

Pierce Airrow II Series

Operation, Service & Parts Manual



CMW®

Issue 1.1



053-1129

Overview

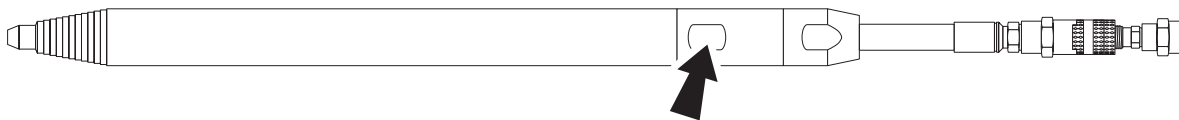


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Serial Number Location

Record serial number and date of purchase in spaces provided. Piercing tool serial number is located as shown.



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Item	
date of manufacture	
date of purchase	
piercing tool serial number	



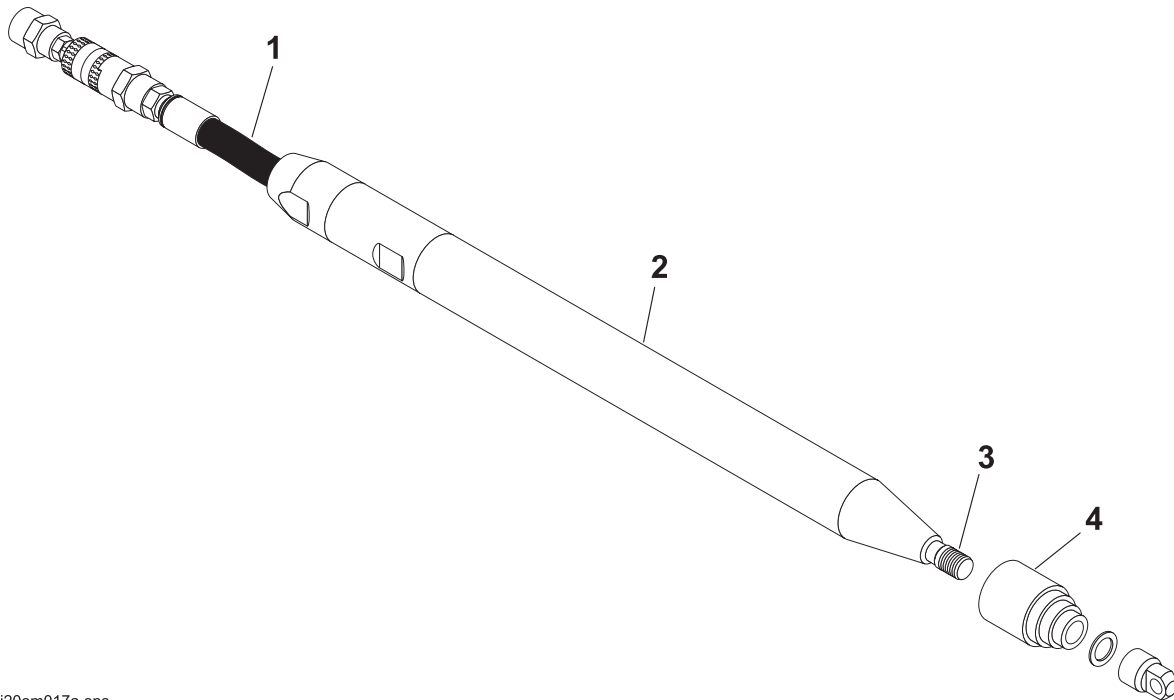
Intended Use

The Ditch Witch Pierce Arrow II series piercing tools are used to pneumatically pierce ground or to push pipe through the ground and under existing structures such as roads, driveways, railroad tracks, sidewalks, and cart paths. Additionally, lightweight materials can be pulled back through a bore made by the tool. The PA225 model has a standard nose configuration. The PA270, PA310 and PA425 models offer the standard nose configuration while the PA270T, PA310T and PA425T models have threaded noses which can be fitted with optional nose expanders and covers designed for varying soil conditions. Optional clamp-on rear expanders and tail adapters are also available for PA270, PA310 and PA425 models.

Ditch Witch Pierce Arrow II tools are intended for operation in ambient temperatures from 0° to 115°F (-18° to 46°C). Use in any other way is considered contrary to the intended use. These tools should be operated, serviced, and repaired only by persons familiar with their particular characteristics and acquainted with the relevant safety procedures.

Unit Components

Basic Piercing Tool

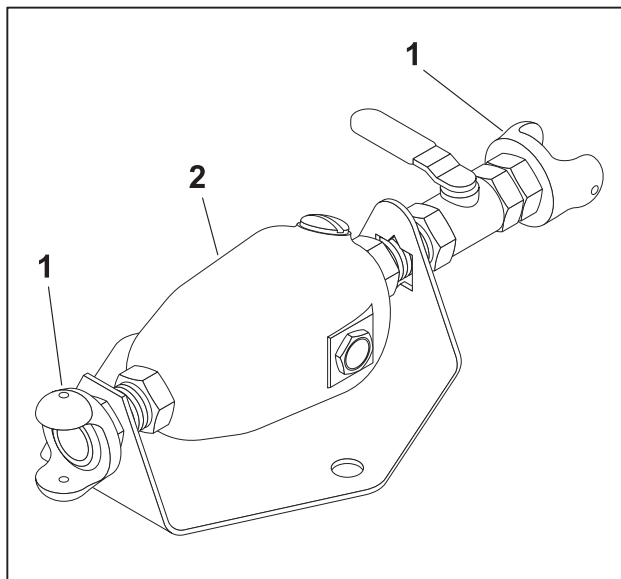


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- | | |
|--------------|--|
| 1. Whip hose | 3. Head adapter |
| 2. Body | 4. Optional tool head (stepped head shown) |

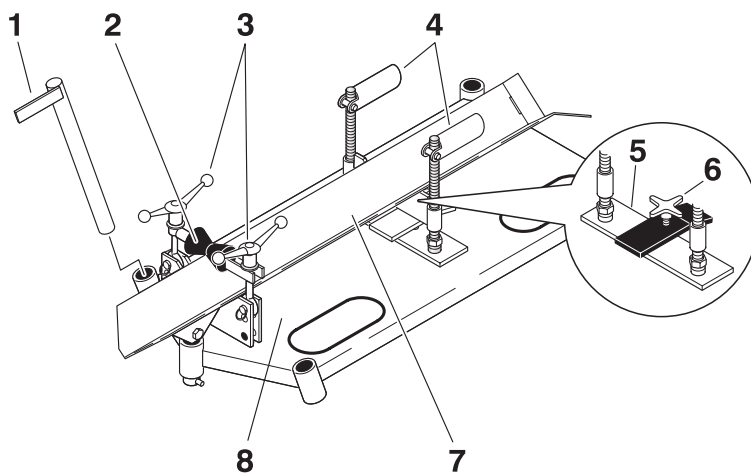
Oiler

- 1. Claw couplers
- 2. Oil reservoir



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Piercing Tool Launcher



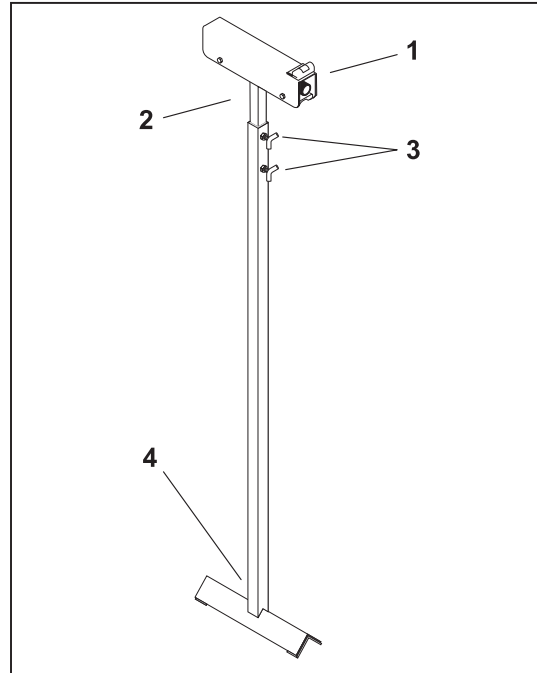
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- 1. Hold down stake
- 2. Roller
- 3. Wing knobs
- 4. Tilt adjustment handles
- 5. Left/right adjustment plate
- 6. Adjustment knob
- 7. Launcher guide
- 8. Launcher pad

Aiming Sight

1. Scope assembly
2. Top extension
3. Wing nuts
4. Bottom extension

IMPORTANT: For information on how to adjust the aiming sight, see "Adjust Optional Aiming Sight" in **Preparation**.



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About This Manual

This manual contains information for the proper use of this machine. See the beige **Operation Overview** pages for basic operating procedures. Cross references such as "See page 50" will direct you to detailed procedures.

Bulleted Lists

Bulleted lists provide helpful or important information or contain procedures that do not have to be performed in a specific order.

Numbered Lists

Numbered lists contain illustration callouts or list steps that must be performed in order.

"Continued" Indicators



indicates that a procedure is continued on the next page.

Foreword



This manual is an important part of your equipment. It provides safety information and operation instructions to help you use and maintain your Ditch Witch equipment.

Read this manual before using your equipment. Keep it with the equipment at all times for future reference. If you sell your equipment, be sure to give this manual to the new owner.

If you need a replacement copy, contact your Ditch Witch dealer. If you need assistance in locating a dealer, visit our website at **www.ditchwitch.com** or write to the following address:

The Charles Machine Works, Inc.
Attn: Marketing Department
PO Box 66
Perry, OK 73077-0066
USA

The descriptions and specifications in this manual are subject to change without notice. The Charles Machine Works, Inc. reserves the right to improve equipment. Some product improvements may have taken place after this manual was published. For the latest information on Ditch Witch equipment, see your Ditch Witch dealer.

Thank you for buying and using Ditch Witch equipment.

Pierce Airrow II Series Operator's Manual

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This product is covered by one or more of the following Allied Construction Products, LLC patents:
U.S. 3,410,354; 3,758,328; 4,662,457; 4,809,789; other U.S. patents pending.

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Safety

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Guidelines

Follow these guidelines before operating any jobsite equipment:


- Complete proper training and read operator's manual before using equipment.
- Contact One-Call (811) and any utility companies which do not subscribe to One-Call. Have all underground pipes and cables located and marked before operating equipment. If you damage a utility, contact utility company.
- Classify jobsite based on its hazards and use correct tools and machinery, safety equipment, and work methods for jobsite.
- Mark jobsite clearly and keep spectators away.
- Wear personal protective equipment.
- Review jobsite hazards, safety and emergency procedures, and individual responsibilities with all personnel before work begins. Safety videos are available from your Ditch Witch dealer.
- Replace missing or damaged safety shields and safety signs.
- Use equipment carefully. Stop operation and investigate anything that does not look or feel right.
- Do not operate unit where flammable gas is present.
- Contact your Ditch Witch dealer if you have any question about operation, maintenance, or equipment use.


Safety Alert Classifications


These classifications and the icons defined on the following pages work together to alert you to situations which could be harmful to you, jobsite bystanders or your equipment. When you see these words and icons in the book or on the machine, carefully read and follow all instructions. **YOUR SAFETY IS AT STAKE.**



Watch for the three safety alert levels: **DANGER**, **WARNING** and **CAUTION**. Learn what each level means.

 **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

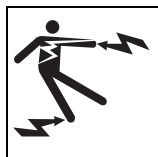
 **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Watch for two other words: **NOTICE** and **IMPORTANT**.

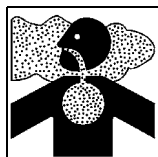
NOTICE can keep you from doing something that might damage the machine or someone's property. It can also alert you against unsafe practices.

IMPORTANT can help you do a better job or make your job easier in some way.

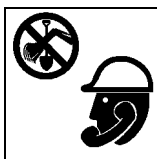
Safety Alerts



⚠ DANGER Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.



⚠ DANGER Deadly gases. Lack of oxygen or presence of gas will cause sickness or death. Provide ventilation.



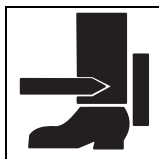
⚠ WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.



⚠ WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.



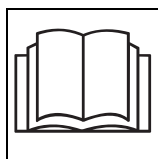
⚠ CAUTION Fall possible. Slips or trips may result in injury.



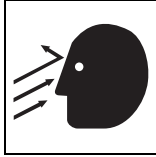
⚠ WARNING Moving parts could cut off hand or foot. Stay away.



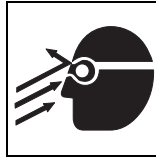
⚠ WARNING Explosion possible. Serious injury or equipment damage could occur. Follow directions carefully.



⚠ WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.



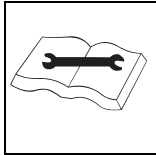
⚠ WARNING Looking into fiber optic cable could result in permanent vision damage. Do not look into ends of fiber optic or unidentified cable.



⚠ WARNING Pressurized fluid or air could pierce skin and cause injury or death. Stay away.



⚠ WARNING Moving traffic - hazardous situation. Death or serious injury could result. Avoid moving vehicles, wear high visibility clothing, post appropriate warning signs.



⚠ WARNING Improper control function could cause death or serious injury. If control does not work as described in instructions, stop machine and have it serviced.



⚠ CAUTION Flying objects may cause injury. Wear hard hat and safety glasses.



⚠ CAUTION Exposure to high noise levels may cause hearing loss. Wear hearing protection.



⚠ CAUTION Improper handling or use of chemicals may result in illness, injury, or equipment damage. Follow instructions on labels and in material safety data sheets (MSDS).

Emergency Procedures

**⚠ WARNING**

Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

Before operating any equipment, review emergency procedures and check that all safety precautions have been taken.

EMERGENCY SHUTDOWN - Turn ignition switch to stop position or push remote engine stop button (if equipped).

Electric Strike Description

**⚠ DANGER**

Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.

When working near electric cables, remember the following:

- Electricity follows all paths to ground, not just path of least resistance.
- Pipes, hoses, and cables will conduct electricity back to all equipment.
- Low voltage current can injure or kill. Almost one-third of work-related electrocutions result from contact with less than 440 volts.

Most electric strikes are not noticeable, but indications of a strike include:

- power outage
- smoke
- explosion
- popping noises
- arcing electricity

If any of these occur, assume an electric strike has occurred.

If an Electric Line is Damaged

1. **DO NOT MOVE.** Stay where you are.
2. **DO NOT TOUCH ANY EQUIPMENT.**
3. Warn others that an electric line has been hit and that they should stay away.
4. Have someone contact the utility company.
5. Do not resume drilling or allow anyone into area until given permission by electric company.



If a Gas Line is Damaged



⚠ WARNING Fire or explosion possible. Fumes could ignite and cause burns. No smoking, no flame, no spark.



⚠ WARNING Explosion possible. Serious injury or equipment damage could occur. Follow directions carefully.

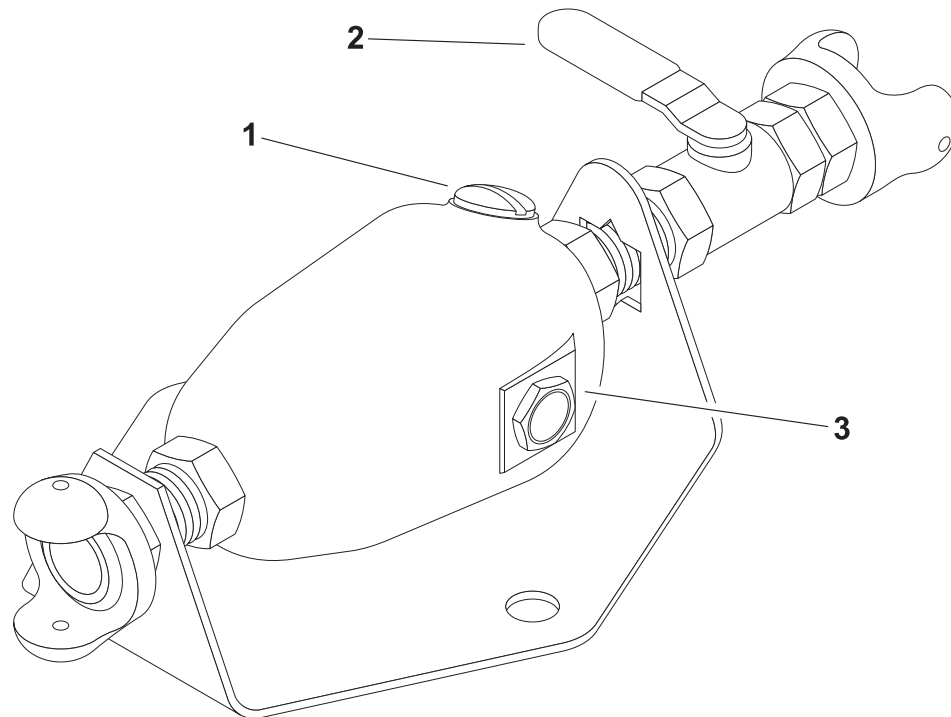
1. Immediately shut off compressor and remove any ignition sources.
2. **LEAVE AREA** as quickly as possible.
3. Warn others that a gas line has been cut and that they should leave area.
4. Contact emergency personnel.
5. Contact utility company.
6. Do not return to area until given permission by utility company.

If a Fiber Optic Cable is Damaged

Do not look into cut ends of fiber optic or unidentified cable. Vision damage can occur.

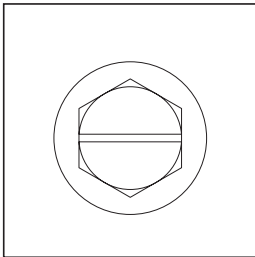
Controls

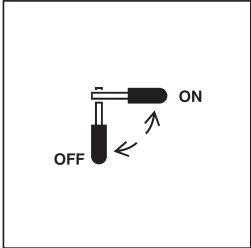
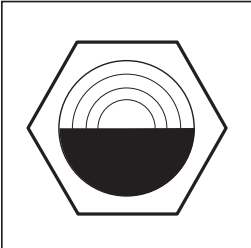
Oiler



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- 1. Plug
- 2. Air supply valve (on and off)
- 3. Sight glass

Item	Description	Notes
<p>1. Plug</p>  <p>om0629h.eps</p>	<p>To add oil, remove fill plug from the oiler with a flat head screwdriver.</p>	<p>IMPORTANT: Tighten plug fully before operating oiler.</p>

Item	Description	Notes
<p>2. Air supply valve</p>  <p>om2492a.eps</p>	<p>To close air supply and stop tool, move valve perpendicular to edge of oiler cover to OFF.</p> <p>To open air supply and turn tool on, move valve parallel to edge of oiler cover to ON.</p>	
<p>3. Sight glass</p>  <p>ic0270h.eps</p>	<p>Used to monitor the amount of oil remaining in the oiler.</p> <p>Stop unit and fill oiler when level drops below halfway point on glass.</p>	<p>NOTICE: Discharge air from oiler before opening fill plug. For instructions on how to discharge air from the oiler, see "Adjust Oil Flow" on page 66.</p>

Prepare

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Gather Information

A successful job begins before the bore. The first step in planning is reviewing information already available about the job and jobsite.

Job Plan

Review blueprints or other plans and make sure you have taken bore enlargement into account. Check for information about existing or planned structures, elevations, or proposed work that may be taking place at the same time.

One-Call Services

Contact your local One-Call (811 in USA) or the One-Call referral number (888-258-0808 in USA and Canada) to have underground utilities located before digging. Also contact any utilities that do not participate in the One-Call service.



Pullback Material

Ask for a sample of the material you will be pushing or pulling back. Check its weight and stiffness. Check that you have appropriate pulling devices.

Traffic Control

If working near a road or other traffic area, contact local authorities about safety procedures and regulations.

Emergency Services

Have the telephone numbers for local emergency and medical facilities on hand. Check that you will have access to a telephone.

Classify Jobsite

**WARNING**

Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.

Inspect Jobsite and Identify Hazards

- Wear personal protective equipment including hard hat, safety eye wear, steel-toed boots, and hearing protection.
 - Wear electrically insulating boots on all jobsites. Wear high-top boots with legs of pants tucked completely inside. Boots must meet the electric hazard protection requirements of ANSI Z-41, 1991, when tested at 14,000 volts.
 - Wear electrically insulating gloves on all jobsites. Gloves must have 17,000 AC maximum use voltage, according to ASTM specification D120-87.
 - Do not wear jewelry or loose clothing.
 - Mark jobsite clearly and keep spectators away.
 - If jobsite classification is in question or if the possibility of unmarked electric utilities exists, classify jobsite as electric.
 - Cutting high voltage cable can cause electrocution. Expose lines by hand before using tool.
-
- Follow U.S. Department of Labor regulations on excavating and trenching (Part 1926, Subpart P), and other similar regulations.
 - Contact One-Call (811 in the USA) or the One-Call referral number (888-258-0808 in USA and Canada) and any utility companies which do not subscribe to One-Call.
 - Inspect jobsite and perimeter for evidence of underground hazards, such as:
 - “Buried utility” notices
 - Utility facilities without overhead lines
 - Gas or water meters
 - Junction boxes
 - Drop boxes
 - Light poles
 - Manhole covers
 - Sunken ground
 - Have an experienced locating equipment operator sweep area within 20' (6 m) to each side of bore path. Verify previously marked line and cable locations.
 - Mark location of all buried utilities and obstructions.
 - Classify jobsite.

Select a Classification

Jobsites are classified according to underground hazards present.

If working . . .	then classify jobsite as . . .
within 10' (3 m) of a buried electric line	electric
within 10' (3 m) of a natural gas line	natural gas
within 10' (3 m) of any other hazard	other

IMPORTANT: If you have any doubt about jobsite classification, or if jobsite might contain unmarked hazards, take steps outlined previously to identify hazards and classify jobsite before working.

Remember, jobsite is classified by hazards in place -- not by line being installed.

NOTICE: This tool is not to be used on jobsites where flammable gas is present.



Apply Precautions

Once classified, precautions appropriate for jobsite must be taken.

NOTICE: The Ditch Witch piercing tool is **NOT** a directional drilling system and has **NO** electric strike system.

Electric Jobsite Precautions

Do not use Ditch Witch piercing tools on an electric jobsite.

Natural Gas Jobsite Precautions

Do not use Ditch Witch piercing tools on a gas jobsite.

Other Jobsite Precautions

You can use a variety of methods to safely avoid other underground hazards. Talk with those knowledgeable about hazards to determine which precautions should be taken or if job should be attempted.

Select Start and End Points



WARNING Moving traffic - hazardous situation. Death or serious injury could result. Avoid moving vehicles, wear high visibility clothing, and post appropriate warning signs.

NOTICE: Vehicle and pedestrian traffic must be a safe distance from jobsite. Allow at least 10' (3 m) buffer zone around equipment.

Select one end to use as a starting point. Consider the following when selecting a starting point:

- Slope
Consider how slope will affect setup of piercing tool. Remember that tool tends to rise during a bore. See "Determine Bore Depth" on page 27 to calculate amount of rise.
- Traffic
- Space

Check that starting and ending points allow enough space for changes in tool direction.

Check that there is enough space for operator to maneuver around tool. See "Excavate Pits" on page 30 for recommended width of pit.

- Comfort

Consider shade, wind, fumes, and other site features.

Plan and Mark Bore Path

Plan the bore path from planned entry pit to planned exit pit before starting bore. Bore path can be marked on ground with spray paint or flags, or written on paper for operator reference. End of bore path should be marked with a highly visible stake or post that will be used as a target marker for the aiming sight, tool, and launcher.

For complicated bores, consult an engineer. Have jobsite surveyed and bore path calculated. Be sure engineer knows minimum entry pitch, pipe lengths, and location of all underground utilities.

For less complicated paths, the bore will be limited by entry pitch, location of all underground utilities, and minimum depth.

Determine Bore Depth

Starting depth of tool is affected by rise, tool size, and soil type.

According to Rise

The piercing tool rises in most soils. To allow for rise in most soil conditions, start tool in entry pit below planned target pit depth. Starting depth of tool should be lowered 1/8-1/4" for each foot or 10-20 mm for each meter of compaction bore.

EXAMPLE:

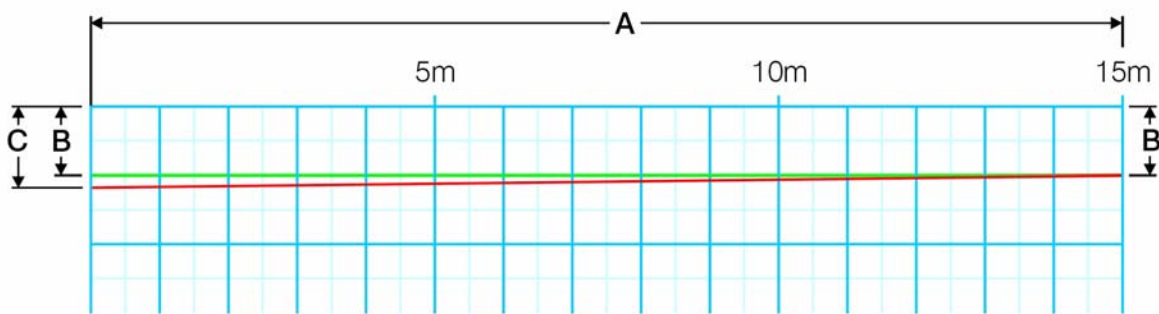
US: If the bore needs to be 4' deep at the target pit (B) and is 50' long (A), then multiply 50 by 1/8 (.125), add the result to 4' and start tool at 4' plus 6-1/4" (C). (Convert fractions to decimals if using calculator.)



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$$50 \times .125'' + 4' = 4' 6.25''$$

METRIC: If the bore needs to be 1 m deep at the target pit (B) and is 15 m long (A), then multiply 15 m X 10 mm or 15 X 10, convert to meter (.15), add the result to 1 m, and start tool at 1.15 m (C).



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$$15 \times 10 \text{ mm} + 1 \text{ m} = 1.15 \text{ m}$$

Note: Experience will help you determine appropriate starting depths for various soil types.

According to Tool Size

When using a piercing tool, bore depth should be at least ten times the tool's diameter to prevent soil mounding. Measure bore clearance from lowest point of any structure or surface that soil movement may damage.

EXAMPLE:

If you are using the PA310 (3.1" or 79 mm) tool...

Multiply 10 X 3.1" (79 mm) and start initial compaction bore depth at least 31" (790 mm) deep.

Note: If using an expander, calculate bore depth using diameter of expander at widest point.

According to Soil Type

When boring in hard soil, launch tool deeper to prevent soil mounding. For information on soil types, see "Evaluate Soil Type" on page 29.

Note: Experience will help you determine appropriate starting depths and clearances for various soil types and conditions.

Evaluate Soil Type

Carefully select and prepare jobsite. Take soil samples from several locations along bore path to determine the best head for soil conditions. The following soil types and conditions will affect the tool's operation and help you determine if the Ditch Witch piercing tool is suitable for the job.

Soil type	Suitability of tool
soft, compressible soil	excellent
porous soil (coral, sandstone)	poor
sand	not suitable
solid rock	not suitable

NOTICE: Extremely wet conditions can cause loss of performance due to decreased friction on the tool body. Extremely cold conditions may cause the exhaust ports to plug with ice. Operators should use their best judgment in these situations.



Excavate Pits



⚠ WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.



⚠ CAUTION Fall possible. Slips or trips may result in injury.



⚠ WARNING Moving traffic - hazardous situation. Death or serious injury could result. Avoid moving vehicles, wear high visibility clothing, post appropriate warning signs.

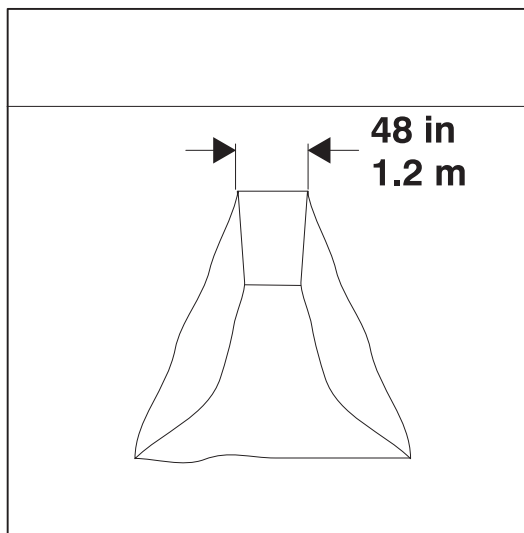
NOTICE: Read, understand, and follow U.S. Department of Labor regulations on confined spaces, excavating, and trenching.

Entry Pit

Dig an entry pit long enough to house launching tool and piercing tool.

Pit must be wide enough for operator to maneuver around tool. A width of at least 48" (1.2 m) is recommended.

Pit must also be deep enough to launch tool at appropriate depth. See "Determine Bore Depth" on page 27.

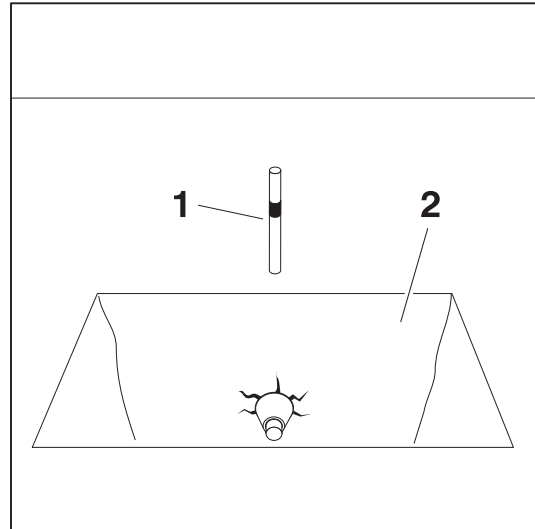


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Target Pit

Most bores require a target pit (2) to verify that the target is reached. Using a beacon head and tracking system will allow you to dig just before the bore is complete and keep the target pit small.

1. Mark end of bore path with a highly visible target marker (1). This will be used as a target for the aiming sight, tool, and launcher.
2. If a beacon is not used, dig a target pit deep and wide enough to allow 2' (600 mm) below and on either side of the target.



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Check Supplies

Check to make sure you have the following supplies:

- Service tools for your size of tool
- Optional nose expanders and covers (when using threaded tools)
- Optional rear expanders
- Loctite® 242 or 248 thread locking compound
- Pullback device
- Product to be installed
- Marking flags or paint
- Highly visible target marker
- Pierce Airrow Summer Oil (p/n 256-611) or Winter Oil (p/n 256-614)
- Duct tape
- Black or red spray paint
- Spray lubricant
- Pipe joint compound and brush (if pushing or pulling back pipe)
- Electrically insulating boots and gloves
- Notepad and pencil

Prepare Equipment



CAUTION

Improper handling or use of chemicals may result in illness, injury, or equipment damage. Follow instructions on labels and in material safety data sheets (MSDS).

Check Fluid Levels

- Fuel in compressor
- Oil in oiler

NOTICE: Do not use ATF or other lubricants. Use only Pierce Arrow Summer Oil (p/n 256-611) or Winter Oil (p/n 256-614).



Check Condition and Function

- Hoses and valves
- Connectors
- Oiler plug
- Launcher
- Pipe stand
- Aiming sight

Check Tail Adapter

Be sure to check that tail adapter is tight. If loose, see "Replace Tail Adapter" on page 78.

Pierce Hole

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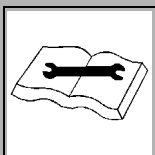
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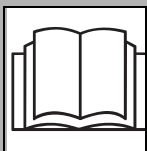




⚠ WARNING Improper control function could cause death or serious injury. If control does not work as described in instructions, stop machine and have it serviced.



⚠ WARNING Crushing weight. If load falls or moves, it could kill or crush you. Use proper procedures and equipment or stay away.



⚠ WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.



⚠ CAUTION Exposure to high noise levels may cause hearing loss. Wear hearing protection.

NOTICE: When reversing the tool, keep tension on the air hose to prevent tool from backing up over the hose, kinking it, and restricting the air supply to the tool. If air supply is cut off, tool will stop and have to be dug up.

IMPORTANT: Monitor sight glass frequently to ensure oiler does not run out of oil.

Connect Hoses



CAUTION

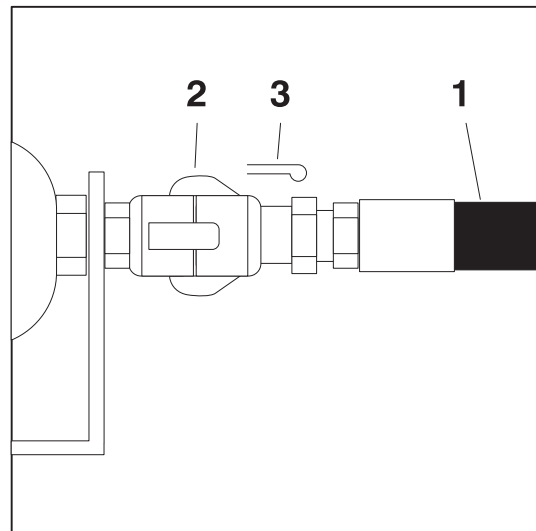
High pressure. Flying objects may cause injury. Wear hard hat and safety glasses. If couplings are not securely connected, air hoses could come loose and cause serious injury.

Compressor Hose

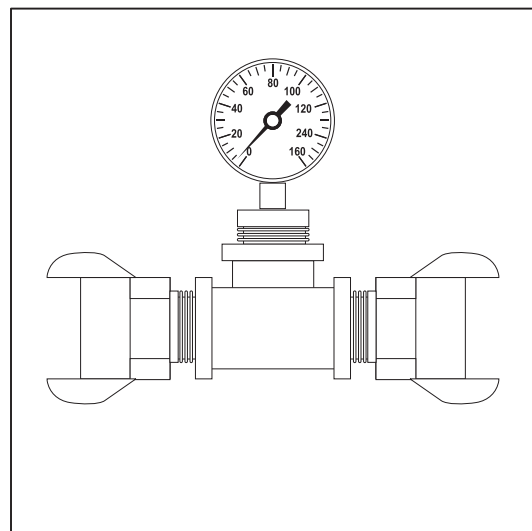
1. Check couplings. Make sure all gaskets are securely seated.
2. Connect compressor hose to compressor.
3. Install coupling clip (3).
4. Turn compressor on and blow air through the compressor hose to flush out possible debris.
5. Turn off compressor.
6. Connect compressor hose (1) to oiler using coupling clip at two-claw coupler (2).
7. Check that air supply valve on oiler is closed.
8. Turn compressor on again.

IMPORTANT: Pressure at tool should be 110 psi (7.5 bar) for proper operation.

To determine pressure more easily, use inline pressure gauge (p/n 217-542) installed between oiler and compressor hose to determine pressure.



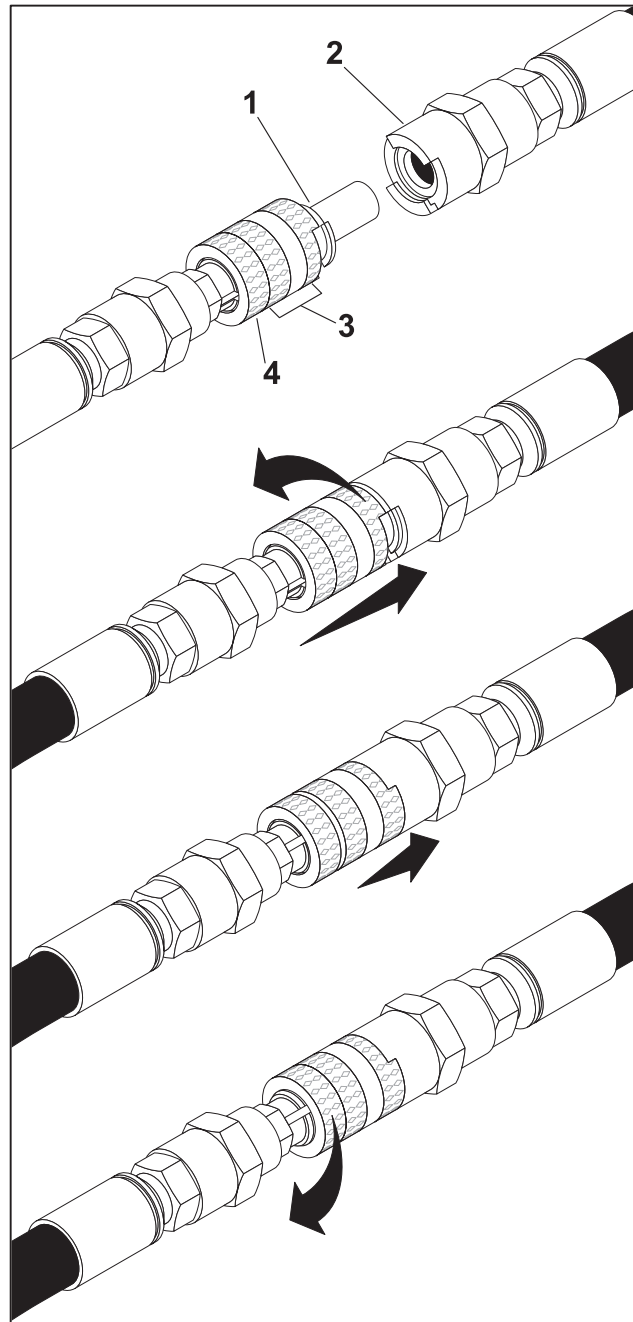
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Hoses with QDC Couplers

1. Loosen lock ring (4) and slide stop ring (3) back.
2. Align tabs on quick coupler plug (1) with notches in quick coupler socket (2).
3. Insert quick coupler plug into the quick coupler socket and rotate 45° to engage tabs.
4. Slide stop ring into notches in quick coupler socket.
5. Tighten lock ring to hold stop ring in position.



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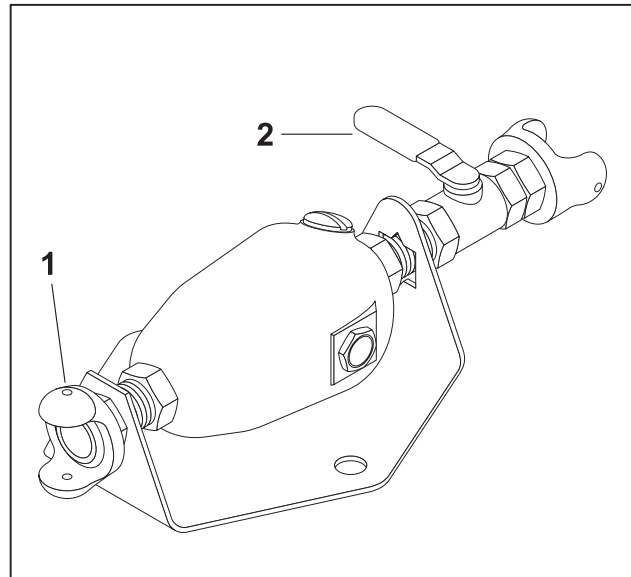
Oiler Hose

IMPORTANT: Monitor the progression of the tool through the bore by marking the air hose in equal increments. For additional accuracy, measure length of bore. Measure the same distance from front of tool along hose. Mark distance of bore on hose.

1. Check air hose coupling. Make sure all gaskets are securely seated.
2. If the hose is new, pour 2 oz (60 ml) of Pierce Airrow oil into hose at oiler end to coat lining.
3. Connect air hose to oiler at QDC (1).
4. Slowly move air supply valve (2) to ON.

NOTICE: Secure hose end firmly. Loose hose can whip and cause injury or become contaminated by dirt.

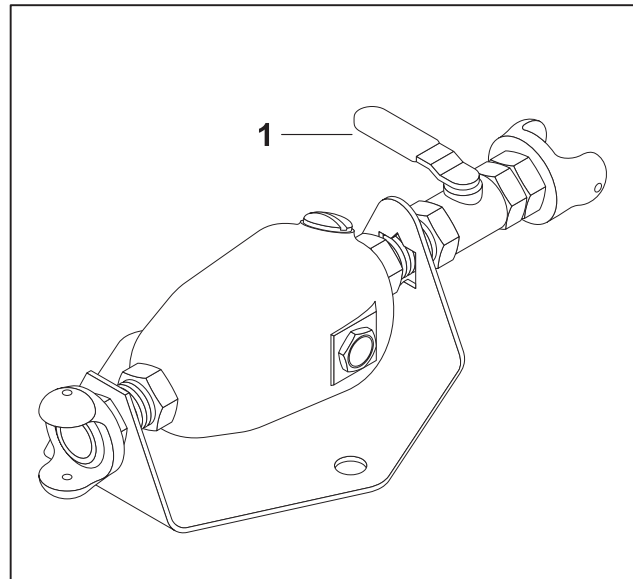
5. After flushing debris, move air supply valve to OFF.
6. Check connections again and tighten if necessary.
7. Connect air hose to tool whip hose.



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Start and Test Tool

1. Ensure that air supply valve (1) on oiler is in OFF position.
2. Start compressor.
3. Move air supply valve to ON in one quick motion.
4. Once tool starts operating, slowly move air supply valve toward OFF until tool operates slowly.



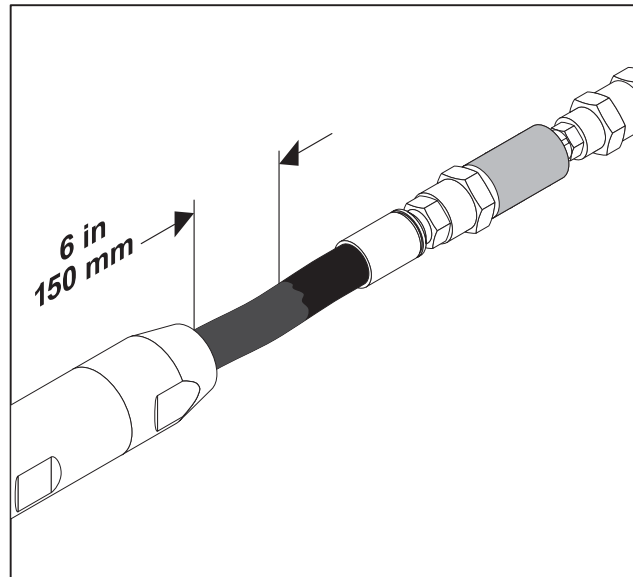
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5. Inspect whip hose at rear of tool after operating tool for a short time.

When oil flow is correct, oiler should use 4 to 6 oz (120 to 180 ml) of oil per hour and 6 to 8" (150 to 200 mm) of the whip hose should be lightly coated with oil as shown.

NOTICE: If hose is not coated as shown or oiler is not using correct amount of oil, see "Adjust Oil Flow." If oil flow is correct, see "Monitor Tool."

IMPORTANT: Wrap hose coupling with tape to keep dirt and other contaminants out.



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6. Move air supply valve to OFF. Tool should stop moving.

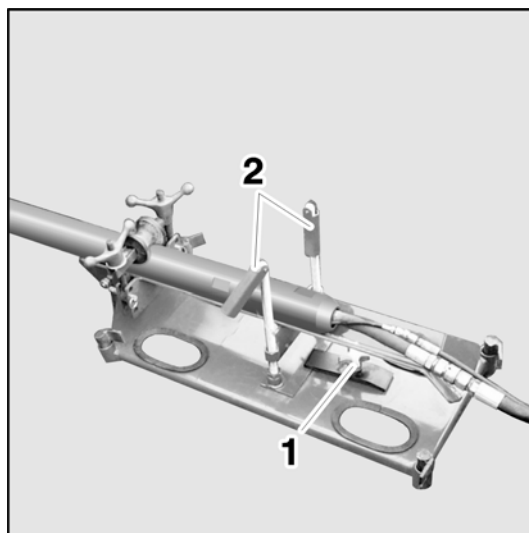
If tool does not work as indicated, see "Troubleshoot" on page 71.



Execute Bore

Bore

1. Ensure that tool stays firmly against pit wall until tool is at least 1' (300 mm) in ground.
2. Move air supply valve to OFF to stop tool.
3. Check direction with aiming sight and pitch with level.
4. If direction adjustment is needed, loosen adjustment knob (1) and move left/right adjustment plate underneath to adjust tool direction.
5. If pitch adjustment is needed, turn tilt adjustment handles (2) on launcher until tool is at desired pitch.
6. Repeat check as needed until tool is completely in ground (at least every 1' or 300 mm).
7. When tool is in the ground and aimed correctly, move air supply valve all the way to ON.



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If Tool Stops or Is Deflected from Bore Path

1. If tool is completely in the ground and is deflected away from bore path or stops making progress, reverse tool (see "Change Tool Direction" on page 42) and back tool completely out of bore.

NOTICE: When reversing the tool in a bore, keep tension on the air hose to prevent tool from backing up over the hose, kinking it, and restricting the air supply to the tool. If air supply is cut off, tool will stop and have to be dug up.

2. Once tool is completely out of bore, move launcher a short distance to vary the entry point and begin new bore.

Change Tool Direction

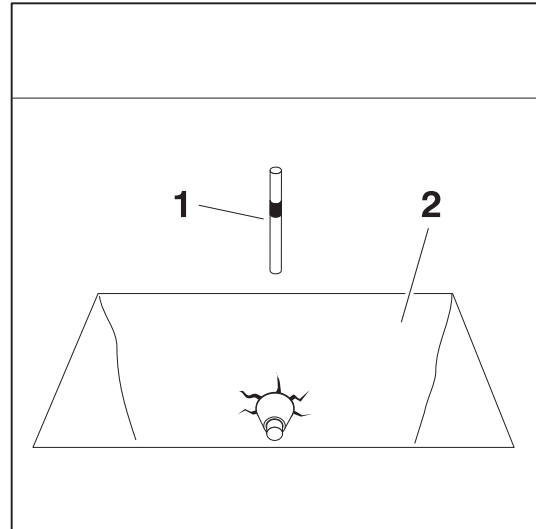
Reverse	Forward
<ol style="list-style-type: none"> 1. Move air supply to OFF. 2. Rotate hose counter-clockwise until assembly turns 1/4 turn. 3. Open air supply valve and verify that tool is in reverse. 4. Increase air pressure and drive tool out of hole. 	<ol style="list-style-type: none"> 1. Move air supply to OFF. 2. Rotate hose counter-clockwise until assembly turns 1/4 turn. 3. Open air supply valve and verify that tool is in reverse. 4. Increase air pressure and drive tool out of hole.

Exit Bore



WARNING Crushing weight could cause death or serious injury. Use proper procedures and equipment or stay away.

1. When nose of tool appears in target pit (2), move air supply valve to OFF to stop tool.
2. Remove target marker (1).

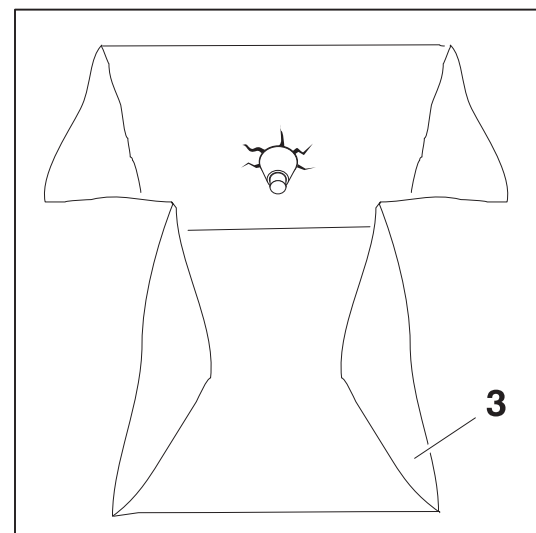


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3. Dig exit pit (3) large enough to accommodate length and flexibility of pullback material.

IMPORTANT: No exit pit is needed if tool will be reversed and backed out of bore.

4. Move air supply valve to ON and restart tool.
5. Support tool as it exits the bore. Protect whip hose.
6. Move air supply valve to OFF and turn compressor off.
7. Discharge air from oiler.
8. Disconnect whip hose from hose and install dust cap or tape end.
9. Lift tool out of pit using sling and backhoe, if necessary. Do not lift by whip hose.
10. Return to entry pit and pull hose back through bore.



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IMPORTANT: If air hose will be used to pull a cable or other pullback device through the bore, do not remove from bore until device is properly attached (see "Pull Back Material").

Pull Back Material

Use the air hose to install a pullback device such as a cable through the bore. The pullback device can then be used to pull heavier material back through the bore.

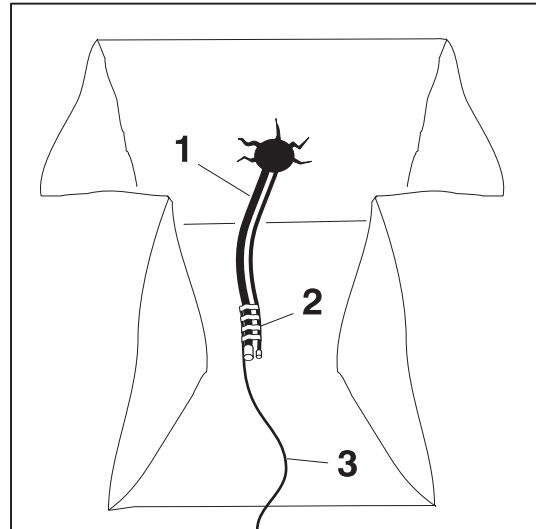
Install Pullback Device

1. Align at least 12" (300 mm) of the end of air hose (1) with 12" (300 mm) of the beginning of the pullback device (3).

IMPORTANT: Cap or tape over air hose ends to prevent contamination.

2. Securely connect (2) the pullback device (3) to the air hose (1).
3. Return to entry pit and pull air hose and pullback device through bore.

NOTICE: If air hose and pullback device become lodged in bore, do not jerk or use excessive force. Return to target pit, remove pullback device and air hose out of exiting hole and start over.



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Attach Pullback Material

NOTICE: This method is recommended for pulling back lightweight material only.

1. In target pit securely attach pullback material to pullback device.
2. Return to entry pit and pull pullback device until pullback material appears in entry pit.
3. If pulling pipe, stop as the end of each section nears the bore hole in the entry pit. Return to the target pit and attach next pipe section according to the manufacturer's instructions.

IMPORTANT: Be certain that each section is securely connected before you pull it into the bore.

4. After pullback is complete, remove pullback device from pullback material and store properly.

Push Pipe

Pipe pushing drives steel pipes directly into the ground. It is extremely accurate and installs pipe in one single operation. Ditch Witch piercing tools can push large diameter pipe from 6-14" (150-350 mm).

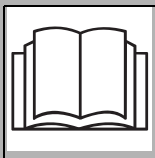
Use the optional tool launcher when pushing pipe. Plastic and cast iron pipe cannot be pushed. Materials that cannot be pushed can be pulled back through the completed bore. See "Pull Back Material" on page 44.

There are two methods of pipe pushing:

Pushing Method	Description
Closed push (end of pipe covered)	Push point covers entry end of first pipe. Used with small diameter pipes.
Open push (end of pipe open)	Cutting edge adapter installed on entry end of first pipe. Soil enters open end of pipe. Used with larger pipes. Used to make shallow, accurate bores.



⚠ DANGER Electric shock. Contacting electric lines will cause death or serious injury. Know location of lines and stay away.

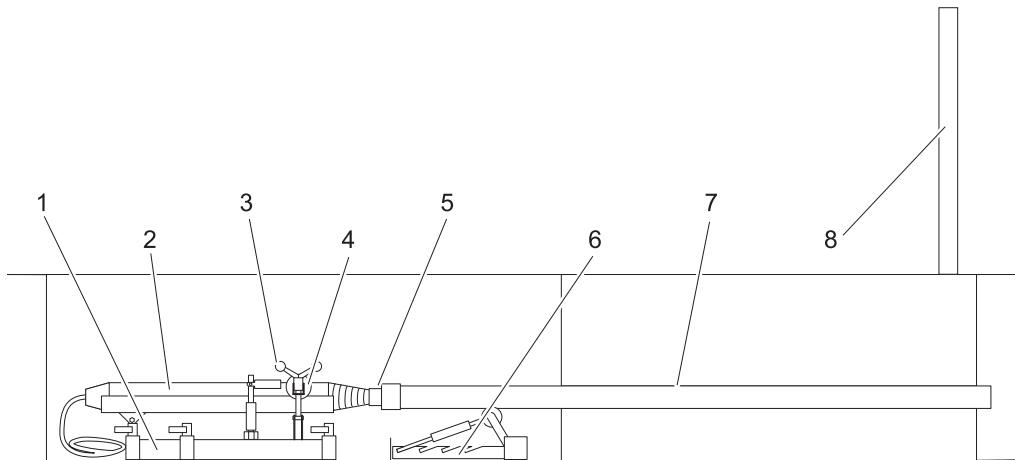


⚠ WARNING Incorrect procedures could result in death, injury, or property damage. Learn to use equipment correctly.

NOTICE:

- Do not use Ditch Witch piercing tools on an electric jobsite.
- Use supporting devices such as pipe stands (p/n 352-450) to support weight when elevated.
- Always have at least two support devices on elevated tool and pipe.
- Make sure that supporting devices are serviced and capable of supporting tool and pipe weight.

Setup



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IMPORTANT: Entry pit must be large enough for pipe joints. If necessary, cut pipe into sections. Entry pit must be wide enough to work along full length of pipe.

1. Set first joint of pipe (7) and pipe stand (6) into pit.
2. Measure depth of bore and mark entry point.
3. Install cutting edge adapter on entry end of first pipe for an open push or a pipe push point for a closed push. See "Pipe Pushing Accessories" on page 64.
4. Manually push entry end of pipe into ground at entry point.
5. Set other end of pipe on pipe stand (6). Place level on pipe and adjust pipe until pipe is level.
6. Screw pipe pusher cone (5) onto rear of pipe section (if used).

Note: If pipe is smaller than pipe pusher thread size, use high pressure bushing with an ANSI rating of at least 600 lb to reduce female thread to correct size.

7. Set optional aiming site on pipe. See "Set Up Launcher and Tool" on page 56.
8. Move pipe stand as needed to align pipe until crosshairs of aiming sight are centered on the target marker (8) and pipe, and stake into place.
9. Place launcher into pit, align with target marker (8) and pipe, and stake into place.
10. Place tool (2) in launcher and insert nose of tool into tapered end of pipe pusher cone (5).
11. Use wing knobs (3) to tighten roller (4) on top of tool.
12. Check alignment of tool with aiming sight. If adjustment is needed, loosen the adjustment knob and move left/right adjustment plate (1) underneath left or right until crosshairs of aiming sight are centered on the target marker.
13. Securely tighten adjustment knob.
14. Place level on tool and adjust launcher guide (if needed) with tilt adjustment handles until tool is level.

Push and Install Pipe



CAUTION

Exposure to high noise levels may cause hearing loss. Wear hearing protection.

NOTICE: To prevent pipe threads from breaking, use tool launcher and pipe stands in entry pit to support tool and pipe throughout the push.

Push First Pipe Section

1. Ensure tool direction is forward. Move air supply valve to ON in one quick movement.

NOTICE: Ensure that tool remains in pipe pusher cone.

2. Quickly move air supply valve halfway between ON and OFF to slow tool.
3. When 2-3' (.5-1 m) of pipe has entered soil, move air supply valve to OFF.
4. Check pipe alignment with aiming sight. If necessary, push pipe in needed direction.
5. Move air supply valve to 3/4 open.
6. When end of pipe section nears the bore hole, move air supply valve to OFF and stop tool.
7. Change tool direction to reverse.
8. Move air supply valve to ON and operate tool until it releases from pipe pusher cone.
9. Move air supply valve to OFF and remove tool from pipe stand and launcher.
10. Remove pipe pusher cone and high pressure bushing (if used) from pipe.

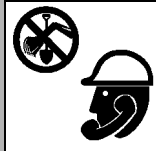


Push Subsequent Pipe Sections

1. Connect next pipe joint according to manufacturer's instructions.
2. Use aiming sight to check alignment with target marker and make needed adjustments.
3. Install pipe pusher cone onto rear of added pipe section.
4. Place tool on launcher and insert tool into tapered end of pipe pusher cone.
5. Change tool direction to forward and move air supply valve to halfway between ON and OFF to start tool. See "Change Tool Direction" on page 42.
6. Once tool is started, move air supply valve to ON and begin the bore.
7. When end of pipe section nears the bore hole, move air supply valve to OFF and stop tool.
8. Change tool direction to reverse. See "Change Tool Direction" on page 42.
9. Move air supply valve to ON and operate tool until it releases from pipe pusher cone.
10. Move air supply valve to OFF and remove tool from pipe stand and launcher.
11. Repeat steps 1-10 to complete bore and install pipe.
12. Move air supply valve to OFF when first pipe reaches target pit.
13. Change tool direction to reverse (See "Change Tool Direction" on page 42) and air supply valve to ON to release tool from pipe pusher cone.
14. Move air supply valve to OFF and remove pipe pusher cone and high pressure bushing (if used).
15. In target pit, remove cutting edge or push point from pipe. If open push, remove spoil.

Remove Spoil

The most common means of spoil removal is air pressure or water methods. If these methods fail, mechanical augers or hydraulic pushers can be used. The “pig” method is used to remove any remaining spoil.



WARNING Jobsite hazards could cause death or serious injury. Use correct equipment and work methods. Use and maintain proper safety equipment.



WARNING Pressurized fluid or air could pierce skin and cause injury or death. Stay away.



CAUTION Flying objects may cause injury. Wear hard hat and safety glasses.

NOTICE: While pipe is being pressurized, stay at least 100' (30 m) from both ends of pipe and 10' (3 m) from exposed sides of pipe. Designate personnel to control access to entry pit and target pit. Erect barriers to keep people away.



Air Pressure Method

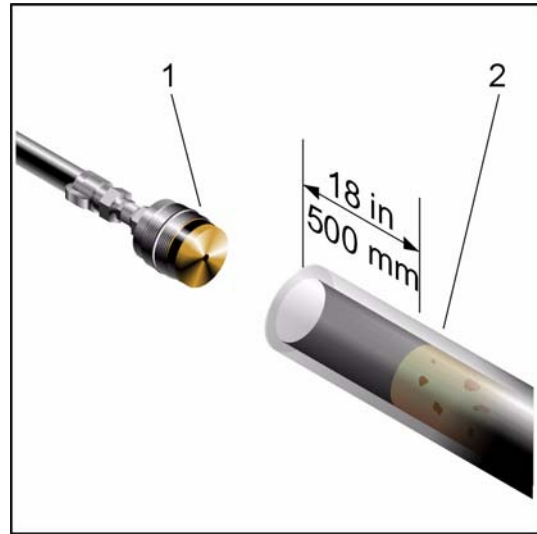
1. Remove pipe pusher cone and other equipment from both ends of pipe.
2. Remove spoil from inside the first 12-18" (300-500 mm) of last pipe (2).

NOTICE: If the compressor does not have a discharge valve, install one inline away from the pit.

3. Install blowout sealing plug (1) into end of pipe and tighten by turning large adjustment nut clockwise until plug fits snugly.

IMPORTANT: Any plug used for spoil removal should have at least an ANSI 150-lb rating.

4. When plug is sealed, attach compressor air hose and pressurize pipe. Do not exceed 100 psi (7 bar).
5. Keep pipe pressurized for up to 30 minutes.
6. If spoil does not clear with air pressure, discharge air pressure from pipe and use water method.

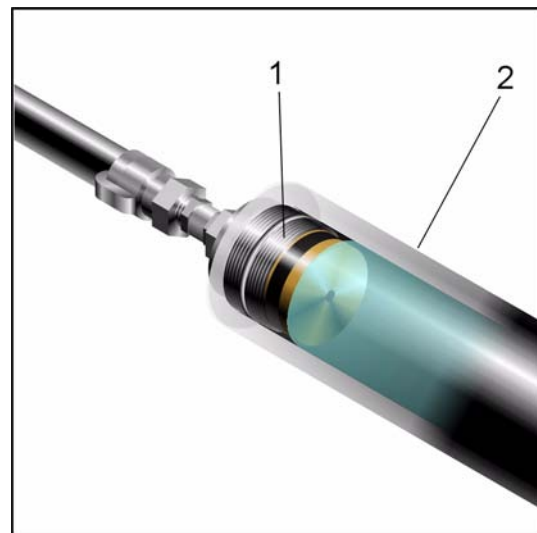


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Water Method

1. After air pressure has been discharged from pipe (2), remove two-claw coupler and connect water line to end of plug.
2. Fill empty section of pipe with water.
3. Close and disconnect water line.
4. Replace two-claw coupler on the blowout sealing plug (1).
5. Connect air compressor hose to blowout sealing plug (1) and open air valve to pressurized pipe.

NOTICE: Do not exceed 100 psi (7 bar).



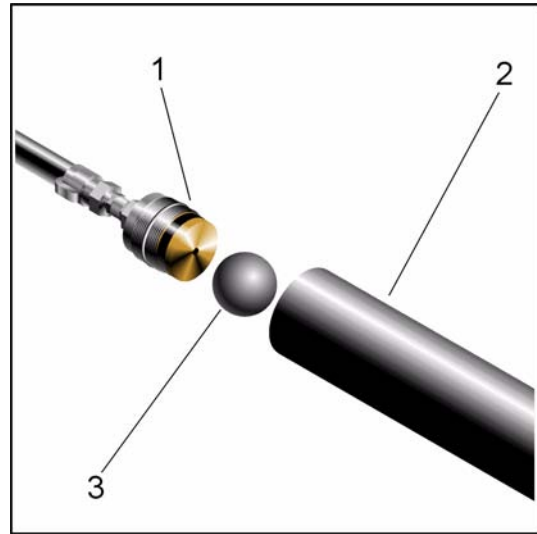
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Note: If these methods do not work, or if air leaks around spoil without clearing spoil from pipe, discharge air from pipe and contact your Ditch Witch dealer for information on mechanical augers and hydraulic pushers.

Pig Method

Pigs are plastic-coated foam balls or shapes that seal and clean the pipe after most of the spoil has been blown or washed out. Contact your Ditch Witch dealer for information on where to obtain pigs.

1. After air pressure has been discharged from pipe (2), remove blowout sealing plug (1) and disconnect air hose.
2. Clear spoil and water from inside pipe (2) and insert pig (3).
3. Reinstall plug (1) and air hose.
4. Pressurize pipe. Air or water pressure will cause pig to force remaining spoil through pipe.



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Systems and Equipment

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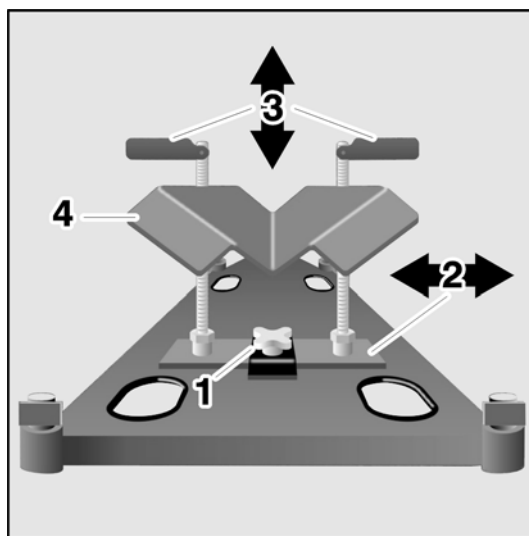


Optional Launcher

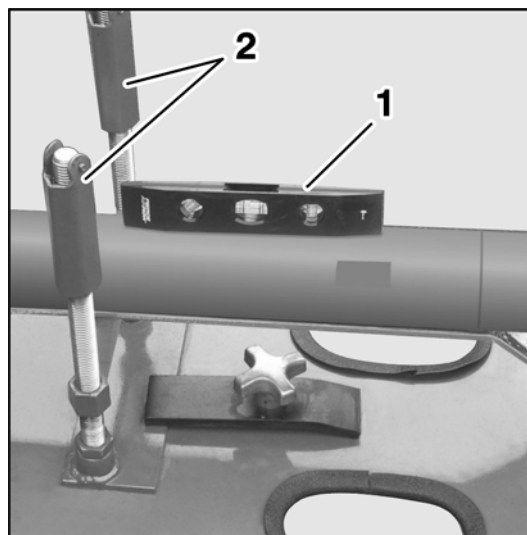
Set Up Launcher and Tool

IMPORTANT: Remember to start tool below target 1/8-1/4" for each foot (10-20 mm for each meter) of bore. See "Determine Bore Depth" in **Preparation**.

1. Place launcher in pit with roller end of launcher guide as near to the entry point as possible.
2. Closely align launcher with bore path.
3. Stake down launcher pad being careful to keep launcher guide aligned with bore path.
4. Loosen adjustment knob (1).
5. Set tool on top of launcher guide (4) with tool nose toward the entry point.
6. Set aiming sight on top of tool and hold in place.
7. Loosen wingnuts on aiming sight and extend aiming sight to needed height.
8. Tighten wingnuts.
9. Move left/right adjustment plate (2) until crosshairs of the aiming sight are centered on the target marker.
10. Tighten adjustment knob (1) securely.
11. Once launcher and tool are correctly aligned with target marker, remove aiming sight from launcher.
12. Place torpedo level (1) on top of tool.
13. Adjust pitch of tool by turning tilt adjustment handles (2) until tool is at desired pitch.
14. Remove level from tool.



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Optional Aiming Sight

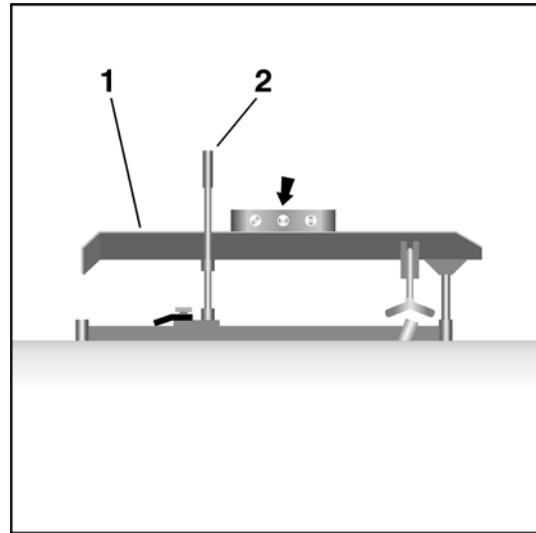
Adjust

This procedure should be done before the first use of the aiming sight and again only as needed.

1. Position tool launcher perpendicular to a wall at a distance of at least 20' (7 m).

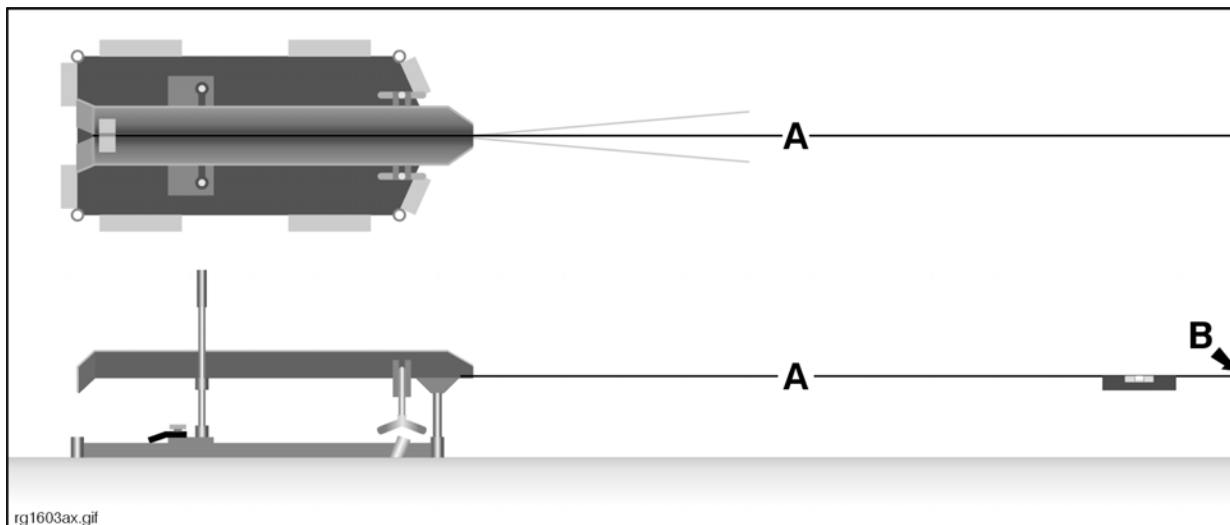
IMPORTANT: Mark the position of launcher base with tape to ensure that it stays lined up.

2. Place a torpedo level (p/n 259-131) on top of the launcher guide (1).
3. Adjust and level the launcher guide using the tilt adjustment handles (2).
4. When launcher guide is level, tighten tilt adjustment handles to hold launcher guide in position.



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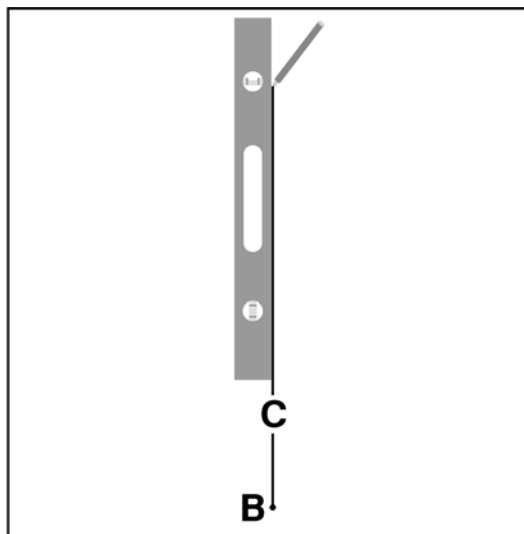




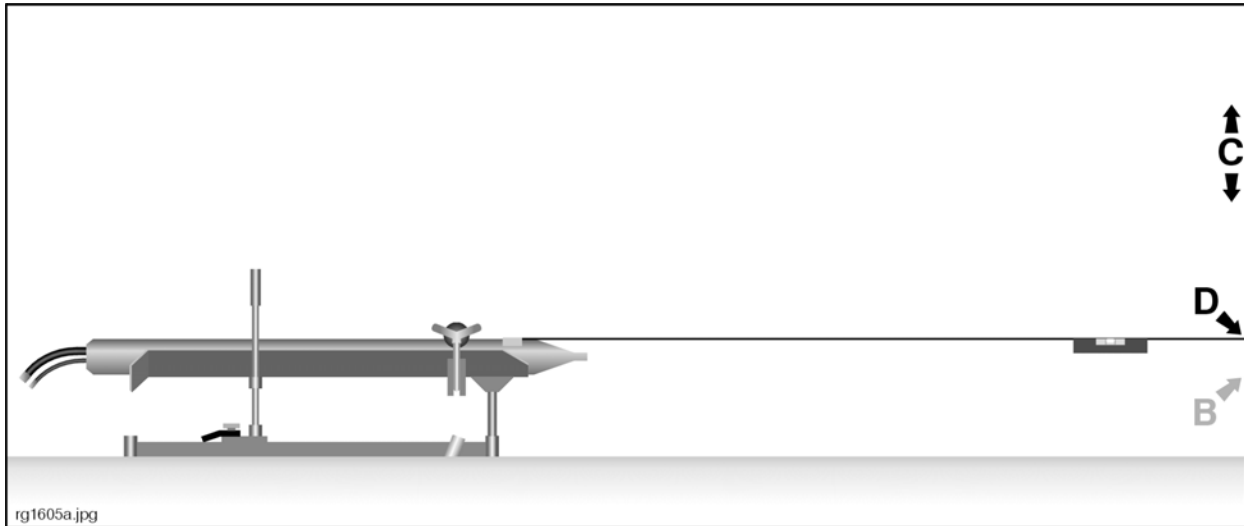
5. Center and tape a string (A) to inside rear of launcher guide.
6. Extend string (A) to the wall and use level to make sure string is level.

IMPORTANT: Make sure string extends in a straight line as shown and **not** at an angle or settings will be off.

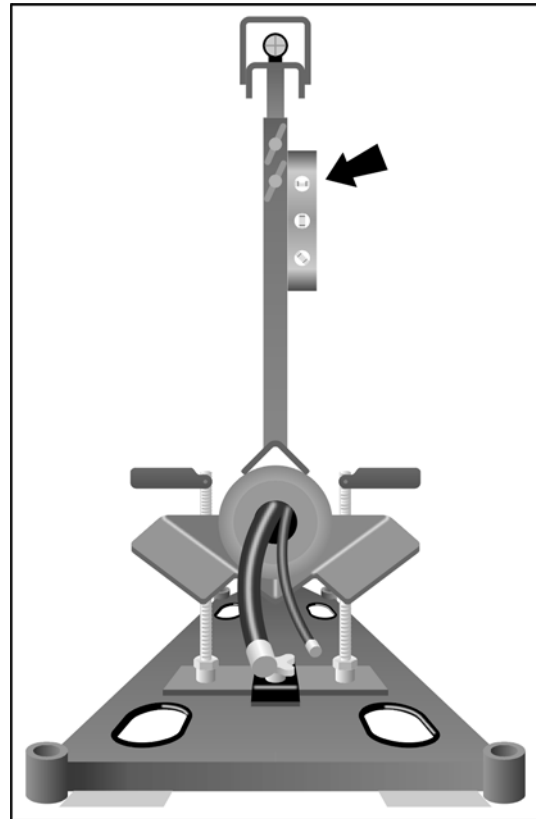
7. Mark a reference point (B) where string contacts wall.
8. Remove string.
9. Use a level to draw a vertical line (C) approximately 6' (1.8 m) upward from reference mark (B).

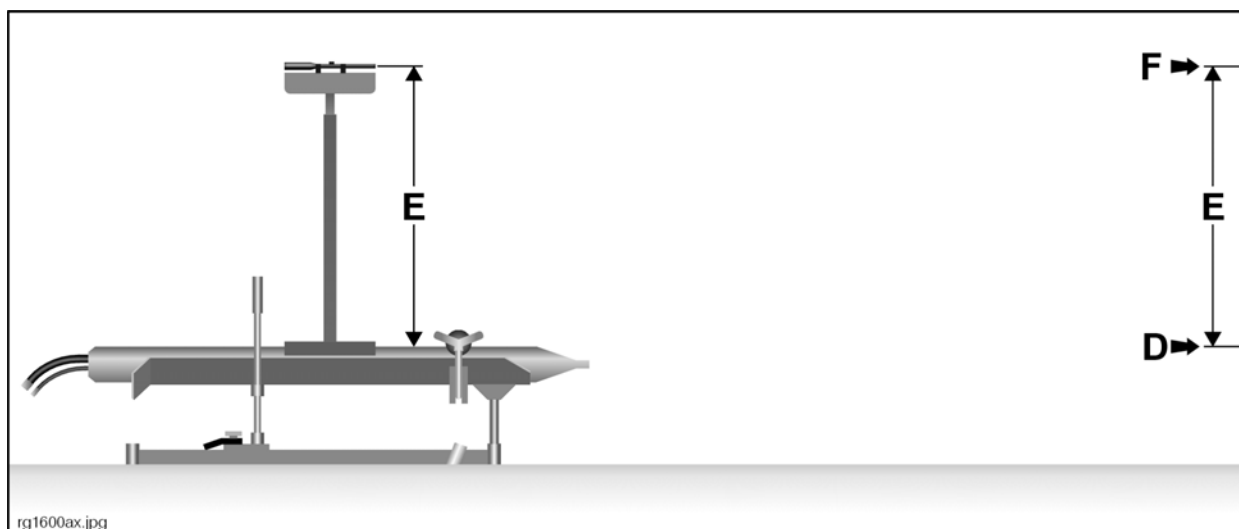


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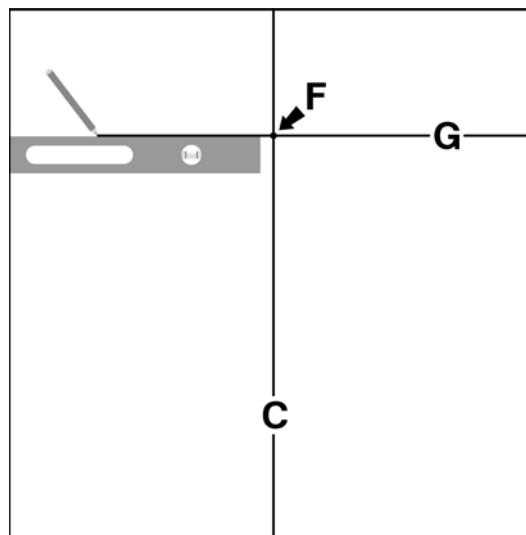


10. Place tool in launcher.
11. Attach a string to top center, front end of tool.
12. Extend string to line (C).
13. Use a level to make sure string is level.
14. Mark point (D) where string meets line (C).
15. Place aiming sight on tool body, loosen wingnuts, and use top extension to adjust scope to comfortable eye level.
16. Tighten wingnuts.
17. Use torpedo level to ensure that aiming sight is level and exactly vertical.

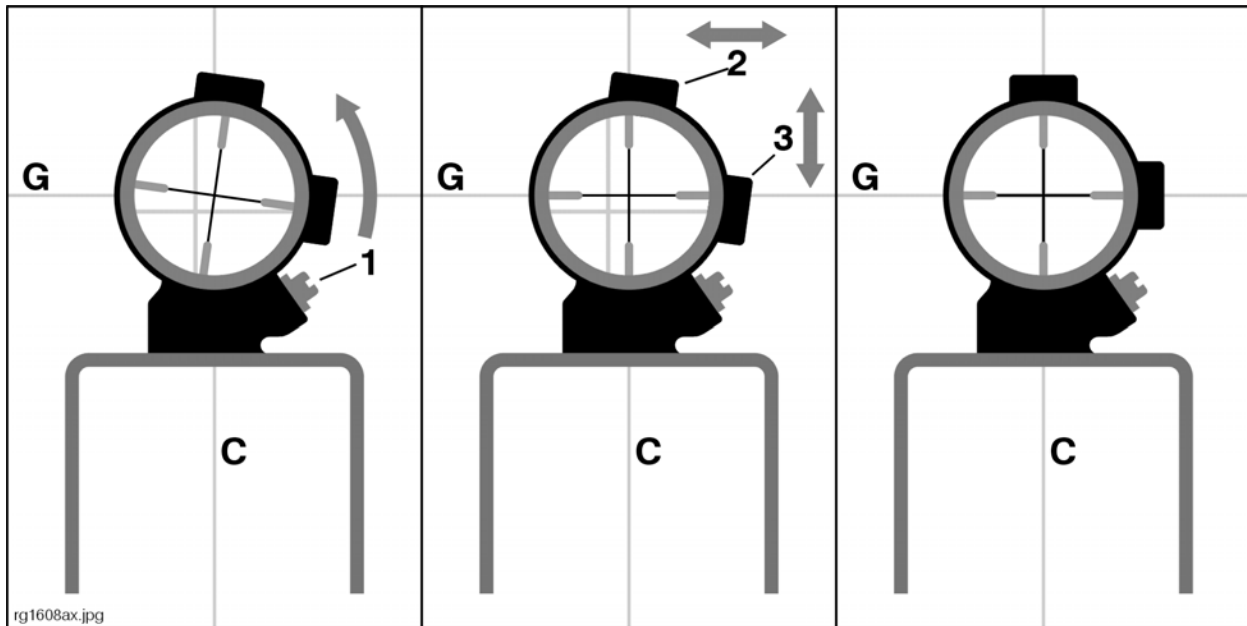




18. Remove scope cover.
19. Measure distance (E) from top of tool to center of aiming sight scope.
20. Remove aiming sight from top of tool.
21. Transfer measurement (E) to vertical line on wall starting at (D) and mark reference point (F) at top of measurement (E).
22. Use a level to draw a horizontal line (G) through the top reference mark (F).
23. Extend line (G) approximately 2' (600 mm) either side of line (C).



rg1607ax.jpg



24. Place aiming sight on top of tool.

25. Use torpedo level to make sure aiming sight is vertical.

IMPORTANT: Aiming sight uses a rifle scope. Keep your eye a short distance back from scope for proper eye relief.

26. View reference lines (C) and (G) through scope. Scope crosshair intersection may not line up with intersection of reference lines (C) and (G) as shown on left. If not, follow steps 27 through 29 to correct.

27. Loosen two scope clamp screws (1) to rotate scope and align scope crosshair lines and reference lines (C) and (G). Turn scope slightly until vertical crosshair is parallel with vertical line on wall. Knurled eyepiece lock ring may be loosened to adjust focus if necessary.

Note: Be sure to keep aiming sight vertical and level during this procedure.

28. Use set screw (2) to move scope crosshair intersection left or right until vertical crosshair aligns with line C.

29. Use set screw (3) to move scope crosshair intersection up or down until horizontal crosshair aligns with line G.

30. Replace dust caps and scope cover.

31. Tighten two scope clamp screws. Ensure that knurled eyepiece lock ring is loose enough to allow future focus adjustments without having to remove scope cover.

IMPORTANT: Once the initial adjustment procedures are performed, only minor focus adjustments should be needed to view target markers for each bore path. Leave scope cover attached to aiming sight to prevent damage to scope.



Optional Tool Heads

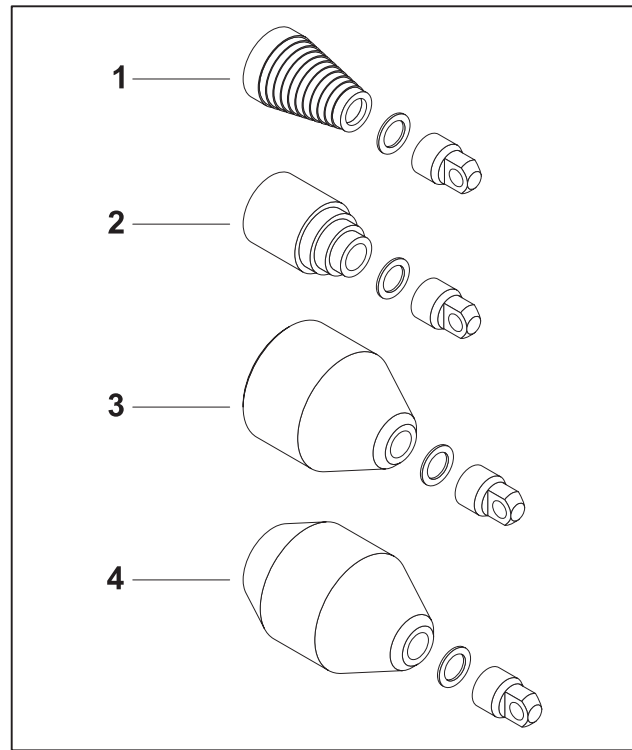
Optional Tool Heads

Optional tool heads are available for threaded models. Optional heads come in a variety of styles for different soils or uses.

Select Head Type

Once you have determined the soil type, use the following table to determine which head or expander is most suitable for soil conditions and job situations.

Head type	Suitable for
tapered (grooved) head	wet, spongy, or loose soil conditions with no anticipated obstructions
stepped head	hard, dry, compacted soil conditions
non-reversible expander	enlarging existing tool path on a second pass
reversible expander	enlarging existing tool path as tool is removed from hole



j20om029a.eps

1. tapered (grooved)
2. stepped
3. non-reversible expander
4. reversible expander

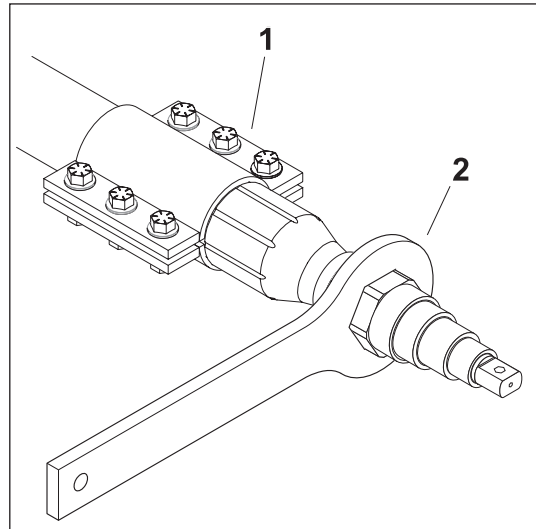
Install Tool Head (T models only)

NOTICE:

- Always clean mud and dirt from outside of tool before installing expanders. When removing or installing any tool accessory, do not use pipe wrenches or other tools that could cause damage to tool body.
- Use clamp wrench to hold tool body in vise and prevent tool body damage.

1. Place tool on work surface and remove anvil cover.
2. Install special clamp on tool body near nose end (1). Orient clamp so that bolts are aligned with flats.
3. Install 6 bolts, washers and nuts and hand tighten.
4. Tighten bolts in crossing pattern as indicated in table below.
5. Place clamp in vise and use tool head wrench (2) to remove/install tool heads.

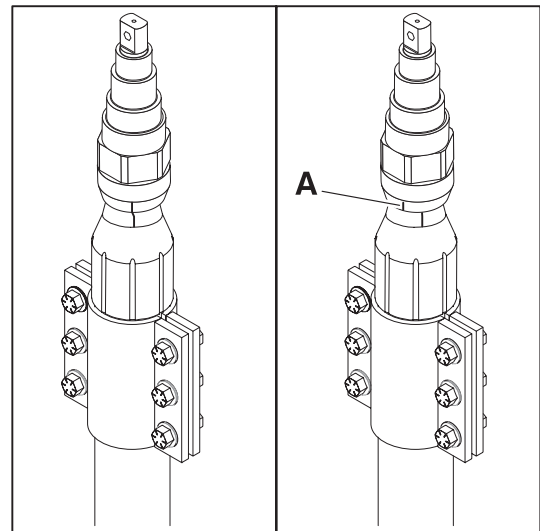
NOTICE: Grip directly behind the splined section of tool body.



Rg0733c.eps

6. Apply Loctite® 242 or 248 to cleaned threads of tool head.
7. Install tool head and tighten using tool head wrench.
8. Mark a scribe line across both tool head and tool body.
9. Strike tool head wrench with sledge until scribe lines (A) are separated 1/2-5/8" (13-16 mm).

IMPORTANT: If clamp bolts are fully tightened, tool will not be damaged.



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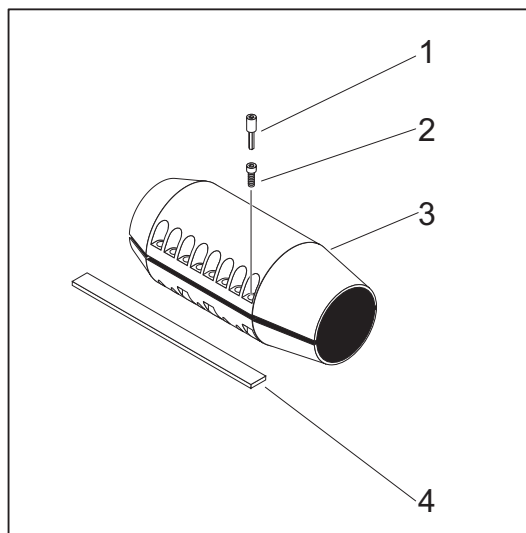


Optional Expanders

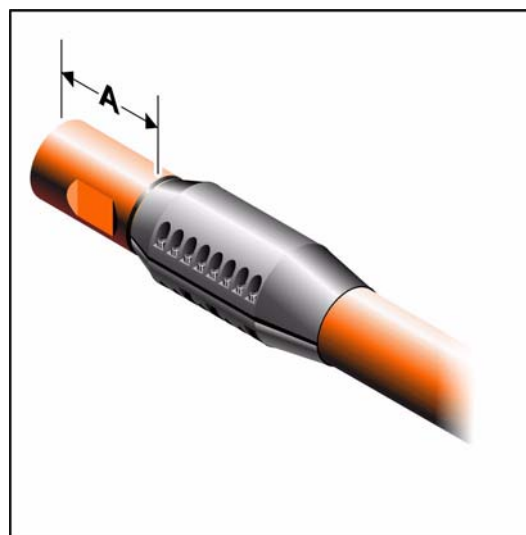
Bolt-on expanders are available. Expanders can accomplish a larger diameter bore in a single pass.

NOTICE: Always clean mud and dirt from outside of tool before installing expanders. When removing or installing any tool accessory, do not use pipe wrenches or other tools that could cause damage to tool body.

1. Remove tailpiece.
2. Remove bolts (2) from expander using hex socket (1) supplied with expander and start four bolts into deep threaded holes on bottom side of expander.
3. Place clamp strip (4) into expander slot. Strip is used to spread the expander to ease installation and should not protrude into body bore of expander.
4. Finger tighten bolts against clamp strip to hold strip in place.
5. Tighten bolts alternately to spread expander.
6. Slide expander over tool body from the tailpiece end.
7. Slide expander forward 7" (178 mm) for clearance (A) to install tailpiece.
8. Install tailpiece.
9. Once expander is positioned, remove bolts and clamp strip. Save the clamp strip for future use.



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om0618h.jpg

10. Apply Loctite® 242 or 248 to expander bolt threads.
11. Install all bolts into the top holes of expander.

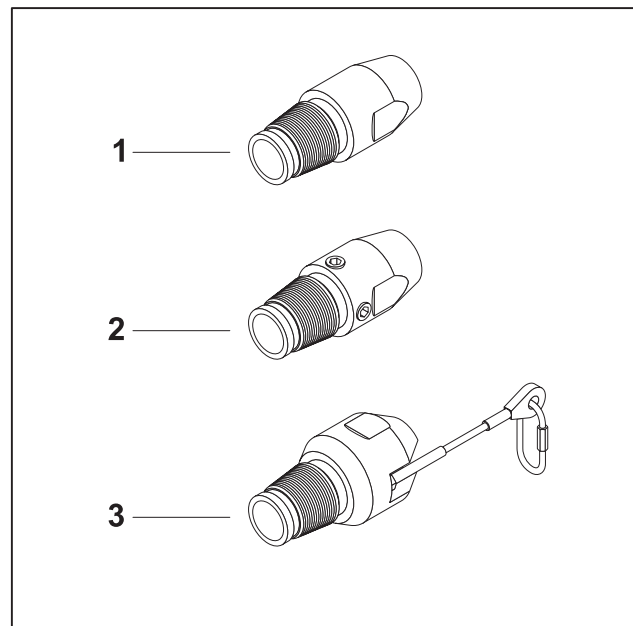
NOTICE: Do not over-tighten bolts.

12. Use hex socket to tighten bolts evenly in alternating pattern until each bolt is torqued to specifications listed in table below.
13. Strike expander several times with ballpeen hammer on side opposite slot. Check fastener torque and tighten again if necessary.
14. Repeat striking and tightening procedure until fasteners do not loosen when expander is struck.
15. After tightening bolts, ensure that striker moves freely inside tool body.

NOTICE: Stabilize fastener torque to prevent fasteners from working loose during tool operation. Check fastener torque before and after each use of tool.

Optional Tailpieces

Remove existing tailpiece and thread on optional tailpiece.



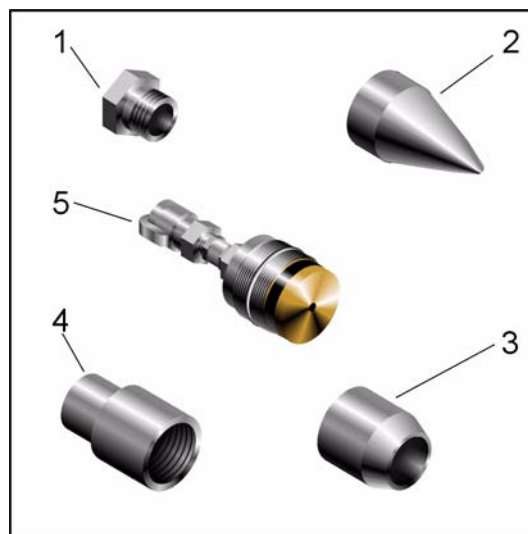
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1. tapered
2. PVC puller
3. cable puller

Pipe Pushing Accessories

A variety of accessories are available to make pipe pushing easier and more efficient. For more information, contact your Ditch Witch dealer.

1. **Pipe bushing:** Insert into front of the first pipe to prevent mushrooming as the pipe is pushed through the bore.
2. **Pipe push point:** Install on front of first pipe for closed-end push. Recommended for pushing smaller pipe.
3. **Cutting edge adapter:** Install onto the front of the first pipe for an open-end pipe push to create an air pocket in the pipe and prevent spoils from compacting in pipe.
4. **Pusher cone:** Install large end on end of pipe being pushed and insert nose of tool into smaller tapered end.
5. **Blowout sealing plug:** Use to seal end of last pipe and blow air through full length of installed pipe to remove spoils from inside the pipe.



om0619h.jpg

Oiler

Set Oil Flow Valve

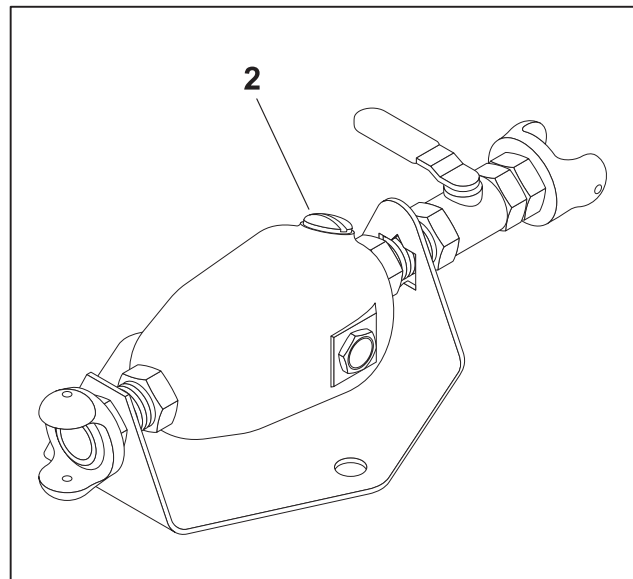


CAUTION

Improper handling or use of chemicals may result in illness, injury, or equipment damage. Follow instructions on labels and in material safety data sheets (MSDS).

1. Before connecting the oiler to the hoses, remove fill plug (2).

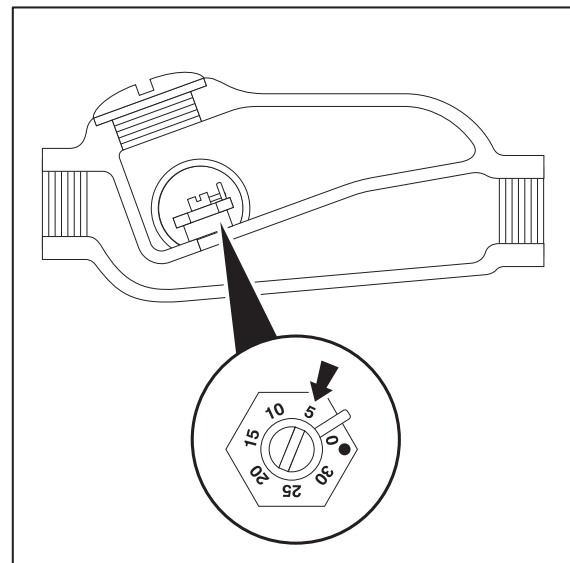
IMPORTANT: Set oiler on a flat, level area.



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2. Locate internal flow valve and use a flat blade screwdriver to turn adjustment screw slot to 5.
3. Securely replace fill plug.

IMPORTANT: For more oil flow adjustments see "Adjust Oil Flow" on page 66 and "Optimize Oil Flow Rate" on page 67.



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Adjust Oil Flow

**WARNING**

Pressurized fluid or air could pierce skin and cause injury or death.

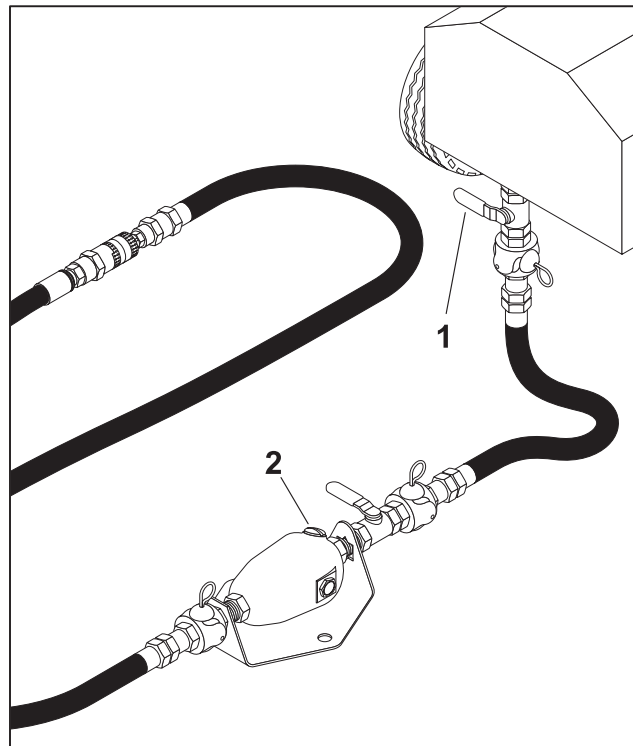
NOTICE: To prevent serious injury, do not attempt to remove fill plug with oiler under pressure. If pressure in oiler is not discharged before fill cap is opened, cap could cause injury or death.

**CAUTION**

Flying objects may cause injury. Wear hard hat and safety glasses.

NOTICE: Even after discharging air pressure, oiler reservoir may still be pressurized. Keep face and upper body away from oiler as fill plug is removed.

1. Close air supply valve at compressor and move air supply valve (1) on oiler to OFF.
2. Carefully remove fill plug (2) from oiler reservoir.



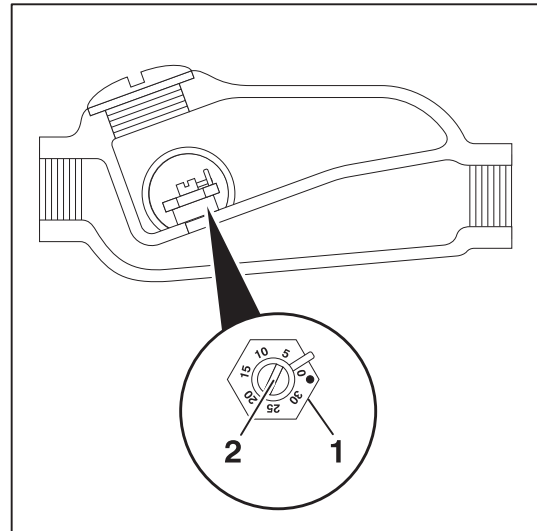
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3. Visually locate oil flow valve (1) and adjustment screw (2) inside oiler reservoir.
4. To adjust oil flow, use flat blade screwdriver to turn adjustment screw (2) on valve. Turn adjustment screw slot to higher number for more oil flow or lower number for less flow.

Note: Flow rate adjustment markings are from 0 to 30.

5. Replace fill plug before opening air supply valves at oiler and compressor.

NOTICE: Monitor oil level to ensure that oil flow is 4-6 oz/hr (120-180 mL/hr). If this adjustment does not correct oil flow, see "Optimize Oil Flow Rate" on page 67



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Optimize Oil Flow Rate

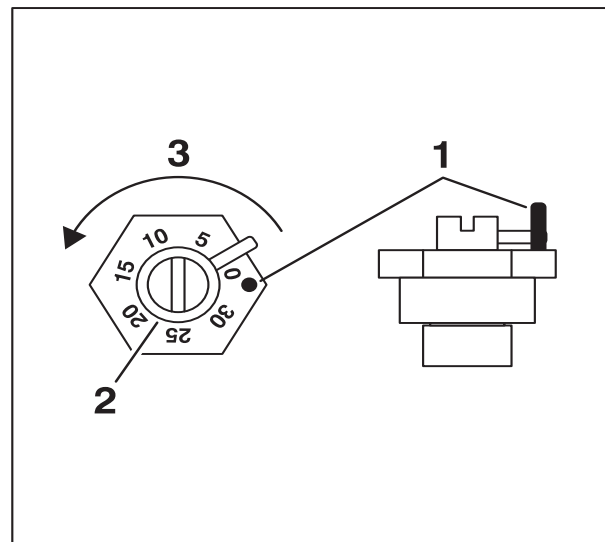
The oil flow rate can be increased beyond normal adjustments by removing the oil flow valve from the oiler and relocating the stop pin in relation to the adjusting screw. Increasing the adjustment limit in this way allows greater oil flow.



1. Discharge air pressure from oiler and remove fill plug.

NOTICE: See "Adjust Oil Flow" on page 66 for correct procedure in removing fill plug.

2. Remove oil flow valve from inside oiler reservoir using a 3/4" (19-mm) thin wall socket.
3. Remove stop pin (1) from valve by pulling straight up with pliers. Be careful not to bend or damage pin.
4. Loosen adjustment screw (2) one full turn counterclockwise (3) past stop pin (1).
5. Replace stop pin and install oil flow valve into oiler.
6. Replace fill plug before opening air supply valves at oiler and compressor.



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De-Ice Tool

Procedure

Follow this procedure when ice chips are present in tool exhaust.

1. Stop air flow to the tool.
2. Wait several minutes for tool to warm.
3. Pour 2 oz (60 cc) of Pierce Airrow oil into air hose at compressor.
4. Start tool.

Tips

If tool ices repeatedly, try one of the following:

- Increase amount of lubricant delivered to tool.
- Condition (heat or dry) the air before delivery to tool.
- Use Pierce Airrow Winter Oil (p/n 256-614).

Optional Kits

Equipment	Description
extension hose kits	3/4" or 1" hose and a set of couplers for use between standard hose and oiler on jobs longer than 50' (15 m)

Complete the Job

Chapter Contents

Tool Body and Hoses 70

Oiler 70



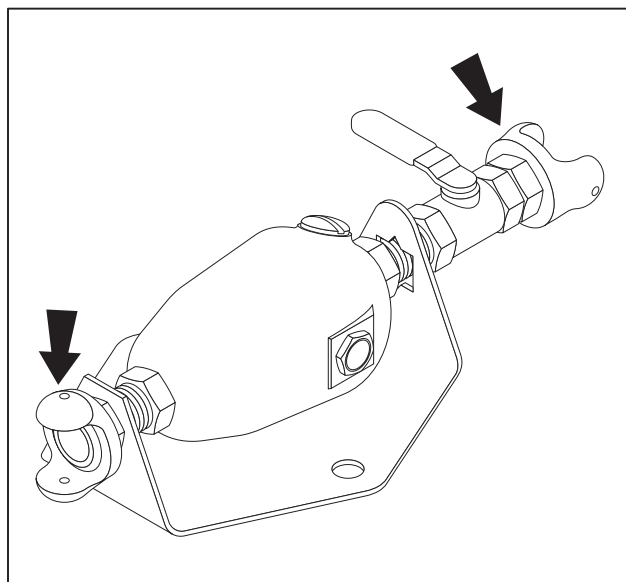
When the job is complete, the tool should be given proper care in order to extend its life. Additionally, the tool must be rebuilt yearly. For information on rebuild kits, see your Ditch Witch dealer.

Tool Body and Hoses

1. Remove tool from the exit pit or entry pit and remove tape and coupling clips.
2. Uncouple whip hose from air hose.
3. Carefully remove any dirt and oil residue from whip hose.
4. Pour a generous amount of Pierce Airrow oil into the whip hose.
5. Install dust caps or tape whip hose end.
6. Store tool in a dry area to prevent condensation inside tool.

Oiler

1. Carefully remove any dirt or residue from oiler surfaces.
2. Cover QDC bodies (shown).
3. Store oiler on a flat area to prevent oil from leaking.



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Troubleshoot



Chapter Contents

Tool Will Not Run or Start	72
Tool Operates Erratically in Forward	72
Tool Operates Erratically in Reverse	73
Tool Stops in Ground	73
Tool Has Low Impact Power	74
Tool Penetrates Ground Slowly	74

Symptom: Tool Will Not Run or Start

Possible Cause	Solution
Restriction in air supply hose.	Disconnect hose and purge restriction.
Valve stem is bent.	Replace valve stem.
Air pressure is low.	Check air pressure.
Ice has built up inside unit.	Follow de-icing instructions. See page 68.
Internal clearances are excessive.	Replace body, striker or valve.
Foreign material is inside unit.	Dissassemble and clean.
Internal parts are broken or misaligned.	Dissassemble, then repair and replace.
Surfaces are rusted or rough-sliding.	Dissassemble, then clean and polish.

Symptom: Tool Operates Erratically in Forward

Possible Cause	Solution
Restriction in air supply hose.	Disconnect hose and purge restriction.
Valve stem is bent.	Replace valve stem.
Air pressure is high.	Check air pressure.
Ice has built up inside unit.	Follow de-icing instructions. See page 68.
Tool has hit an obstacle.	Reverse tool and try again.

Symptom: Tool Operates Erratically in Reverse



Possible Cause	Solution
Restriction in air supply hose.	Disconnect hose and purge restriction.
Valve stem is bent.	Replace valve stem.
Air pressure is high.	Check air pressure.
Ice has built up inside unit.	Follow de-icing instructions. See page 68.
Shock absorber has deteriorated.	Replace shock absorber.
Tool lubrication is insufficient.	Follow lubrication instructions.

Symptom: Tool Stops in Ground

Possible Cause	Solution
Restriction in air supply hose.	Disconnect hose and purge restriction.
Ice has built up inside unit.	Follow de-icing instructions. See page 68.
Ground is too hard or too soft.	Re-evaluate job application.
Tool has hit an obstacle.	Reverse tool and try again.

Symptom: Tool Has Low Impact Power

Possible Cause	Solution
Restriction in air supply hose.	Disconnect hose and purge restriction.
Air pressure is low.	Check air pressure.
Ice has built up inside unit.	Follow de-icing instructions. See page 68.
Shock absorber has deteriorated.	Replace shock absorber.
Internal clearances are excessive.	Replace body, striker or valve.
Tool lubrication is insufficient.	Follow lubrication instructions.
Internal parts are broken or misaligned.	Disassemble, then repair and replace.
Surfaces are rusted or rough-sliding.	Disassemble, then clean and polish.

Symptom: Tool Penetrates the Ground Slowly

Possible Cause	Solution
Air pressure is high.	Check air pressure.
Ground is too hard or too soft.	Re-evaluate job application.
Tool has hit an obstacle.	Reverse tool and try again.

Service

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- Remove Whip Hose and Fittings83
- Disassemble Valve Stem Components83
- Remove End Cap Components84

Field Repair

Location	Task	Notes
	Replace quick disconnect fitting	
	Replace whip hose	
	Replace tail adapter	
	Replace nose cap	Threaded (T) models only

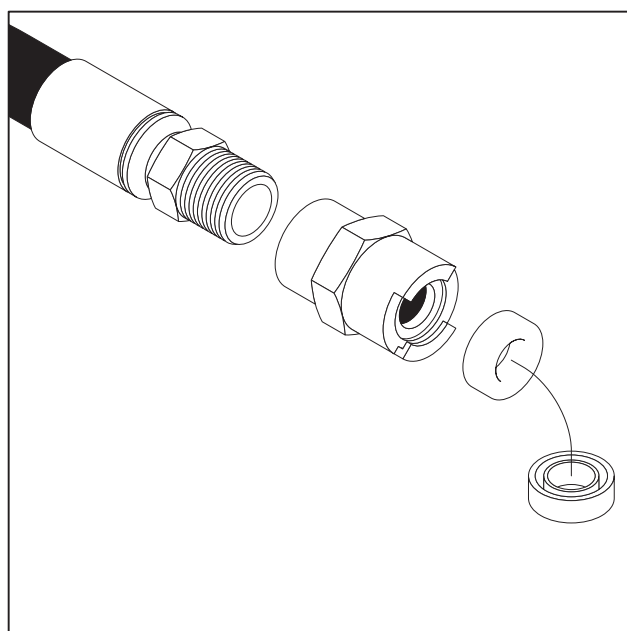
Replace Quick Disconnect Fitting

Remove

1. Secure tool in vise.

IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Make a mark across joint.
3. Use electric heat gun to loosen quick disconnect fitting adhesive.
4. Use wrench to loosen the joint.
5. Remove the whip hose fitting from socket.
6. If replacement is not necessary, do not disassemble quick disconnect socket.
If replacement is necessary, pry gasket from socket. Discard gasket.



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Install

1. Secure tool in vise.

IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. If installing previously used fitting, install new gasket with grooved face toward quick disconnect fitting. Ensure gasket seats properly.
If installing new fitting, gasket is already installed.
3. Find free end of whip hose and apply blue Loctite 242 or 248 to the external threads of the hose fitting.
4. Thread the quick disconnect fitting onto the whip hose fitting and hand tighten.
5. Use wrenches to tighten joint until marks align.

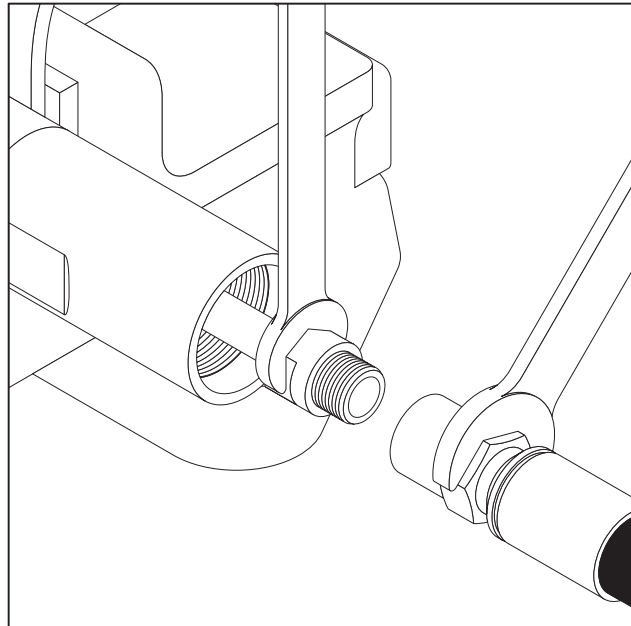
Replace Whip Hose

Remove

1. Secure tool in vise.

IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Remove tail adapter. See "Remove Tapered Tail Adapter" on page 82.
3. Turn whip hose/valve assembly counter-clockwise and pull away from end cap.
4. Place wrench on the flats of thread adapter and brace against the edge of end cap.
5. Pry adapter outward with enough force to prevent valve stem from pulling back into end cap.
6. Use wrenches to break joint.
7. Unthread whip hose hex fitting from thread adapter.
8. Remove whip hose from valve stem and end cap.



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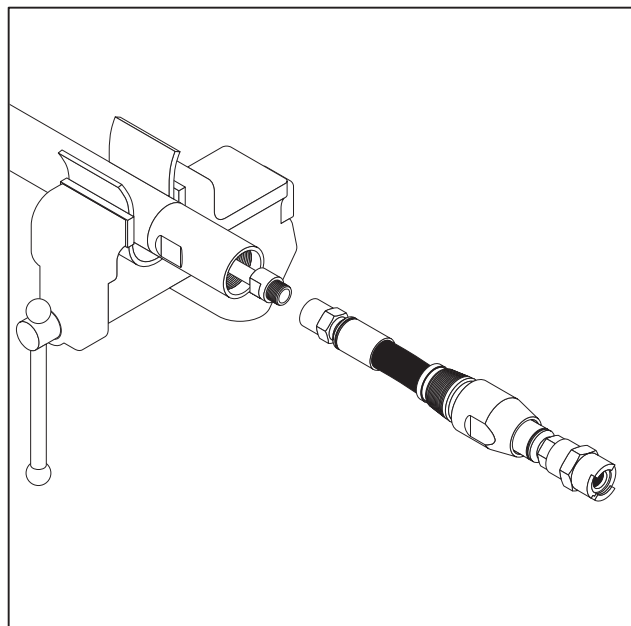


Install

1. Secure tool in vise.

IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Apply blue Loctite 242 or 248 to the threads at the end of the thread adapter.
3. Thread the female hex fitting of the whip hose onto the thread adapter. Hand tighten.
4. Turn whip hose counter-clockwise and pull it away from end cap.
5. Place wrench on the flats of thread adapter and brace against the edge of end cap.
6. Pry adapter outward with enough force to prevent valve stem from pulling back into end cap.
7. Use wrenches to tighten whip hose flex fitting onto thread adapter.
8. Install tail adapter. See "Remove Tapered Tail Adapter" on page 82.



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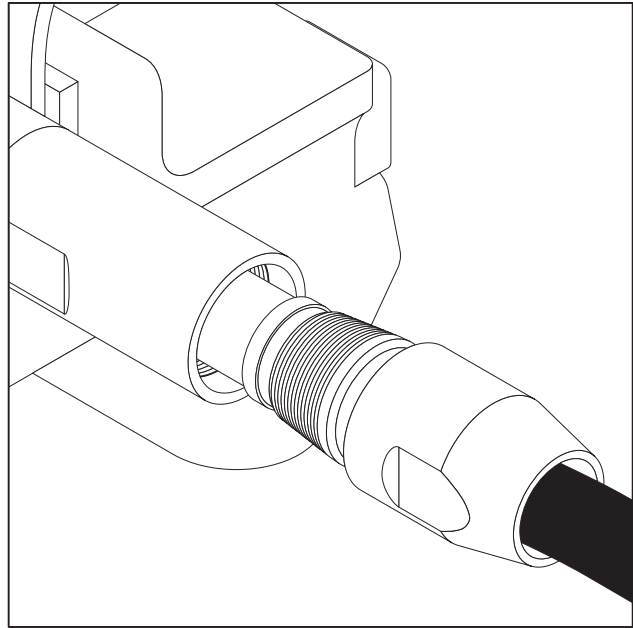
Replace Tail Adapter

Remove

1. Secure end cap in vise.

IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Use end cap wrench to loosen tail adapter. A 6' (m) piece of pipe may need to be placed over wrench handle to break joint.
3. Unthread tail adapter and slide it off over the whip hose.



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Install

1. Secure tool in vise.

IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Apply light coat of anti-seize lubricant on external threads of tapered tail adapter and internal threads of end cap.
3. Slide tapered tail adapter over the whip hose with threaded end toward end cap.
4. Thread tapered tail adapter onto end cap and hand tighten.
5. Use wrenches to tighten tapered tail adapter securely.

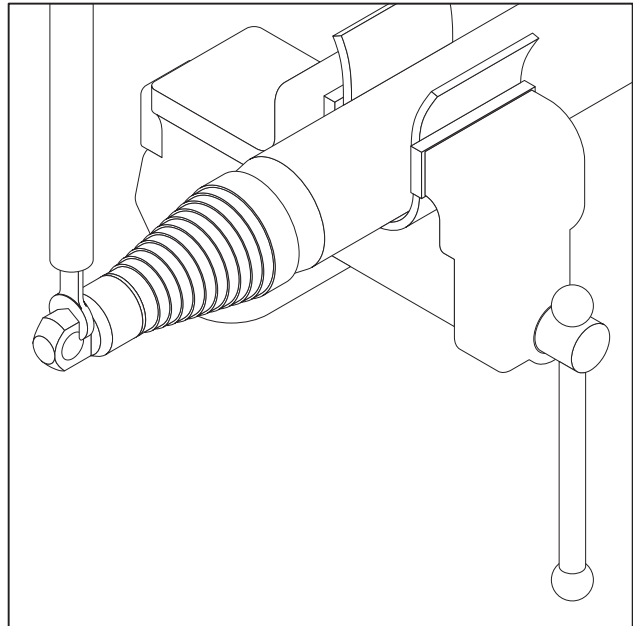
Replace Nose Cap (T models only)

Remove

1. Place tool in vise.

IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Use wrench to loosen nose cap from body. A 6' (1.8 m) piece of pipe may need to be placed over wrench handle to break joint.
3. Unthread and remove nose cap.
4. Remove Nord-Lock® washer.
5. Remove nose cover.



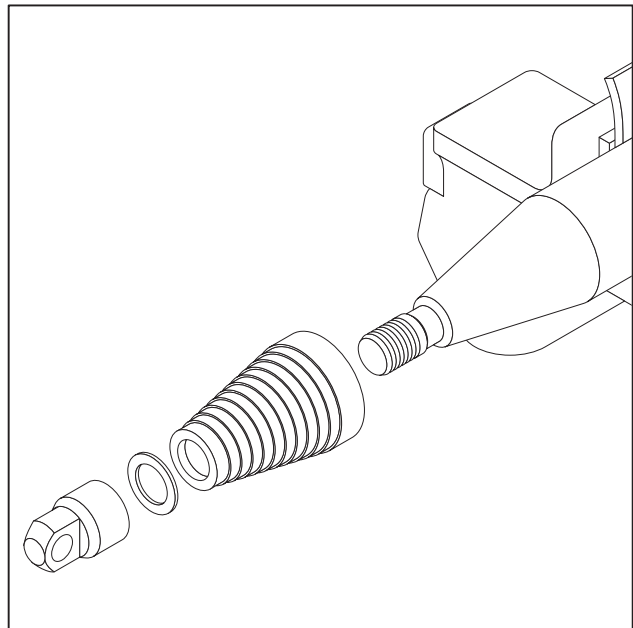
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Install

1. Place tool body in a vise.

IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Install nose cover onto body.
3. Slip Nord-Lock washer onto body hand-tight.
4. Thread cap onto body hand-tight.
5. Tighten nose cap to 1000 ft•lb (1356 n•m).



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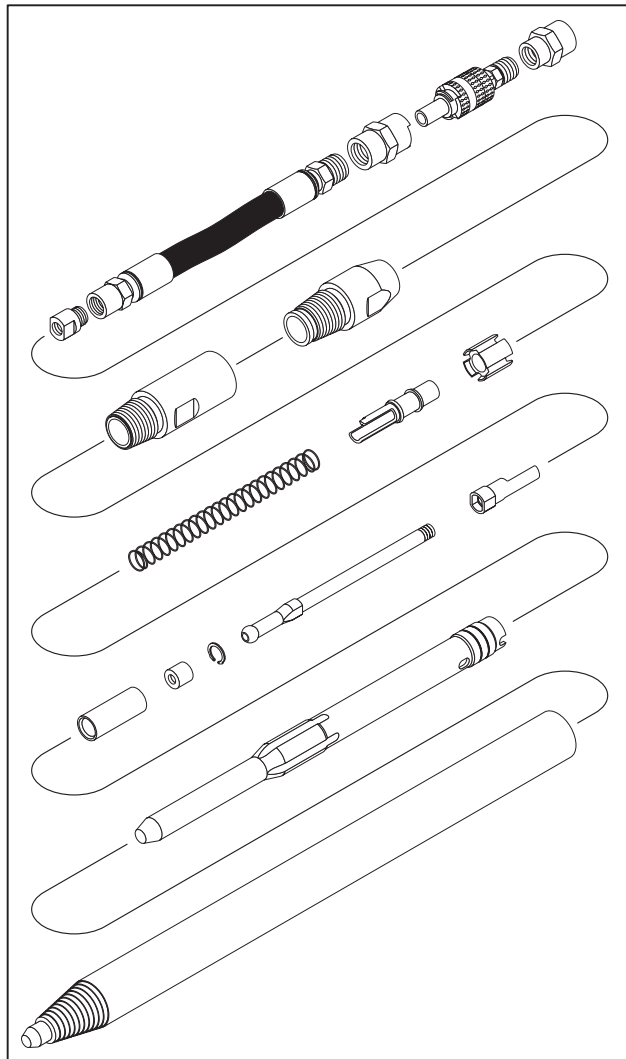


Rebuild

Disassemble and inspect components yearly or when production drops. Replace components as needed.

Disassembly Overview

1. Remove tail assembly and striker.
2. Remove tapered tail adapter.
3. Remove whip hose and fittings.
4. Disassemble valve stem components.
5. Remove end cap components.



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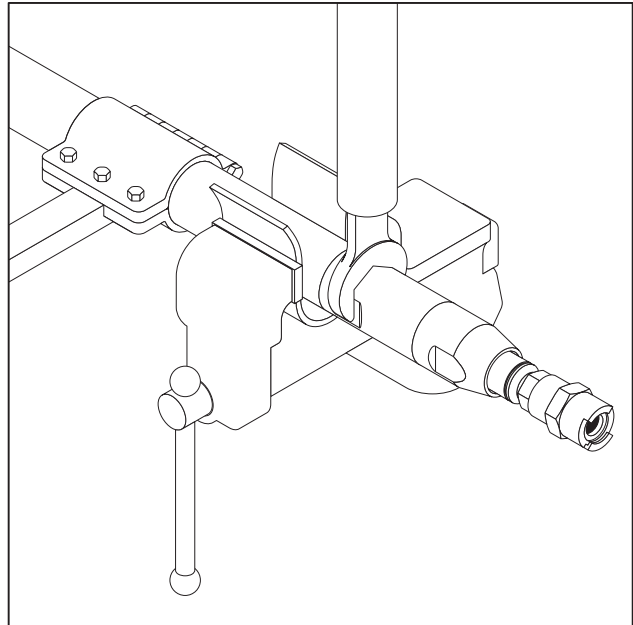
Remove Tail Assembly and Striker

1. Place tool in vise and attach girth grip wrench to tool body.

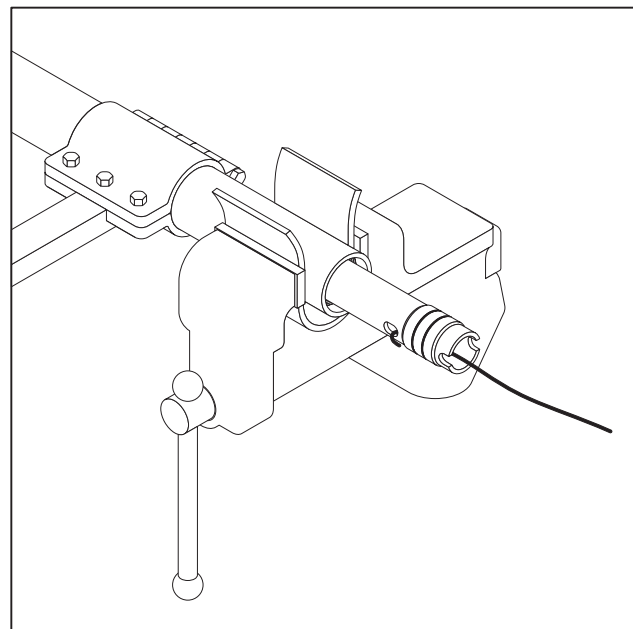
IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Position wrench near tail assembly.
3. Place 6' (1.8 m) piece of pipe over wrench handle and loosen joint.
4. Remove tail assembly and cover to prevent contamination.

5. Insert heavy-gauge wire with a hook at the end into a striker air hole and carefully pull striker from body.
6. Clean striker and cover to prevent contamination.
7. Cover the open end of the body to prevent contamination.



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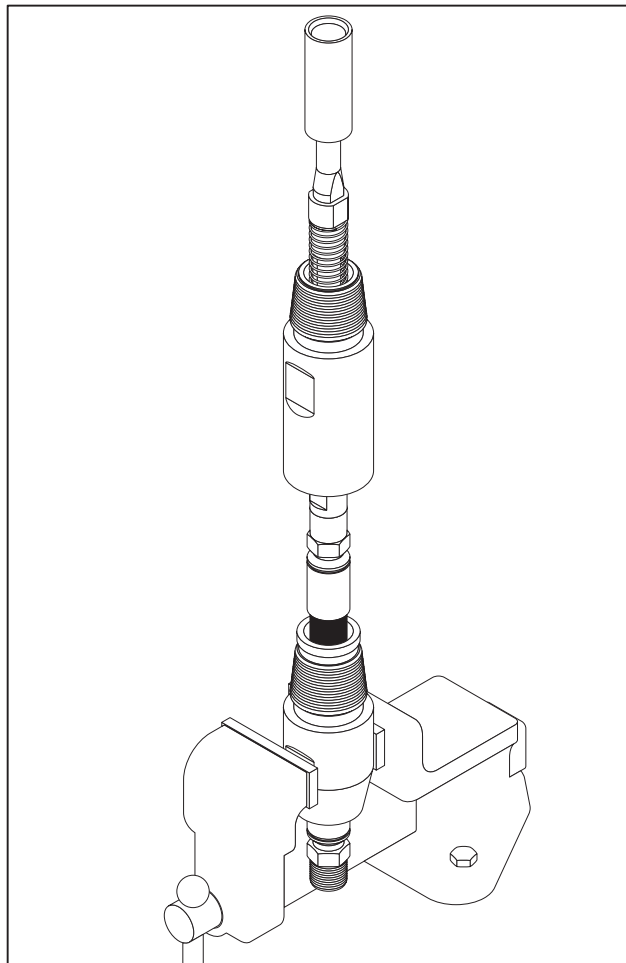


Remove Tapered Tail Adapter

IMPORTANT:

- Do not grip end cap by threads.
- **On PA225 only**, remove QDC fitting before removing tail adapter.

1. Secure end cap in vise.
2. Use end cap wrench to loosen tail adapter. A 6' (1.8 m) piece of pipe may need to be placed over wrench handle to break joint.
3. Unthread tail adapter and slide it off over the whip hose.



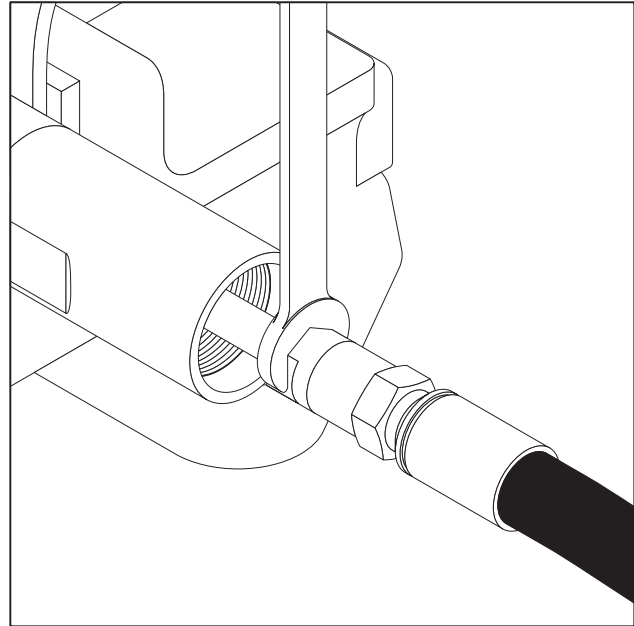
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Remove Whip Hose and Fittings

1. Secure end cap in vise.
2. Turn whip hose/valve assembly counter-clockwise as far as it will go **by hand**.
3. Press valve stem and valve components toward end cap.
4. Use electric heat gun to heat thread adapter adhesive.
5. Use wrenches to break joint.

IMPORTANT: To avoid rapid release of valve spring, hold in place by hand while removing whip hose and thread adapter.

6. Slide valve stem, valve spring and valve from end cap.
7. Remove spring from around the valve guide inside end cap and from valve stem.
8. Slide valve finger off valve stem assembly.



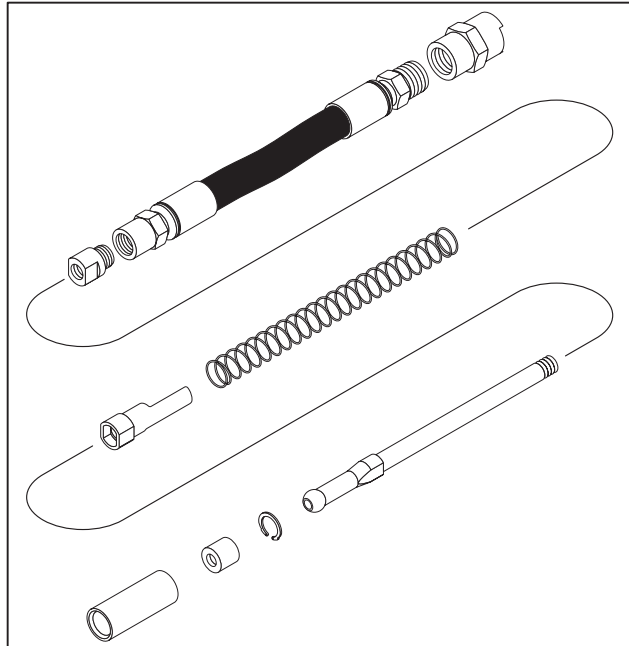
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Disassemble Valve Stem Components

1. Loosen snap ring and remove from valve. Discard snap ring.
2. Place valve with stem in the Arbor press with threaded end facing down.
3. Use valve bushing punch to press valve stem from valve sleeve.

IMPORTANT: Valve stem and valve bushing punch will fall through press plate. Catch them as they release.

4. Place valve stem into Arbor press with threaded end facing down.
5. Use valve bushing punch to press valve stem until ball end is removed from valve bushing socket. Discard valve bushing.



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IMPORTANT: Valve stem and valve bushing punch will fall through press plate. Catch them as they release.

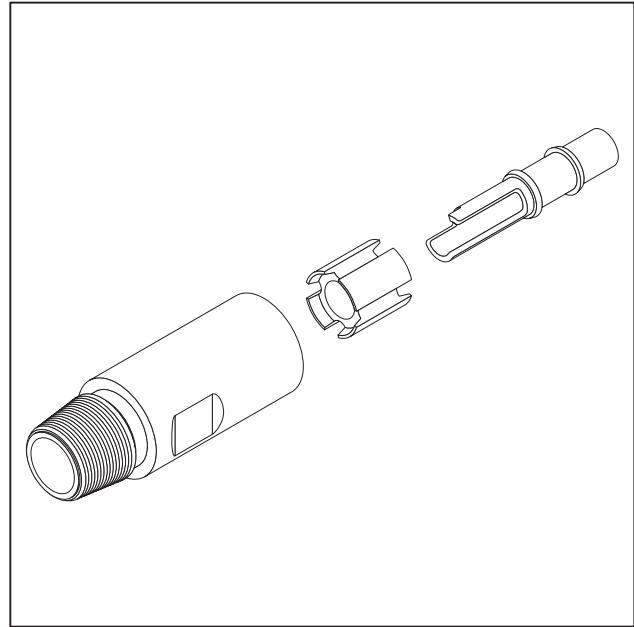
Remove End Cap Components

PA225 & PA270 & PA425

1. Place end cap in Arbor press with external threaded end facing up.
2. Use valve guide pusher and valve bushing punch to press valve guide and shock absorber from end cap.

IMPORTANT: Valve guide will fall through press plate. Catch it as it releases.

3. Place shock absorber and valve guide on Arbor press.
4. Position valve guide pusher over valve guide.
5. Press valve guide through shock absorber. Discard shock absorber.



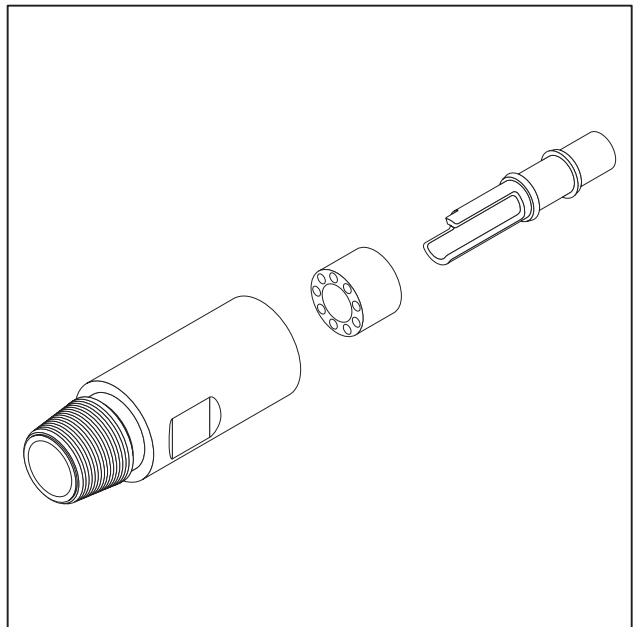
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PA310

1. Place end cap in Arbor press with external threaded end facing up.
2. Use valve guide pusher and valve bushing punch to press valve guide and shock absorber from end cap.

IMPORTANT: Valve guide will fall through press plate. Catch it as it releases.

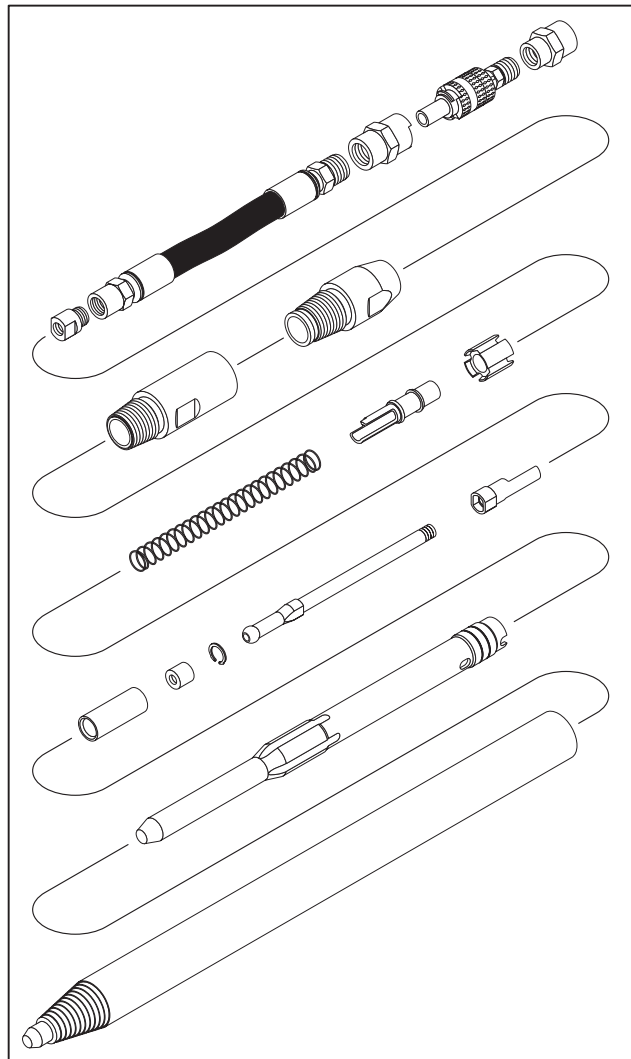
3. Place end cap in vise.
4. Use pry bar to move shock absorber until holes are accessible.
5. Insert pry bar through large center hole and remove shock absorber. Discard shock absorber.



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Assembly Overview

1. Assemble end cap components.
2. Assemble valve stem components.
3. Install whip hose and fittings.
4. Install tapered tail adapter.
5. Install tail assembly and striker.



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Assemble End Cap Components

1. Lubricate internal surface of shock absorber with rubber lube.
2. Place shock absorber on the press plate and place the valve guide installation tool in the center bore of the shock absorber.
3. Slide valve guide onto the valve guide installation tool.
4. Position valve guide pusher over valve guide.
5. Press valve guide and insertion tool through shock absorber.
6. Remove valve guide pusher from valve guide.
7. Position end cap on the press plate with threaded end down and insert shock absorber installation tool into upper end of end cap.
8. Lubricate outer surface of shock absorber with rubber lube. Place shock absorber into installation tool with fingers facing down.
9. Center shock absorber pusher tool over shock absorber.
10. Slowly press the shock absorber into the end cap until the pusher tool touches the installation tool.
11. Remove shock absorber installation tool and shock absorber pusher from end cap.

Assemble Valve Stem Components

1. Place valve stem on press plate, ball end up. Place valve bushing over the ball and press into place.
2. Slowly pull lever on press until bushing snaps into place. The bushing should be loose and free to rotate on the ball.
3. Slide the valve sleeve onto the valve bushing as far as it will go by hand.
4. Place valve bushing press tool with small end facing up on the press plate.
5. With valve sleeve centered on valve press tool, slowly press valve sleeve onto the valve bushing.
6. Stop pressing when internal shoulder of valve sleeve touches the top of valve bushing.
7. Remove any displaced plastic from inside the valve to reveal the snap ring groove.
8. Slide snap ring over valve stem. Using needle-nose or retaining ring pliers, compress and fit the snap ring into the groove until it snaps into place.

IMPORTANT: Properly installed valve will have no more than 0.015" of end play.

Secure Valve Stem to End Cap

1. Place end cap on level surface and secure with strap wrench or vise.
2. Slide valve stem assembly into the valve finger until wrench flats are seated in the pocket.
3. Slide spring into smaller end of end cap with spring fitting around the outside of the valve guide and the valve stem inside the valve guide.
4. Press the valve end of the valve stem toward the end cap by hand until the threads on the stem are accessible.
5. Apply blue Loctite 242 or 248 to the threads at the end of the valve stem.
6. Thread the thread adapter onto the valve stem and tighten finger tight.
7. Place socket over the thread adapter to hold adapter in place.
8. Place open-end wrench across the flats of valve stem and thread the valve stem onto the thread adapter.
9. Tighten thread adapter onto the valve stem.



Install Whip Hose and Fittings

1. Press valve end of valve stem toward the end cap until thread adapter is accessible.
2. Place open-end wrench behind exposed thread adapter. Brace wrench against edge of end cap and pry stem outward with enough force to prevent valve stem from pulling back into end cap.
3. Apply blue Loctite 242 or 248 to threads at the end of the thread adapter.
4. Thread female hex fitting of the whip hose onto the adapter. Tighten finger tight.
5. Continue holding thread adapter in position and place open-end wrenches across the flats of thread adapter and whip hose hex fittings.
6. Tighten whip hose hex fitting onto thread adapter.
7. Install new gasket with grooved face toward quick disconnect fitting, if fitting is being reused. Verify that gasket seats properly.

If a new quick disconnect fitting is being installed, it already contains a gasket.

8. Place whip hose and attached tail assembly on assembly surface.
9. Apply blue Loctite 242 or 248 to external threads of hose fitting.
10. Thread quick disconnect fitting onto whip hose fitting and hand tighten.
11. Fit open-end wrenches across the flats of the whip hose fitting and quick disconnect socket.
12. Hold the whip hose fitting in place and turn the quick disconnect fitting until joint is secure.

Install Tapered Tail Adapter

1. Clamp body/anvil in vise.

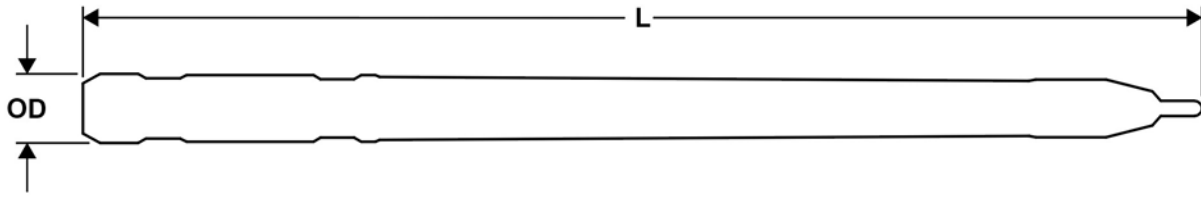
IMPORTANT: Protect body/anvil from clamp marks which could cause premature tool failure.

2. Lubricate external surface and internal bore of striker.
3. Slide striker into the body/anvil.
4. Apply anti-seize thread lubricant to threads of end cap and body/anvil.
5. Coat valve assembly components with lubricant.
6. Thread end cap onto body/anvil and hand tighten.
7. Apply light coat of anti-seize lubricant to external threads of tapered tail adapter and internal threads of end cap.
8. Slide tapered tail adapter over whip hose with threaded end toward end cap.
9. Thread tapered tail adapter into end cap and hand tighten.

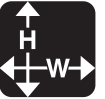
Tighten Joints

1. Place strap wrench on body/anvil and place wrench on tail adapter flats.
2. Tighten joints until there is metal-to-metal contact.
3. Place mark across both joints.
4. Place 6' (1.8 m) pipe over wrench handle and tighten until scribe marks have moved 3/8" (9 mm).
5. Remove tool from vise.

Specifications



rg1599a.eps



PA225		U.S.	METRIC
OD	Diameter	2.24 in	57 mm
L	Overall length	39.6 in	1 m
	Weight	31 lb	14 kg
	Operating pressure	110 psi	7.6 bar
	Air consumption	20 cfm	0.6 m ³ /min
	Percussion rate	585 bpm	
	Delivery hose inside diameter	0.75 in	19 mm

PA270		U.S.	METRIC
OD	Diameter	2.7 in	68 mm
L	Overall length		
	Standard	50 in	1.27 m
	Threaded	52.8 in	1.34 m
	Weight		
	Standard	53 lb	24 kg
	Threaded	56 lb	25 kg
	Operating pressure	110 psi	7.6 bar
	Air consumption	32 cfm	0.9 m ³ /min
	Percussion rate	450 bpm	
	Delivery hose inside diameter	0.75 in	19 mm

PA310		U.S.	METRIC
OD	Diameter	3.1 in	79 mm
L	Overall length		
	Standard	54.7 in	1.39 m
	Threaded	57.9 in	1.47 m
	Weight		
	Standard	75 lb	34 kg
	Threaded	80 lb	36 kg
	Operating pressure	110 psi	7.6 bar
	Air consumption	40 cfm	1.2 m ³ /min
	Percussion rate	440 bpm	
	Delivery hose inside diameter	0.75 in	19 mm

PA425		U.S.	METRIC
OD	Diameter	4.25 in	108 mm
L	Overall length		
	Standard	66.7 in	1.69 m
	Threaded	69.9 in	1.78 m
	Weight		
	Standard	170 lb	77 kg
	Threaded	177 lb	80 kg
	Operating pressure	110 psi	7.6 bar
	Air consumption	110 cfm	3.1 m ³ /min
	Percussion rate	425 bpm	
	Delivery hose inside diameter	1 in	25.4 mm

Specifications are called out according to SAE recommended practices where indicated. Specifications are general and subject to change without notice. If exact measurements are required, equipment should be weighed and measured. Due to selected options, delivered equipment may not necessarily match that shown.

Parts Pages

Chapter Contents

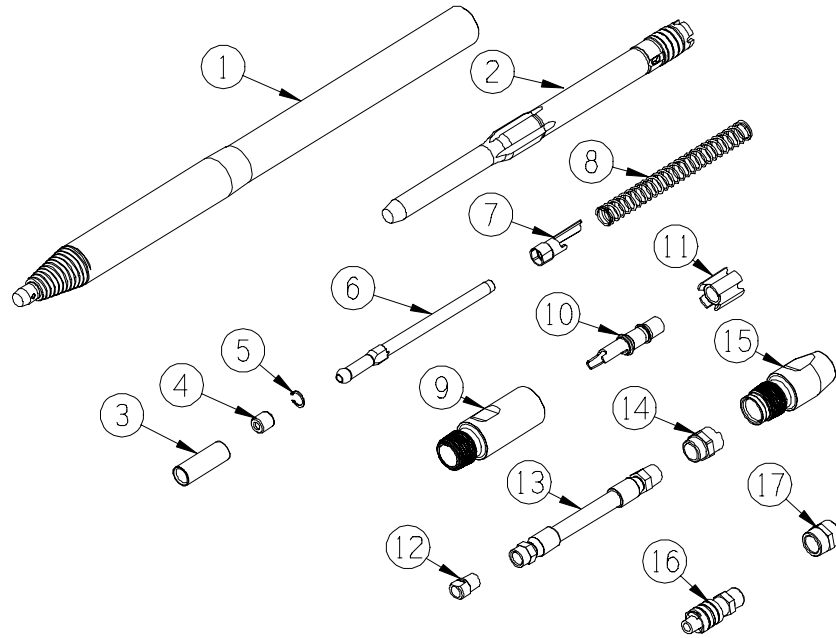
PA225

PA270

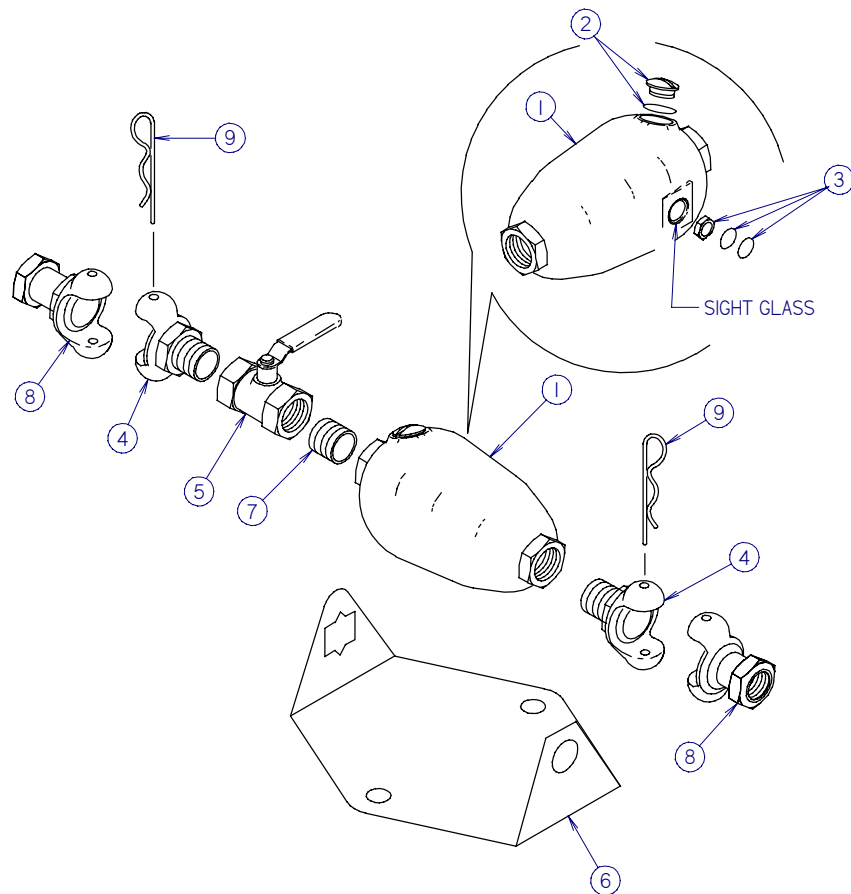
PA310

PA425





Model PA225 Pierce Arrow II Assembly			
Item No.	Qty.	Part No.	Description
1	1	AL571621	Body-Anvil Assembly
2	1	AL571638	Striker
3	1	AL571631	Valve Sleeve
4	1	AL571632	Valve Bushing
5	1	AL571634	Snap Ring
6	1	AL571633	Valve Stem
7	1	AL571635	Valve Finger
8	1	AL571639	Valve Spring
9	1	AL571626	End Cap
10	1	AL571628	Valve Guide
11	1	AL571627	Shock Absorber
12	1	AL571656	Adapter Stem
13	1	AL571637	Hose Assembly
14	1	AL831027	QD Coupling Socket
15	1	AL571629	Tail Adapter
16	1	AL102395	QD Coupler Plug w/Lock Ring
17	1	AL798056	Adapter

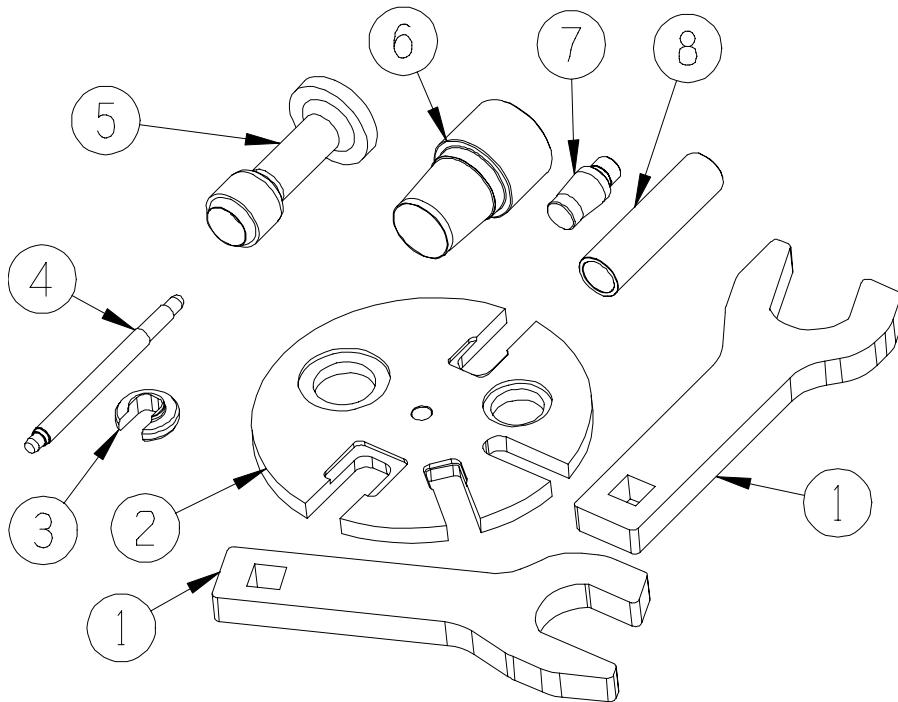


MODELS: PA225, PA270, PA310, PA425 OILER

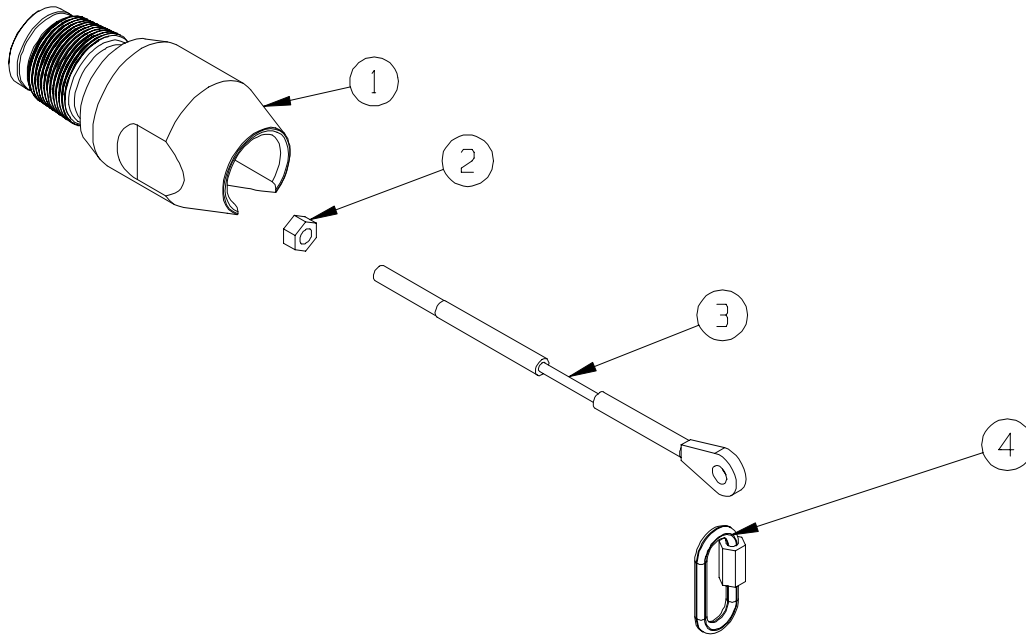
REF #	QTY.	PART #	DESCRIPTION
	1	300-3684	OILER ASSEMBLY - INCLU REF. NO.'S 1 & 4 THRU 10.
1	1	120-159	OILER - INCL. REF NO.'S 2 & 3
		110-607	VALVE
		165-752	VALVE GASKET
2	1	500-500	PLUG
		155-737	O-RING (214 D70)
		500-501	PLUG (LESS O-RING)
3	1	191-063	SIGHT DISK KIT
		157-023	SEAL RING
		500-499	LOCKNUT
4	2	120-010	CLAW COUPLING (3/4"-NPT MALE)
		116-278	COUPLING GASKET
5	1	120-018	SHUT-OFF VALVE
6	1	352-458	LUBRICATOR BASE
7	1	115-163	ALL THREAD (SEE FOOTNOTE 1)
8	2	120-009	CLAW COUPLING (3/4"-NPT FEMALE)
9	2	110-410	SAFETY CLIP
10	1	256-611	P.A. OIL (QUART) SUMMER, NOT SHOWN
	1	256-614	P.A. OIL (QUART) WINTER, NOT SHOWN, NOT INCLUDED IN ASSEMBLY

FOOTNOTES:

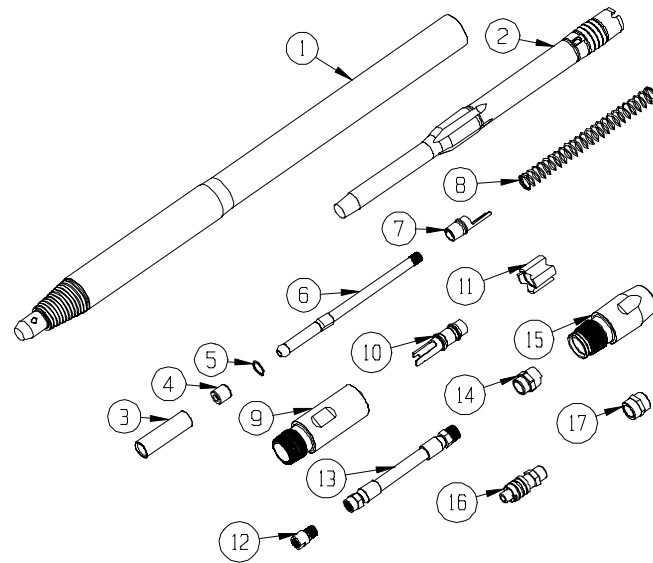
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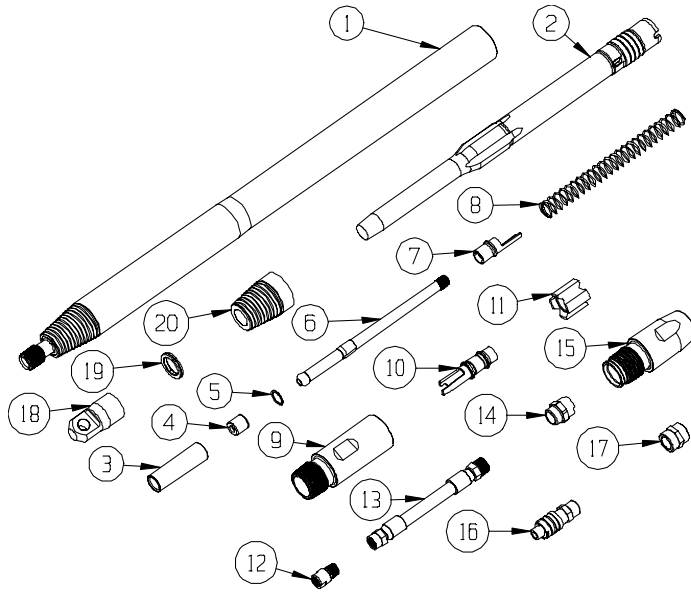
Model PA225 Pierce Arrow II Service Kit Part No. AL571646			
Item No.	Qty.	Part No.	Description
1	2	AL571653	Wrench 1.875 inch
2	1	AL571655	Press Plate Assembly
3	1	AL571650	Valve Bushing Press Tool
4	1	AL571652	Valve Bushing Punch
5	1	AL571649	Shock Absorber Pusher
6	1	AL571648	Shock Absorber Installation Tool
7	1	AL571647	Valve Guide Installation Tool
8	1	AL571651	Valve Guide Pusher



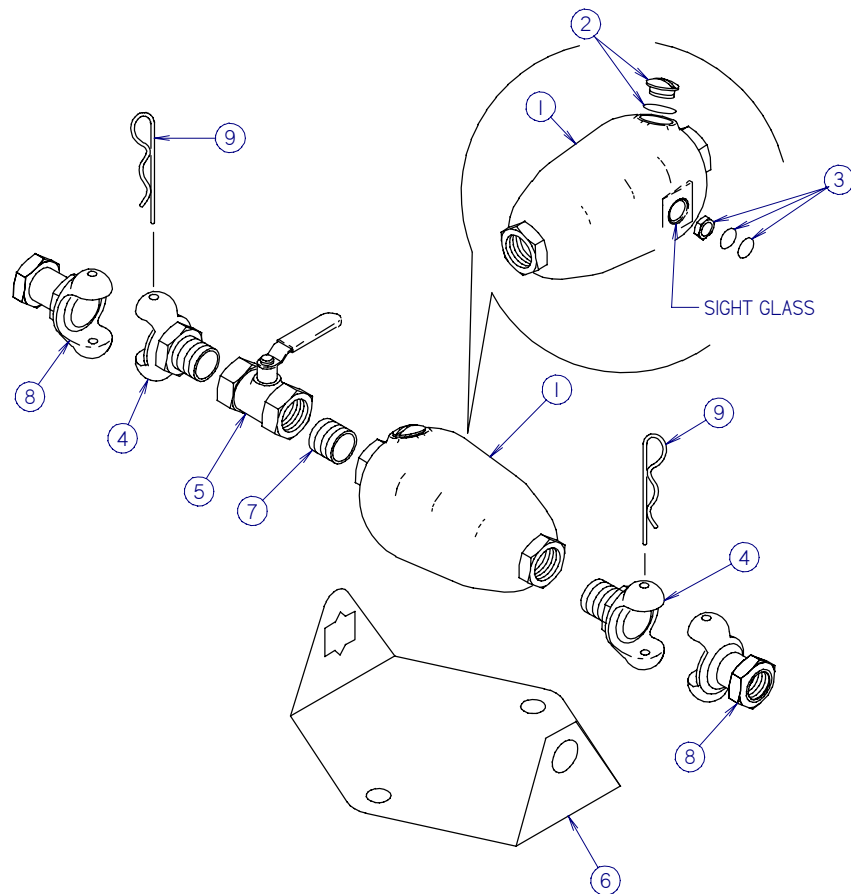
Model PA225 Tail Adapter Cable Puller Part No. AL571644			
Item No.	Qty.	Part No.	Description
1	1	AL571645	Tail Adapter Cable Puller
2	1	AL815592	Hex Nut 5/16-24
3	1	AL831108	Connector Cable
4	1	AL831090	Thread Chain Connector



Model PA270 Assembly			
Item No.	Qty.	Part No.	Description
1	1	AL571969	Body/Anvil Assy. – Non TH
2	1	AL571975	Striker
3	1	AL571977	Valve Sleeve
4	1	AL571978	Valve Bushing
5	1	AL571979	Snap Ring
6	1	AL571980	Valve Stem
7	1	AL571981	Valve Finger
8	1	AL571982	Valve Spring
9	1	AL571983	End Cap
10	1	AL571984	Valve Guide
11	1	AL571985	Shock Absorber
12	1	AL571986	Adapter Stem
13	1	AL571637	Hose Assembly
14	1	AL831027	Q.D Coupler Socket
15	1	AL571988	Tail Adapter
16	1	AL102395	Q.D. Coupler Plug W/Loc
17	1	AL798056	Adapter



Model PA270 Threaded Assembly			
Item No.	Qty.	Part No.	Description
1	1	AL571973	Body/Anvil Assy. – TH
2	1	AL571975	Striker
3	1	AL571977	Valve Sleeve
4	1	AL571978	Valve Bushing
5	1	AL571979	Snap Ring
6	1	AL571980	Valve Stem
7	1	AL571981	Valve Finger
8	1	AL571982	Valve Spring
9	1	AL571983	End Cap
10	1	AL571984	Valve Guide
11	1	AL571985	Shock Absorber
12	1	AL571986	Adapter Stem
13	1	AL571637	Hose Assembly
14	1	AL831027	Q.D Coupler Socket
15	1	AL571988	Tail Adapter
16	1	AL102395	Q.D. Coupler Plug W/Loc
17	1	AL798056	Adapter
18	1	AL571992	Nose Cap
19	1	AL90598	Nordlock NL33
20	1	AL571991	Nose Cover Grooved

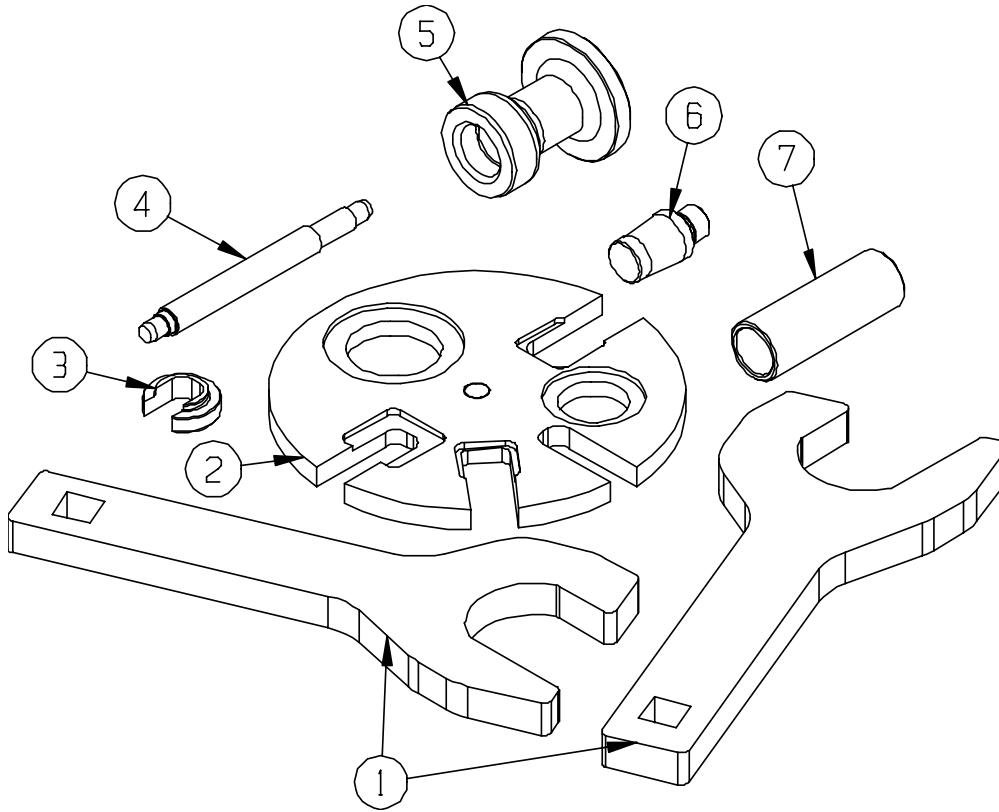


MODELS: PA225, PA270, PA310, PA425 OILER

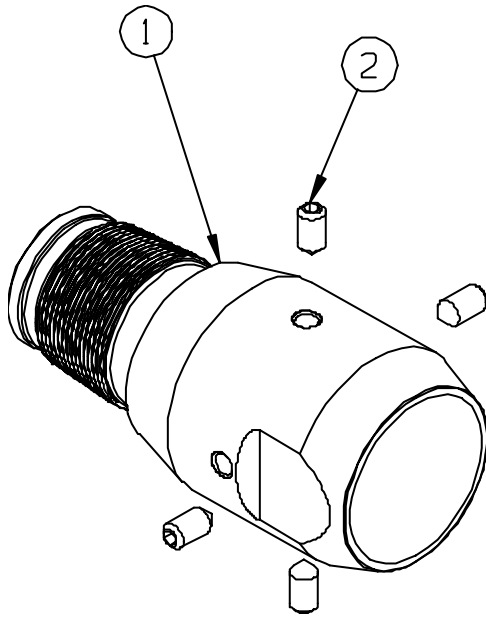
REF #	QTY.	PART #	DESCRIPTION
	1	300-3684	OILER ASSEMBLY - INCLU REF. NO.'S 1 & 4 THRU 10.
1	1	120-159	OILER - INCL. REF NO.'S 2 & 3
		110-607	VALVE
		165-752	VALVE GASKET
2	1	500-500	PLUG
		155-737	O-RING (214 D70)
		500-501	PLUG (LESS O-RING)
3	1	191-063	SIGHT DISK KIT
		157-023	SEAL RING
		500-499	LOCKNUT
4	2	120-010	CLAW COUPLING (3/4"-NPT MALE)
		116-278	COUPLING GASKET
5	1	120-018	SHUT-OFF VALVE
6	1	352-458	LUBRICATOR BASE
7	1	115-163	ALL THREAD (SEE FOOTNOTE 1)
8	2	120-009	CLAW COUPLING (3/4"-NPT FEMALE)
9	2	110-410	SAFETY CLIP
10	1	256-611	P.A. OIL (QUART) SUMMER, NOT SHOWN
	1	256-614	P.A. OIL (QUART) WINTER, NOT SHOWN, NOT INCLUDED IN ASSEMBLY

FOOTNOTES:

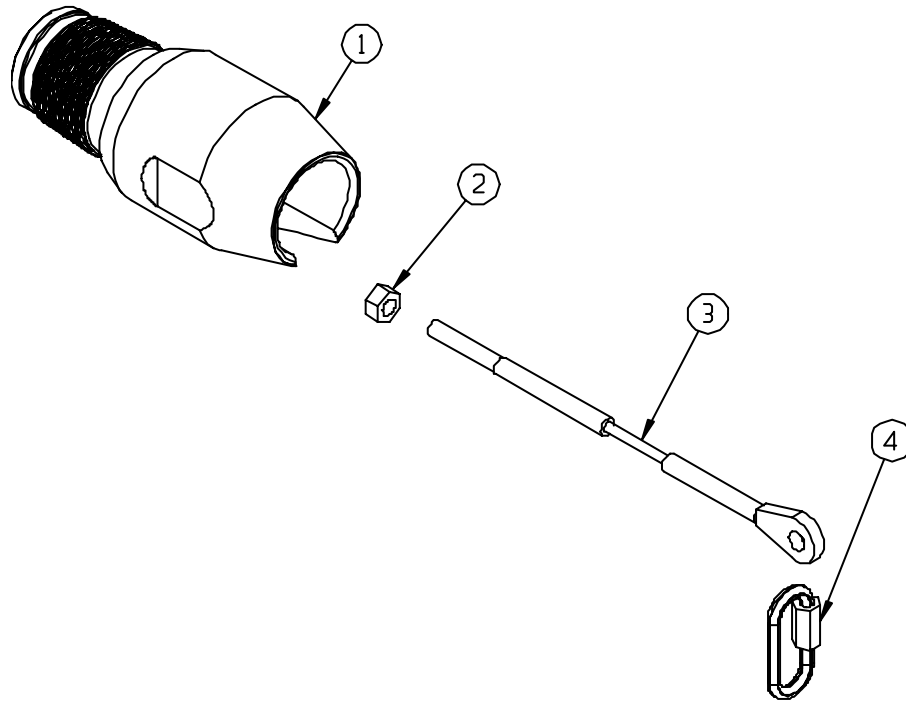
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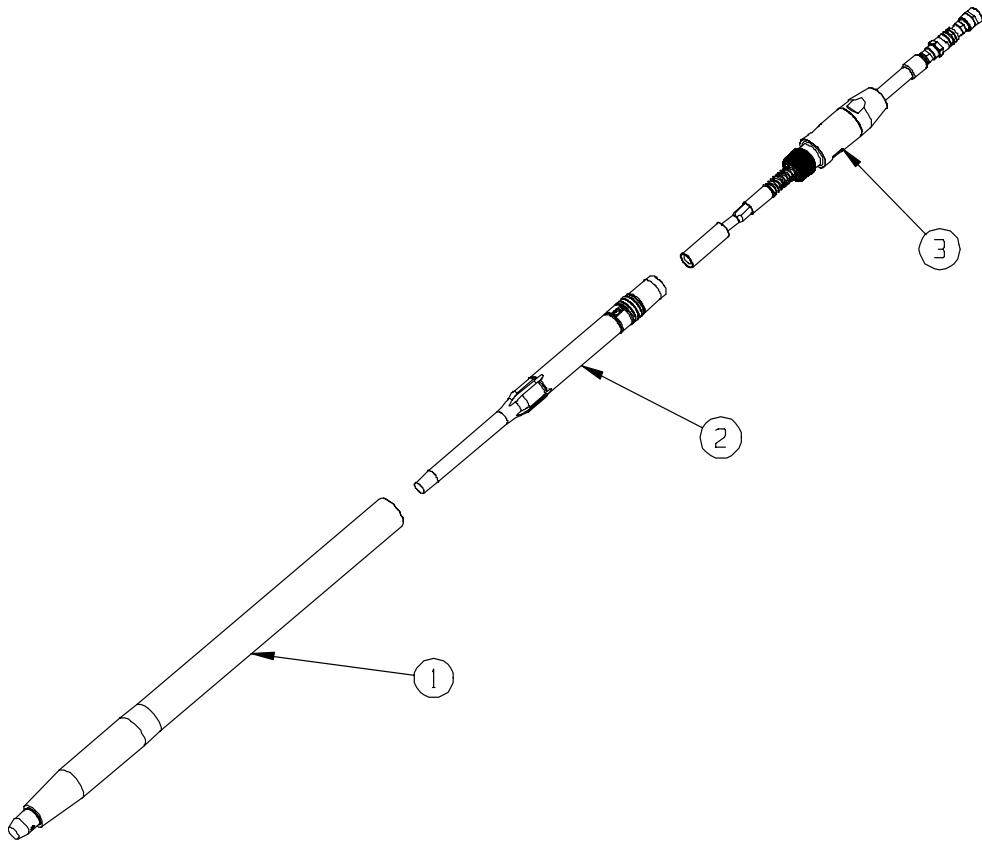
Model PA270 Service Kit Part No. AL572161			
Item No.	Qty.	Part No.	Description
1	2	AL572162	Wrench, 2 3/8 inch
2	1	AL572163	Press Plate Assembly
3	1	AL572165	Tool, Valve Bushing
4	1	AL572166	Tool, Valve Bushing Punch
5	1	AL572167	Tool, Shock Pusher
6	1	AL572169	Tool, Valve Guide Install
7	1	AL572170	Tool, Valve Guide Pusher



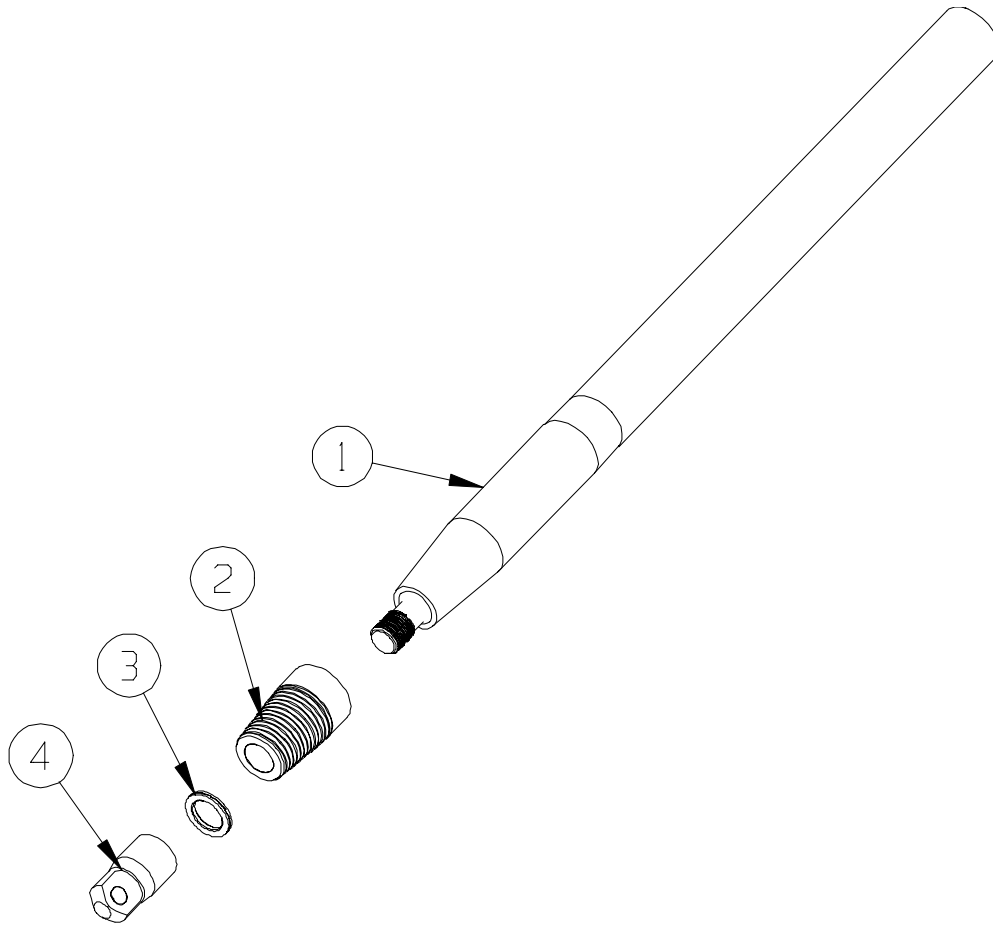
Model PA270 PVC Puller Assembly Part No. AL571993			
Item No.	Part No.	Qty.	Description
1	AL571994	1	PVC Puller 2 inch
2	AL831732	4	Set Screw 3/8-16 X .75 Cone Point



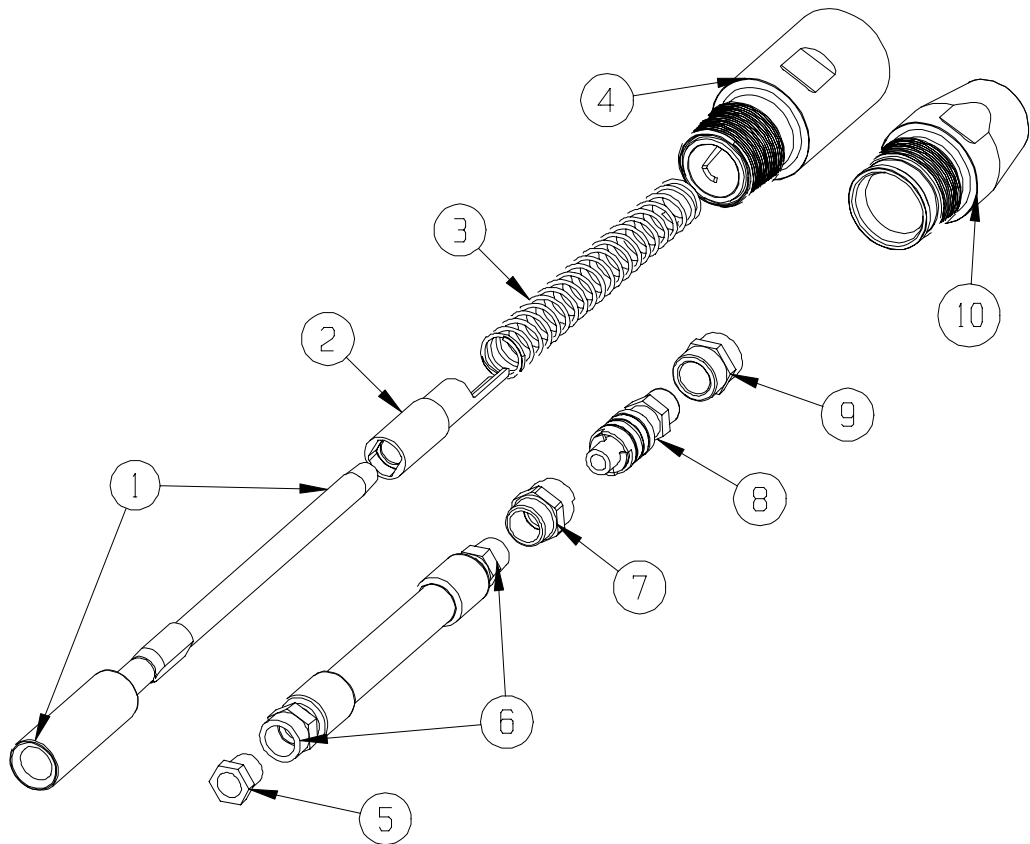
Model PA270 Tail Adapter Cable Puller Part No. AL571995			
Item No.	Part No.	Qty.	Description
1	AL571996	1	Tail Adapter Cable Puller
2	AL815592	1	Hex Nut 5/16-24
3	AL831108	1	Connector Cable
4	AL831090	1	Threaded chain Connector



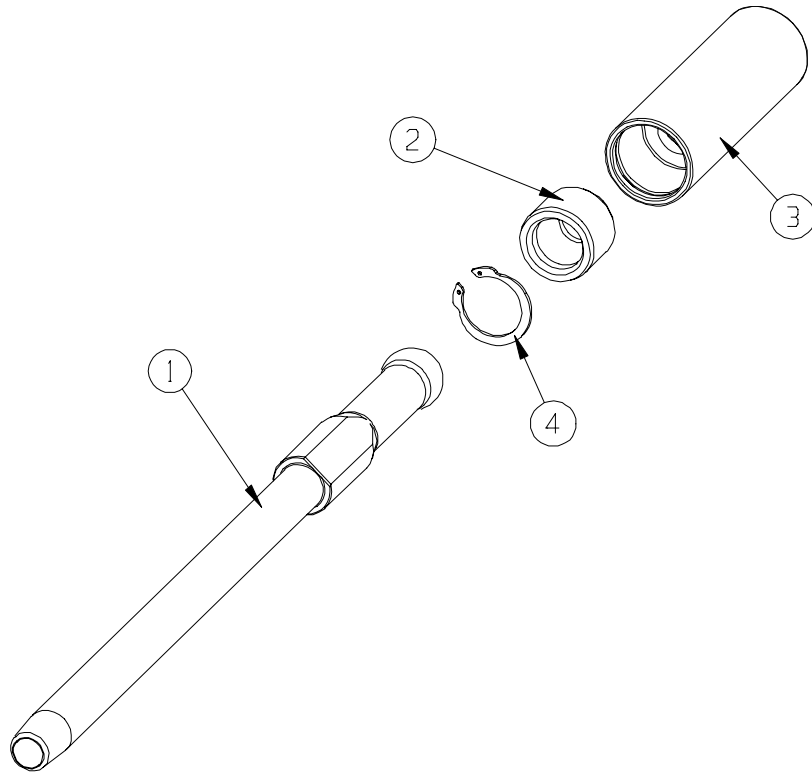
Model PA310 Pierce Arrow II Assembly			
Item No.	Qty.	Part No.	Description
3	1	AL570801	Tail Assembly
2	1	AL570440	Striker
1	1	AL570605	Body/Anvil Assembly



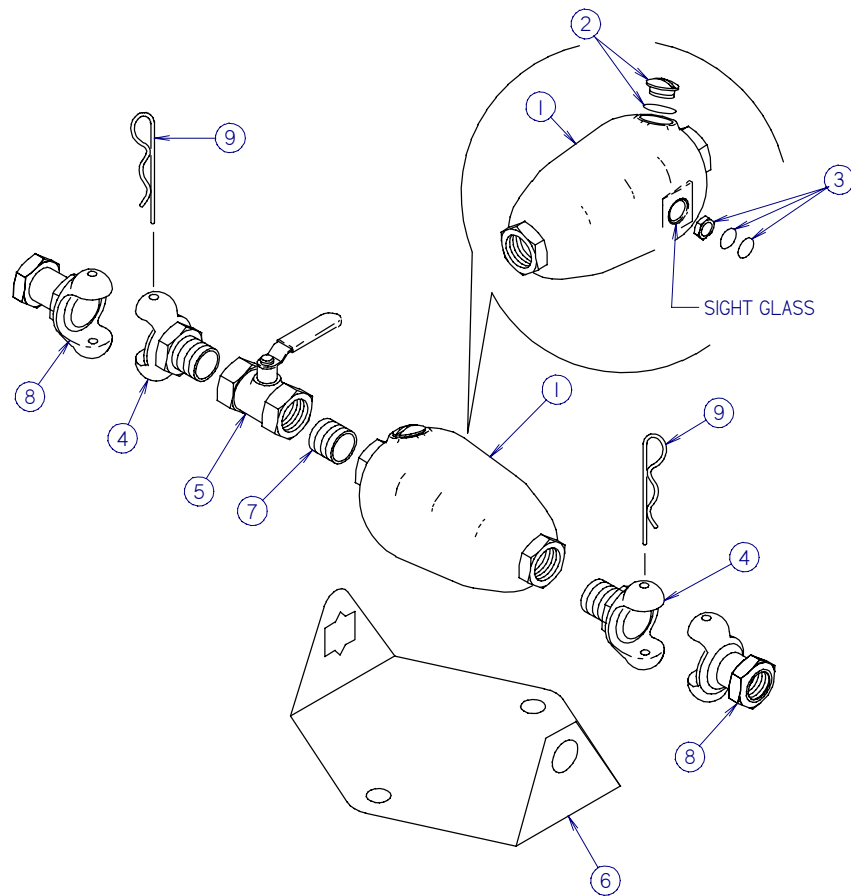
Model PA310 Threaded Nose Body Assembly			
Item No.	Qty.	Part No.	Description
1	1	AL570620	Body Assembly (includes items 2,3 and 4)
2	1	AL570846	Grooved Nose Cover
3	1	AL571061	Nord-Lock® Washer
4	1	AL570619	Nose Cap



Model PA310 Pierce Arrow II Tail Assembly Part No. AL570801			
Item No.	Qty.	Part No.	Description
10	1	AL570438	Tapered Tail Adapter
9	1	AL798056	Adapter
8	1	AL102395	Quick Coupler Plug With Lock
7	1	AL831027	Quick Coupler Socket
6	1	AL571093	Whip Hose Assembly
5	1	AL831165	Adapter Valve Stem
4	1	AL570439	End Cap Assembly
3	1	AL831121	Valve Spring
2	1	AL570613	Valve Fingers
1	1	AL570612	Valve with Stem Assembly



Model PA310 Pierce Arrow II Valve with Stem Assembly Part No. AL570612			
Item No.	Qty.	Part No.	Description
4	1	AL831118	Snap Ring – Valve
3	1	AL570437	Valve Sleeve
2	1	AL570610	Valve Bushing
1	1	AL570611	Valve Stem

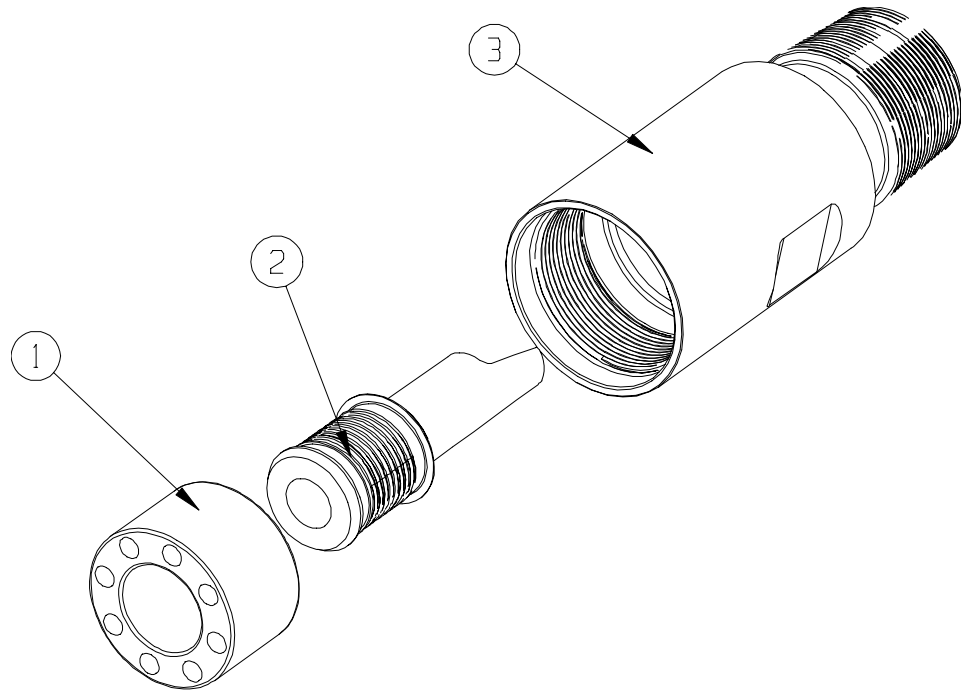


MODELS: PA225, PA270, PA310, PA425 OILER

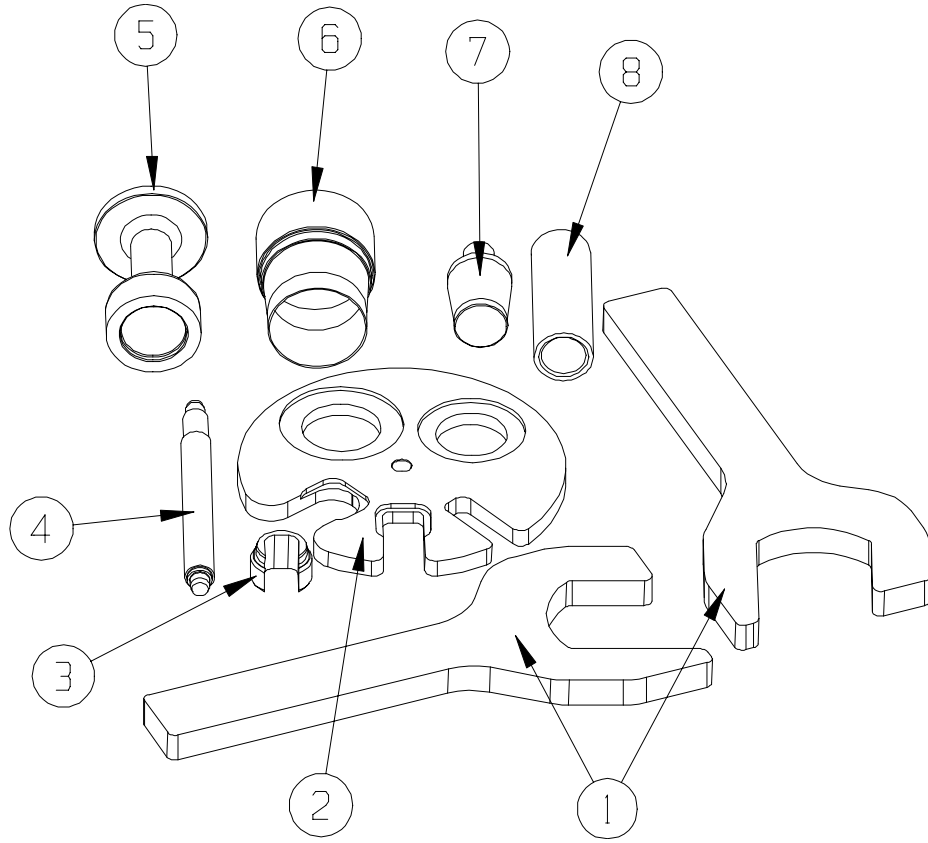
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	1	300-3684	OILER ASSEMBLY - INCLU REF. NO.'S 1 & 4 THRU 10.
1	1	120-159	OILER - INCL. REF NO.'S 2 & 3
		110-607	VALVE
		165-752	VALVE GASKET
2	1	500-500	PLUG
		155-737	O-RING (214 D70)
		500-501	PLUG (LESS O-RING)
3	1	191-063	SIGHT DISK KIT
		157-023	SEAL RING
		500-499	LOCKNUT
4	2	120-010	CLAW COUPLING (3/4"-NPT MALE)
		116-278	COUPLING GASKET
5	1	120-018	SHUT-OFF VALVE
6	1	352-458	LUBRICATOR BASE
7	1	115-163	ALL THREAD (SEE FOOTNOTE 1)
8	2	120-009	CLAW COUPLING (3/4"-NPT FEMALE)
9	2	110-410	SAFETY CLIP
10	1	256-611	P.A. OIL (QUART) SUMMER, NOT SHOWN
	1	256-614	P.A. OIL (QUART) WINTER, NOT SHOWN, NOT INCLUDED IN ASSEMBLY

FOOTNOTES:

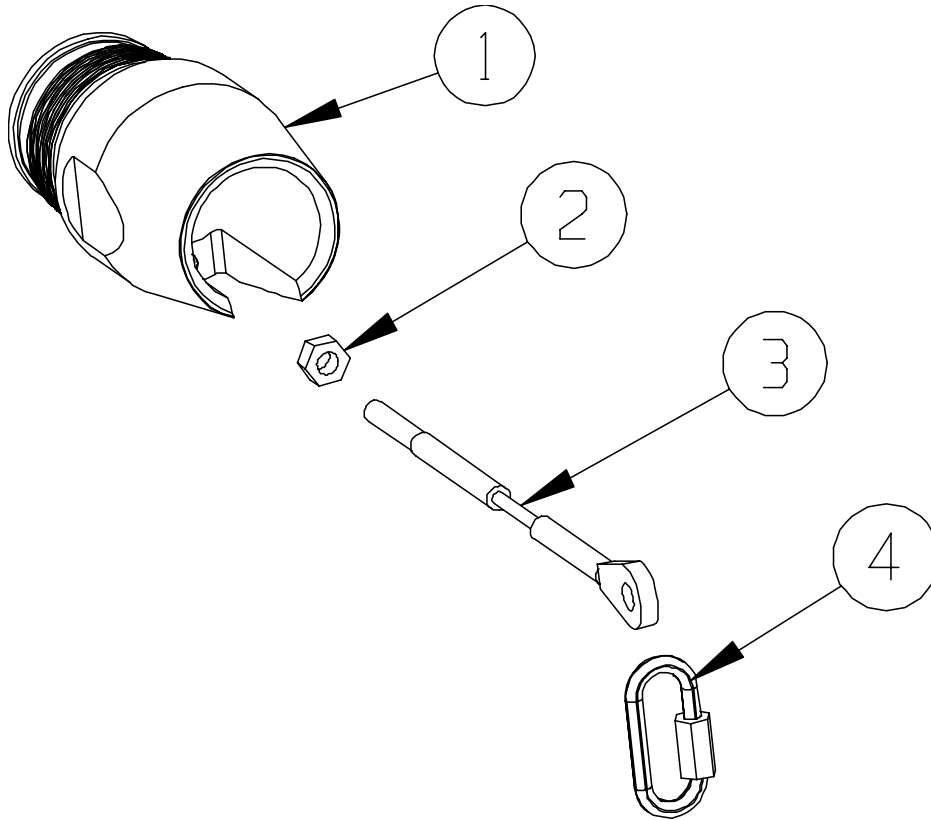
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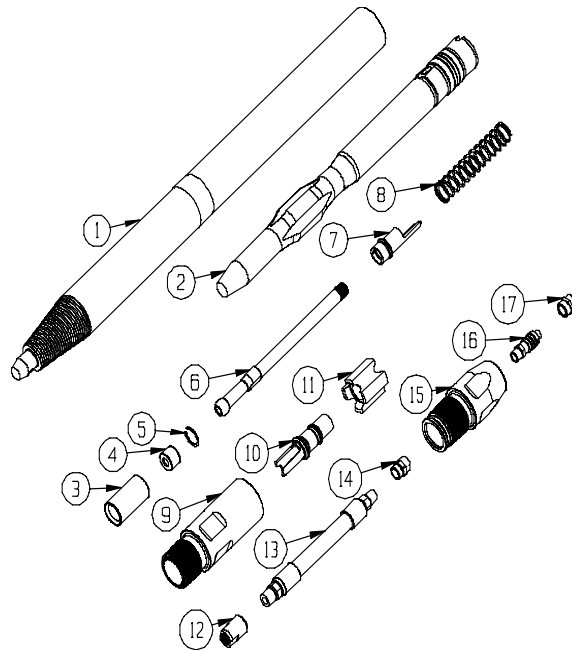
Model PA310 Pierce Arrow II End Cap with Guide Part No. AL570439			
Item No.	Qty.	Part No.	Description
3	1	AL570433	End Cap
2	1	AL831158	Valve Guide
1	1	AL831812	Shock Absorber



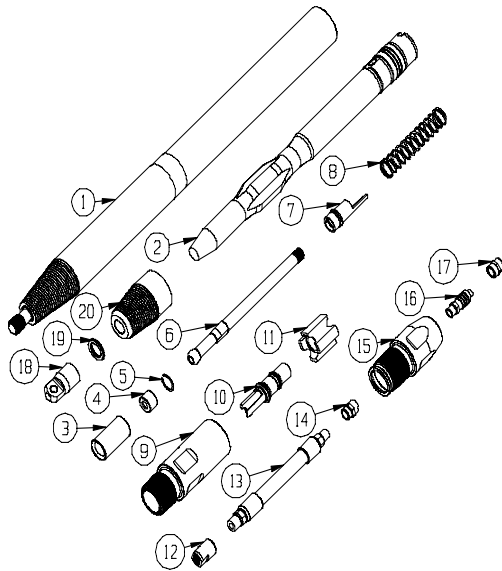
Model PA310 Pierce Arrow II Service Kit Part No. AL571095			
Item No.	Qty.	Part No.	Description
8	1	AL571098	Valve Guide Pusher
7	1	AL570430	Valve Guide Installation Tool
6	1	AL570431	Shock Absorber Installation Tool
5	1	AL570432	Shock Absorber Pusher
4	1	AL571183	Valve Bushing Punch
3	1	AL570451	Valve Bushing Press Tool
2	1	AL571096	Press Plate Assembly
1	2	AL571182	Wrench 2.75 inch



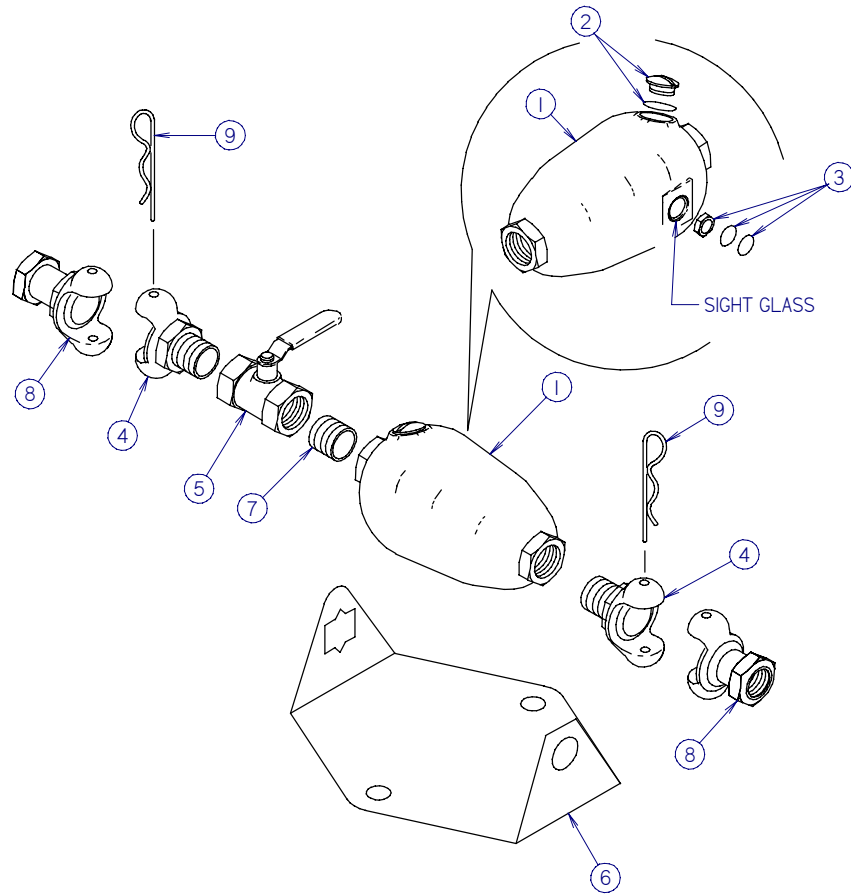
Model PA310 Tail Adapter Cable Puller Part No. AL571440			
Item No.	Part No.	Qty.	Description
4	AL831090	1	Threaded Chain Connector
3	AL831108	1	Connector Cable
2	AL815592	1	Hex Nut 5/16-24
1	AL571440	1	Tail Adapter Cable Puller



Model PA425 Pierce Airrow II Assembly			
Item No.	Qty.	Part No.	Description
1	1	AL572129	Body/Anvil Assy.
2	1	AL572132	Striker
3	1	AL572134	Valve Sleeve
4	1	AL572135	Valve Bushing
5	1	AL572136	Snap Ring
6	1	AL572137	Valve Stem
7	1	AL572138	Valve Finger
8	1	AL572139	Valve Spring
9	1	AL572140	End Cap
10	1	AL572141	Valve Guide
11	1	AL572142	Shock Absorber
12	1	AL572143	Stem Adapter
13	1	AL572144	Whip Hose
14	1	AL831027	Q.D Coupler Socket
15	1	AL572145	Tail Adapter
16	1	AL102395	Q.D. Coupler Plug W/Loc
17	1	AL798056	Adapter



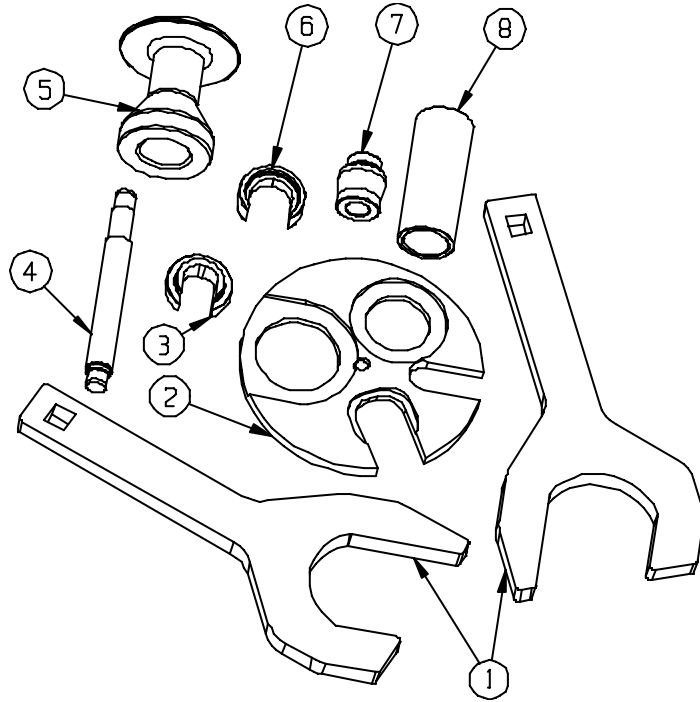
Model PA425T Pierce Arrow II Assembly			
Item No.	Qty.	Part No.	Description
1	1	AL572152	Body/Anvil Assy. – THD'S
2	1	AL572132	Striker
3	1	AL572134	Valve Sleeve
4	1	AL572135	Valve Bushing
5	1	AL572136	Snap Ring
6	1	AL572137	Valve Stem
7	1	AL572138	Valve Finger
8	1	AL572139	Valve Spring
9	1	AL572140	End Cap
10	1	AL572141	Valve Guide
11	1	AL572142	Shock Absorber
12	1	AL572143	Stem Adapter
13	1	AL572144	Whip Hose
14	1	AL831027	Q.D Coupler Socket
15	1	AL572145	Tail Adapter
16	1	AL102395	Q.D. Coupler Plug W/Loc
17	1	AL798056	Adapter
18	1	AL570619	Nose Cap
19	1	AL571061	Nordlock NL39
20	1	AL572153	Nose Cover Grooved



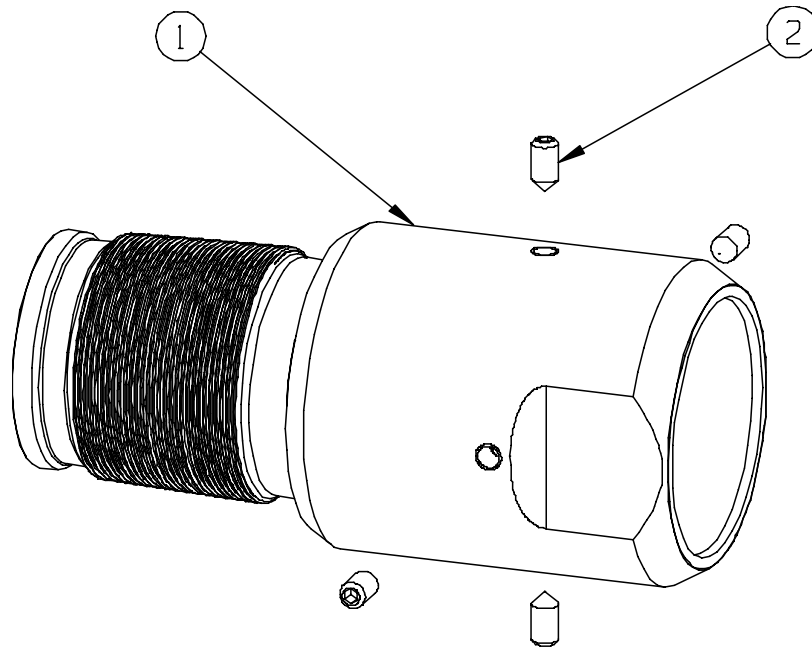
MODELS: PA225, PA270, PA310, PA425 OILER			
REF #	QTY.	PART #	DESCRIPTION
	1	300-3684	OILER ASSEMBLY - INCLU REF. NO.'S 1 & 4 THRU 10.
1	1	120-159	OILER - INCL. REF NO.'S 2 & 3
		110-607	VALVE
		165-752	VALVE GASKET
2	1	500-500	PLUG
		155-737	O-RING (214 D70)
		500-501	PLUG (LESS O-RING)
3	1	191-063	SIGHT DISK KIT
		157-023	SEAL RING
		500-499	LOCKNUT
4	2	120-010	CLAW COUPLING (3/4"-NPT MALE)
		116-278	COUPLING GASKET
5	1	120-018	SHUT-OFF VALVE
6	1	352-458	LUBRICATOR BASE
7	1	115-163	ALL THREAD (SEE FOOTNOTE 1)
8	2	120-009	CLAW COUPLING (3/4"-NPT FEMALE)
9	2	110-410	SAFETY CLIP
10	1	256-611	P.A. OIL (QUART) SUMMER, NOT SHOWN
	1	256-614	P.A. OIL (QUART) WINTER, NOT SHOWN, NOT INCLUDED IN ASSEMBLY

FOOTNOTES:

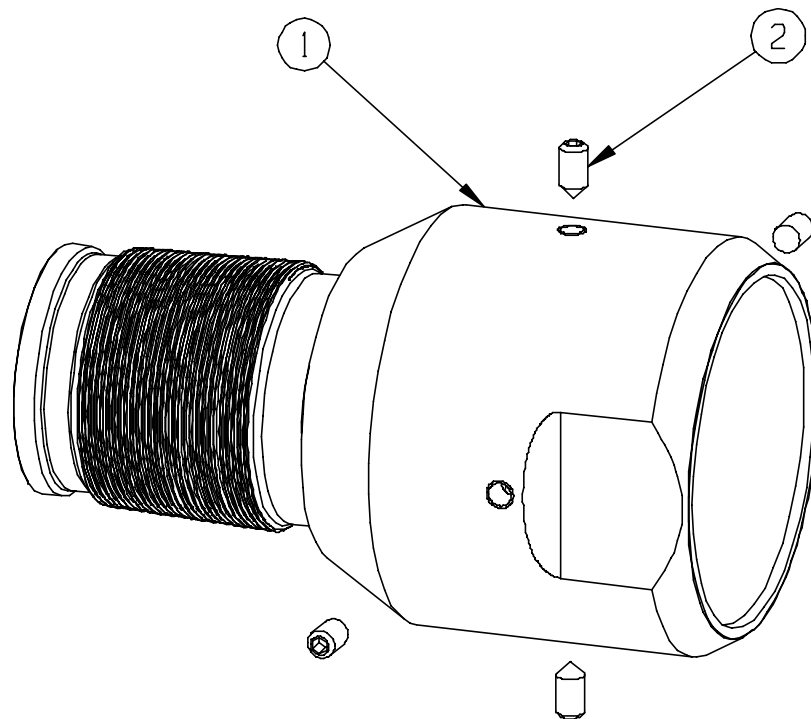
1. REF NO. 7 & 8 ARE OPTIONAL IN PLACE OF REF NO.4.



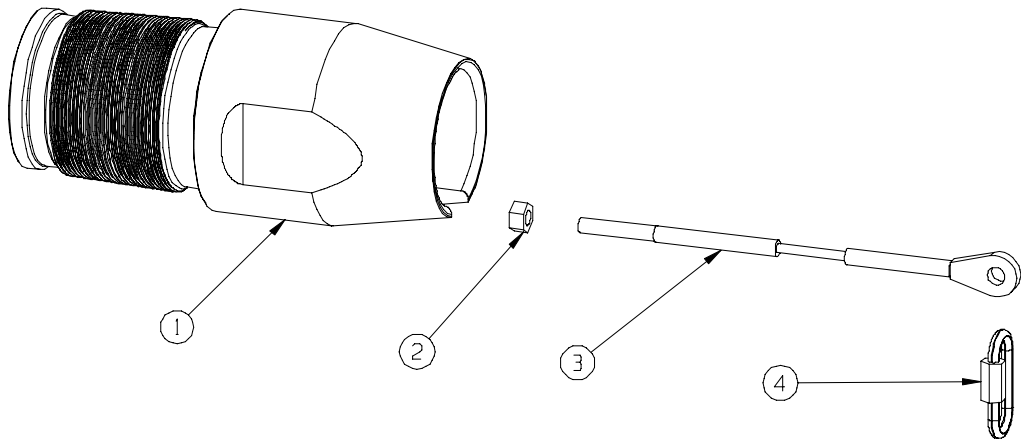
Model PA425 PIERCE AIRROW II Service Kit Part No. AL572171			
Item No.	Qty.	Part No.	Description
1	2	AL572172	Wrench, 3-3/4-inch
2	1	AL572173	Press Plate Assembly
3	1	AL572175	Tool, Valve Bushing
4	1	AL572176	Tool, Valve Bushing Punch
5	1	AL572177	Tool, Shock Pusher
6	1	AL572178	Tool, Stem removal
7	1	AL572179	Tool, Valve Guide Install
8	1	AL572180	Tool, Valve Guide Pusher



Model PA270 PA270T 3 INCH PVC Puller Assembly Part No. AL572159			
Item No.	Part No.	Qty.	Description
1	AL572160	1	PVC Puller 3 inch
2	AL831732	4	Set Screw 3/8-16 X .75 Cone Point



Model PA270 PA270T 4 INCH PVC Puller Assembly Part No. AL572181			
Item No.	Part No.	Qty.	Description
1	AL572182	1	PVC Puller 4 inch
2	AL831732	4	Set Screw 3/8-16 X .75 Cone Point



Model PA425 PA425T Tail Adapter Cable Puller Part No. AL572157			
Item No.	Part No.	Qty.	Description
1	AL572158	1	Tail Adapter Cable Puller
2	AL815592	1	Hex Nut 5/16-24
3	AL831108	1	Connector Cable
4	AL831090	1	Threaded chain Connector

Support

Procedure

Notify your dealer immediately of any malfunction or failure of Ditch Witch equipment.

Always give model, serial number, and approximate date of your equipment purchase. This information should be recorded and placed on file by the owner at the time of purchase.

Return damaged parts to dealer for inspection and warranty consideration if in warranty time frame.

Order genuine Ditch Witch replacement or repair parts from your authorized Ditch Witch dealer. Use of another manufacturer's parts may void warranty consideration.

Resources

Publications

Contact your Ditch Witch dealer for publications and videos covering safety, operation, service, and repair of your equipment.

Ditch Witch Training

For information about on-site, individualized training, contact your Ditch Witch dealer.



Warranty

Ditch Witch Equipment and Parts Limited Warranty Policy

Subject to the limitations and exclusions herein, free replacement parts will be provided at any authorized Ditch Witch dealership for any Ditch Witch equipment or parts manufactured by The Charles Machine Works, Inc. (CMW) that fail due to a defect in material or workmanship within one (1) year of first commercial use (Exception: 2 years for all SK attachments). Free labor will be provided at any authorized Ditch Witch dealership for installation of parts under this warranty during the first year following initial commercial use of the serial-numbered Ditch Witch equipment on which it is installed.

Exclusions from Product Warranty

- Wear-related failure of parts subject to ground contact including, but not limited to, digging teeth, digging chains, sprockets, backhoe buckets, plow blades, drill pipe, drill bits, backreamers, and swivels.
- All incidental or consequential damages.
- All defects, damages, or injuries caused by misuse, abuse, improper installation, alteration, neglect, or uses other than those for which products were intended.
- All defects, damages, or injuries caused by improper training, operation, or servicing of products in a manner inconsistent with manufacturer's recommendations.
- All engines and engine accessories (these are covered by original manufacturer's warranty).
- Tires, belts, and other parts which may be subject to another manufacturer's warranty (such warranty will be available to purchaser).
- All implied warranties not expressly stated herein, including any warranty of fitness for a particular purpose and merchantability.

IF THE PRODUCTS ARE PURCHASED FOR COMMERCIAL PURPOSES AS DEFINED BY THE UNIFORM COMMERCIAL CODE, THEN THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE FACE HEREOF AND THERE ARE NO IMPLIED WARRANTIES OF ANY KIND WHICH EXTEND TO A COMMERCIAL BUYER. ALL OTHER PROVISIONS OF THIS LIMITED WARRANTY APPLY INCLUDING THE DUTIES IMPOSED.

Ditch Witch products have been tested to deliver acceptable performance in most conditions. This does not imply they will deliver acceptable performance in all conditions. Therefore, to assure suitability, products should be operated under anticipated working conditions prior to purchase.

Defects will be determined by an inspection within thirty (30) days of the date of failure of the product or part by CMW or its authorized dealer. CMW will provide the location of its inspection facilities or its nearest authorized dealer upon inquiry. CMW reserves the right to supply remanufactured replacement parts under this warranty as it deems appropriate.

Extended warranties are available upon request from your local Ditch Witch dealer or CMW.

Some states do not allow exclusion or limitation of incidental or consequential damages, so above limitation of exclusion may not apply. Further, some states do not allow exclusion of or limitation of how long an implied warranty lasts, so the above limitation may not apply. This limited warranty gives product owner specific legal rights and the product owner may also have other rights which vary from state to state.

For information regarding this limited warranty, contact CMW's Product Support department, P.O. Box 66, Perry, OK 73077-0066, or contact your local Ditch Witch dealer.

First version: 1/91; Latest version: 1/03

**A Note To
Ditch Witch
Equipment Owners:**

If your equipment was purchased through a Ditch Witch dealer, there is no need to read further.

However, if you purchased from any other source, please fill out the form on the reverse side and return it to us.

This will enable you to receive updates on this equipment as well as information on new products of interest.

Thanks for using Ditch Witch equipment.

(Please Fold Along This Line And Seal At Bottom With Tape)



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 23 PERRY OKLAHOMA

POSTAGE WILL BE PAID BY

**The Charles Machine Works, Inc.
P.O. Box 66
Perry, Oklahoma 73077-9989**



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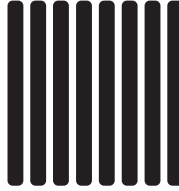
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Ditch Witch® Registration Card

Please Type or Print All Information

Purchaser's Company Name

Attention

Street Address or P.O. Box

City County

State Zip Nation

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Phone Number With Area Code

Model Serial Number

Attachments/Accessories Serial Numbers

Attachments/Accessories Serial Numbers

Attachments/Accessories Serial Numbers

Name of Ditch Witch Dealership

Your Signature

Ditch Witch® Registration Card

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