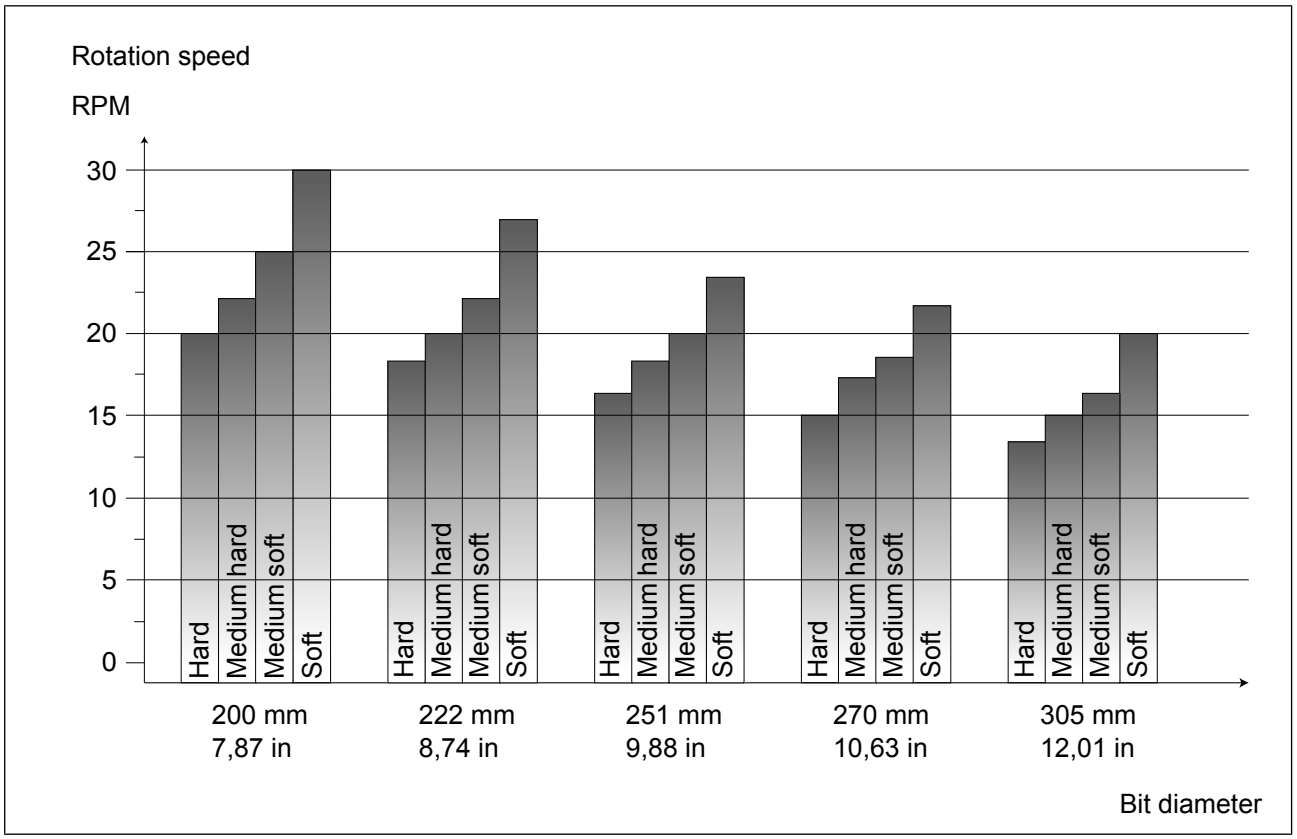
FLOW RATES AND LUBRICATION WITH VARIOUS CHOKE SIZES: RH550w 8"

Correct lubrication during drilling!



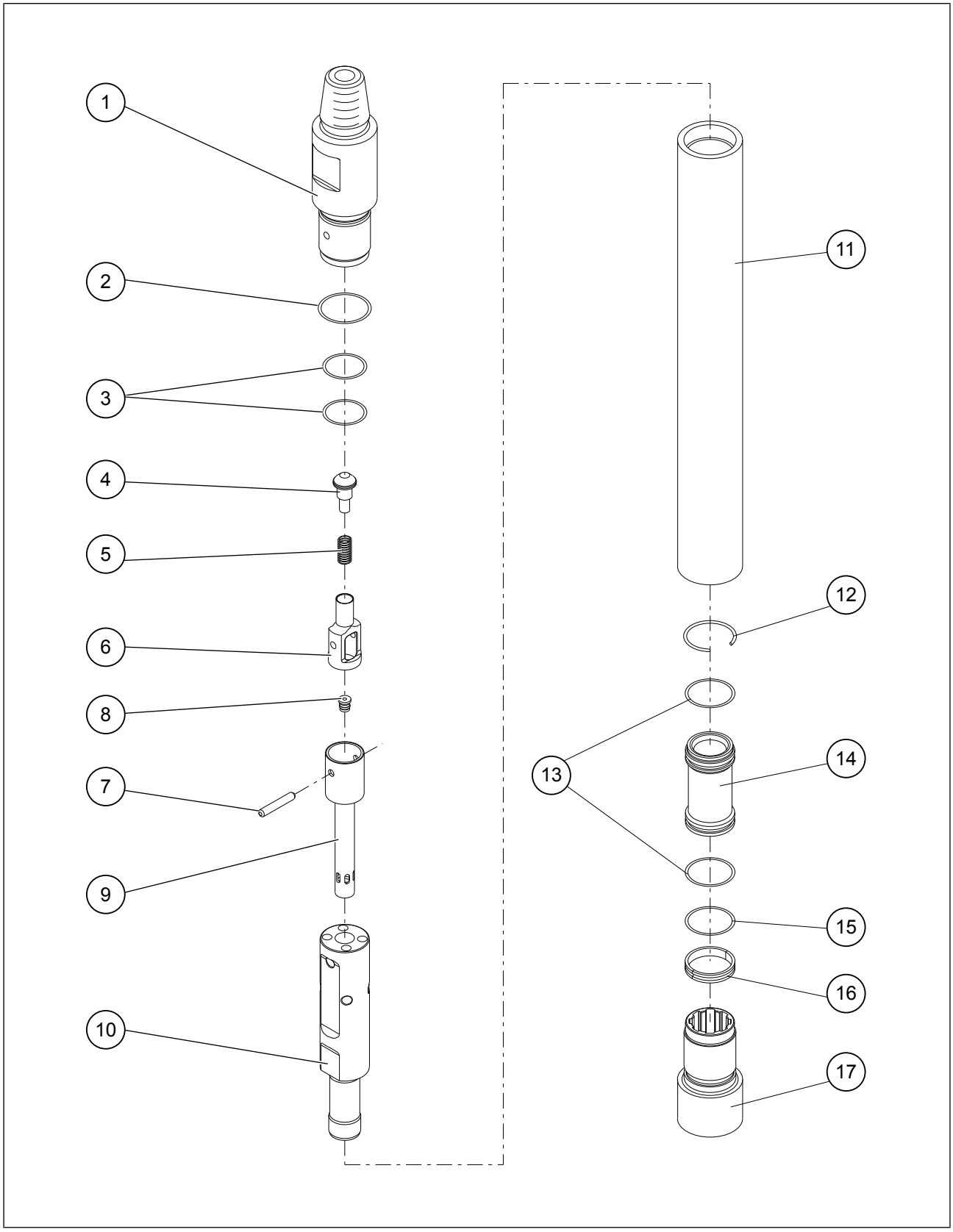
ROTATION SPEED WITH VARIOUS BIT SIZES: RH550w 8"

Rotational speed is largely determined by drilling conditions. As a result of its higher piston frequency and penetration rate, the RH550 may need a higher rotation speed than conventional hammers. Depending on the rock type and conditions, it may be necessary to increase rotation speed 10-15 percent to achieve the smoothest and most efficient drilling.



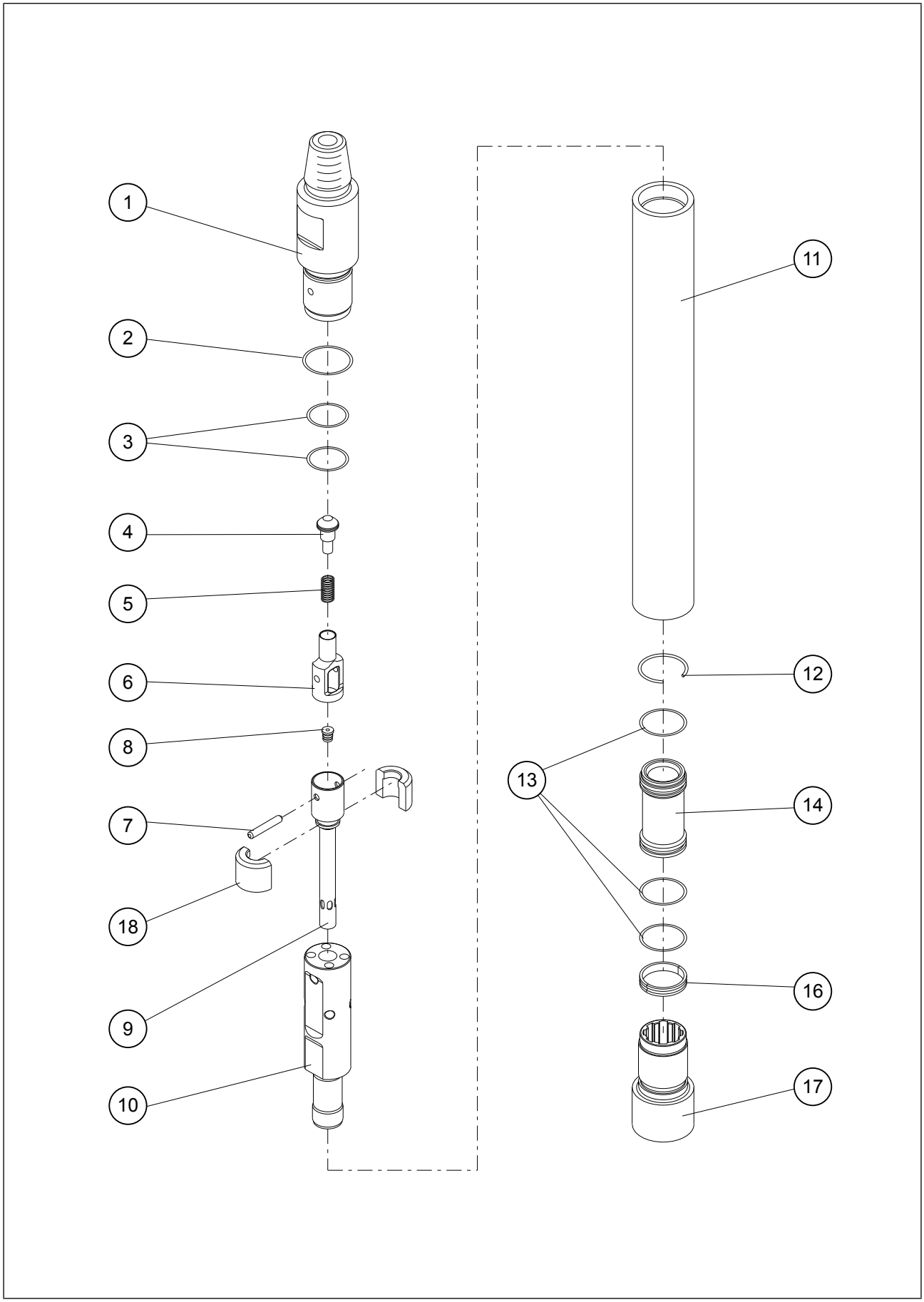
8. RH550 PARTS

RH550r 3”



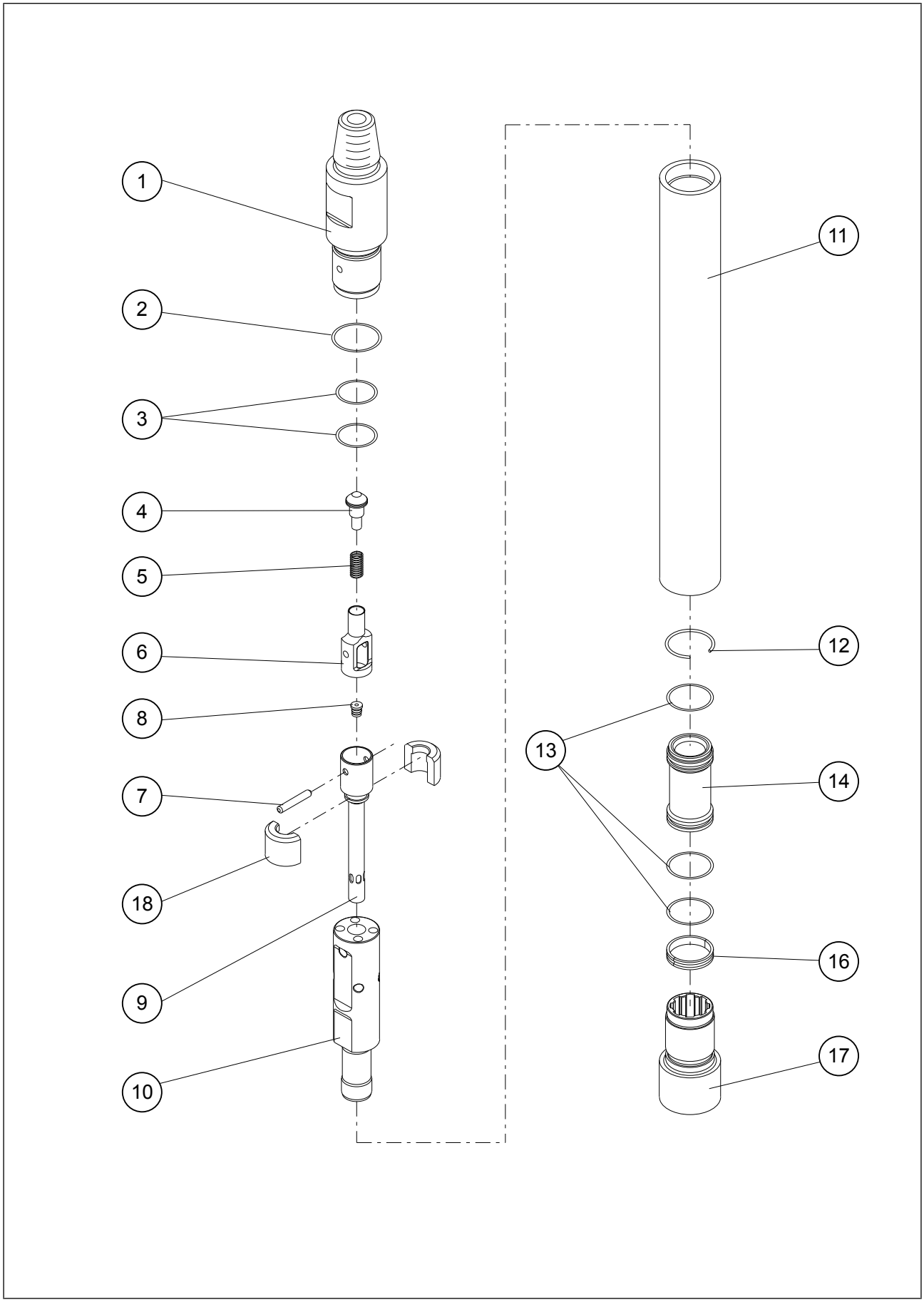
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5530-RMA/16S	3”, 2 3/8” API REG PIN	1
	Complete Hammer	32-5530-RMA/63S	3”, #21 CUBEX PIN	1
1.1	Top sub (incl. parts 2 and 3)	33-3A001/16A	2 3/8” API REG PIN	1
1.2	Top sub (incl. parts 2 and 3)	33-3A001/63A	#21 CUBEX PIN	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99006A		1
5	Check valve spring	22-99149		1
6	Check valve guide	39-3A001		1
7	Feed tube retaining pin	12-99021		1
8	Choke set	29-48017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-3A001A		1
10	Piston	36-3A081		1
11	Piston case (incl. part 12)	35-3A006A		1
12	Retaining ring	23-99027		1
13	O-ring			3
14	Guide sleeve (incl.part 13)	26-3A010A		1
15	O-ring			1
16	Bit retaining ring (incl. part 15)	27-3A006A		1
17	Driver sub	34-3A006		1
	Parts to be ordered separately:			
30	Seal kit	38-3A056	Including parts 2, 3, 13 and 15.	1

RH550 4”



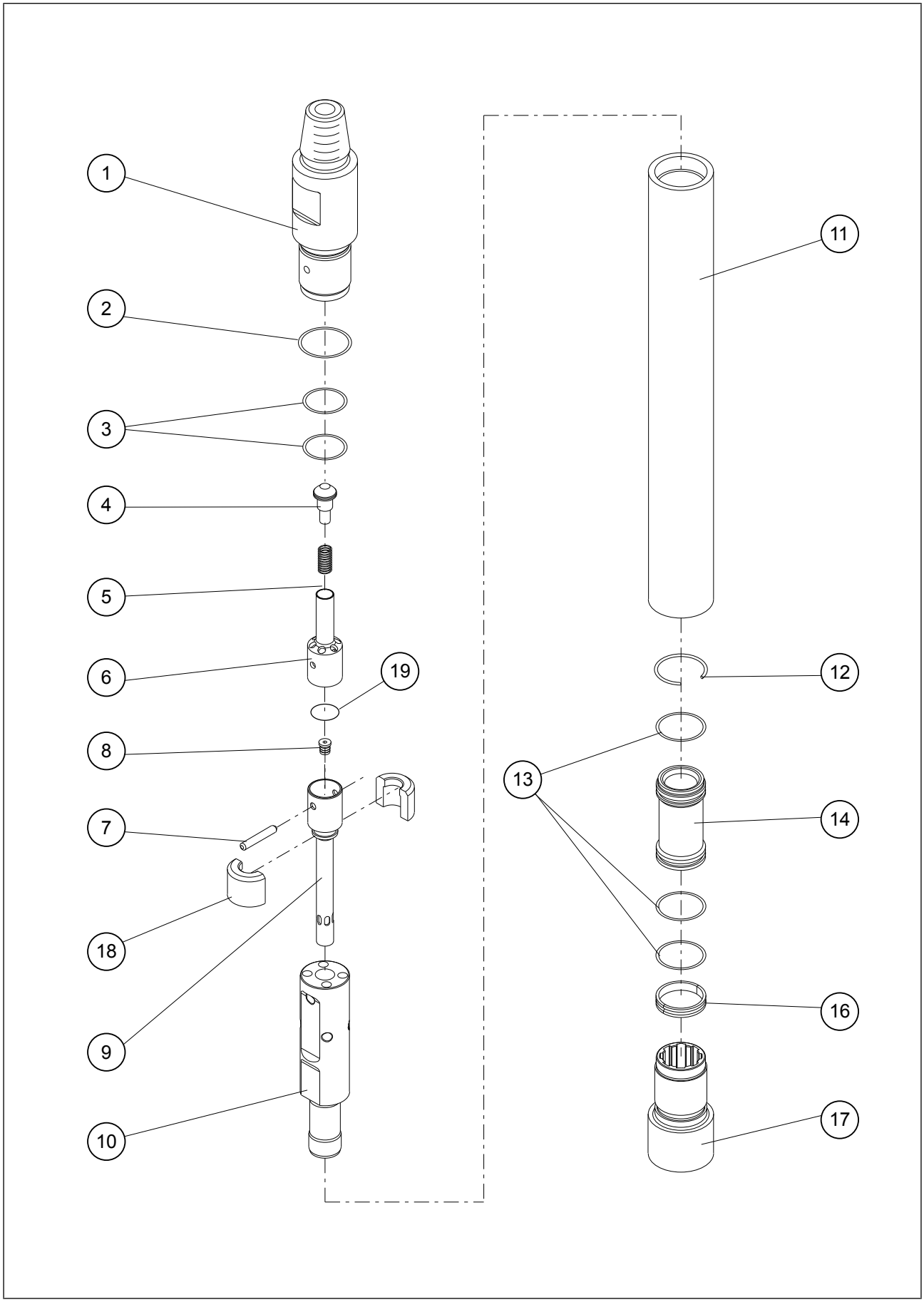
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5540-HMA/11S	4”, 2 7/8” API REG PIN	1
	Complete Hammer	32-5540-HMA/16S	4”, 2 3/8” API REG PIN	1
1.1	Top sub	33-48001-1/11	2 7/8” API REG PIN	1
1.2	Top sub	33-48001-1-16	2 3/8” API REG PIN	1
2	O-ring			1
3	O-ring			2
4	Check valve dart	25-99001		1
5	Check valve spring	22-99071		1
6	Check valve guide	39-48001		1
7	Feed tube retaining pin	12-99014		1
8	Choke set	29-48017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube	37-48001		1
10	Piston	36-48K81		1
11	Piston case	35-48014		1
12	Retaining ring	23-99029		1
13	O-ring			3
14	Guide sleeve	26-48J10		1
16	Bit retaining ring	27-48006		1
17	Driver sub	34-48006		1
18	Tuning ring	56-48552	Low volume option	1
	Parts to be ordered separately:			
30	Seal kit	38-48056	Including parts 2, 3 and 13.	1

RH550r 4”



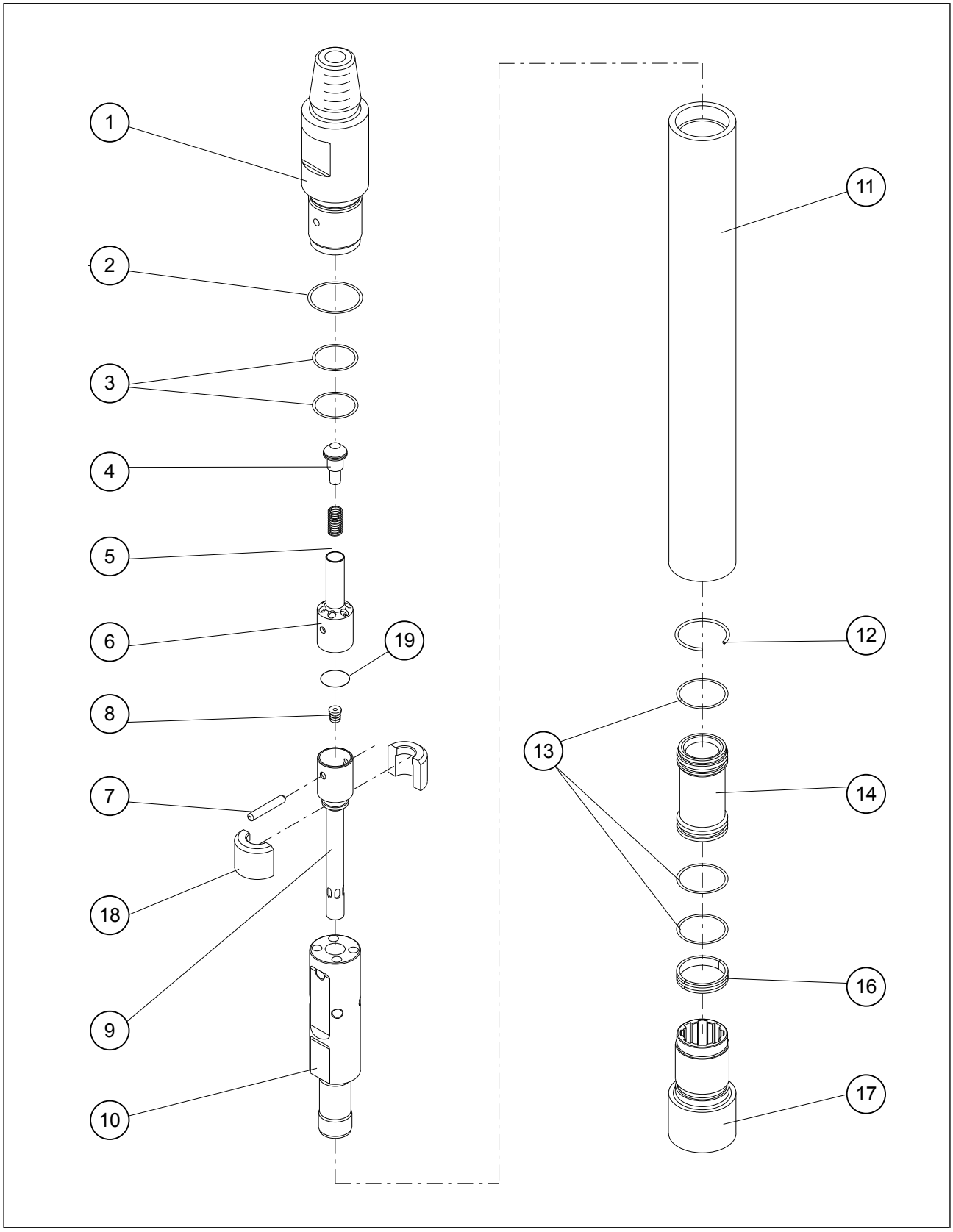
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5540-RMA/11S	4”, 2 7/8” API REG PIN	1
	Complete Hammer	32-5540-RMA/16S	4”, 2 3/8” API REG PIN	1
	Complete Hammer	32-5540-RMA/77S	4”, #24 CUBEX PIN	1
1.1	Top sub (incl. parts 2 and 3)	33-48001-1/11A	2 7/8” API REG PIN	1
1.2	Top sub (incl. parts 2 and 3)	33-48001-1/16A	2 3/8” API REG PIN	1
1.3	Top sub (incl. parts 2 and 3)	33-48001-1/77A	#24 CUBEX PIN	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99001A		1
5	Check valve spring	22-99071		1
6	Check valve guide	39-48001		1
7	Feed tube retaining pin	12-99014		1
8	Choke set	29-48017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-48001A		1
10	Piston	36-48J81/B		1
11	Piston case (incl. part 12)	35-48014A		1
12	Retaining ring	23-99029		1
13	O-ring			3
14	Guide sleeve (incl. part 13)	26-48J10A		1
16	Bit retaining ring (incl. part 13)	27-48006A		1
17	Driver sub	34-48006		1
18	Tuning ring	56-48552	Low volume option	1
	Parts to be ordered separately:			
30	Seal kit	38-48056	Including parts 2, 3 and 13.	1

RH550 5”



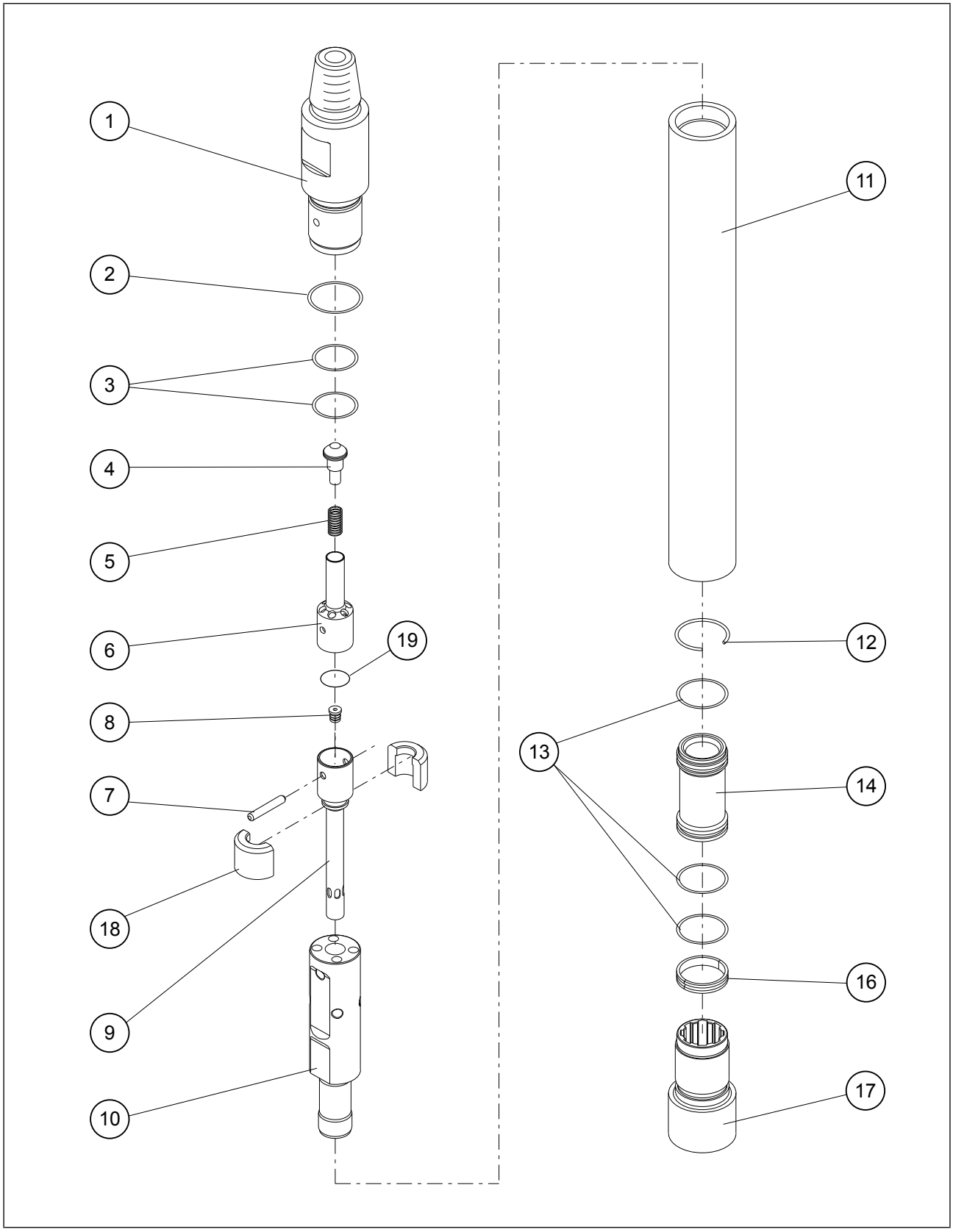
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5550-SMA/04S	5”, 3 1/2” API REG PIN	1
	Complete Hammer	32-5550-SMA/11S	5”, 2 7/8” API REG PIN	1
	Complete Hammer	32-5550-SMA/77S	5”, #24 CUBEX PIN	1
1.1	Top sub (incl. part 2 and 3)	33-58D01/04A	3 1/2” API REG PIN	1
1.2	Top sub (incl. parts 2 and 3)	33-58D01/11A	2 7/8” API REG PIN	1
1.3	Top sub (incl. parts 2 and 3)	33-58D01/77A	#24 CUBEX PIN	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99000A		1
5	Check valve spring	22-99072		1
6	Check valve guide	39-58S01		1
7	Feed tube retaining pin	12-99018		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-58001A		1
10	Piston	36-58J81		1
11	Piston case (incl. part 12)	35-58D06A		1
12	Retaining ring	23-99032		1
13	O-ring			3
14	Guide sleeve (incl. part 13)	26-58J10A		1
16	Bit retaining ring (incl. part 13)	27-58006A		1
17	Driver sub	34-58D69		1
18	Tuning ring	56-58552	Low volume option	1
19	O-ring			1
	Parts to be ordered separately:			
30	Seal kit	38-58D56	Including parts 2, 3, 13 and 19.	1

RH550r 5”



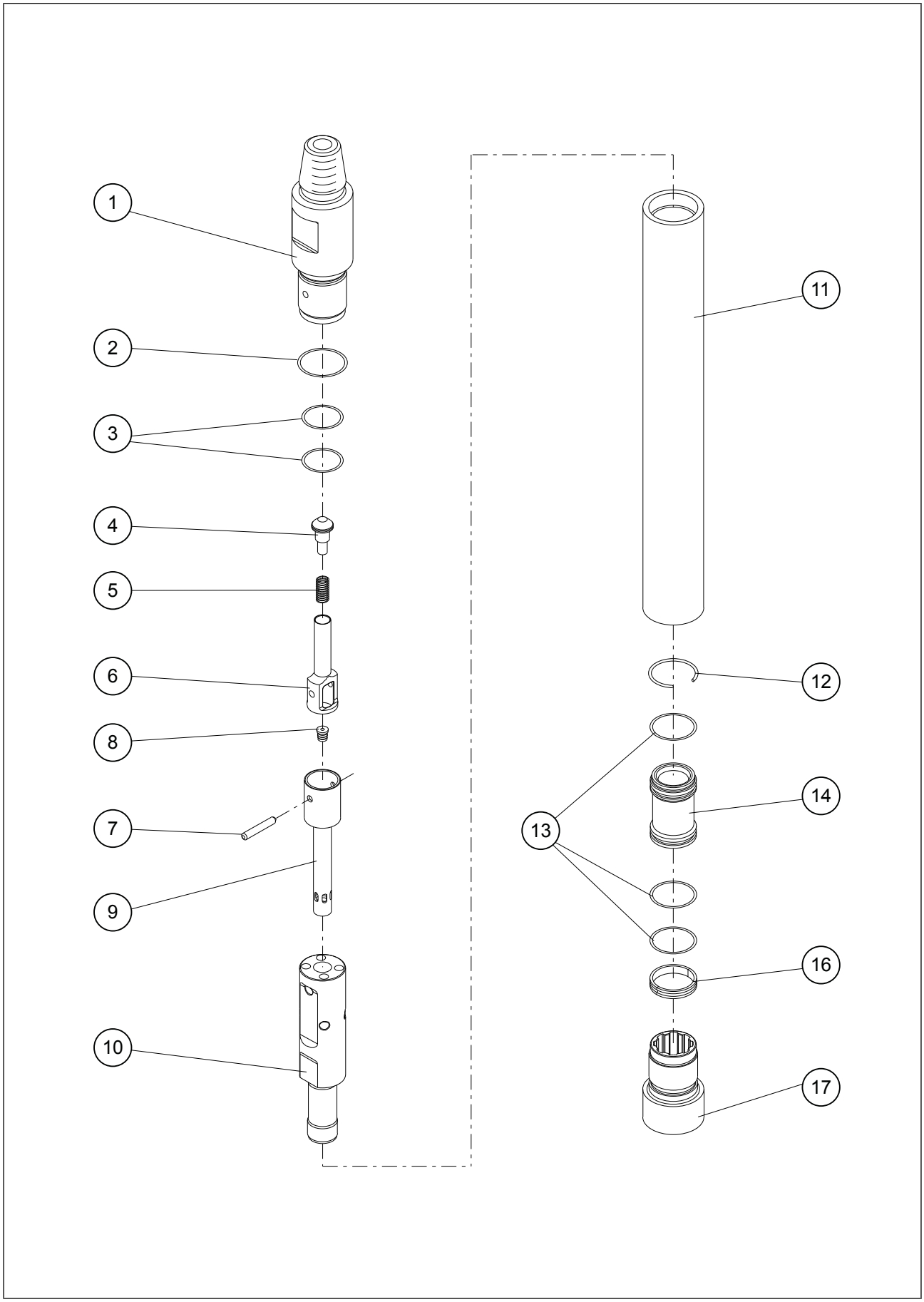
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5555-RMA/04C	5”, 3 1/2” API REG PIN RE-TRAC	1
	Complete Hammer	32-5555-RMA/11C	5”, 2 7/8” API REG PIN RE-TRAC	1
	Complete Hammer	32-5555-RMA/77C	5”, #24 CUBEX PIN RE-TRAC	1
1.1	Top sub (incl. parts 2 and 3)	33-58S02/04CA	3 1/2” API REG PIN RE-TRAC	1
1.2	Top sub (incl. parst 2 and 3)	33-58S02/11CA	2 7/8” API REG PIN RE-TRAC	1
1.3	Top sub (incl. parts 2 and 3)	33-58S02/77CA	#24 CUBEX PIN RETRAC	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99002A		1
5	Check valve spring	22-99072		1
6	Check valve guide	39-58S01		1
7	Feed tube retaining pin	12-99018		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-58001A		1
10	Piston	36-58J81		1
11	Piston case (incl. part 12)	35-58007A		1
12	Retaining ring	23-99032		1
13	O-ring			3
14	Guide sleeve (incl. part 13)	26-58J10A		1
16	Bit retaining ring (incl. part 13)	27-58006A		1
17	Driver sub	34-58070		1
18	Tuning ring	56-58552	Low volume option	1
19	O-ring			1
	Parts to be ordered separately:			
30	Seal kit	38-58D56	Including parts 2, 3, 13 and 19.	1

RH550g 5”



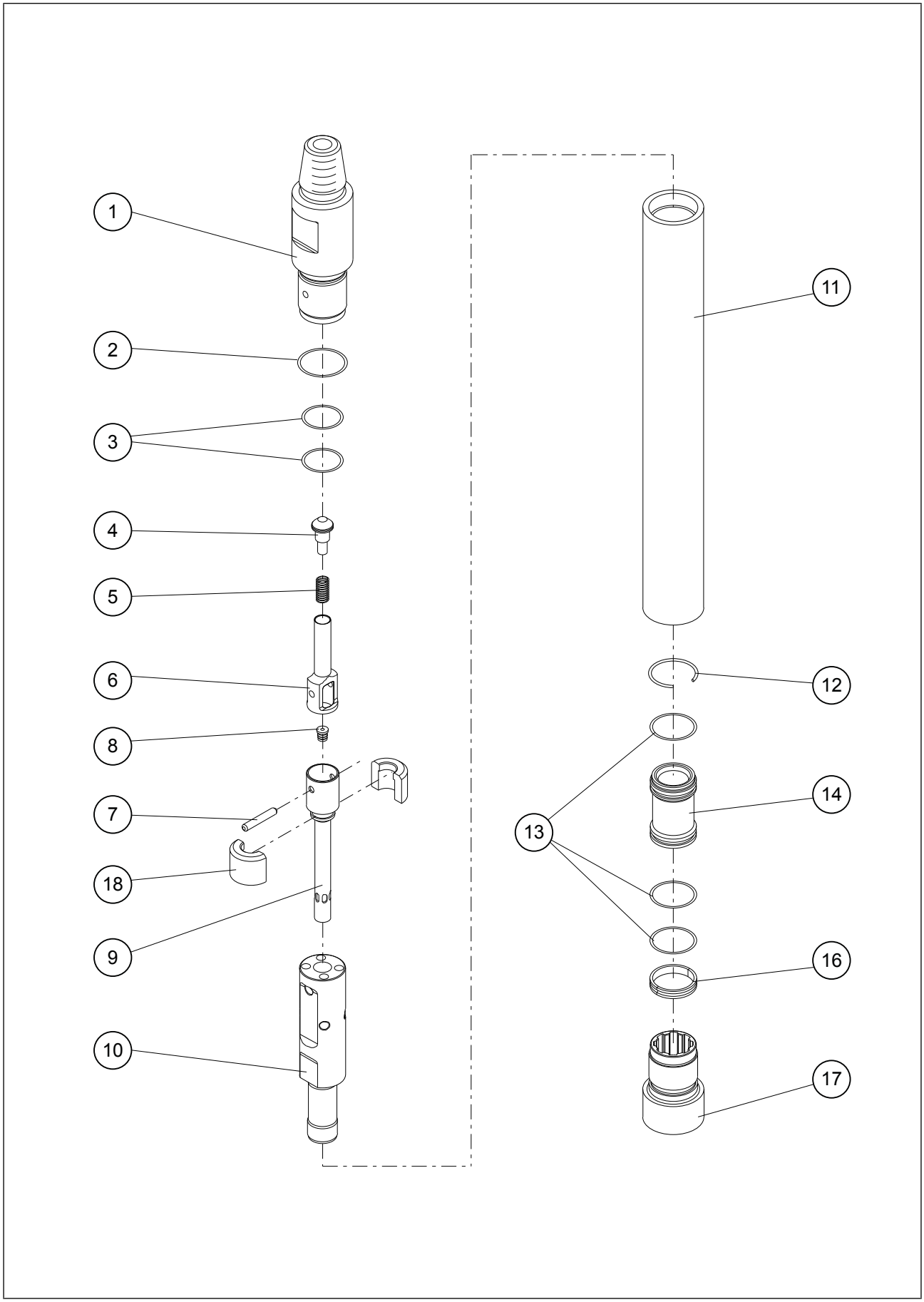
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5555-GMA/04C	5”, 3 1/2” API REG PIN RE-TRAC	1
	Complete Hammer	32-5555-GMA/11C	5”, 2 7/8” API REG PIN RE-TRAC	1
	Complete Hammer	32-5555-GMA/77C	5”, #24 CUBEX PIN RE-TRAC	1
	Complete Hammer	32-5555-GMA/77S	5”, #24 CUBEX PIN	1
	Complete Hammer	32-5555-GMA/83S	5”, 3 1/8” DIBH	1
1.1	Top sub (incl. parts 2 and 3)	33-58D02/04CA	3 1/2” API REG PIN RE-TRAC	1
1.2	Top sub (incl. parts 2 and 3)	33-58D02/11CA	2 7/8” API REG PIN RE-TRAC	1
1.3	Top sub (incl. parts 2 and 3)	33-58D02/77CA	#24 CUBEX PIN RETRAC	1
1.5	Top sub	33-58D02/77	#24 CUBEX PIN	1
1.6	Top sub	33-58D02/83	3 1/8” DIBH	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99000A		1
5	Check valve spring	22-99072		1
6	Check valve guide	39-58S01		1
7	Feed tube retaining pin	12-99018		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-58001A		1
10	Piston	36-58J81/B		1
11	Piston case (incl. part 12)	35-58D07A		1
12	Retaining ring	23-99032		1
13	O-ring			3
14	Guide sleeve (incl. part 13)	26-58J10A		1
16	Bit retaining ring (incl. part 13)	27-58006A		1
17	Driver sub	34-58D70		1
18	Tuning ring	56-58552	Low volume option	1
19	O-ring			1
	Parts to be ordered separately:			
30	Seal kit	38-58D56	Including parts 2, 3, 13 and 19.	1

RH550 6”



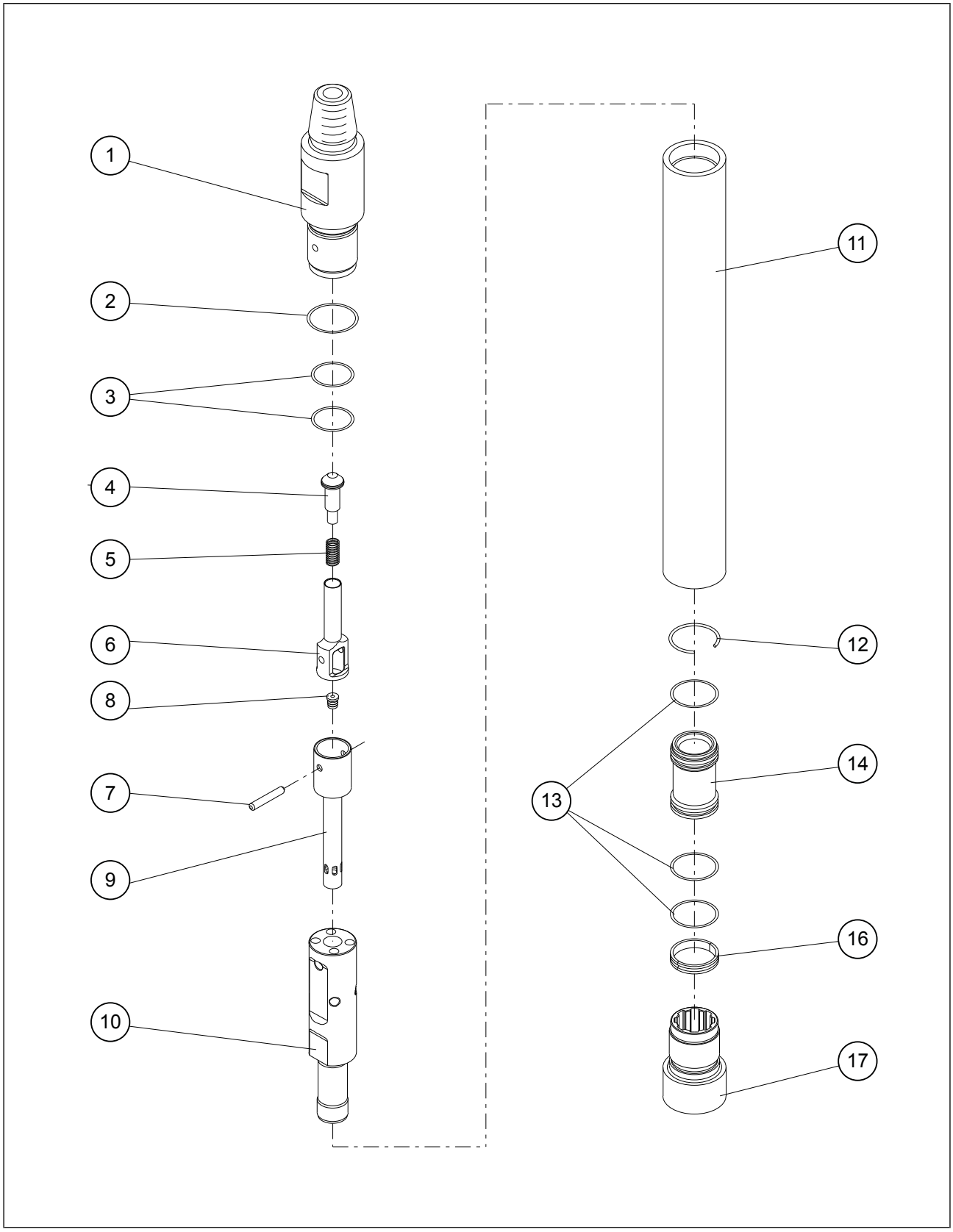
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5560-SMA/04S	6”, 3 1/2” API REG PIN	1
	Complete Hammer	32-5560-SMA/56S	6”, #28 CUBEX PIN	1
	Complete Hammer	32-5560-SMA/25S	6”, 3 1/2” API REG BOX	1
1.1	Top sub (incl. parts 2 and 3)	33-68D08/04A	3 1/2” API REG PIN	1
1.2	Top sub (incl. parts 2 and 3)	33-68D08/56A	#28 CUBEX PIN	1
1.4	Top sub	33-68D08/25	3 1/2” API REG BOX	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99000A		1
5	Check valve spring	22-99072		1
6	Check valve guide	39-68001		1
7	Feed tube retaining pin	12-99013		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-68601A		1
10	Piston	36-68J81		1
11	Piston case (incl. part 12)	35-68D14A		1
12	Retaining ring	23-99028		1
13	O-ring			3
14	Guide sleeve (incl. part 13)	26-68J10A		1
16	Bit retaining ring (incl. part 13)	27-68006A		1
17	Driver sub	34-68D69		1
	Parts to be ordered separately:			
30	Seal kit	38-68656	Including parts 2, 3 and 13.	1

RH550w 6”



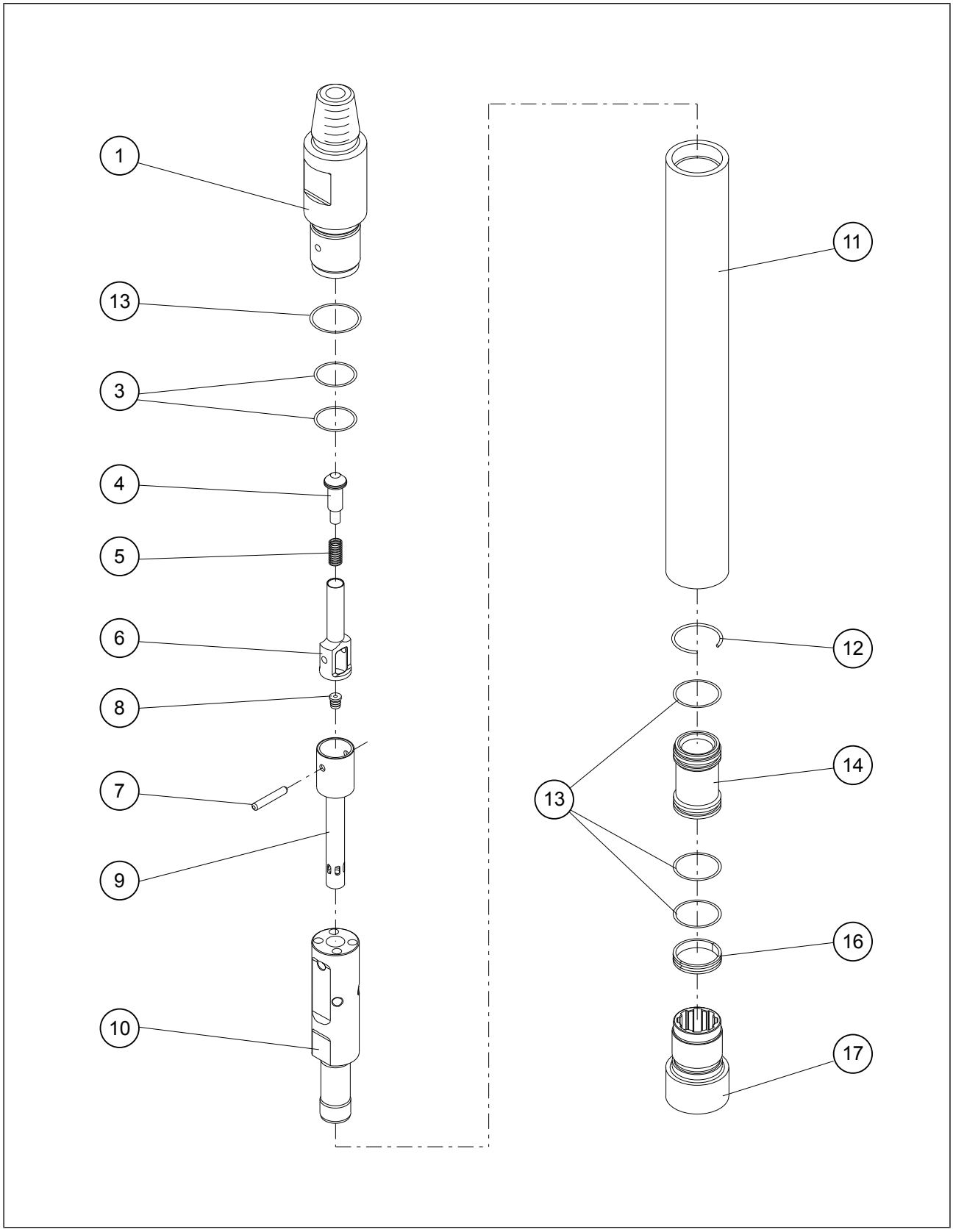
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5560-WMA/04S	6”, 3 1/2” API REG PIN	1
	Complete Hammer	32-5560-WMA/56S	6”, #28 CUBEX PIN	1
	Complete Hammer	32-5560-WMA/25S	6”, 3 1/2” API REG BOX	1
1.1	Top sub (incl. parts 2 and 3)	33-68N08/04A	3 1/2” API REG PIN	1
1.2	Top sub (incl. parts 2 and 3)	33-68N08/56A	#28 CUBEX PIN	1
1.4	Top sub	33-68N08/25	3 1/2” API REG BOX	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99000A		1
5	Check valve spring	22-99072		1
6	Check valve guide	39-68001		1
7	Feed tube retaining pin	12-99013		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-68301A		1
10	Piston	36-68J81		1
11	Piston case (incl. part 12)	35-68D14A		1
12	Retaining ring	23-99028		1
13	O-ring			3
14	Guide sleeve (incl. part 13)	26-68J10A		1
16	Bit retaining ring (incl. part 13)	27-68006A		1
17	Driver sub	34-68D69		1
18	Tuning ring	56-68552	Low volume option	1
	Parts to be ordered separately:			
30	Seal kit	38-68656	Including parts 2, 3 and 13.	1

RH550g 6”



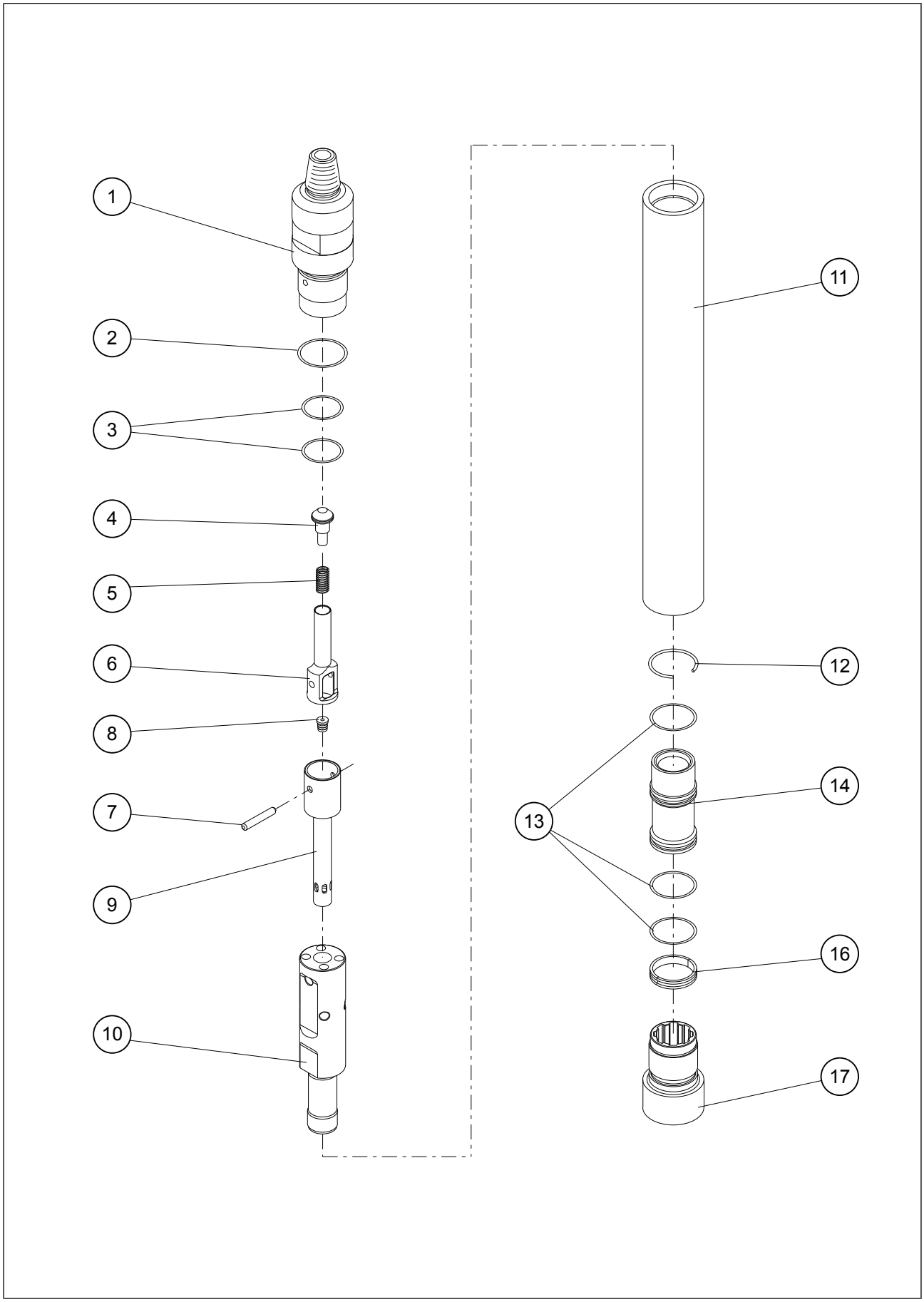
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5565-GMA/04C	6”, 3 1/2” API REG PIN RE-TRAC	1
	Complete Hammer	32-5565-GMA/56C	6”, #28 CUBEX PIN RE-TRAC	1
	Complete Hammer	32-5565-GMA/55C	6”, 3 1/2” BECO PIN RE-TRAC	1
	Complete Hammer	32-5565-GMA/56S	6”, #28 CUBEX PIN	1
	Complete Hammer	32-5565-GMA/74C	6”, 3 1/2” IF PIN	1
1.1	Top sub (incl. parts 2 and 3)	33-6L009/04CA	3 1/2” API REG PIN	1
1.2	Top sub (incl. parts 2 and 3)	33-6L009/56CA	#28 CUBEX PIN RETRAC	1
1.4	Top sub	33-6L009/55C	3 1/2” BECO PIN RETRAC	1
1.5	Top sub	33-6LD02/56	#28 CUBEX PIN	1
1.6	Top sub	33-6L009/74C	3 1/2” IF PIN	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99002A		1
5	Check valve spring	22-99072		1
6	Check valve guide	39-68001		1
7	Feed tube retaining pin	12-99013		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-68601A		1
10	Piston	36-68J81		1
11	Piston case (incl. part 12)	35-6LD68A		1
12	Retaining ring	23-99028		1
13	O-ring			3
14	Guide sleeve (incl. part 13)	26-68J10A		1
16	Bit retaining ring (incl. part 13)	27-68006A		1
17	Driver sub	34-6LD70		1
	Parts to be ordered separately:			
30	Seal kit	38-68656	Including parts 2, 3 and 13.	1

RH550r 6”



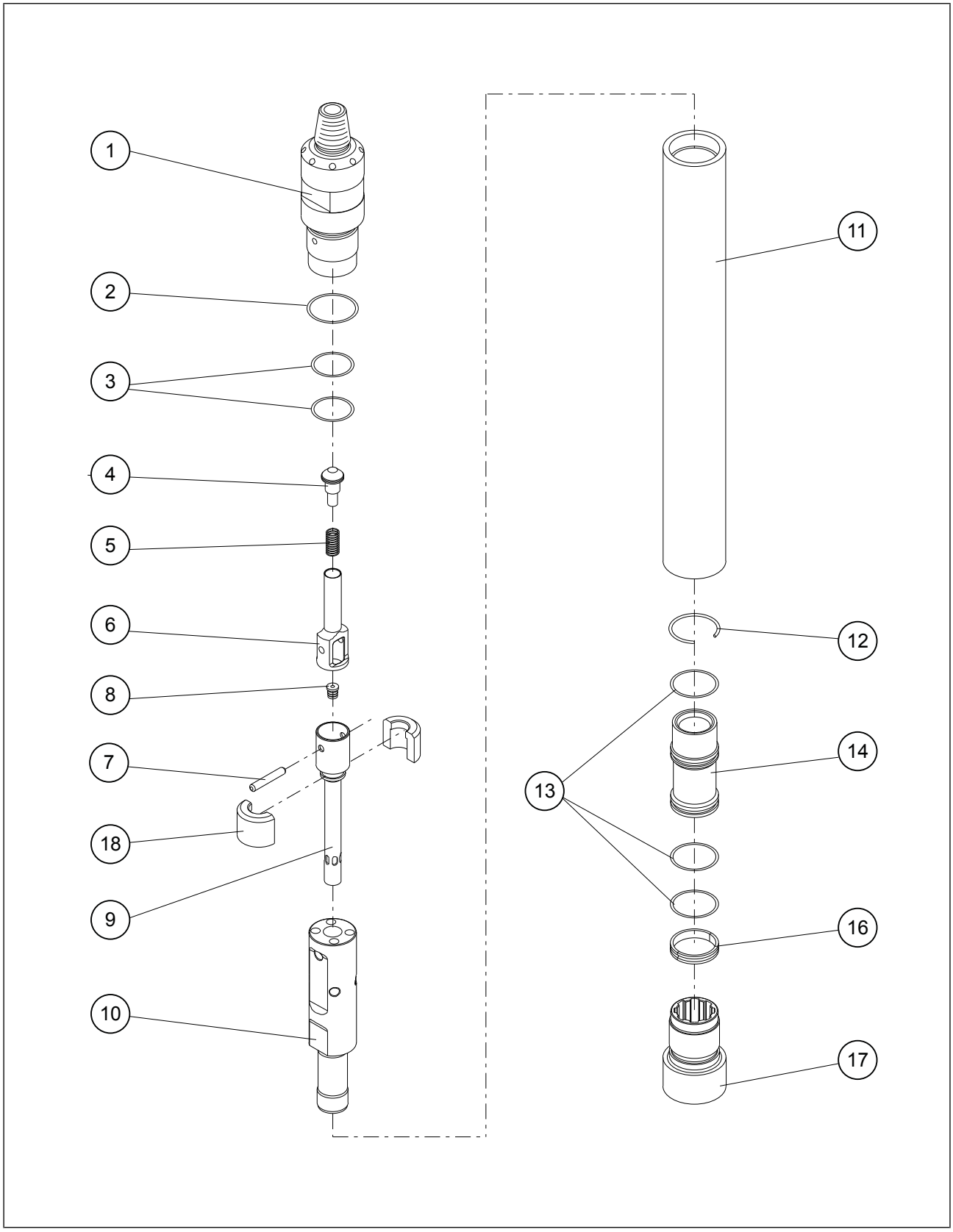
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5565-RMA/04C	6”, 3 1/2” API REG PIN RE-TRAC	1
	Complete Hammer	32-5565-RMA/56C	6”, #28 CUBEX PIN RE-TRAC	1
	Complete Hammer	32-5565-RMA/55C	6”, 3 1/2” BECO PIN RE-TRAC	1
	Complete Hammer	32-5565-RMA/74C	6”, 3 1/2” IF PIN	1
1.1	Top sub (incl. part 3 and 13)	33-68602/04CA	3 1/2” API REG PIN	1
1.2	Top sub (incl. part 3 and 13)	33-68602/56CA	#28 CUBEX PIN RETRAC	1
1.4	Top sub	33-68602/55C	3 1/2” BECO PIN RETRAC	1
1.5	Top sub	33-68602/74C	3 1/2” IF PIN	1
3	O-ring			2
4	Check valve dart (incl. part 5)	25-99000A		1
5	Check valve spring	22-99072		1
6	Check valve guide	39-68001		1
7	Feed tube retaining pin	12-99013		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-68601A		1
10	Piston	36-68J81		1
11	Piston case (incl. part 12)	35-68668A		1
12	Retaining ring	23-99028		1
13	O-ring			4
14	Guide sleeve (incl. part 13)	26-68J10A		1
16	Bit retaining ring (incl. part 13)	27-68006A		1
17	Driver sub	34-68670		1
	Parts to be ordered separately:			
30	Seal kit	38-68656	Including parts 3 and 13.	1

RH550w 8”



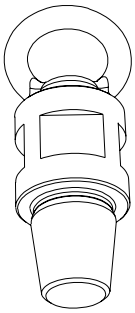
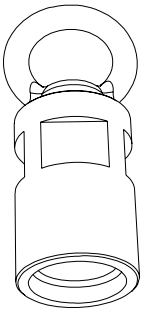
Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5585-WMA/19S	8”, 4 1/2” API REG PIN	1
1	Top sub (incl. parts 2 and 3)	33-88302/19A	4 1/2” API REG PIN	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	38-11663A		1
5	Check valve spring	38-1-1235-073		1
6	Check valve guide	39-88001		1
7	Feed tube retaining pin	12-99016		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-88301A		1
10	Piston	36-88J81		1
11	Piston case (incl. part 12)	35-88302A		1
12	Retaining ring	23-99030		1
13	O-ring			3
14	Guide sleeve (incl. part 13)	26-88J10A		1
16	Bit retaining ring (incl. part 13)	27-88006A		1
17	Driver sub	34-88007		1
	Parts to be ordered separately:			
30	Seal kit	38-88056	Including parts 2, 3 and 13.	1

RH550r 8”



Item	Description	Part no.	Specification	Qty
	Complete Hammer	32-5585-RMA/19C	8”, 4 1/2” API REG PIN RE-TRAC	1
	Complete Hammer	32-5585-RMA/19T	8”, 4 1/2” API REG PIN RE-TRAC TRIPLE LEAD	1
	Complete Hammer	32-5585-RMA/72C	8”, 4 1/2” BECO PIN RE-TRAC	1
1.1	Top sub (incl. parts 2 and 3)	33-88002/19CA	4 1/2” API REG PIN RE-TRAC	1
1.2	Top sub	33-88T02/19C	4 1/2” API REG PIN RE-TRAC TRIPLE LEAD	1
1.3	Top sub	33-88002/72C	4 1/2” BECO PIN RETRAC	1
2	O-ring			1
3	O-ring			2
4	Check valve dart (incl. part 5)	38-11663A		1
5	Check valve spring	38-1-1235-073		1
6	Check valve guide	39-88001		1
7	Feed tube retaining pin	12-99016		1
8	Choke set	29-68017	blank, 1/8”, 3/16”, 1/4”	1
9	Feed tube (incl. part 7 and blank choke)	37-88001A		1
10	Piston	36-88J81		1
11	Piston case (incl. part 12)	35-88002A		1
12	Retaining ring	23-99030		1
13	O-ring			3
14	Guide sleeve (incl part 13)	26-88J10A		1
16	Bit retaining ring (incl part 13)	27-88006A		1
17	Driver sub	34-88007		1
18	Tuning ring	56-88552	Low volume option	1
	Parts to be ordered separately:			
30	Seal kit	38-88056	Including parts 2, 3 and 13.	1

9. SPECIAL TOOLS

Part no.	Thread type	
BG00016436	3 1/2” API REG PIN	
BG00016425 BG00016426 BG00016427 BG00016428 BG00016429	2 3/8” API REG BOX 2 7/8” API REG BOX 3 1/2” API REG BOX 3 1/2” API IF BOX 4 1/2” API REG BOX	

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