

Hole Openers

The Mills Machine holeopener is used **to enlarge or ream an existing pilot hole** or can be run above a pilot bit to **simultaneously drill and enlarge a hole**. These rugged tools are built for the toughest drilling applications.

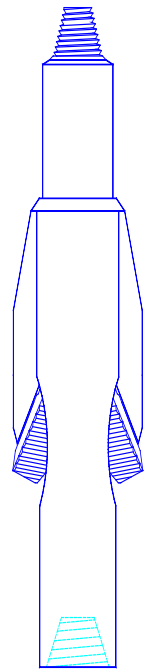
The use of holeopeners has gone from an optional operation to standard practice for most drillers. There are several advantages described on the reverse side of this page. The prime reasons for using holeopeners are **economy, accuracy, speed and flexibility of size**. With **over forty-five years of experience** Mills Machine can design and manufacture the exact tool for your individual requirements.

Fabricated Roller Cone (see Rotary Holeopeners, in this catalog)

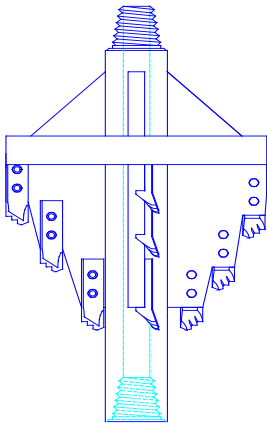
Fixed Arm Roller Cone (see Rotary Holeopeners, in this catalog)

Drag Bit, fixed and replaceable blade (see Rotary Drag Bit in this catalog)

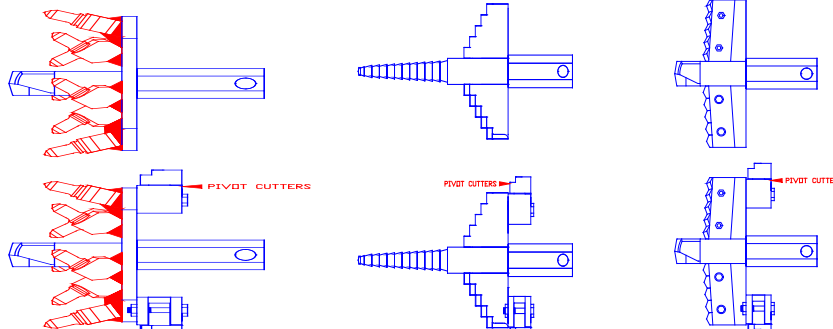
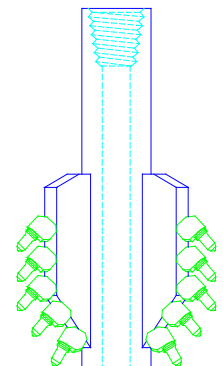
Claw Bit (see Rotary Claw Bit in this catalog)



Holeopeners or **Roller Back Reamers** are available for **Horizontal Road Boring** or **Horizontal Directional Drilling** applications. Configurations include roller cone, drag (blade) type or claw (bullet) type in any size and with any connection. These rugged units are manufactured with a reverse pitch on the cutters for pulling back through the pilot hole.



We also manufacture a line of **Free Bore** and **Casing Push** bits for the Horizontal road Boring market. Configurations include roller cone, drag (blade) type or claw (bullet) type in any size and with any hex connection. The **Roller Cone** type features a special **Positive Cam Lock Design** for pushing casing as you drill. This type of bit is made to cut very **hard rock** formations. **Blade and Bullet** configurations are offered with a flip out cutters for **soft to medium** formations.



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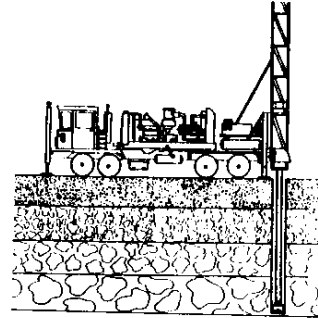
Advantages of Hole Openers

1. Cost and availability of large tricone rock bits.

Large diameter rock bits are expensive and difficult to find compared to the economy of Holeopeners using smaller rock bit segments.

2. Large diameter holes with small rigs.

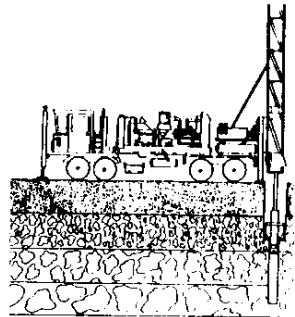
Large holes can be drilled with smaller rigs by opening the hole up in stages. A smaller hole requires less power.



Drill Pilot Hole

3. Straighter hole.

Drill a straighter hole by drilling a pilot hole then attaching the pilot bit to the bottom of a holeopener, which will follow the existing hole. A pilot hole will normally be straighter because the smaller the hole the straighter the hole.



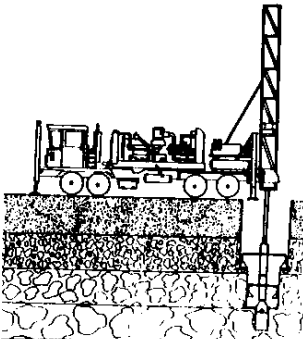
Enlarge Hole

4. Cutter replacement.

To extend the initial cost investment of a Holeopener, the cutters on most any design can be replaced. Bolt-on drag bit and claw holeopeners can be replaced in the field. Fixed blade and roller cone holeopeners may require factory replacement.

5. Sizes and formations available.

Holeopeners can be manufactured in any size and made to drill any formation from soft clay to hard granite.



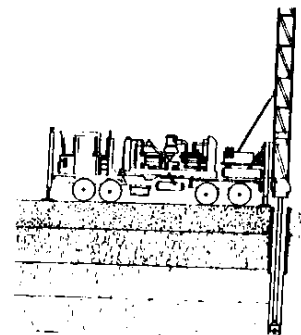
Either Enlarge Hole Further

6. Surface casing and starter holes.

Holeopeners provide a convenient way to drill larger diameter holes for setting surface casing and shallow starter holes.

7. New jobs.

With the capability of drilling larger diameter holes, several job markets could open up. For example: mining air shafts, elevator holes, power line holes, municipal water wells, foundation holes and mouse or rat holes for drill pipe storage.

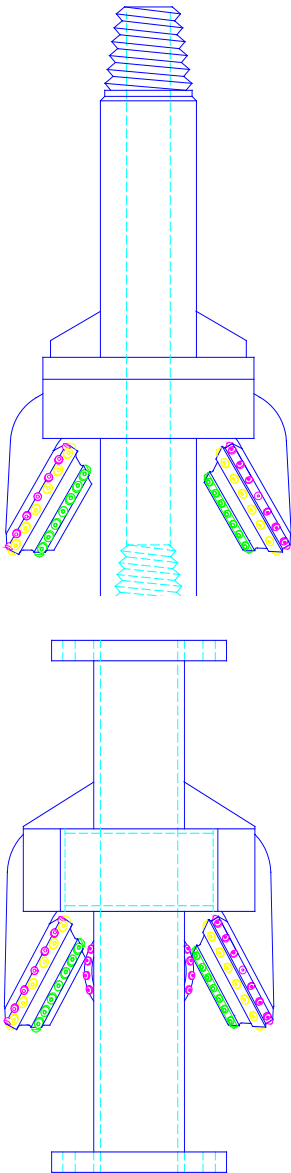


Or Set Casing and Finish Hole

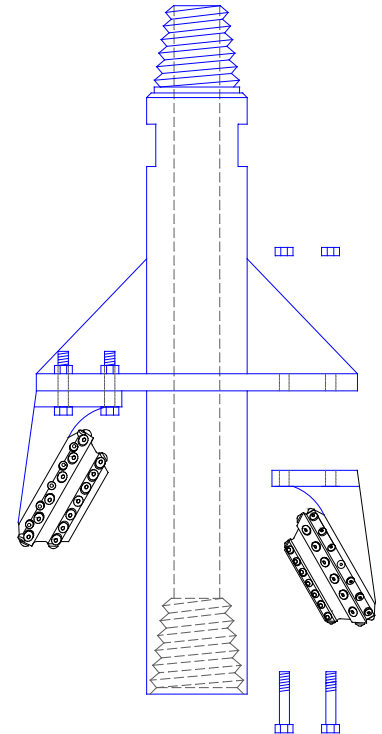
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Advantages of Hole Openers

Mills Machine has been manufacturing **Split Bit Type Roller Cone Holeopeners** for over **45 years**. These ruggedly constructed, high-quality units are made from **4142 heat treated alloy steel** and split roller rock bit cutters. Each holeopener is custom manufactured for your specific application.



- Sizes Range from 5 1/2 to 118.
- One, Two or Multiple Stage Designs.
- Regular or Reverse and Air or Fluid Circulation as shown at left
- Any Thread or Flange Size
- Steel Tooth or TCI Button in New, Retip or Rerun Condition
- Soft, Medium or Hard Formation Cutters.
- Extended Top or Bottom Neck with Flats
- Fabricated Fixed Cutter or Bolt on Cutter Design
- Blade and Bullet Cutter Designs are available



Please use the **questionnaire** for the roller cone holeopeners on the next page.

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Fabricated Roller Cone Holeopener

Application Questionnaire Fabricated Roller Cone Holeopener

Company _____
 Address _____

 City, State Zip _____

Phone _____
 Fax _____
 Contact _____

****Quantity:** _____ ****Hole Size** _____
****Pilot Diameter** _____ Pilot Bit Type _____
Cutters **Bearing**:** **Conventional** **Sealed**
 ****Steel Tooth Cones** **New** **Retip**
 Formation: **Soft** **Med. Soft** , **Medium** ,
 Med. Hard , **Hard**
OR ****TCI Button Bit Cones** **New** **Rerun**
 Formation: 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9
****Top Connection:** _____ **Pin** **Box**
****Bottom Connection:** _____ **Pin** **Box**

Sketch:

**** Must fill out these items. Fill out more if possible
 or custom product requested.**

Number of Stages _____ Length: S to S _____ OR Overall _____

Is Holeopener Going Inside of Casing? Yes No

Casing ID _____

Top Neck Dimensions: OD _____ ID _____ Length _____

Knurled

Bottom Neck Dimensions: OD _____ ID _____ Length _____

Breakout

Flats: Two Sided Four Sided

Special _____

Flat Length _____ Location _____

Dimensions: Flat to Flat _____ OR Depth per Side _____

Location _____

Float Valve: Bore Only Install: Customer Furnished Mills Furnished

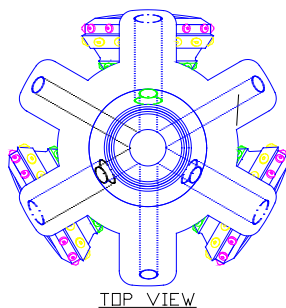
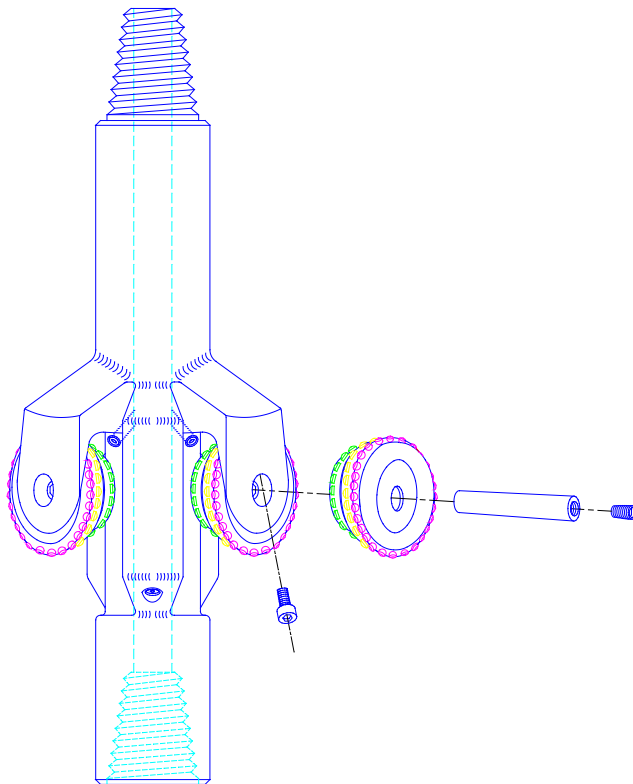
Brand _____ Model & Size _____

Special Requirements: _____

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Fixed Arm Roller Cone Holeopener with Replaceable Cutters

Mills Machine Company has been a manufacturing fabricated cutter (split bit) holeopeners for over **45 years**. In 1994 we started working with some companies in Louisiana to secure prints and specifications to build oil field type holeopeners with demountable roller cones. These Holeopeners are manufactured from a solid piece of 4142 heat-treated alloy steel and the arms are fabricated into the body. The roller cones are held in place by sliding the cutter journal into a cam lock slot and then a load pin is inserted through the journal to hold the cutter in place. These rugged Holeopeners feature cutters that are interchangeable with one of the most popular name brand Oil Field Holeopener Manufacturers.



Fixed Arm roller cone holeopeners range in size from 10 5/8 to 26 diameter. We offer **open or sealed bearing** construction with **Steel Teeth or TCI Buttons** in **soft, medium and hard formations**. The bit is available in a **Single or Double Stage** design depending on the pilot hole and enlarged hole size. The Holeopeners are available with either 3 or 6 jets. We are one of the very few manufacturers that have ever made a Two Stage Holeopener in this design.

The cutters are **field replaceable** and can be disassembled to replace the bearings and seals. Steel tooth cutters can be retipped to **extend the life** of the cutter.

The top connection includes breakout flats or extended fishing neck. The bottom connection will be made to fit your pilot bit. We can also, furnish a bull nose to guide the holeopener.

Please use the **questionnaire** for the fixed arm roller holeopeners with replaceable cutters on the next page.

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Application Questionnaire Fixed Arm Roller Cone Holeopener with Replaceable Cutters

Company _____
 Address _____

 City, State Zip _____

Phone _____
 Fax _____
 Contact _____

****Quantity:** _____ **Hole Size** _____
****Pilot Diameter** _____ **Pilot Bit Type** _____
Cutters: **Bearing**:** **Conventional** **Sealed**
 ****Steel Tooth Cutters**
 Formation: **Soft** , **Med. Soft** , **Medium** ,
 Med. Hard , **Hard**
OR **TCI Button Bit Cutters ▽
 Formation: 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9
****Top Connection:** _____ **Pin** **Box**
****Bottom Connection:** _____ **Pin** **Box**

Sketch:

**** Must fill out these items. Fill out more if possible or custom product requested.**

Is Holeopener Going Inside of Casing? Yes No
 Casing ID _____
 Number of Stages _____ Length: S to S _____ OR Overall _____
 Top Neck Dimensions: OD _____ ID _____ Length _____
 Knurled
 Bottom Neck Dimensions: OD _____ ID _____ Length _____
 Breakout
 Flats: Two Sided Four Sided
 Special _____
 Flat Length _____ Location _____
 Dimensions: Flat to Flat _____ OR Depth per Side _____
 Location _____
 Float Valve: Bore Only ▽ Install: Customer Furnished ▽ Mills Furnished ▽
 Brand _____ Model & Size _____

Special Requirements: _____

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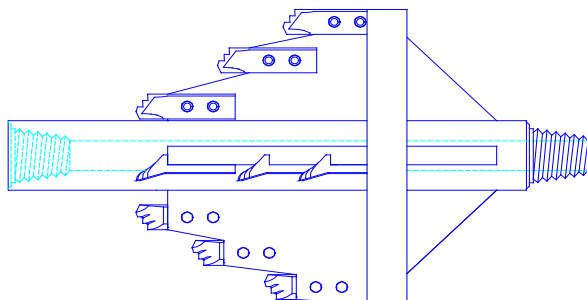
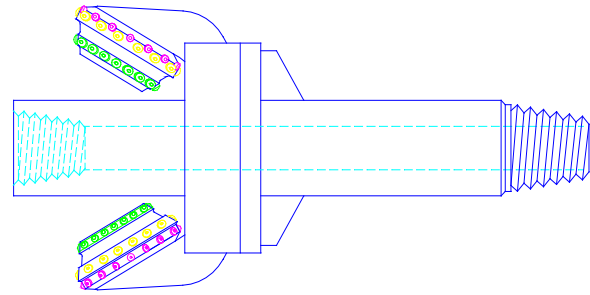
Horizontal Directional Drilling

Roller Cone Horizontal Holeopeners.

Mills Machine has **forty years of experience** behind our full line of horizontal roller holeopeners available in sizes from 6 to 120 (150 mm to 3 Meters) and larger. We manufacture the larger holeopeners to meet your specific design. These ruggedly constructed units are made from **4142 alloy steel** and the rock bit cutters of your choice.

The horizontal holeopeners can be single stage, two stage or multiple stage depending on the pilot hole and the enlarged hole size. The lead and trailing necks can be as long or short as you desire with breakout flats or lugs as needed. Circulation can be standard or reverse for horizontal or raised bore drilling. Circulation can also be fluid or air depending on your rig capabilities.

Roller cone, horizontal holeopeners are made from rock bits designed for the specific formation. Available are steel tooth or TCI button bits in new, retip or rerun condition.



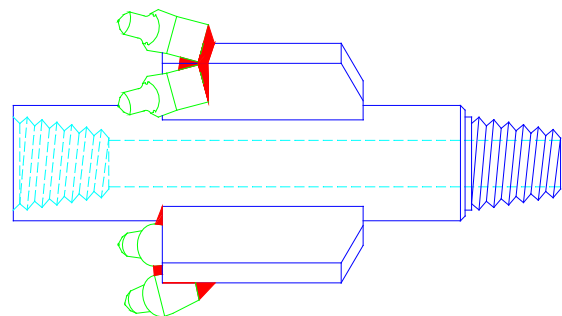
Drag Type Horizontal Holeopeners

Mills also manufactures large drag holeopeners for horizontal drilling using step tooth or digger tooth construction or a combination of teeth and bits. Used in soft to medium formations, the sizes start where the standard catalog sizes leave off and are, again, designed for your specific needs. We have manufactured units with drag teeth on the working end and bullet claw bits on the reverse side in case of cave-in.

Bullet Type Horizontal Holeopeners

Replaceable bullet cutters give longer life for the cutter head body and ease of use for the driller. These holeopeners are meant for use in clay or medium shale rock (up to 6000 psi rock) and are available in sizes 6 inches to 10 feet in diameter and their corresponding metric dimensions.

The only limit on our capabilities is your imagination. Working together, we can solve the tough problems.



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Horizontal Directional Drilling

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Underreamers

Roller Cone and Drag Type Underreamers are just two more examples of our goal to bring expensive Oil Field technology to other drilling markets at an economical cost. We have been manufacturing both types of Underreamer designs for over twenty years and based on the feedback from our customers out in the field we have been able to offer continual improvements.

The primary use for both of these tools is to open up the bore hole below the casing. Most drillers are trying to straighten up a dog leg down the hole, which may be preventing advancement of the casing.

Other uses include opening up zones down the hole to increase the yield of a well or seal off salt water intrusion from the bottom of the hole.

The construction industry has used underreamers for tie back or anchor holes in any type of dirt, rock or concrete formations.

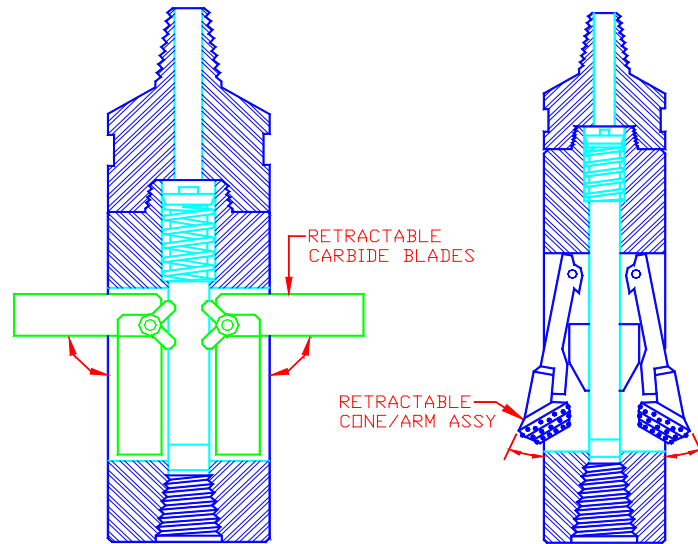
Our Underreamers can be opened up anywhere down the hole and as many times as needed but, **you must have adequate annular space for the blades or rollers to open up.** Most drillers pull the casing up 3 or 4 feet and lower the underreamer below the casing and then open the tool and start drilling. The tools operate with either **air or fluid pressure** and require as little as 60 – 100 lbs. of pressure to force the cutter arms out.

The bodies and cutter arms are manufactured from heat treated steel.

The piston is carbonized steel to reduce abrasion and features a replaceable

BLADE TYPE UNDERREAMER

CONE TYPE UNDERREAMER



tungsten carbide jet nozzle to adjust to your individual compressor or mud pump output.

Additional circulation holes have been added into the side of the piston body to keep the cuttings out of the cutter slots.

The simple, rugged design features easily replaced components for long term, trouble free operation. The operation of our Underreamers is very simple. The tool is hydraulically operated by pump pressure which forces a spring loaded actuating piston downward. A cam attached to the lower end of the actuating piston forces the cutter arms out to the desired cutting diameter. When the pump pressure is shut off, a coil spring forces the piston upward causing the cutter arms to retract back into the body.

We can custom manufacture an underreamer to meet your individual requirements.

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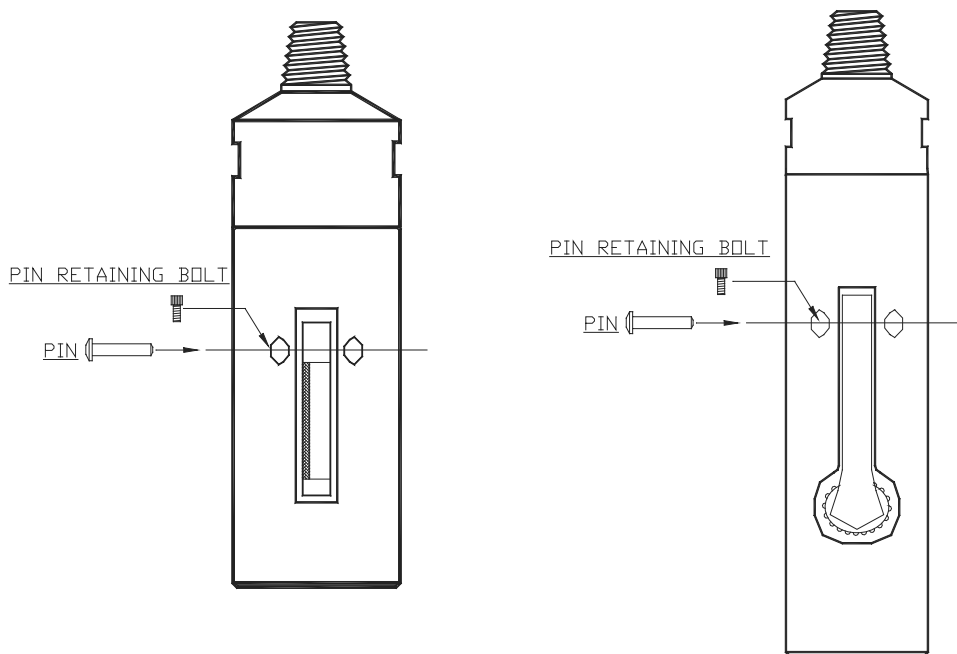
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Underreamer Maintenance

Drag or Roller Cone Underreamers: Clean and lubricate your underreamer after each use and store in a dry area. Periodically disassemble the underreamer and lubricate the piston and check on the condition of the cup seal and compression spring. Insure that there is no dirt in the system that hinders flow of air or fluid. Check the replaceable carbide jet plug (if you have one installed) for abrasive wear. Note you can adjust the fluid flow by changing the jet plug diameter and for your convenience we use a standard tricone rock bit jet. Check the rubber cup seal for edge wear and the actuator spring for strength.

Replacement of the underreamer arm is a simple operation. First remove the pin retaining bolt, and then remove the pin using a punch or round bar. The blade or roller cone arm is then easily removed. To check the piston assembly, remove the top sub and pull the piston assembly out of the body to check the jet plug, cup seal and actuator spring.

Drag Underreamers need the blades replaced, when the Tungsten Carbide coating becomes worn. Roller Cone Underreamers, need the roller cone assembly replaced when the teeth, buttons or bearings become worn. If the underreamer is a custom size we may require the complete assembly to be returned for reworking the roller arms. If you have any technical questions please contact us.



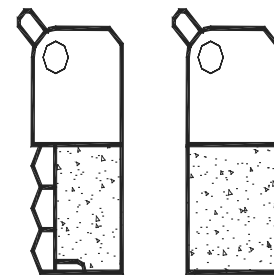
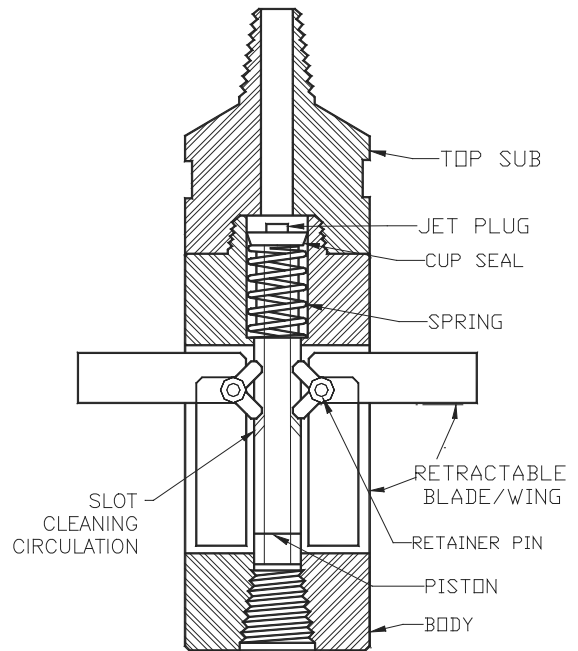
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Drag Type Underreamer

Mills Machine Company has been manufacturing and continually improving the design of its **Drag Type (Blade) Underreamer** for over twenty years. The design is simple, yet rugged enough to provide the most efficient operation for opening up a soft to medium formation hole. Through the use of highly efficient tungsten carbide tipped alloy steel blades, the tool is exceptionally fast in opening up a hole below the casing. The primary uses for this type of tool is to provide clearance for running casing, to obtain adequate annular space for cementing, to enlarge zones for gravel pack completion or tie back anchor holes. Recommended for use in sand, dirt, clay, sand rock, sandstone, and hard shale formations.

The Mills Machine Drag Type (Blade) Underreamer:

- Enlarges the borehole below the casing.
- Produces positive cutter blade opening by direct pump pressure. Several blade designs are available for soft to hard formations.
- Rubber piston cup is designed for fluid or air drilling.
- Features simple, rugged construction with a minimum of parts to ensure trouble-free operation.
- Has adjustable carbide jet orifices to match output from your pump or compressor.
- Features additional circulation holes drilled into the piston body to keep cuttings out of the cutter slots.
- Sizes for 4 casing and larger with tungsten carbide inserts or crushed carbide chips.
- Any thread type, breakout flats, or float valve bore available.



Serrated Carbide

Cutrite Carbide

The Mills Machine Underreamer is hydraulically operated by pump pressure which forces a spring loaded actuating piston downward. A milled opening in the side of the piston forces the cutter blades out to the desired cutting diameter. **Adequate annular space is required to open the blades.** When the pump pressure is shut off, a coil spring forces the piston upward causing the cutter blades to retract back into the body. The tool can be opened up anywhere down enabling you to open up as many zones as you like.

To maintain your Mills underreamer simply clean and lubricate after each use and store in a dry area. Spare parts kits are available with the original purchase of your underreamer and for field repair of your tool.

Please use the **questionnaire** for the drag underreamers on the next page.

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Application Questionnaire

Drag Underreamer

Drag Underreamer

Company _____
Address _____
City, State Zip _____

Phone _____
Fax _____
Contact _____

****Quantity:** _____ **Closed Diameter** _____
Open Diameter _____

****Pilot Diameter** _____ *Pilot Bit Type* _____

****Top Connection:** _____ **Pin** **Box**

****Bottom Connection:** _____ **Pin** **Box**

Circulation: Air PSI _____ or Fluid PSI _____

****Must fill out these items. Fill out more if possible or custom product requested.**

*Cased Hole**:* OD _____ ID _____
OR *Uncased Hole:* ID _____

Blade: Cutrite Carbide Serrated Carbide
Top Neck Dimensions: OD _____ ID _____
Knurled Length _____

Bottom Neck Dimensions: OD _____ ID _____
Length _____

Breakout Flats: Two Sided Four Sided
Special _____

Flat Length _____ Location _____

Dimensions: Flat to Flat _____
OR Depth per Side _____

Location _____

Float Valve: Bore Only *Install:* Customer Furnished
Mills Furnished

Brand _____ Model & Size _____

Special Requirements: _____

Replacement Parts: Cutrite Blades _____, Serrated Blade _____
Blade Pins _____, Pin Retaining Bolt _____
Springs _____, Cup Seal _____, Jet Plugs _____

Sketch:

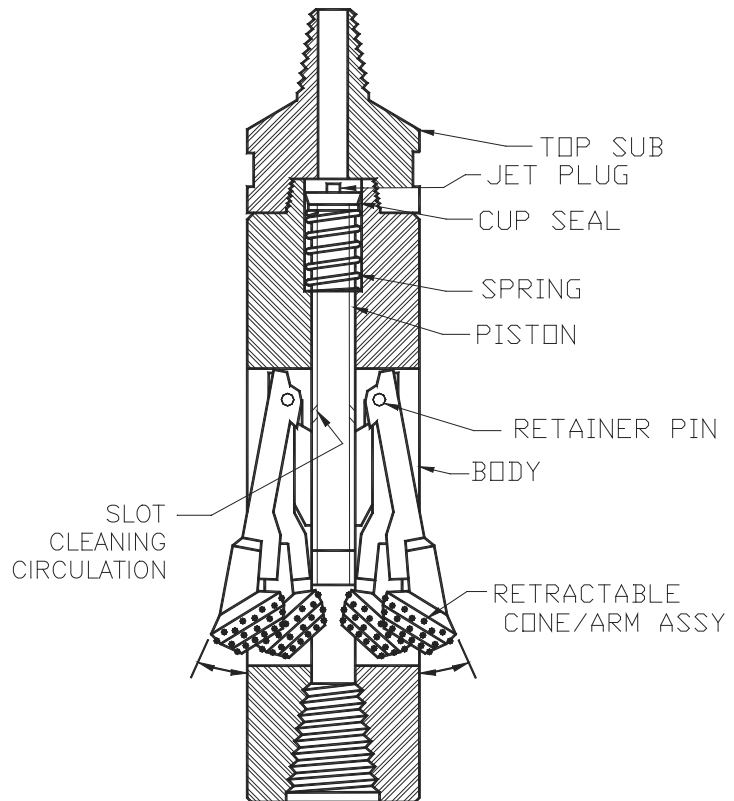
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Roller Cone Type Underreamer

Mills Machine Company has been manufacturing and continually improving the design of its **Roller Cone Underreamer** for over twenty years. The design is simple, yet rugged enough to provide the most efficient operation for opening up a hole. Through the use of highly efficient rock bit cones on the cutting arms, the tool is exceptionally fast in opening up a hole. The primary uses for this type of tool is to provide clearance for running casing, to obtain adequate annular space for cementing, or to enlarge zones for gravel pack completion. Recommended for soft to hard rock formations.

The Mills Machine Roller Cone Underreamer:

- Enlarges the borehole below the casing.
- Produces positive cutter arm opening by direct pump pressure.
- Rubber piston cup is designed for fluid or air drilling.
- Features simple, rugged construction with a minimum of parts to ensure trouble-free operation.
- Has adjustable carbide jet orifices to match output from your pump or compressor.
- Features additional circulation holes drilled into the piston body to keep cuttings out of the cutter slots.
- Sizes for 6 casing and larger with Steel Tooth or TCI Button Cutters.
- Any thread type, breakout flats, or float valve bore available.



The Mills Machine Underreamer is hydraulically operated by pump pressure which forces a spring loaded actuating piston downward. A cam attached to the lower end of the actuating piston forces the cutter arms out to the desired cutting diameter. **Adequate annular space is required to open the blades.** When the pump pressure is shut off, a coil spring forces the piston upward causing the cutter arms to retract back into the body. The tool can be opened up anywhere down enabling you to open up as many zones as you like.

To maintain your Mills underreamer simply clean and lubricate after each use and store in a dry area. Spare parts kits are available with the original purchase of your underreamer and for field repair of your tool.

Please use the **questionnaire** for the roller cone underreamers on the next page.

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Application Questionnaire
Roller Cone Underreamer **Roller Cone Underreamer**

Company _____
Address _____
City, State Zip _____

Phone _____
Fax _____
Contact _____

****Quantity:** _____ **Closed Diameter** _____
Open Diameter _____

****Pilot Diameter** _____ *Pilot Bit Type:* _____

Cutters Bearing:** **Conventional**
Steel Tooth:** New Retip
Formation: Soft , Med. Soft , Medium ,
Med. Hard

OR TCI Button Bit:** New Rerun
Formation: 1 , 2 , 3 , 4 , 5

****Top Connection:** _____ Pin Box

****Bottom Connection:** _____ Pin Box

Circulation: Air PSI _____ or Fluid PSI _____

Sketch:

****Must fill out these items. Fill out more if possible or custom product requested.**

Cased Hole: OD _____ ID _____
OR *Uncased Hole:* ID _____

Top Neck Dimensions: OD _____ ID _____
Knurled Length _____

Bottom Neck Dimensions: OD _____ ID _____
Length _____

Breakout Flats: Two Sided Four Sided
Special _____
Flat Length _____ *Location* _____
Dimensions: Flat to Flat _____
OR Depth per Side _____
Location _____

Float Valve: Bore Only *Install:* Customer Furnished
Mills Furnished
Brand _____ *Model & Size* _____

Jet Size: Standard Special _____ Center Out

Special Requirements: _____

Replacement Parts: Cone Assembly _____, Cams _____, Cup Seal _____,
Retainer Pin _____, Pin Retaining Bolt _____,
Spring _____, Jet Plugs _____.

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