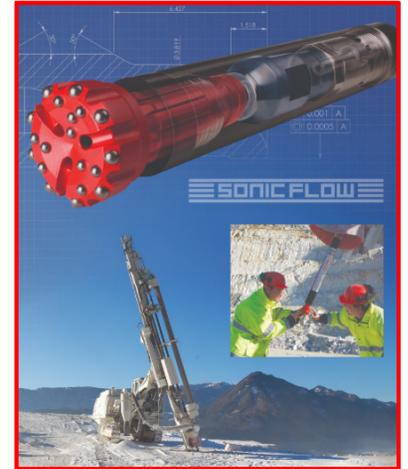




R O C K M O R E
I N T E R N A T I O N A L

Rock Drilling Tools



Failure Troubleshooting

DTH Drilling Tools - *Bits and Hammers* -



Table of Contents

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Common Problems

ROCKMORE's rock drilling tools are manufactured to the highest quality standards. Even in the most challenging environments that rock drilling can offer, our products will exhibit expected performance.

The most common causes of failure are:

- Improper working practices
- Incorrect service operations
- Poor operating procedures
- Extreme field conditions
- Incorrect tool selection for required rock conditions



R O C K M O R E
I N T E R N A T I O N A L

Rock Drilling Tools

Failure Troubleshooting

DTH Bits



DTH Bits

- Proper Maintenance -

Drill bits will last longer and cut faster when carbides are sharpened and the steel matrix is properly maintained.

Button carbides should be sharpened when they attain flats that are 1/4 (one quarter) of their major diameter.

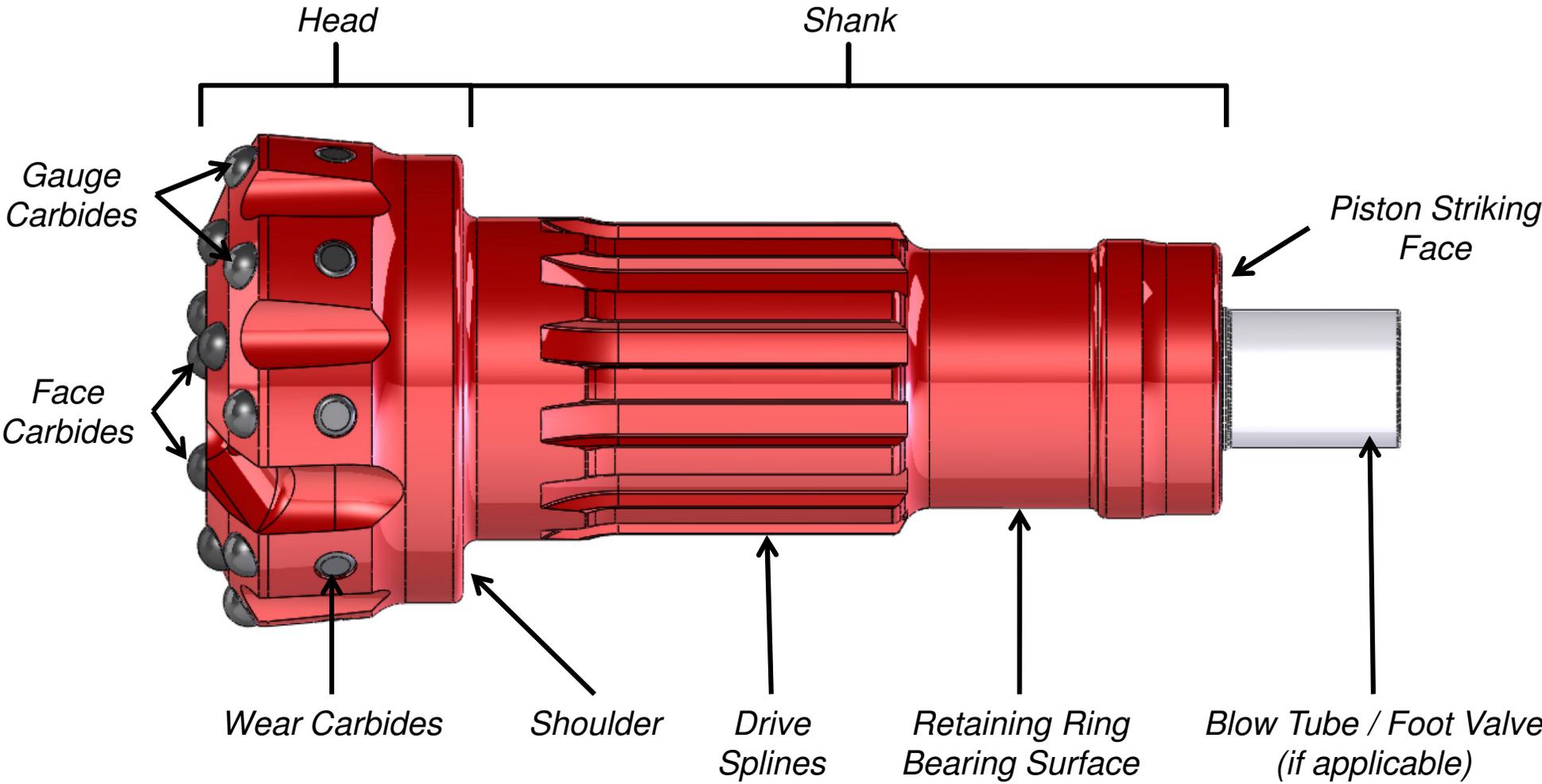
Dull carbide buttons will drill slower and fatigue faster, encouraging failure of the carbides and the steel matrix.

Before drilling, inspect the condition and lubrication of all drill string components, including the hammer. Replace any worn out parts, following manufacturer's recommended discard limits closely.



DTH Bits

Bit Elements





DTH Bits - Head -

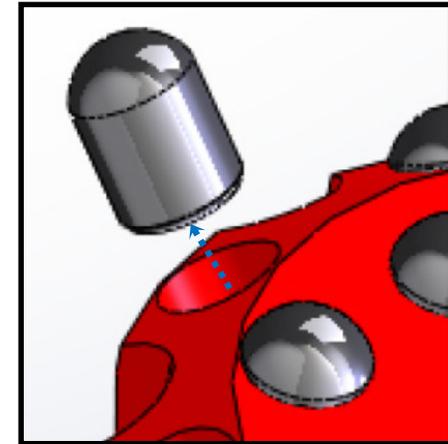
Failure: Carbide pop-out

Cause of failure:

- Excessive body wash
- Excessive bit body grinding
- Drilling in very soft or extremely abrasive conditions
- Drilling in excessive unconsolidated rock
- Excessive energy produced by the piston
- Insufficient feed pressure
- Back hammering / dry firing

Action required:

- Follow proper carbide sharpening procedures to avoid over grinding bit body; replace worn out bits
- Adjust drilling parameters to rock conditions
- Adjust feed pressure to rock conditions
- Stop percussion until the bit is in full contact with rock





DTH Bits - Head -

Failures:

Carbide broken inside socket &
Top of carbide sheared off at body

Cause of failures:

- Over heating of the bit
- Drilling with flat carbides
- Forceful rotation against obstacles in rock

Action required:

- Adjust rotation speed and other drilling parameters to rock conditions
- Sharpen dull carbides, following proper carbide sharpening procedures
- Adjust feed pressure to rock conditions; in difficult drilling conditions--such as loose or fractured material, or when encountering obstructions--use already damaged bits to avoid damaging bits in good condition



[Additional pictures, see page 50](#)



DTH Bits - Head -

Problems:

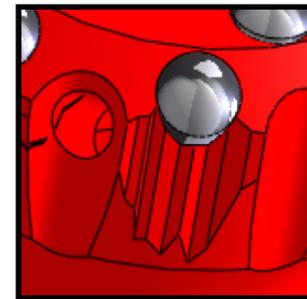
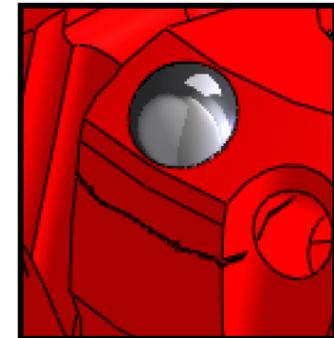
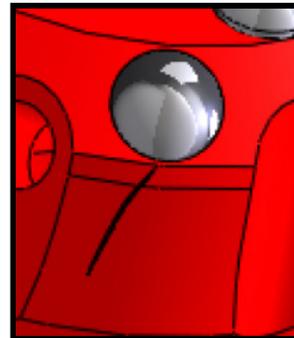
Crack in body near carbide; Crack in body originating from bottom of carbide socket; & Carbide intact, surrounding matrix missing

Cause of problems:

- Excessive interference between the bit and the carbide

Action required:

- Return to manufacturer for analysis





DTH Bits - Head -

Problems:

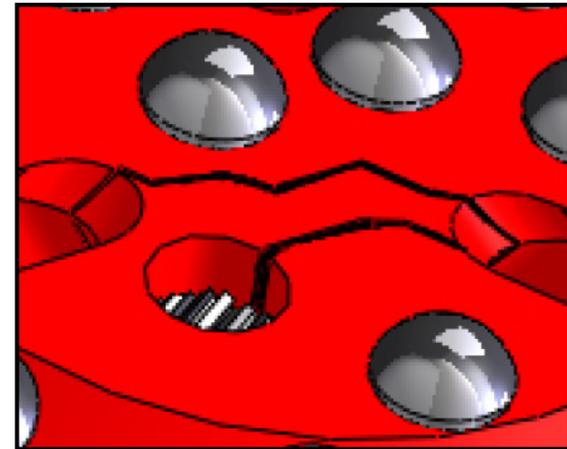
Crack on face between flushing holes, flushing hole and carbide, or between carbides

Cause of problems:

- Excessive feed force
- Drilling with flat carbides

Action required:

- Adjust feed force to rock conditions
- Sharpen dull carbides, following proper carbide sharpening procedures



[Additional picture, see page 51](#)



DTH Bits - Head -

Failures:

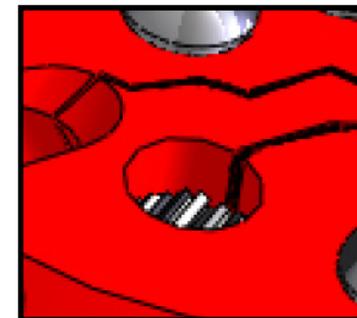
Top of carbide crushed down to level of body &
Carbide crushed inside body

Cause of failures:

- Over drilling in a non-abrasive rock, such as limestone
- Improper carbide grinding intervals
- Excessive carbide protrusion from poor grinding practices

Action required:

- Inspect carbides frequently for snake skin wear pattern (see page 16)
- Shorten grinding intervals when drilling in non-abrasive rock
- Sharpen carbides when dull or micro cracks begin to form, following proper carbide sharpening procedures
- When sharpening carbides do not remove excessive body; carbides should not protrude more than 3/4 of the carbide diameter



[Additional picture, see page 52](#)



DTH Bits - Head -

Failures:

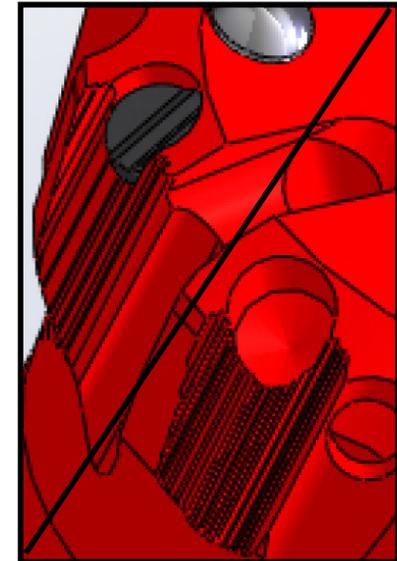
Carbide partially missing, surrounding matrix damaged & Carbide completely missing, surrounding matrix damaged

Cause of failures:

- Over drilling of bit
- Drilling with flat carbides
- Improper grinding intervals
- Drilling with a bit already missing carbide

Action required:

- Inspect carbides more frequently
- Sharpen dull carbides, following proper carbide sharpening procedures
- Increase grinding intervals
- Discard and replace worn out or damaged bits



[Additional picture, see page 53](#)



DTH Bits - Head -

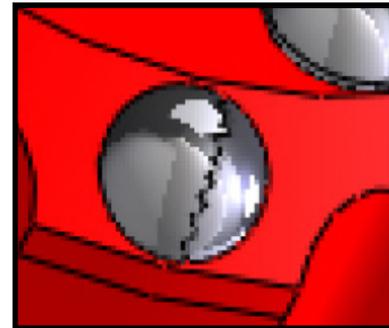
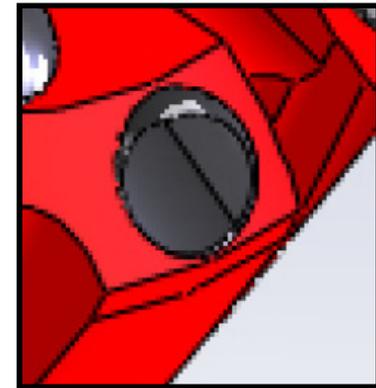
Failures: Carbide chipped & Carbide cracked

Cause of failures:

- Over drilling of bit
- Drilling in a non-abrasive rock
- Improper grinding intervals
- Carbide grade too hard for the rock condition
- Slow rotation and bit is not positioned into solid rock

Action required:

- Inspect carbides frequently for snake skin wear pattern (see page 16)
- Sharpen carbides when dull or micro cracks begin to form, following proper carbide sharpening procedures
- Select bits with suitable carbide hardness for drilling application
- Do not start percussion until the bit is in full contact with rock





DTH Bits - Head -

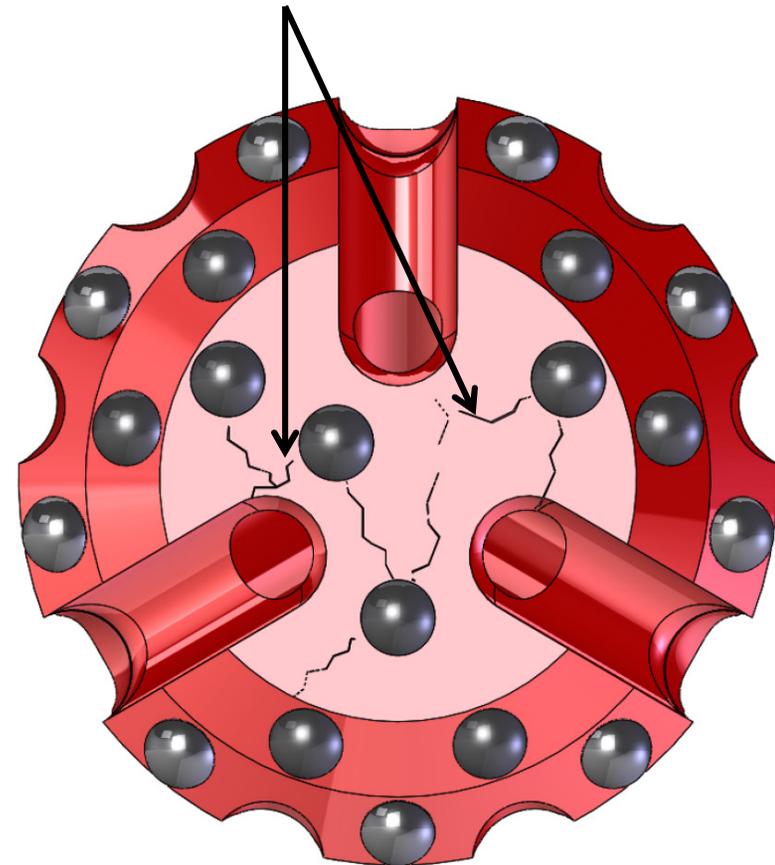
Problem: Face cracking

Cause of problem:

- Excessive feed force

Action required:

- Reduce feed force until the carbides engage in the rock
- When drilling deep holes, “pull back” may need to be used to compensate for the weight of the drill string pushing on the bit excessively





DTH Bits - Head -

Problem:

Body wash – Excessive steel wear on the
bit body and bit face

Cause of problem:

- Drilling in extremely abrasive conditions

Action required:

- Slow rotation as much as possible to help create larger cuttings that will flush up the hole more efficiently
- Maximize flushing
- Use drilling foam to help flush or lift the rock cuttings
- Clean drill holes regularly
- Adjust hammer choke to reduce up-hole velocity of rock cuttings



[Additional pictures, see page 54](#)



DTH Bits - Head -

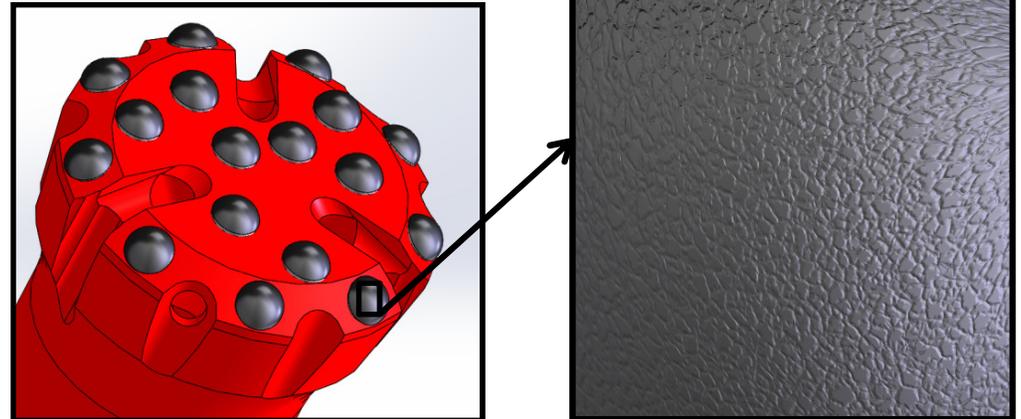
Problem: Carbide snake skin wear pattern *

Cause of problem:

- Drilling in a non-abrasive rock, such as limestone
- Improper carbide grinding intervals

Action required:

- Inspect carbides frequently
- Shorten grinding intervals when drilling in non-abrasive rock
- Sharpen carbides when dull or micro cracks begin to form, following proper carbide sharpening procedures



* Snake skin is a wear pattern of micro cracks that develop from drilling fatigue in non-abrasive rock. The cracks will eventually penetrate deeper and cause large chunks to break away.

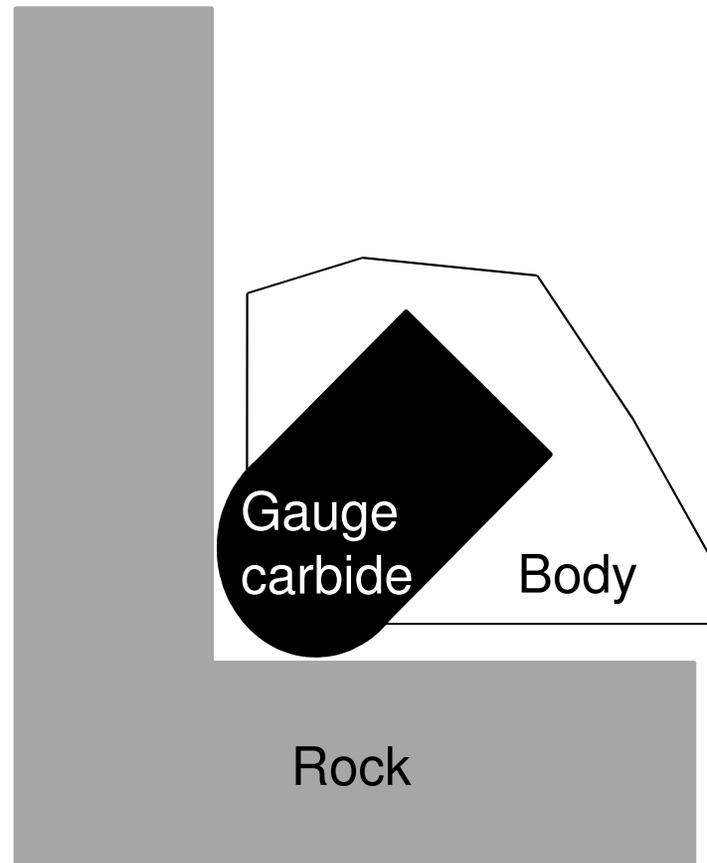
[Additional pictures, see page 55](#)



DTH Bits - Head -

Dynamics

Diagram 1 of 2



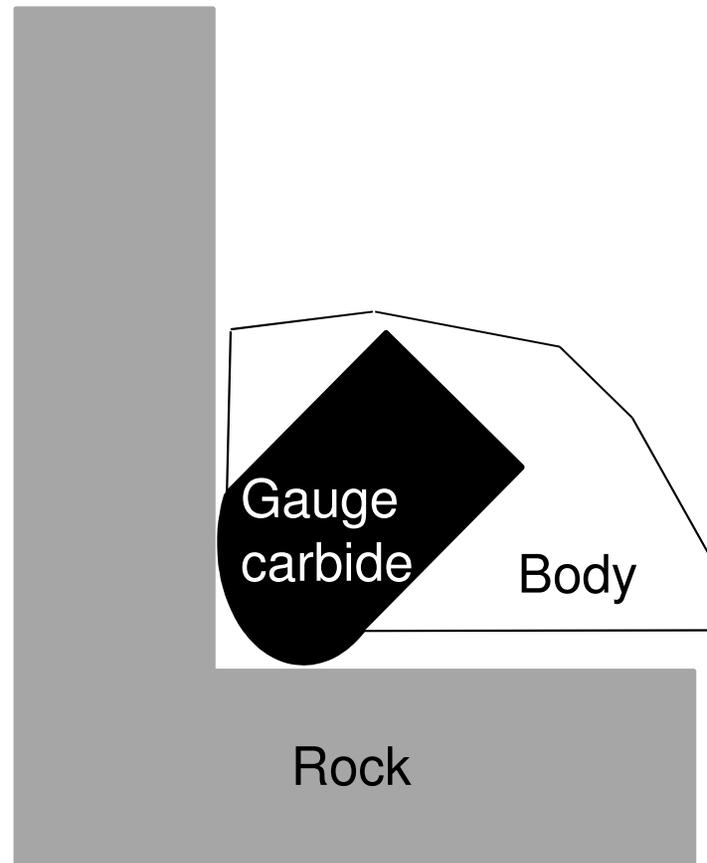
Carbide buttons are designed to resist compressive forces not shear forces.



DTH Bits - Head -

Dynamics

Diagram 2 of 2



As the carbide buttons starts to wear, they develop a flat surface. As the flat enlarges the load on the carbide changes from compressive to shear.



DTH Bits - Shank -

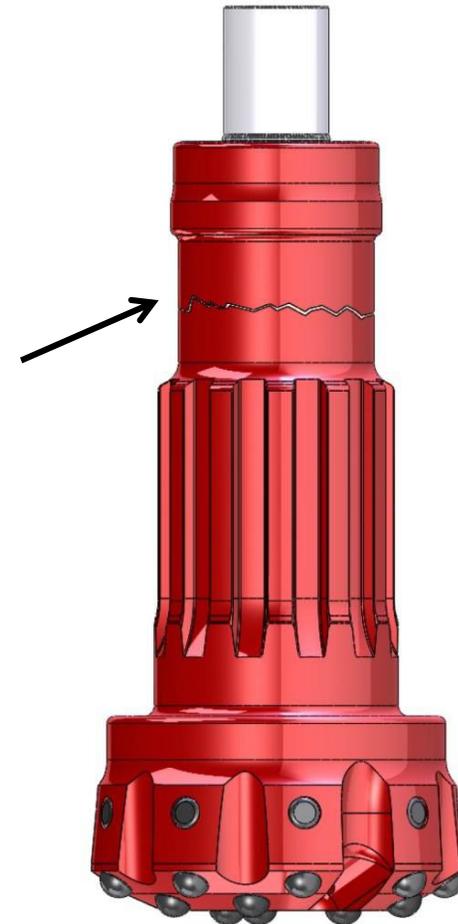
Failure:
Shank break across the retaining ring bearing surface

Cause of failure:

- Lack of lubrication
- Worn out bit retaining rings
- Worn out guide bushing (not applicable for Rockmore's ROK series DTH hammers)

Action required:

- Use the correct type and quantity of hammer oil
- Inspect the condition of the bit, retaining rings, and guide bushing before drilling
- Replace worn out hammer components with new parts





DTH Bits - Shank -

Failure: Shank break across the drive splines

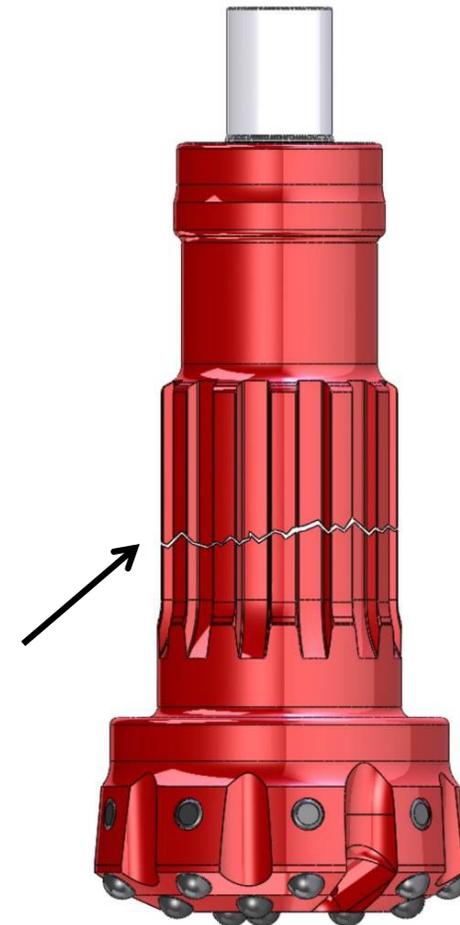
Cause of failure:

- Oversized head diameter, in relation to DTH hammer diameter
- Excessive torque
- Worn out driver sub

Action required:

- Adjust drill settings when using oversized drill bits
- Use a larger DTH hammer recommended for that diameter of bit
- Adjust torque to rock conditions
- Inspect the condition of the bit and driver sub before drilling
- Replace worn out hammer components with new parts

[Additional pictures, see page 56](#)





DTH Bits - Shank -

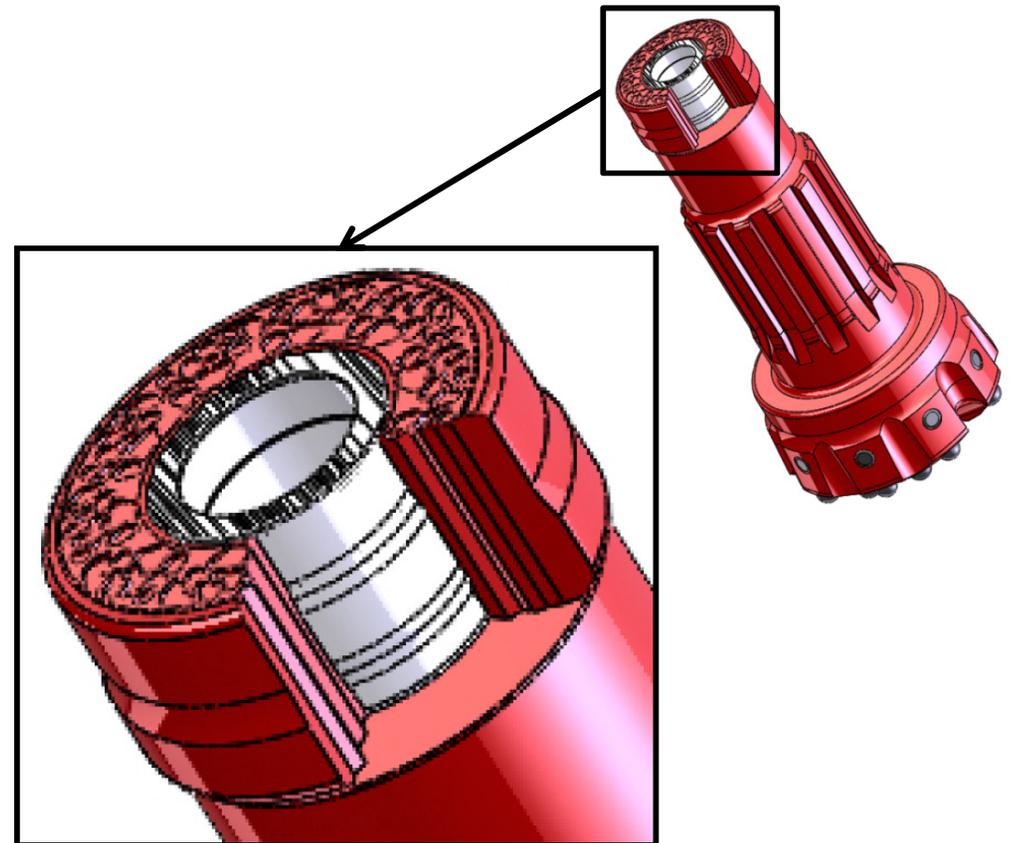
Failure: Broken piston striking face

Cause of failure:

- Worn out piston, bit retaining ring, or driver sub
- Worn out guide bushing (not applicable for Rockmore's ROK series DTH hammers)

Action required:

- Inspect the condition of the piston, bit retaining rings, driver sub and guide bushing before drilling
- Replace worn out hammer components with new parts



[Additional pictures, see page 57](#)



DTH Bits - Shank -

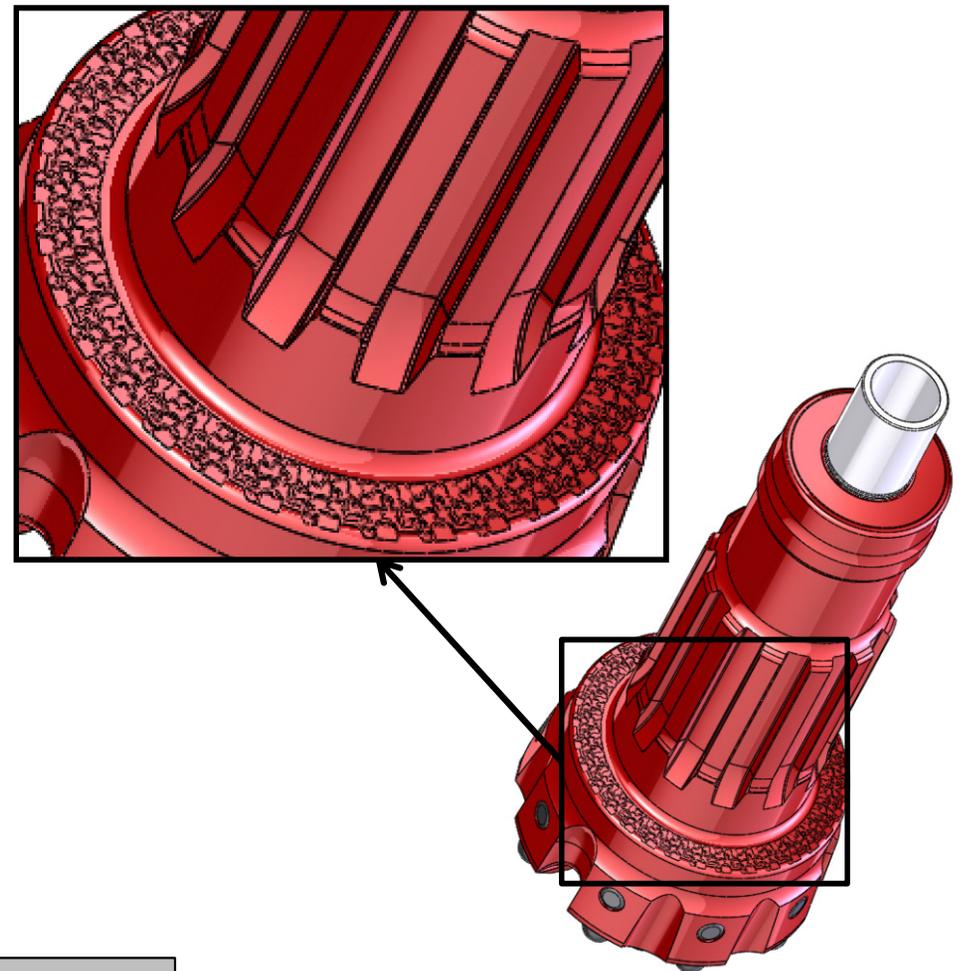
Problem:
Shoulder damage

Cause of problem:

- Incorrect feed force

Action required:

- Adjust feed force to keep the carbide engaged in the rock. More will need to be applied when drilling into soft rock. Less will be needed as drill pipe is added and weight from the drill string increases the feed force.



[Additional picture, see page 58](#)



DTH Bits - Shank -

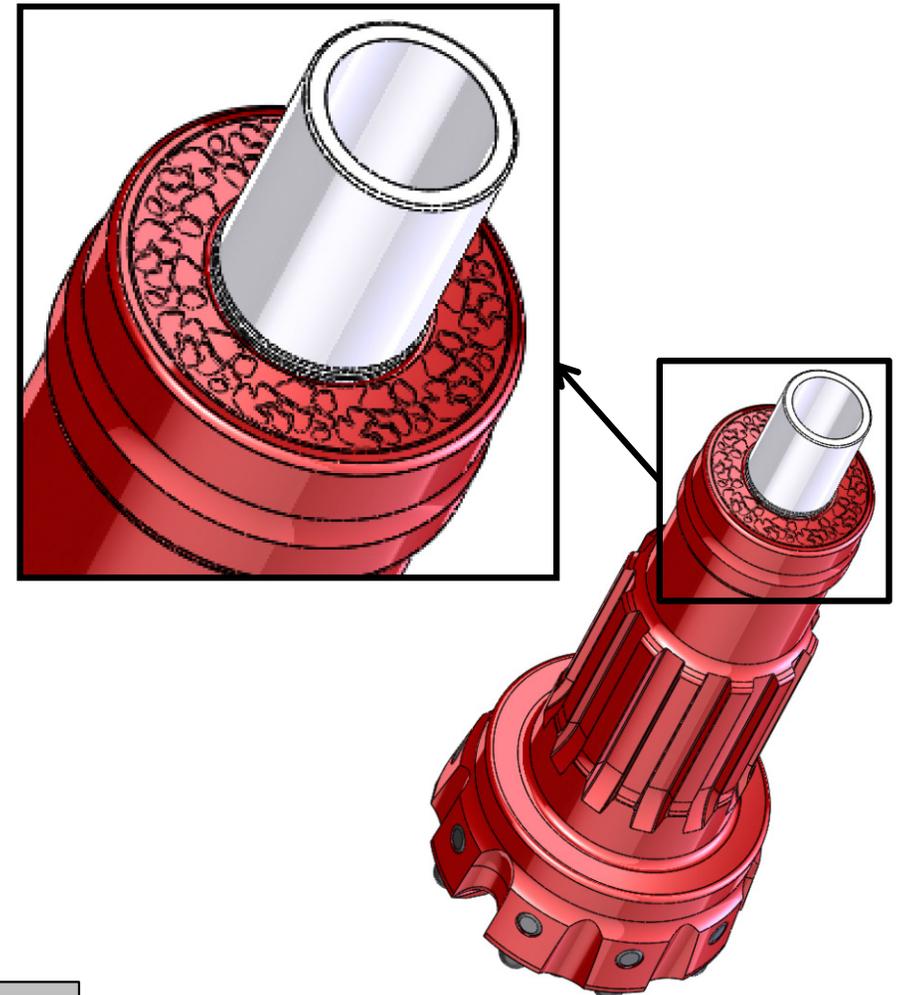
Problem: Piston striking face damage

Cause of problem:

- Insufficient lubrication
- Foreign material trapped between the bit and piston

Action Required:

- Use the manufacturer's recommended type and quantity of hammer oil
- Keep the hammer joints tight; and clean the driver sub, bit retaining ring, and drive splines regularly
- Inspect hammer check valve assembly for proper function



[Additional pictures, see page 59](#)



DTH Bits - Shank -

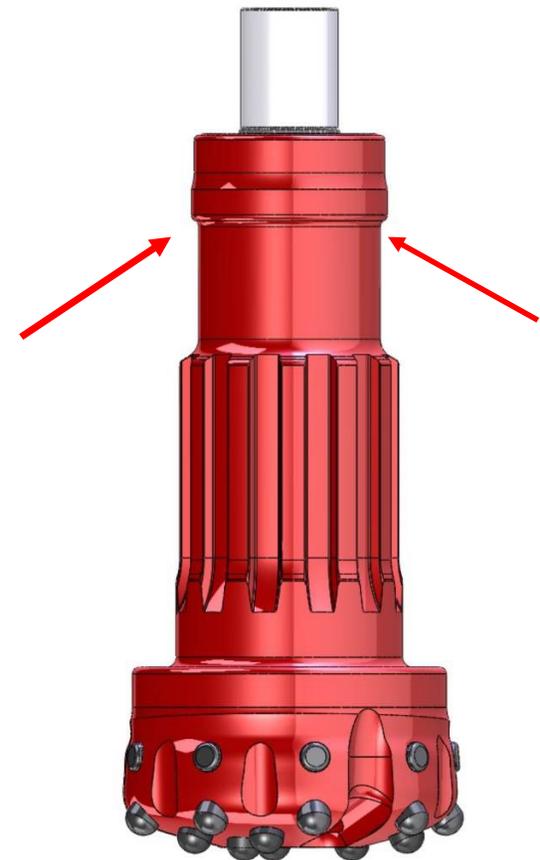
Problem: Bit Retaining Area Damage

Cause of problem:

- Drilling with loose Driver Sub
- Insufficient feed force; Bit out running hammer

Action required:

- Apply proper torque on Driver Sub
- Increase feed force when drilling in soft and unconsolidated rock conditions



[Additional pictures, see page 60](#)



DTH Bits - Blow Tube -

Failure: Broken blow tube / foot valve

Cause of failure:

- Worn out piston, drive splines, or driver sub
- Misalignment
- Lack of lubrication

Action required:

- Inspect the condition of the piston, bit, and driver sub before drilling
- Replace worn out hammer components with new parts
- Use alignment tools and adjust drilling practices to achieve a straighter hole; use bits with concave face design
- Use the correct type and quantity of hammer oil



[Additional pictures, see page 59](#)



R O C K M O R E
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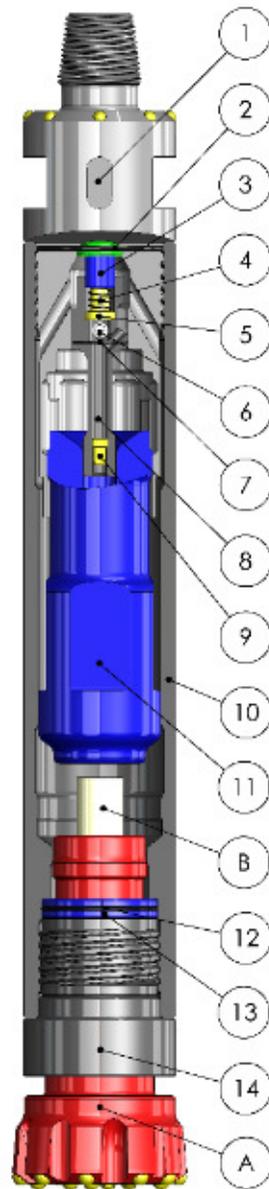
Rock Drilling Tools

Failure Troubleshooting
DTH Hammers



DTH Hammers

- Parts -



Item	Description
1	Top Sub
2	O-Ring
3	Check Valve
4	Spring
5	Spring Rest
6	Pin
7	O-Ring
8	Air Guide
9	Choke
10	Wear Sleeve
11	Piston
B	Bit Blow tube
12	O-Ring
13	Bit Retaining Ring
14	Driver Sub
A	DTH Bit



DTH Hammers - Driver Sub -

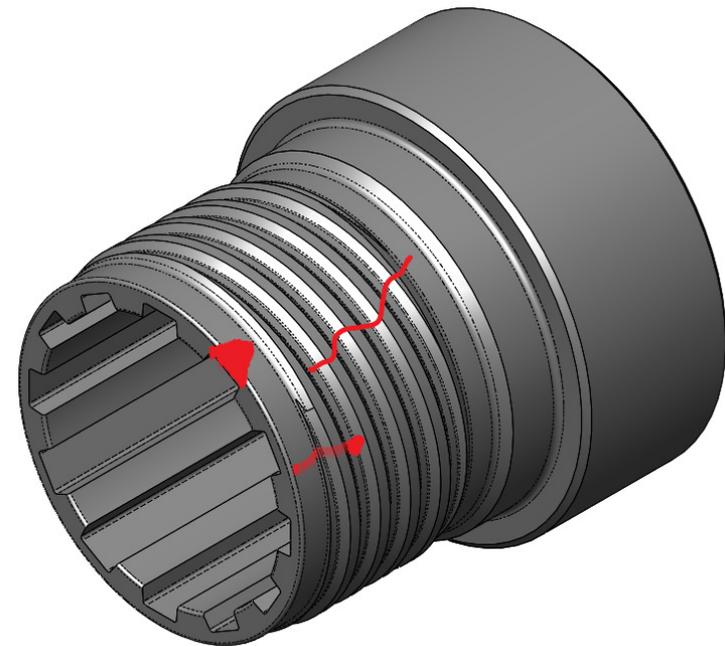
Failure: Broken driver sub

Cause of failure:

- Loose joint
- Gap between driver sub shoulder and wear sleeve
- Not enough feed pressure
- Lack of lubrication on threads

Action required:

- Apply proper make-up torque
- Avoid hammering without rotation
- Increase feed force while drilling in soft and unconsolidated rock conditions
- Apply enough feed pressure
- Replace driver sub
- Apply proper type and quantity of grease to driver sub threads



[Additional pictures, see page 61](#)



DTH Hammers - Driver Sub -

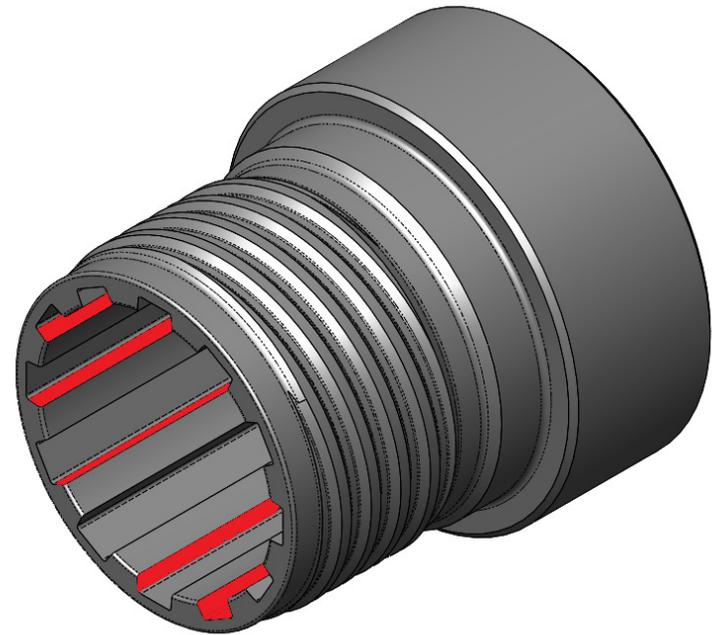
Failure: Excessive drive sub spline wear

Cause of failure:

- Lack of oil lubrication
- Excessive movement.
- Insufficient feed force

Action required:

- Use the correct type and quantity of hammer oil
- Increase weight on bit



[Additional pictures, see page 62](#)



DTH Hammers - Driver Sub -

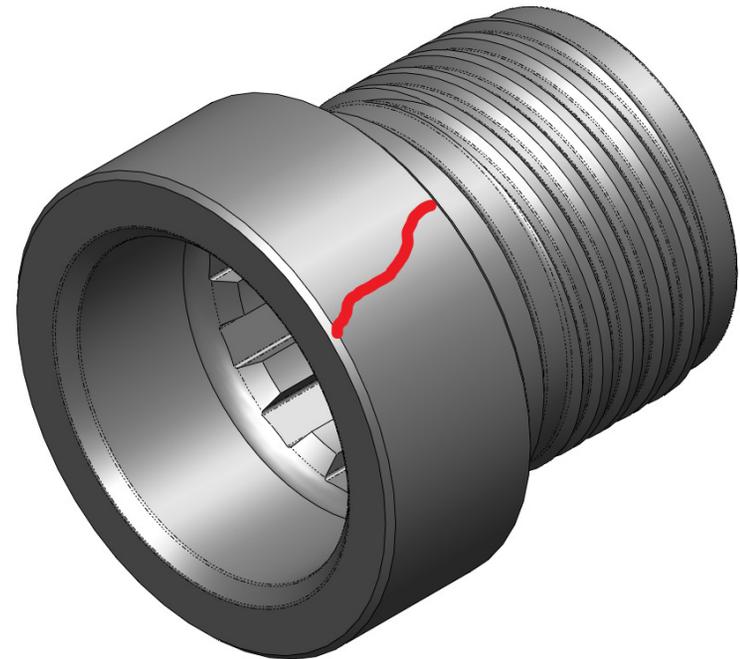
Failure: Cracked driver sub

Cause of failure:

- Abuse with sledge hammer

Action required:

- Use tongs or chains to loosen the driver sub from wear sleeve



[Additional picture, see page 63](#)



DTH Hammers - Driver Sub -

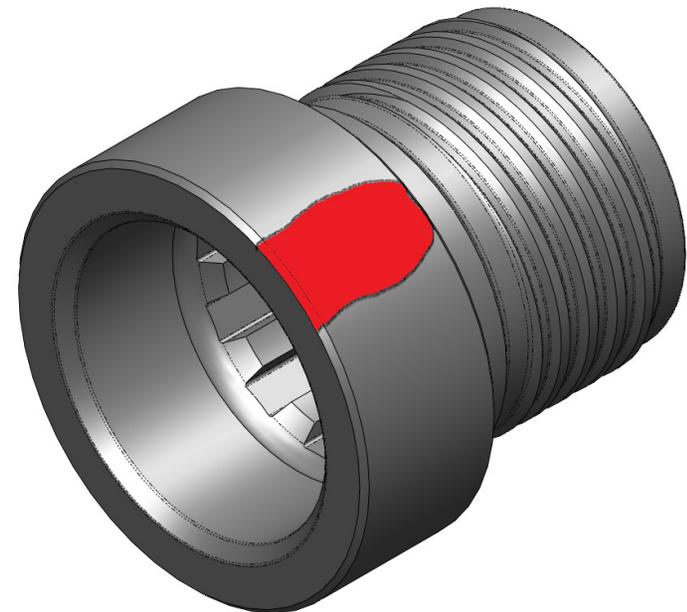
Failure:
Excessive driver sub wear

Cause of failure:

- Excessive wear on bit

Action required:

- Reduce cuttings up hole velocity
- Replace worn bit
- Rotate driver sub frequently



[Additional pictures, see page 64](#)



DTH Hammers - Piston -

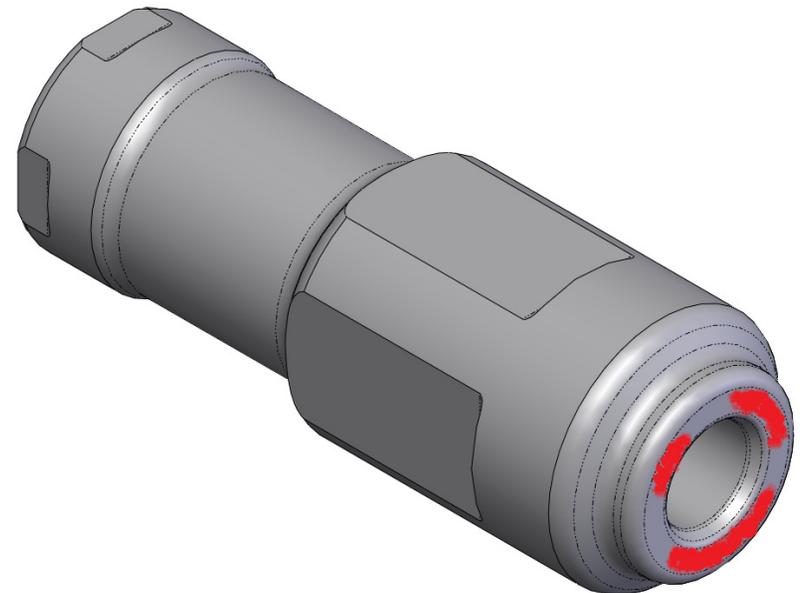
Failure:
Broken striking face

Cause of failure:

- Insufficient feed force
- Debris in hammer
- Check valve not working properly

Action required:

- Increase feed force until reaching smooth rotation
- Inspect and clean hammer from particles
- Replace check valve





DTH Hammers - Piston -

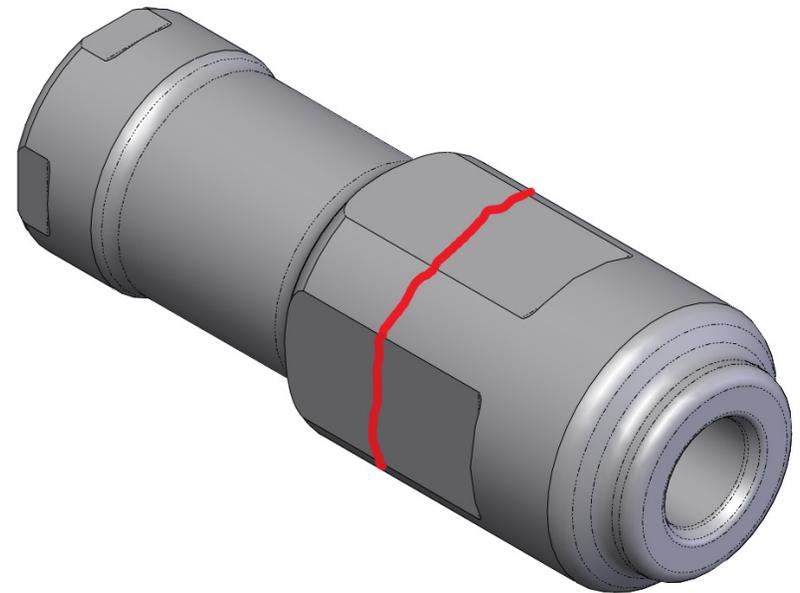
Failure:
Broken piston

Cause of failure:

- Corrosion in piston undercut
- Galling

Action required:

- Clean hammer after drilling with foam
- Check lubrication; use the correct type and quantity of hammer oil



[Additional pictures, see page 65](#)



DTH Hammers - Piston -

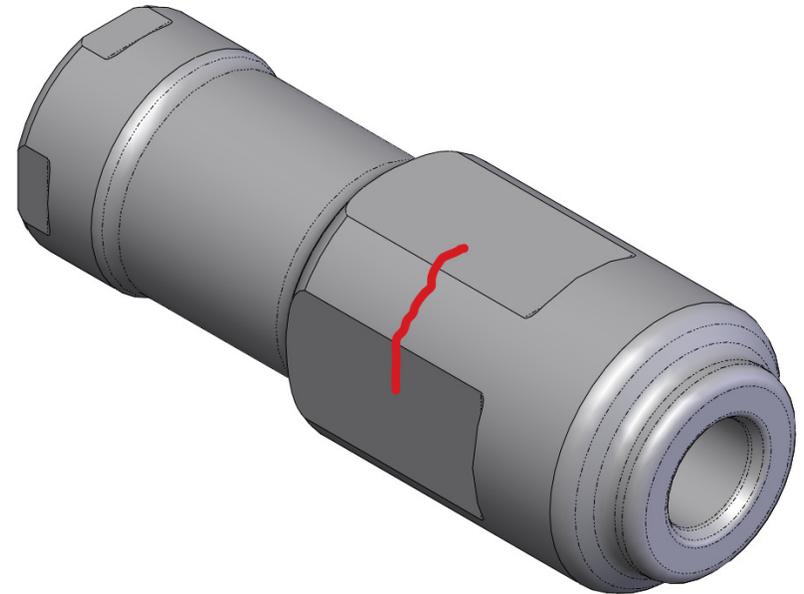
Failure: Piston cracked

Cause of failure:

- Lack of lubrication
- Wrenching on wrong location
- Getting stuck in hole
- Hole deviation

Action required:

- Check lubrication system and ensure oil film is developed in bit flushing holes
- Use wrenching areas to avoid distorting wear sleeve
- Use water when stuck; friction can cause sleeve to distort



[Additional pictures, see page 66](#)



DTH Hammers - Wear Sleeve -

Failure: Cracked wear sleeve

Cause of failure:

- Gripping with jaw wrench on wrong location
- Worn wear sleeve
- Corrosion

Action required:

- Use correct tong placements
- Replace wear sleeve when outside diameter reaches discard limit.
- Ensure pH neutral water; coat with corrosion protector when storing



[Additional pictures, see page 67](#)



DTH Hammers - Top Sub -

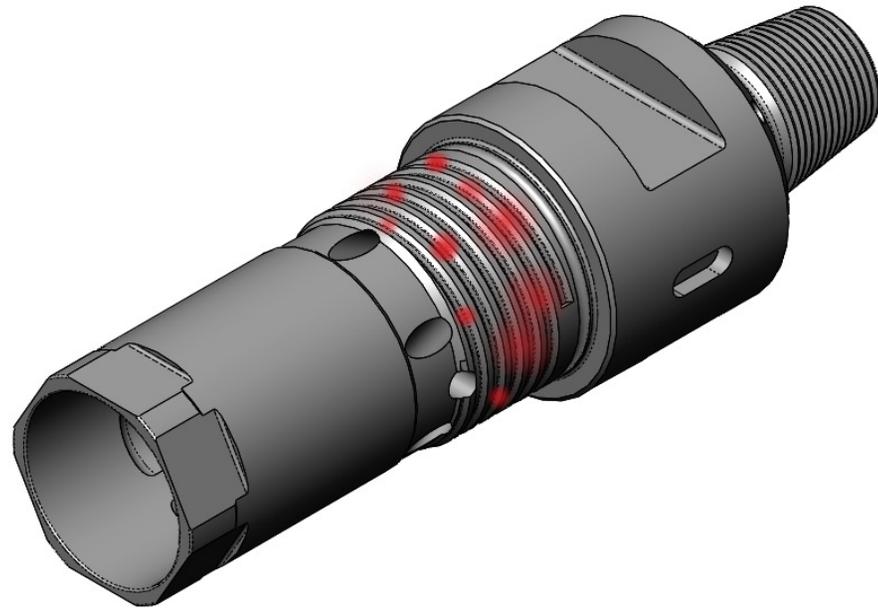
Failure:
Thread failure

Cause of failure:

- Corrosion at thread root

Action required:

- Regular replacement of thread lubricant





DTH Hammers - Top Sub -

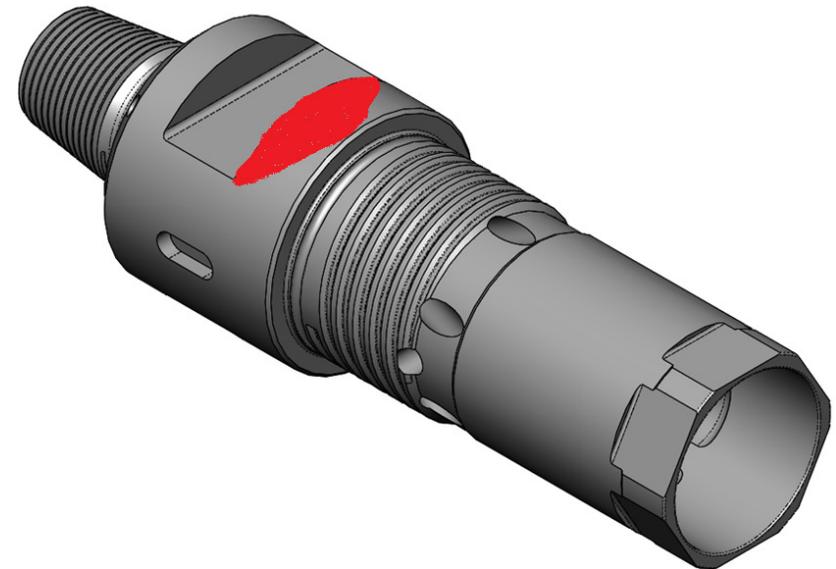
Failure: Broken Top Sub

Cause of failure:

- Improper torque between joints

Action required:

- Apply minimum recommended torque



[Additional pictures, see page 68](#)



DTH Hammers - Top Sub -

Failure: Missing reaming buttons

Cause of failure:

- Excessive top sub wear
- Getting stuck while drilling

Action required:

- Adjust parameters to drilling conditions.
- On unconsolidated rock always use reaming buttons on top sub



[Additional pictures, see page 69](#)



DTH Hammers - Operational -

Failure: Low Penetration Rate

Cause of failure:

- Low operating pressure
- Excessive bit wear
- Driver sub worn too much
- Low rotation speed
- Low feed force for rock conditions
- Contamination in hammer
- Worn hammer parts
- Too much water injection
- Wrong choke size / Missing choke

Action required:

- Check air compressor and /or leaks
- Check drill bit, grind or replace if necessary
- Check driver sub length
- Increase feed force
- Open hammer and clean obstruction; inspect piston, wear sleeve and check dimensions against discard limits
- Reduce level of water injected
- Change choke size



DTH Hammers - Operational -

Failure:
Erratic operation / rotation

Cause of failure:

- Feed force too high
- Rotation speed too slow
- Worn bit blow tube
- Worn driver sub
- Too much water injection
- Worn drill bit

Action required:

- Reduce feed pressure until drilling is smooth
- Adjust RPM to smooth drilling
- Inspect blow tube and replace if necessary
- Inspect driver sub length; shorter subs will restrict air needed to return piston
- Reduce water injection
- Sharpen dull carbides on bit or replace if necessary



DTH Hammers - Operational -

Failure:

Hammer does not operate in hole

Cause of failure:

- Hammer parts broken and/or worn
- Particles in the hammer
- Insufficient compressed air
- Blocked flushing holes in drill bit
- Piston stuck due to pinch wear sleeve
- Broken blow tube

Action required:

- Inspect hammer for damaged parts
- Open and clean hammer from obstructions
- Check compressor operation
- Clean bit flushing holes
- Replace hammer sleeve
- Replace worn blow tube



DTH Hammers - Operational -

Failure:
Hammer deviates at start of hole

Cause of failure:

- Feed force too high
- Drill bit worn

Action required:

- Reduce feed force when collaring
- Remove obstacles before drilling



DTH Hammers - Operational -

Failure:
Debris not coming out of hole

Cause of failure:

- Operating pressure too low
- Slow up hole cuttings velocity
- Flushing air being lost in fissures
- Buildup of debris
- Debris too big

Action required:

- Check air pressure
- Use pipe with large OD
- Drill slow until beyond fissures
- Lift and flush hammer constantly
- Change rotation speed



DTH Hammers - Operational -

Failure:

Vibration and/or squealing noise coming out of hole

Cause of failure:

- Low feed force
- High rotation
- Difficult rock conditions
- Worn out drill bit
- Broken drill bit in hole

Action required:

- Adjust feed force
- Adjust rotation
- Drill carefully, constant flushing, low rotation and feed force
- Sharpen bit buttons or replace if necessary



DTH Hammers - Operational -

Failure:
Hard to uncouple driver sub

Cause of failure:

- Feed force too high
- Insufficient grease on thread
- Low make up torque when connecting driver sub on sleeve
- Poor gripping

Action required:

- Adjust feed force
- Use grease on every thread connection
- Apply proper torque
- Do not grip on threads



DTH Hammers - Operational -

Failure:

Bit and driver sub lost in hole

Cause of failure:

- Hammering without rotation
- Worn driver sub
- Low make up torque when connecting sub on wear sleeve
- Reverse or counter clockwise rotation

Action required:

- Always keep rotation while hammering
- Replace worn driver sub
- Apply proper torque when couple driver sub on hammer sleeve
- Adjust feed force to drilling conditions
- Avoid reverse rotation



DTH Hammers - Operational -

Failure:

Drill bit running off bottom (Back Hammering)

Cause of failure:

- Worn piston
- Excessive water injection
- Debris between driver sub and bit splines
- Bit stuck in firing position

Action required:

- Inspect larger diameter of piston and check with specifications
- Reduce water injection
- Clear debris from hammer
- Check bit and driver sub splines for excessive wear and galling



DTH Hammers - Operational -

Failure:
Melting of internal components

Cause of failure:

- Frictional heating trying to free hammer stuck in hole

Action required:

- Use top sub with retract carbides (back reaming buttons)



R O C K M O R E
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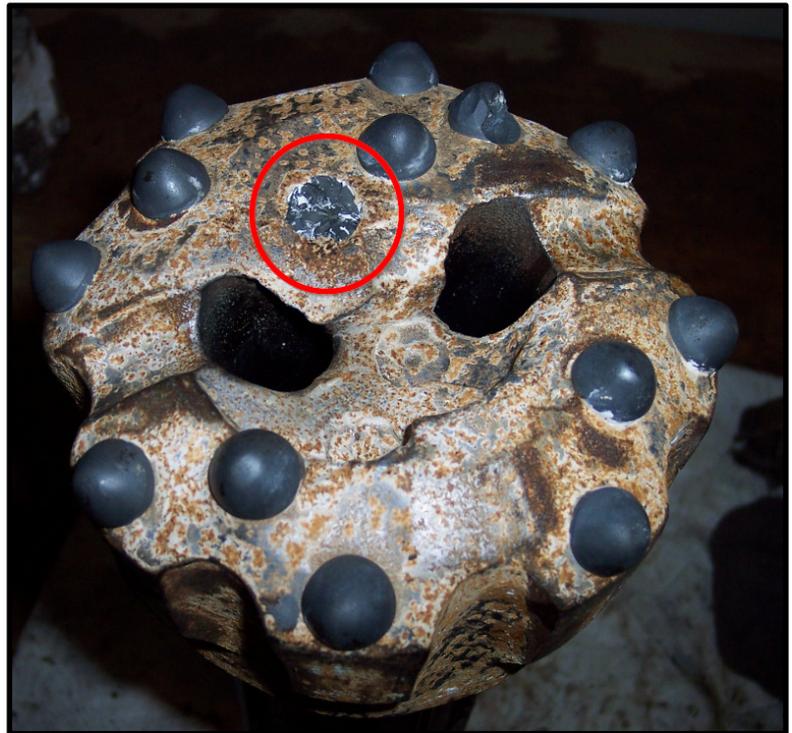
Rock Drilling Tools

Pictures



DTH Bits - Pictures -

Failure: Broken carbide



[Causes & actions, see page 8](#)



DTH Bits - Pictures -

Failure: Crack between flushing holes



[Causes & actions, see page 10](#)



DTH Bits - Pictures -

Failure: Broken carbide inside pocket



[Causes & actions, see page 11](#)



DTH Bits - Pictures -

Failure: Carbide missing, Matrix damage



[Causes & actions, see page 12](#)



DTH Bits - Pictures -

Failure: Excessive steel wear

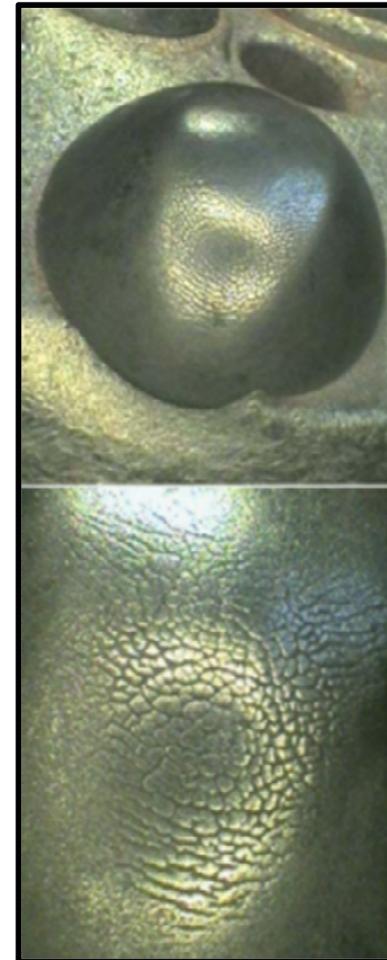


[Causes & actions, see page 15](#)



DTH Bits - Pictures -

Failure: Snake skin wear



[Causes & actions, see page 16](#)



DTH Bits - Pictures -

Failure: Broken shank across splines



[Causes & actions, see page 20](#)



DTH Bits - Pictures -

Failure: Broken striking face



[Causes & actions, see page 21](#)



DTH Bits - Pictures -

Failure: Shoulder damage



[Causes & actions, see page 22](#)



DTH Bits - Pictures -

Failure: Broken foot valve



[Damaged Striking Face - Causes & actions, see page 23](#)

[Broken Blow Tube - Causes & actions, see page 25](#)



DTH Hammer - Pictures -

Failure: Bit Retaining Area Damage



[Causes & actions, see page 24](#)



DTH Hammer - Pictures -

Failure: Broken Driver Sub



[Causes & actions, see page 27](#)



DTH Hammer - Pictures -

Failure: Excessive on Driver Sub splines



[Causes & actions, see page 29](#)



DTH Hammer - Pictures -

Failure: Cracked Driver Sub



[Causes & actions, see page 30](#)



DTH Hammer - Pictures -

Failure: Excessive wear on Driver Sub



[Causes & actions, see page 31](#)



DTH Hammer - Pictures -

Failure: Broken piston



[Causes & actions, see page 33](#)



DTH Hammer - Pictures -

Failure: Piston cracked



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DTH Hammer - Pictures -

Failure: Cracked wear sleeve



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DTH Hammer - Pictures -

Failure: Broken Top Sub



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DTH Hammer - Pictures -

Failure: Top Sub missing Reaming buttons



[Causes & actions, see page 38](#)