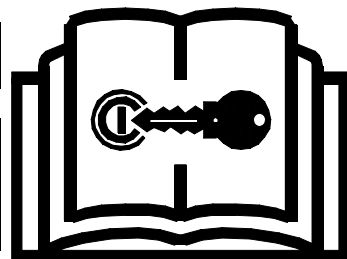


# ***HAMMERHEAD***<sup>TM</sup>

***12" (300 mm), 16" (400 mm)  
20" (508 mm), 24" (600 mm)  
HAMMERHEAD MOLE®  
Pneumatic Boring Tool***

## **Operator's and Maintenance Manual**



mole\_12\_16\_20\_24\_o-m10\_04

Serial No. 93210 - up

Order No. OM1301

# Introduction

This manual explains the proper operation of your machine. Study and understand these instructions thoroughly before operating or maintaining the machine. Failure to do so could result in personal injury or equipment damage. Consult your HammerHead dealer if you do not understand the instructions in this manual, or need additional information.

The instructions, illustrations, and specifications in this manual are based on the latest information available at time of publication. Your machine may have product improvements and features not yet contained in this manual.

Earth Tool Company LLC reserves the right to make changes at any time without notice or obligation.

**Operation, lubrication, and maintenance instructions are included in the Operator's Manual provided with the machine.**

Additional copies of the manuals are available from your HammerHead dealer. Use the reorder number on the front cover to order additional manuals.

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Earth Tool Company LLC  
P.O. Box 3  
Oconomowoc, Wisconsin 53066

## PATENTS

**This machine may be covered by one or more of the following patents:**

[illegible]

(Other U.S. and foreign patents pending.)

### 12" , 16" , 20" and 23" Hammerhead Mole

The unauthorized use of this equipment relating to pipe bursting in North America may infringe U.S. patent number 4738565 or Canadian patent number 1195128. The unauthorized use of this equipment in Europe may infringe European patent number 0094694 relating to pipe bursting. The unauthorized use of this equipment in the U.K. may infringe U.K. patents 2124325 or 2152624 relating to pipe bursting. The unauthorized use of this equipment in Japan may infringe Japan patent number 1303531 relating to pipe bursting. A request for License under these patents should be addressed to and will be considered by British Gas PLC, Commercial Licensing, 59 Bryanston Street, London W1A 2AZ, United Kingdom.

<b>HAMMERHEAD MOLE® and VARI-PITCH™ are trademarks of</b>	<b>Earth Tool Company, LLC.</b>
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## **HAMMERHEAD EQUIPMENT LIMITED WARRANTY**

EARTH TOOL COMPANY LLC, hereinafter sometimes referred to as ETC warrants each new industrial product of its own manufacture to be free from defects in material and workmanship, under normal use and service for one full year after delivery to the owner or 1000 operating hours, whichever occurs first. During the warranty period, the authorized selling HammerHead Dealer shall furnish parts without charge for any HammerHead product that fails because of defects in material and workmanship. Warranty is void unless warranty registration card is returned within ten days from the date of purchase. This warranty and any possible liability of Earth Tool Company LLC hereunder is in lieu of all other warranties, express, implied, or statutory, including, but not limited to any warranties of merchantability or fitness for a particular purpose.

The parties agree that the Buyer's **SOLE AND EXCLUSIVE REMEDY** against ETC, whether in contract or arising out of warranties, representations, or defects shall be for the replacement or repair of defective parts as provided herein. In no event shall ETC's liability exceed the purchase price of the product. The Buyer agrees that no other remedy (including, but not limited to, incidental or consequential loss) shall be available to him. If, during the warranty period, any product becomes defective by reason of material or workmanship and Buyer immediately notifies ETC of such defect, ETC shall, at its option, supply a replacement part or request the return of the product to its plant in Oconomowoc, Wisconsin. No part shall be returned without prior written authorization from ETC, and this warranty does not obligate ETC to bear any transportation charges in connection with the repair or replacement of defective parts. Earth Tool Company LLC will not accept any charges for labor and/or parts incidental to the removal or remounting of parts repaired or replaced under this Warranty.

This Warranty shall not apply to any part or product which shall have been installed or operated in a manner not recommended by ETC nor to any part or product which shall have been neglected, or used in any way which, in ETC's opinion, adversely affects its performance; nor negligence of proper maintenance or other negligence, fire or other accident; nor with respect to wear items; nor if the unit has been repaired or altered outside of an ETC authorized dealership in a manner of which, in the sole judgment of ETC affects its performance, stability or reliability; nor with respect to batteries which are covered under a separate adjustment warranty; nor to any product in which parts not manufactured or approved by ETC have been used, nor to normal maintenance services or replacement of normal service items. Equipment and accessories not of our manufacture are warranted only to the extent of the original Manufacturer's Warranty and subject to their allowance to us, if found defective by them.

ETC reserves the right to modify, alter, and improve any products or parts without incurring any obligation to replace any product or parts previously sold with such modified, altered, or improved product or part.

No person is authorized to give any other Warranty, or to assume any additional obligation on ETC's behalf unless made in writing, and signed by an officer of ETC.

**EARTH TOOL COMPANY LLC**  
**Oconomowoc, Wisconsin**

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# Receiving and Delivery Report

## DEALER PREP

Check or perform the following:

\_\_\_ Check tailcone. Torque bolts to:

- 120 ft-lb (160 Nm) for 12" (300 mm) tool
- 250 ft lb (338 Nm) for the 16" w/20 tailbolts and 20" (508 mm) tool
- 300 ft-lb (407 Nm) for 16" (400 mm) and 24" (600 mm) tool

\_\_\_ Check for foreign material around hose connection at tool and exhaust ports.

\_\_\_ Check for foreign material in hose and around hose coupler.

\_\_\_ Check forward and reverse valve for proper function.

\_\_\_ Check condition of decals.

\_\_\_ Check that two lifting slings are supplied with tool.

\_\_\_ Check that shipping rod is tight (it must be removed prior to operation).

\_\_\_ Check internal striker by rocking tool back and forth. The striker should slide freely.

## Review of Operation

Review and demonstrate with customer the various aspects of tool operation:

\_\_\_ overall explanation of how Hammerhead Mole pneumatic boring tool works

\_\_\_ Hammerhead Mole safety measures

\_\_\_ preparing Hammerhead Mole boring tool for operation

**DEALER/CUSTOMER INFORMATION**

\_\_\_\_\_  
dealer

\_\_\_\_\_  
address

\_\_\_\_\_  
city

\_\_\_\_\_  
state / province

\_\_\_\_\_  
zip / postal code

\_\_\_\_\_  
country

\_\_\_\_\_  
owner

\_\_\_\_\_  
address

\_\_\_\_\_  
city

\_\_\_\_\_  
state / province

\_\_\_\_\_  
zip / postal code

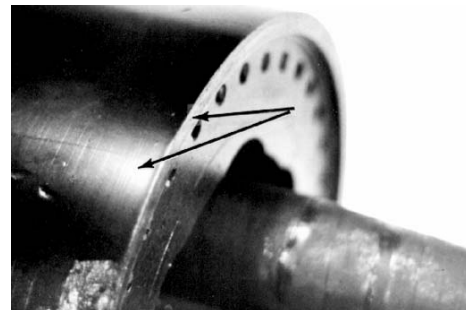
\_\_\_\_\_  
country



## IDENTIFICATION NUMBERS - RECORD

### 12" (300 mm) Tool

Tool Serial Number \_\_\_\_\_



### 16" (400 mm) Tool

Tool Serial Number \_\_\_\_\_



**20" (508 mm) Tool**

Tool Serial Number \_\_\_\_\_



**24" (600 mm) Tool**

Tool Serial Number \_\_\_\_\_



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# Section 10: Safety Messages

General safety messages appear in this Safety Messages section. Specific safety messages are located in appropriate sections of the manual where a potential hazard may occur if the instructions nor proicedures are not followed.

## UNDERSTAND SAFETY ALERT SYMBOL

This is the safety alert symbol. This symbol placed on your machine or in the manual is used to alert you to the potential for bodily injury or death.



## UNDERSTAND SIGNAL WORDS

A signal word “**DANGER**”, “**WARNING**”, or “**CAUTION**” is used with the safety alert symbol.

Safety signs with signal word **DANGER**, **WARNING**, or **CAUTION** are located near specific hazards.

**DANGER** - Imminent hazards which, if not avoided, will result in serious personal injury or death.

**WARNING** - Potential hazards or unsafe practices which, if not avoided, could result in serious personal injury or death.

**CAUTION** - Potential hazards or unsafe practices which, if not avoided, could result in minor personal injury or product or property damage.



## READ, UNDERSTAND, AND FOLLOW INSTRUCTIONS

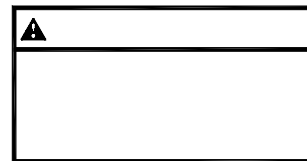
Do not operate the machine unless the instructions in the following manuals have been carefully read and understood:

- This Hammerhead Mole Operator's Manual
- Air compressor manual
- Support machinery manuals

Read and understand all safety messages in this manual and on your machine safety decals.

Safety decals located on your machine contain important information that will help you operate your equipment safely. Keep safety decals in good condition. Replace missing or damaged safety decals.

Allow only responsible, properly instructed individuals to operate the machine. Carefully supervise inexperienced operators.

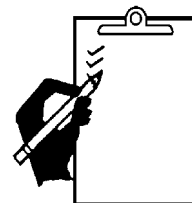


## KEEP MACHINE IN GOOD CONDITION

Be sure the machine is in good operating condition and that all safety devices are installed and functioning properly.

Visually inspect the machine daily before starting the machine. Refer to the daily pre-starting inspection section.

Make no modifications to your equipment unless specifically recommended or requested by Earth Tool Company LLC.





## CALL YOUR ONE-CALL SYSTEM FIRST



**WARNING:** Always contact your local One-Call system before the start of your digging project.



ONE-CALL



**Locate Utilities**  
**CALL 1-888-258-0808**

Before you start any digging project, don't forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority concerned to locate and mark the underground installations. If you don't call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

The One-Call representative will notify participating utility companies of your proposed digging activities. If you are in the U.S. or Canada and do not know the number for the local One-Call representative in your area, dial the North American One-Call number, 1-888-258-0808, for this information. Utilities will then mark their underground facilities by using the following international marking codes:

Red	Electric	Green/Brown	Sewer
Yellow	Gas, Oil or Petroleum	White	Proposed Excavation
Orange	Communication, Telephone, TV	Pink	Surveying
Blue	Potable Water		

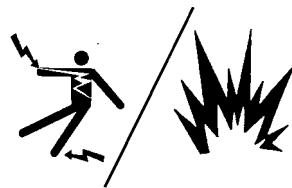
## UNDERGROUND UTILITY CONTACT



**WARNING:** Contact with buried utilities can cause death or serious injury.

- Cut electric cables can shock or electrocute.
- Ruptured gas lines can cause fire or explosion.
- Laser light from cut fiber optic cables can cause eye damage.

Before excavating or drilling, contact the local One-Call system and any utility company that does not subscribe to the One-Call system, to locate all buried utilities in and around the proposed excavation or bore.



**OSHA CFR 29 1926.651** requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Before ramming, contact the One-Call System to locate all buried utilities in and around ram path.

- Select a ram path that will not intersect buried utilities.
- Never ram pipe on a path toward electric or gas lines.
- If the utility cannot be precisely located, have the utility company shut it off before starting any underground work.

## PERSONAL PROTECTION

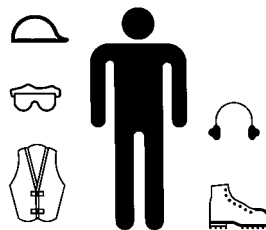
Wear required personal protective equipment including:

- hard hat
- safety shoes
- safety glasses
- hearing protection
- high visibility clothing when working near traffic

Wear close-fitting clothing and confine long hair.

Avoid wearing jewelry, such as rings, wristwatches, necklaces, or bracelets.

Hearing protection may be removed once the Hammerhead Mole has entered the ground. Hearing protection should be removed when working near moving traffic.



## CHECK LAWS AND REGULATIONS

Know and obey all federal, state and local laws and regulations that apply to your work situation.

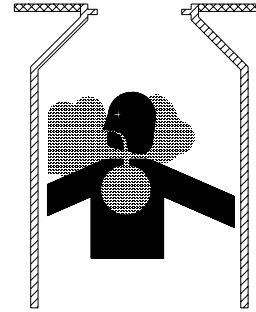
## DO NOT WORK IN TRENCH

Do not work in trench with unstable sides which could cave in. Specific requirements for shoring or sloping trench walls are available from several sources including federal and state O.S.H.A. offices. Be sure to contact suitable authorities for these requirements before working in the trench. Federal O.S.H.A. regulations can be obtained by contacting the Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402. State O.S.H.A. regulations are available at your local state O.S.H.A. office.



## CONFINED SPACE REGULATION

Do not work in a confined space, such as a sewer, until requirements are met to ensure a hazard-free environment. Specific requirements for confined space entry are available from federal and state OSHA offices.

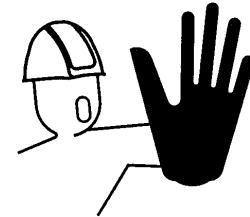


## KEEP SPECTATORS AWAY FROM MACHINE

Keep all spectators and other workers away from the machine and work area while in operation.

## CLEAR WORK AREA

Clear the work area of all objects that might interfere with the proper operation of the tool or hoses. Avoid placing tools or other objects where they can fall into the boring pit.



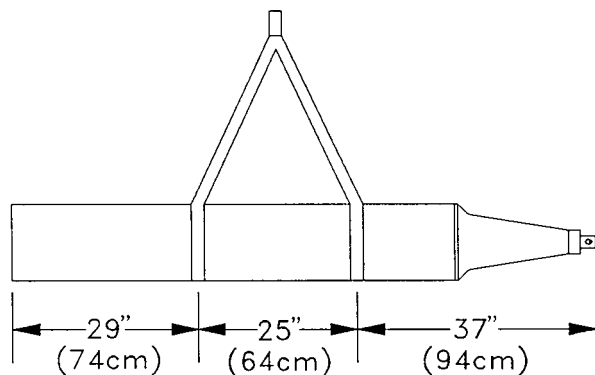
## HANDLING THE BORING TOOL

To avoid back injury, use proper lifting technique. Lift with your legs - not your back!

## Lifting the 12" or 16" Tool

The 12" (300 mm) tool weighs approximately 1600 lb (726 kg). The 16" (300 mm) tool weighs approximately 2700 lb (1225 kg). Attempting to lift the tool by hand can result in back strain and injury.

- Attach the lifting slings to the tool using a choker hitch to prevent the tool from sliding out of the slings.
- Securely attach the lifting slings to lift hook.
- Use lifting equipment designed and equipped specifically to lift objects with slings.
- Do not stand under raised tool or lifting equipment.
- Do not launch tool from lifting straps.



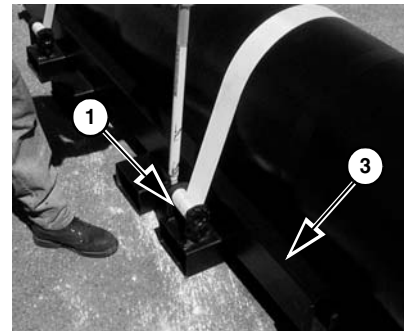
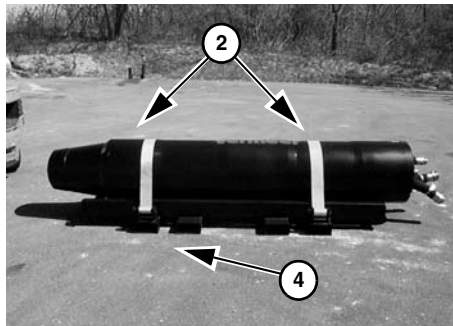
## Lifting the 20" or 24" Tool

The 20" (508 mm) tool weighs 5750 lb (2608 kg). The 24" (580 mm) tool weighs 9,340 lb (4,245 kg). Lifting straps supplied are rated at 13,600 lb (6,200 kg) when used as a choker.

Wrap tie-down straps (1) around tool in center of stamped sections (2), and attach to steel transport pallet (3).

Lift the tool with a fork truck rated for the tool's weight, using lift points (4) on the steel pallet.

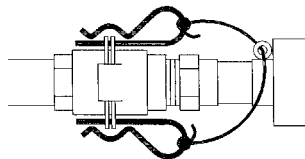
Disconnect tie-down straps and remove tool from transport pallet when operating this tool.



## CHECK HARDWARE

Make sure that all air line couplings are tightened and secured to eliminate the chance of accidental uncoupling. Use hose connection retaining devices such as locking rings, clips, pins, chains, or cables.

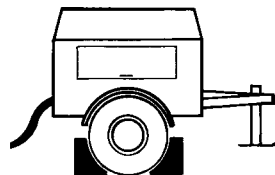
Check the tightness of the tailcone bolts before use. Refer to the *Receiving and Delivery Report Section* for the correct tailbolt torque. Torque in a cross pattern.



## CHECK AIR COMPRESSOR

Be sure the air compressor is securely parked at a safe distance from the excavation pit to prevent pit cave-in. Chock the wheels to prevent the compressor from rolling or falling into the pit.

Maximum air pressure that can be delivered to the tool is 110 psi (760 kPa). Do not exceed this pressure or damage to the tool or personal injury may result.



## PRECAUTIONS DURING OPERATION

Two people are required to operate the boring tool. One person should always be outside the excavation pit and in control of the air supply to the tool in case of an emergency. The boring tool operator must monitor the tool to be sure that the air hose does not cause an unsafe condition around the pit.

Eye protection is necessary when using the boring tool. Avoid looking into the bore hole while the boring tool is in use. High pressure exhaust can eject dirt, stones, or other materials. Be careful when blowing out the hose. Aim the hose away from yourself and other persons.



If the tool runs but does not move forward, turn off the air supply. Check to make sure that the tool is not in contact with a gas line, water line, electrical line, or some other underground obstruction that can be damaged or cause personal injury.

Do not override any safety controls on the tool or any support machinery.

Shut down the unit at the first sign of malfunction or hazardous condition.

Do not disconnect the air supply without first shutting off the air valve. Serious injury may result from the air under high pressure or from uncontrolled hose movement.



## DURING SERVICE

Read and follow the service instructions in this manual before servicing the tool.

Shut off the air supply valve and disconnect the air line before servicing the tool.

Use only authorized parts for repair or replacement. These replacement parts, including bolts, are specified in this manual.

Check the air supply hose periodically for damage to the hose or fittings. Never use the boring tool with damaged or worn air lines or fittings. This will minimize chances of air line breakage while in use.

Check and tighten loose hose clamps and clamp bolts regularly.

Do not use a torch or welder on the boring tool. Applying heat may damage critical parts of the tool. Heating parts of the tool may alter the component's strength and result in premature failure or personal injury.

When the tailcone and rear anvil are removed, be careful when elevating the front of the tool. The heavy striker inside the tool body may slide out.



**WARNING:** Failure to follow any of the preceding safety instructions or those that follow within this manual, could result in serious injury or death. This machine is to be used only for those purposes for which it was intended as explained in this Operator's Manual.



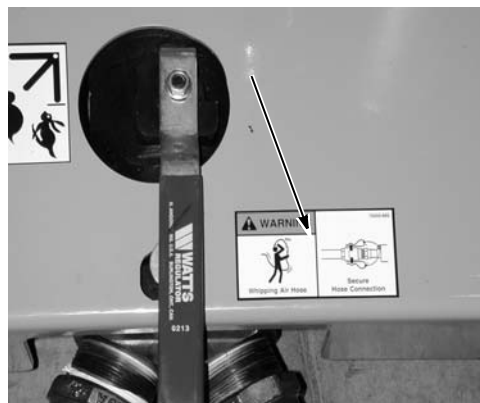
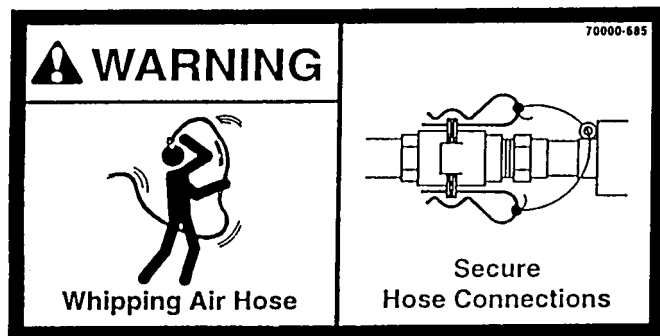
# Section 11: Safety Decals

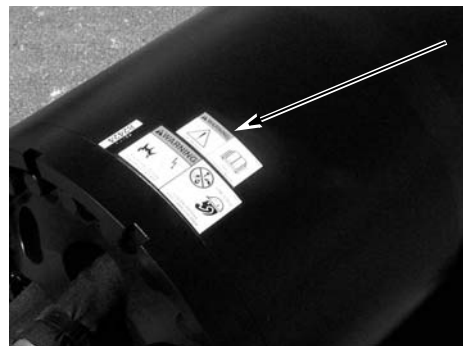
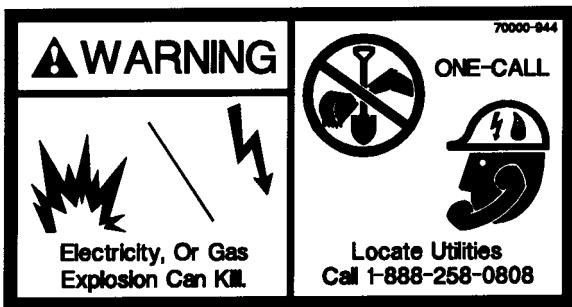
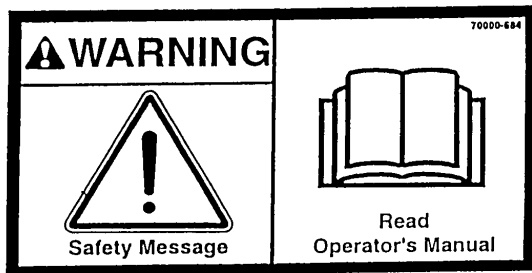
## INSPECTING SAFETY DECALS

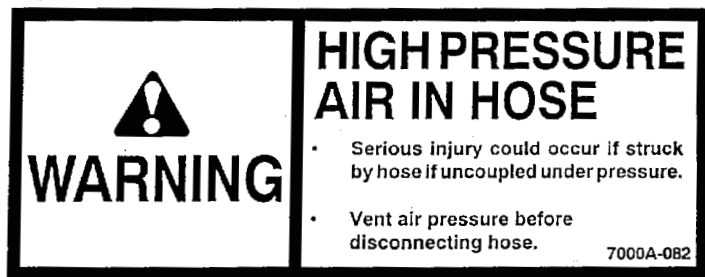
Safety decals located on your machine contain important and useful information that will help you operate your equipment safely.

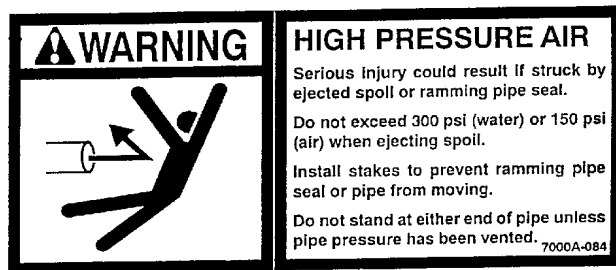
To assure that all decals remain in place and in good condition, follow the instructions given below:

- Keep decals clean. Use soap and water - not mineral spirits, abrasive cleaners, or other similar cleaners that will damage the decal.
- Replace any damaged or missing decals except the decal located on the tool body. When attaching decals, the temperature of the mounting surface must be at least 40° F (5° C). The surface must also be clean and dry.
- When replacing a machine component with a decal attached, replace the decal also.
- Replacement decals can be purchased from your HammerHead equipment dealer.



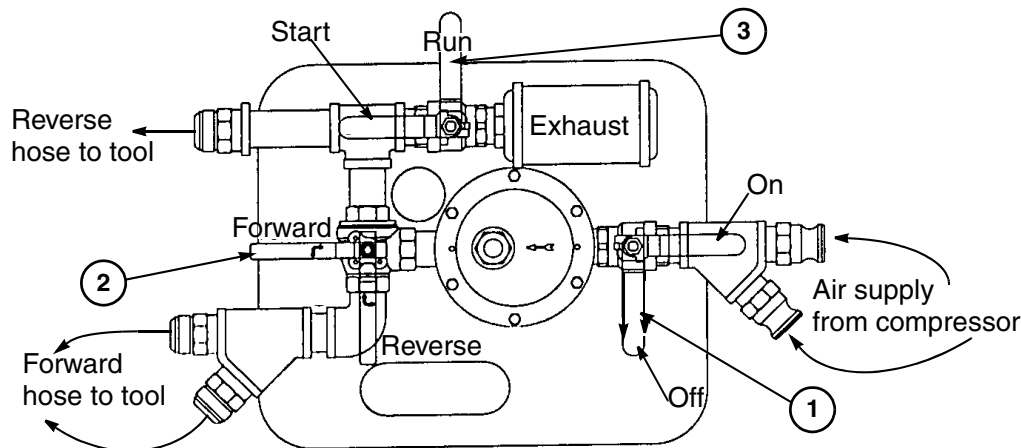






# Section 20: Controls and Adjustments

## AIR VALVES - 12" AND 16" TOOLS



Handle (1) clockwise (perpendicular to valve body) . . . . . off

Handle (1) counterclockwise (parallel to valve body) . . . . . on

Tool speed is variable; the farther the handle is turned toward ON, the faster the speed.

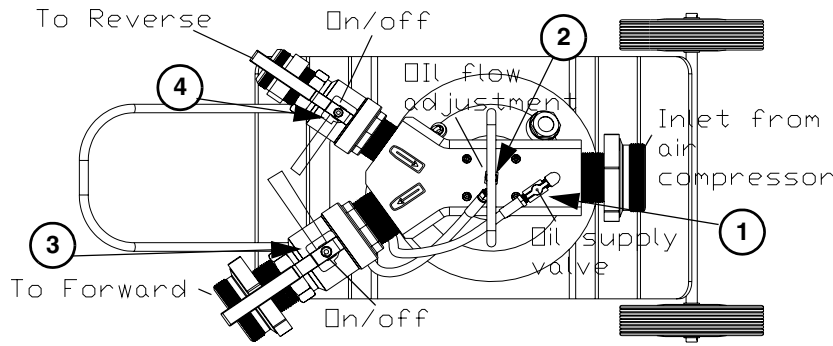
Handle (2) clockwise . . . . . forward

Handle (2) counterclockwise . . . . . reverse

Handle (3) counterclockwise to . . . . . start

Handle (3) clockwise to . . . . . run

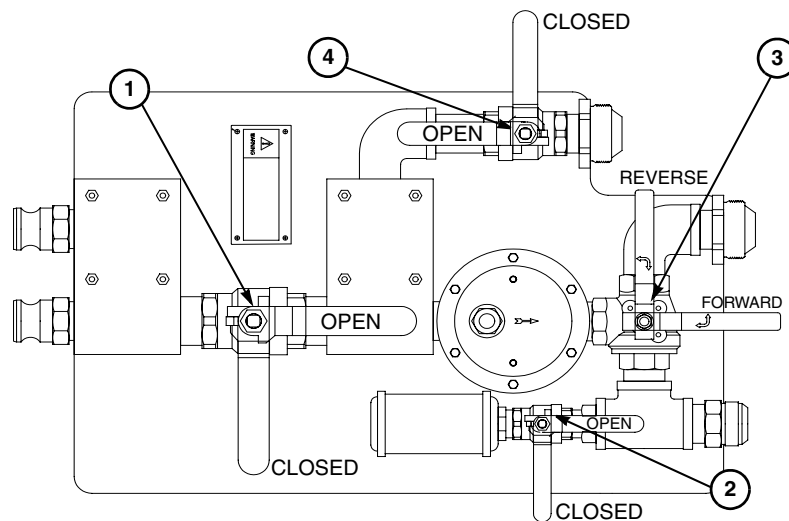
# AIR VALVE - 20" TOOL



- (1) **Supply Valve**  
Supplies pressurized air to oil reservoir. Oiler will not deliver oil to tool if this is not open  
Counterclockwise..... closed  
Clockwise..... open
- (2) **Oil Flow Needle Valve**  
Controls the volume of oil delivered to tool. 1/2 turn from closed to full open.  
Clockwise ..... closed  
Counterclockwise ..... open
- (3) **Forward Valve**  
Counterclockwise ..... run/forward  
Clockwise ..... stop
- (4) **Reverse Valve**  
Counterclockwise ..... open/reverse  
Clockwise..... stop

## AIR VALVES - 24" TOOL

- (1) **Supply Valve**  
Controls air flow from compressor to tool  
Clockwise ..... closed  
Counterclockwise ..... open
- (2) **Muffler Valve**  
Open slightly to start tool and lock tool into col-  
lets. Once tool is locked in, close valve.  
Valve can also be used at the end of a ram after  
tool has been shut off to bleed any remaining  
air out of hoses and tool.  
Clockwise ..... closed  
Counterclockwise ..... open
- (3) **Forward/Reverse Valve**  
Counterclockwise ..... reverse  
Clockwise ..... forward
- (4) **Second Forward Valve**  
Counterclockwise ..... open/forward  
Clockwise ..... closed



## TOOL OILER

During operation, the oiler lubricates the air-powered tool.

**IMPORTANT:** For initial operation of a tool, add oil to the tool whip hose:

- 12" and 16" tools - 16 oz (473 cc)
- 20" and 24" tool - 32 oz (946 cc)

## Pressure Relief

Open Valve (1) to relieve pressure.

Relieve pressure from oiler:

- at end of each use - high pressure air, trapped inside oiler, will force remaining oil into air line.
- before adding oil to reservoir.
- before disconnecting hoses.

## Check and Add Oil

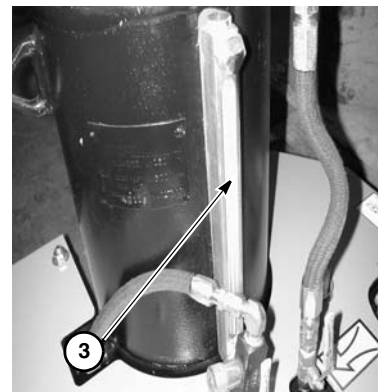
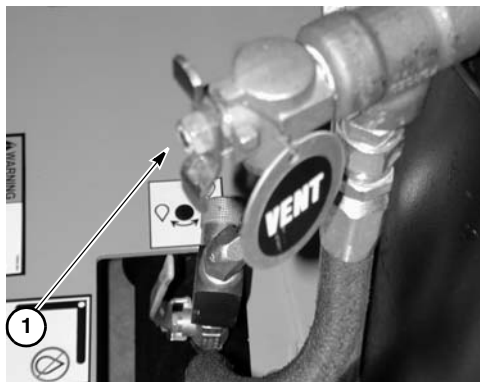
*To add oil:*

Step 1: Turn off air supply.

Step 2: Relieve air pressure.

Step 3: Remove fill plug (2) and check/add oil (refer to *Specifications, page 70-1.*)

Always ensure oil is visible on sight gauge (3) (12" and 16" tools).





## Oiler - Adjust

Adjustments are made due to changes in air pressure and oil viscosity. Oiler is adjusted by turning screw (1) on 12" and 16" tools, and by turning adjustment knob (2) on 24" tool.

To ensure adequate tool lubrication, start on highest setting and then lower until consumption is at the following levels:

- 12" tool: 128 oz (3.78 l) per hour. At this rate, add oil every 3-4 hours.
- 16" tool: 128 oz (3.78 l) per hour. At this rate, add oil every 3-4 hours.
- 20" tool: 128 oz (3.78 l) per hour. At this rate, add oil every 3-4 hours.
- 24" tool: 128 oz (3.78 l) per hour. At this rate, add oil every 5-7 hours.

If external whip hoses are wet with oil, then tool is receiving adequate lubrication.

*To adjust oiling rate:*

Step 1: Turn off air supply.

Step 2: Relieve air pressure (see previous page).

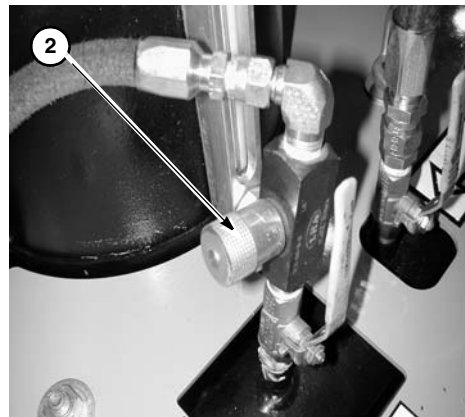
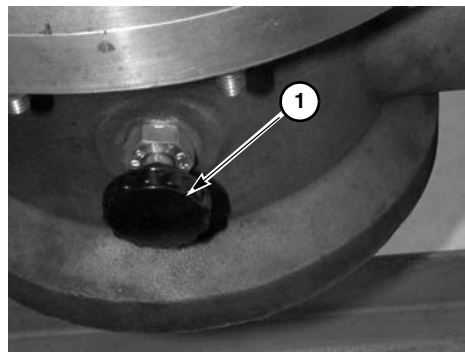
Step 3: Adjust amount of oil supplied to the tool.

"0"lowest rate

**"4"lowest recommended rate**

"9"highest rate

**NOTE:** It may take up to an hour before a setting change is noticed in the tool.

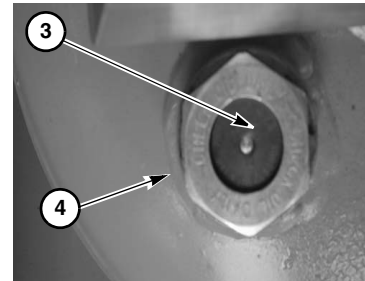
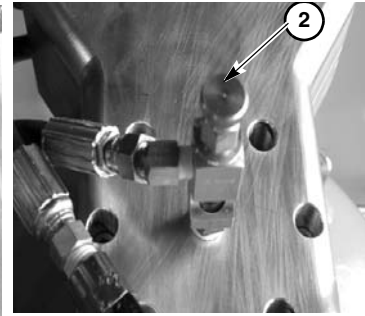
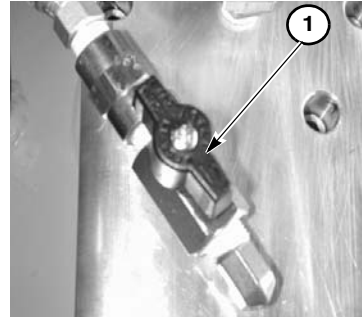


## TOOL OILER - 20" TOOL

During operation, the oiler supplies lubrication to the air powered tool.

### Pressure Relief

- Step 1: Close T-Valve (1) by turning valve 90 degrees so that it is perpendicular to the line. Open position is shown
- Step 2: Close Needle Valve (2) by turning clockwise until it bottoms out. Do not over tighten.
- Step 3: Depress pressure relief button (3) to release pressure in tank.
- Step 4: Remove oil fill cap (4) and fill with oil. Do not overfill.
- Step 5: Replace oil fill cap, open T-Valve and open needle valve.



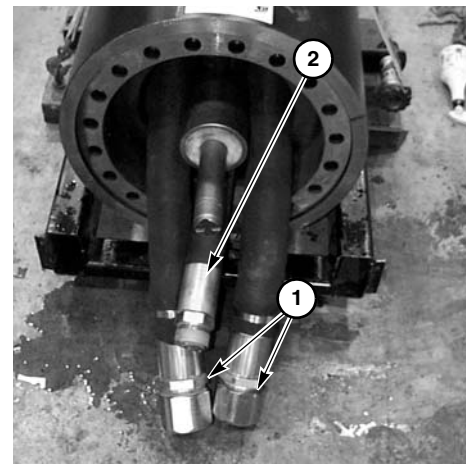
### Oil Delivery Adjustment

The Needle Valve (2) is used to adjust the amount of oil delivered to the tool. From full closed to full open is only 1/2 turn. Opening the valve more than 1/2 turn will not deliver any more oil than 1/2 turn open. When using 2 forward lines to the tool, open the needle valve 1/8 turn. When only delivering air through 1 line, open the needle valve 1/4 turn.

## REAR WHIP HOSE

Large whip hoses (1) supply air for FORWARD.

Small whip hose (2) supplies air for REVERSE.



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# Section 21: Shutdown Procedure

When stopping tool, use the following shutdown procedure.

Step 1: Turn air supply valves OFF .

Step 2: Shut off air compressor(s) (refer to air compressor operator's manual.)

Step 3: Relieve air pressure from tool oilers and hoses.

Step 4: Disconnect air lines from compressor.

**IMPORTANT:** For your safety and the safety of others, use this shutdown procedure before servicing, cleaning, inspecting or transporting tool.

A variation of this procedure may be used if an emergency requires it.

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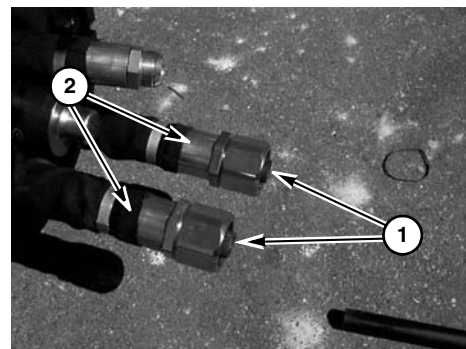
# Section 30: Transporting the Tool

## TRANSPORTING THE 20" OR 24" TOOL

The 24" (600 mm) Hammerhead Mole weighs 9,340 lb (4,245 kg) and the 20" (508 mm) tool weighs 5750 lb (2608 kg). Ensure transport vehicle is rated high enough to carry the system load.

### Transit Rods - Install

Install transit rods (1) into two forward hoses (2) for the 24" tool. The 20" tool requires only 1 transport rod. Remove transit rod(s) for operation.



### Lifting



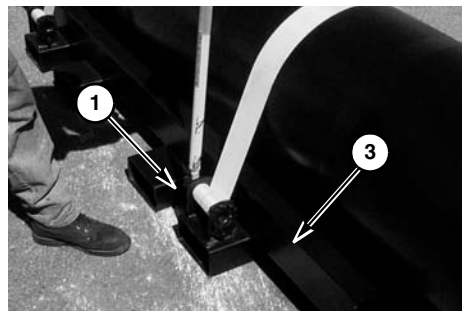
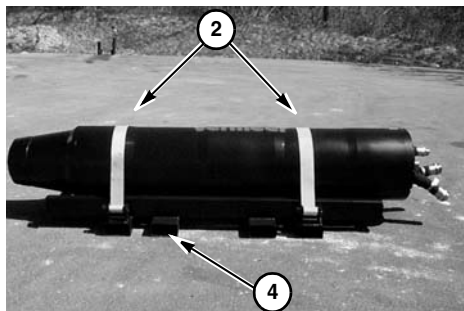
**WARNING: Never lift tool over personnel. The tool or lifting equipment may fall, crushing anyone beneath it. Never stand under raised tool or lifting equipment.**

Lifting straps supplied are rated at 13,600 lb (6,200 kg) when used as a choker. Always use lifting equipment capable of lifting equipment safely. Before lifting, always inspect lifting straps for cuts, scrapes, abrasions, and wear.

Wrap tie-down straps (1) around tool in center of stamped sections (2), and attach to steel transport pallet (3).

Lift tool with a fork truck rated for the tool's weight, using lift points (4) on steel pallet.

Disconnect tie-down straps and remove tool from transport pallet when operating this tool.



## Transporting by Truck

Weight properly distributed to front and rear axles:

- gives the best ride and steering
- eliminates premature failure due to overloaded axles, springs, tires, or related components
- provides necessary traction at front and rear axles.

Consult your vehicle Operator's Manual for proper load distribution and for recommendations in the event of uneven load distribution or axle overload/underload.

## Transporting by Trailer

Weight properly distributed above trailer axles:

- eliminates premature failure due to overloaded axles, springs, tires, or related components
- provides proper tongue weight to towing vehicle for trailer tracking and towing vehicle traction.



# Section 40: Preparing for Operation

## PRE-STARTING INSPECTION

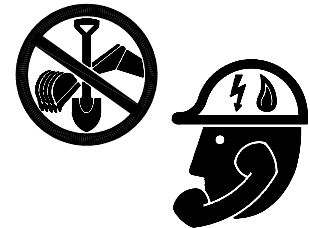
- Inspect rear of tool for any missing, loose, or damaged tailbolts. Ensure bolts are torqued properly.
- Check for foreign material around hose connections at tool and exhaust ports.
- Check supply hoses for foreign material inside and around hose couplers. Blow out hoses to remove any dirt that may have entered hose.
- Remove transit rods from forward hoses.
- Inspect oiler. Ensure it is filled with oil and that valves are in working order.
- Inspect external bushing (1) located at rear of tool. Check tightness of jam nut and condition of bushing.
- Check condition of lifting slings supplied with tool. Ensure they are not frayed, cut, or damaged.
- Check condition of 20" and 24" tool installation kit: ensure ratchets, chains and lifting straps are in good working order.



# CALL YOUR ONE-CALL SYSTEM FIRST



**WARNING:** Always contact your local One-Call system before the start of your digging project.



**Locate Utilities**  
**Call 1-888-258-0808**

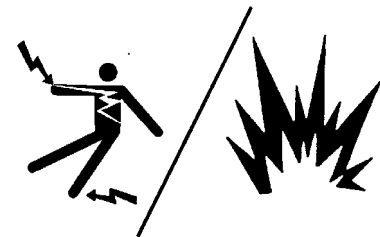
Before you start any digging project, don't forget to call the local One-Call system in your area and any utility company that does not subscribe to One-call. If you don't call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or, experience job delays. The One-Call will notify participating utility companies of your proposed digging activities. If you do not know the number for the local One-Call in your area, you can dial the national One-Call number 1-888-258-0808 for this information. Utilities will then mark their underground facilities by using the following international marking codes:

Red .....	Electric	Green/Brown .....	Sewer
Yellow .....	Gas, Oil or Petroleum	White .....	Proposed Excavation
Orange .....	Communication, Telephone, TV	Pink .....	Surveying
Blue .....	Potable Water		

## Electrocution Avoidance

Electrocution is possible. Serious injury or death may result if the steel pipe being rammed strikes an energized powerline. Take the following precautions to prevent electrocution. Also refer to the operating instructions.

- Call your One-Call System before the start of your ramming project.
- Have qualified persons locate underground utilities.



- When the ramming operation approaches the estimated location of a utility, the exact location of the underground installation must be determined by safe and acceptable means.
- Always wear the necessary electrically insulated gloves and boots that are required for each job function (refer to “Personal Protection,” *page 10-5* section)
- Never stand on the ground and touch the tool or pipe when ramming.

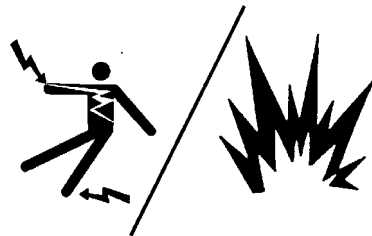
## UNDERGROUND UTILITY CONTACT



**WARNING: Contact with buried utilities can cause death or serious injury.**

- Cut electric cables can shock or electrocute.
- Ruptured gas lines can cause fire or explosion.
- Laser light from cut fiber optic cables can cause eye damage.

**Before excavating or boring, contact the local One-Call system and any utility company that does not subscribe to One-Call, to locate all buried utilities in and around the proposed excavation or bore.**



OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground boring operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

# SOIL SHOES

## Soil Shoes - 20" and 24" Tool

Use a soil shoe when pushing open pipe. It reduces friction on the pipe and makes spoil removal easier.

Either use a factory-made soil shoe, or manufacture a soil shoe as described on following page and install on the leading edge of the pipe.

**IMPORTANT:** Due to the extreme impact force, it is recommended that solid 1-piece pipe is used. Do not ram midweld, spiral pipe, or carrier pipe. Inferior welds or thin-walled pipe may collapse or buckle, and spiral wrap pipe is not designed for ramming application. When installing carrier pipe, a separate pipe should be rammed, and carrier pipe installed inside once the spoil has been removed.

## Soil Shoe Construction

Step 1: Prepare two pieces of metal, in either of two ways:

a. Cut two pieces from flat stock:

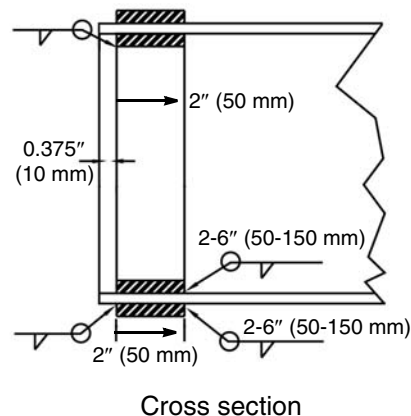
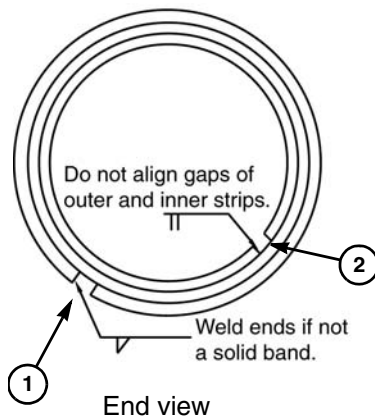
- **Material:** 5/16" (preferred) or 3/8 x 2" (8 mm or 10 mm x 50 mm) flat stock.

- **Width:** 2" (50 mm)

- **Length:** approximately equal to the circumference of the pipe

- **Shape:** Fit bands to curve of pipe

b. Or cut off two pieces 2" (50 mm) wide from end of pipe; split each section to form two bands.



Step 2: Slide first band over pipe. Clamp and tack in place.

Step 3: Shorten length of second band, by approximately seven times the wall thickness, to fit inside pipe.

Step 4: Compress band and insert into pipe. Do not align gaps of outer (1) and inner (2) strips. Clamp and tack into place.

Step 5: Weld ends (1) of outer strip if not a solid band.

**NOTE:** Band may be cut into several pieces if necessary.

Step 6: Weld leading edge of inside and outside pipe bands.

Step 7: Complete with 7018 rod or Lincoln NR204MP wire or equivalent. Do not use a brittle type of welding rod; welds will not withstand the high-impact forces of 23" (580 mm) tool. Skip weld back edges as shown.

**NOTE:** Shown is standard design. Design can vary depending on conditions.

## Soil Shoes - 12" and 16" Tools

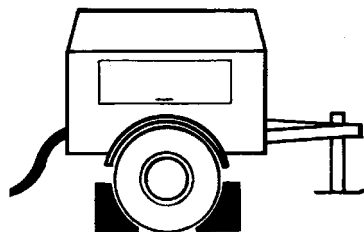
Refer to *Operating the Tool* section, "Soil Shoes," page 50-17.

## AIR COMPRESSOR - CHECK

Securely park air compressor a safe distance from the excavation pit to prevent pit cave-in. Chock wheels to prevent compressor from rolling or falling into the pit.

Maximum air pressure that can be delivered to the tool is 110 psi (760 kPa). Do not exceed this pressure or damage to the tool or personal injury may result.

The 23" (580 mm) Hammerhead Mole pneumatic boring tool requires 1725 cfm (48,800 L/min) to run at maximum efficiency. This amount of air required to run the tool may require the doubling of two smaller air compressors to achieve the proper air flow.



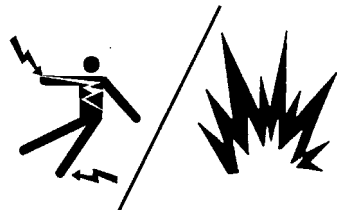
## PREPARE THE SITE



**WARNING:** Do not work in trench with unstable sides which could cave in. Serious injury or death possible if buried or crushed. Specific requirements for shoring or sloping trench walls are available from several sources including federal and state O.S.H.A. offices. Be sure to contact suitable authorities for these requirements before working in the trench.



**WARNING:** Before ramming, check with qualified sources to properly locate all buried utilities in and around ramming path. Contact with buried utilities may cause serious injury or death.



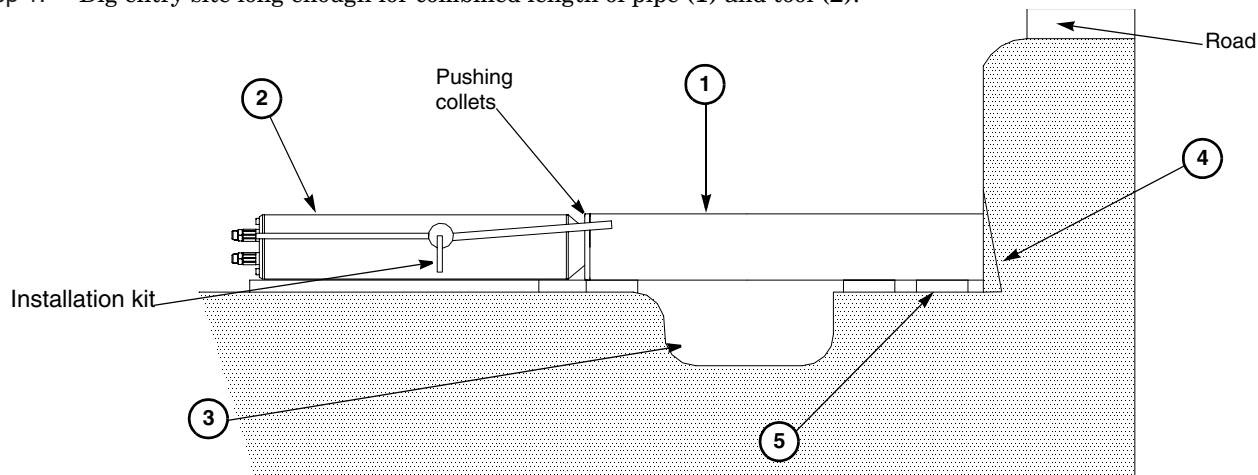
### Entry and Exit Pits

Pits should be long enough to keep service line from kinking during launch.

Dig exit pit at correct location, adding extra width and depth to allow for tool misalignment.

## 20" and 24" Tool

**Step 1:** Dig entry site long enough for combined length of pipe (1) and tool (2).



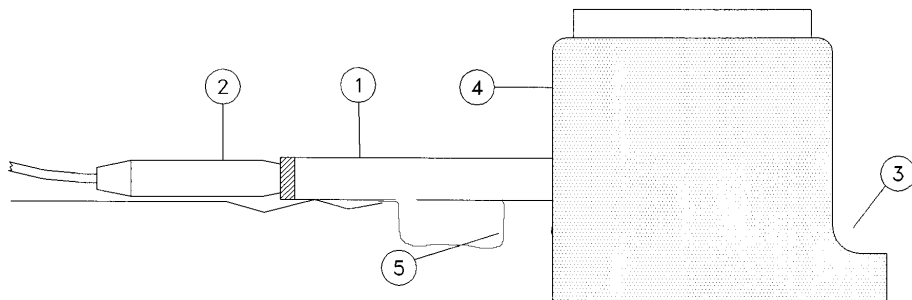
Step 2: Dig a welder's pit **(3)**, to allow welding completely around pipe.

Step 3: Taper trench face **(4)** and dig an undercut **(5)** so pipe will start true and remain at a level grade without riding up.

Step 4: Level bottom of trench to level pipe. Do not use stacked wood to level pipe. Stacks will collapse from the pipe oscillating back and forth.

## 12" and 16" Tools

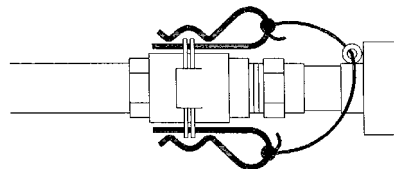
- Step 1: Dig entry site long enough for combined length of pipe (1) and tool (2).
- Step 2: To allow for tool misalignment, dig exit pit (3) deeper than entry site.
- Step 3: Square trench face (4) and dig an undercut (5) so pipe will start and remain level without riding up.
- Step 4: Level bottom of trench to level pipe. Do not use stacked wood to level pipe. Stacks will collapse from the pipe oscillating back and forth.



## AIR SUPPLY HOSES - CONNECT



**WARNING:** Ensure all air line couplings are tightened and secured to eliminate the chance of accidental uncoupling. Serious injury may result from the air under high pressure or from uncontrolled hose movement. Use hose connection retaining devices such as locking rings, clips, pins, chains, or cables.



**IMPORTANT:** Do not allow dirt or other material into air hoses.

- Step 1: Fill oiler with oil (Refer the *Controls and Adjustments* section, "Check and Add Oil," page 20-4).
- Step 2: Connect two hoses to air compressor only. Do not connect other ends of hoses to oiler at this time.



Step 3: Remove any oil or debris that may make hoses slippery.



**WARNING:** Serious injury may result from the air under high pressure or from uncontrolled hose movement. To prevent the hoses from whipping, do not fully open the compressor valve. Be sure to aim the hoses away from yourself and other persons.



Step 4: Hold free ends of hoses tightly and partially open compressor valve to blow air hoses clean.

Step 5: Close compressor valve and connect hoses to oiler.

**NOTE:** To optimize tool performance, adequate air pressure should be available when operating tool. This may require more than one air compressor.

- 12" tool: 600 cfm (17 m<sup>3</sup>/min) at 110 psi (7.6 bar)
  - 16" tool: 1100 cfm (31 m<sup>3</sup>/min) at 110 psi (7.6 bar)
  - 20" tool: 1300 cfm (36.8 m<sup>3</sup>/min) at 110 psi (7.6 bar)
  - 24" tool: 1,725 cfm (48.8 m<sup>3</sup>/min) at 110 psi (7.6 bar)
- Air Supply Hoses - Connect 20" Tool

## AIR SUPPLY HOSE - CONNECT 20" TOOL

**NOTE:** If a single air compressor is not available to deliver the required air to the 20" tool, it is possible to use 2 smaller air compressors in parallel to equal the amount of air required for the tool.

**IMPORTANT:** Do not allow dirt or other material into air hoses. Follow all safety precautions regarding the use of the air supply hoses as listed in the previous warnings.

Step 1: Fill oiler with oil (Refer the *Controls and Adjustments* section, "Check and Add Oil," page 20-4).

- Step 2: Connect air supply hoses to the air compressor. Do not connect the other end to the tool at this time.
- Step 3: Verify that the air supply hoses are clean and free of dirt and debris. Once this is done attach 1 hose to the air inlet side of the tool oiler. Attach the other air supply hose to another air supply hose with the supply coupling. The total length of this hose should be twice as long as the hose attached to the oiler.
- Step 4: Attach the longer hose directly to one of the forward hoses of the tool.
- Step 5: Attach another hose from the forward outlet side of the oiler to the remaining forward hose at the tool.
- Step 6: Connect the reverse hose to the reverse outlet side of the oiler to the reverse hose at the tool.
- Step 7: Double check hose connections and safety clips.

## POSITION TOOL

- Step 1: Check grade and level the pipe.
- Step 2: Insert three collet segments in back end of pipe. If ramming large diameter pipe (above 30" or 76 cm), insert adapter ring and collets. Push collets in until lip of collet contacts pipe edge.



**WARNING:** Keep lifting equipment at a safe distance from the entrance pit to prevent cave-in and the lifting equipment falling into the pit. Serious injury or death is possible if buried or crushed.



**WARNING:** Never lift tool over personnel. The tool or lifting equipment may fall, crushing anyone beneath it. Never stand under raised tool or lifting equipment.

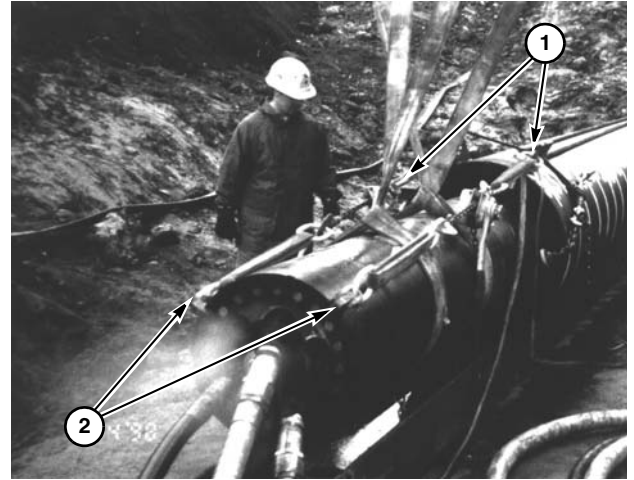
**NOTE:** Use only pipe schedules listed in specifications section. Use of improper thicknesses may cause pipe damage or distortion, preventing welding it to another section.

Step 3: Use suitable lifting equipment and lifting slings to position nose of tool into collets.

### Installation Kit - 20" and 24" Tool

- Step 1: Weld tabs (1) onto pipe to be rammed approximately 6" (15 cm) from end of pipe at approximately 10 and 2 o'clock positions.
- Step 2: Attach hooks (2) to rear of tool in slots provided.
- Step 3: Attach clevises to hooks and to straps as shown.
- Step 4: Attach opposite end of straps to hook on chain end of ratchet.
- Step 5: Attach other end of ratchet chain to other short strap that is attached to tab welded onto pipe.
- Step 6: Repeat for other side.
- Step 7: Tighten ratchets evenly until tool is held tightly into collets.
- Step 8: Start tool to lock it in.

**NOTE:** It may be necessary to re-tighten ratchets occasionally during the ram due to stretching of straps.



## WHIP HOSES - CONNECT



**WARNING:** All three whip hoses must be connected to oiler for proper function. Failure to do so will allow high-pressure air and debris to escape from the unconnected hose, which may cause injury.

- Step 1: Connect all three whip hoses to tool.
- Step 2: To avoid accidental uncoupling, tighten all hose locking collars against fittings or install any hose fitting retaining devices such as locking rings, clips, pins, chains, or cables.

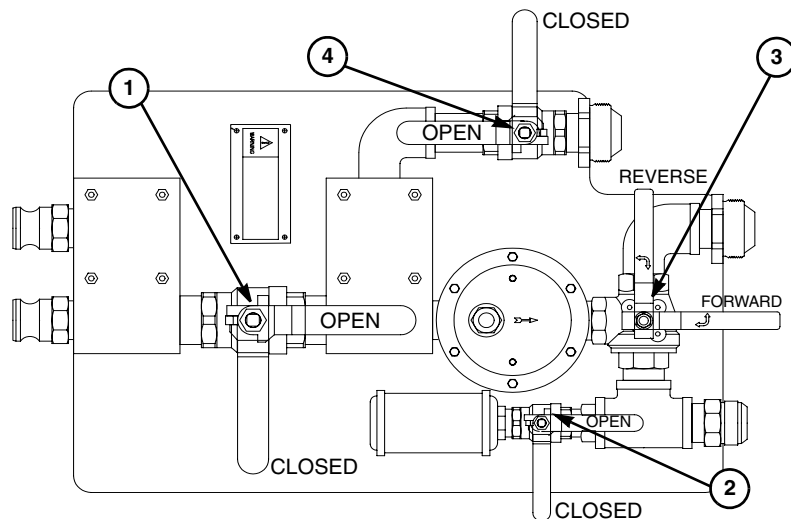
## LOCK TOOL INTO COLLETS

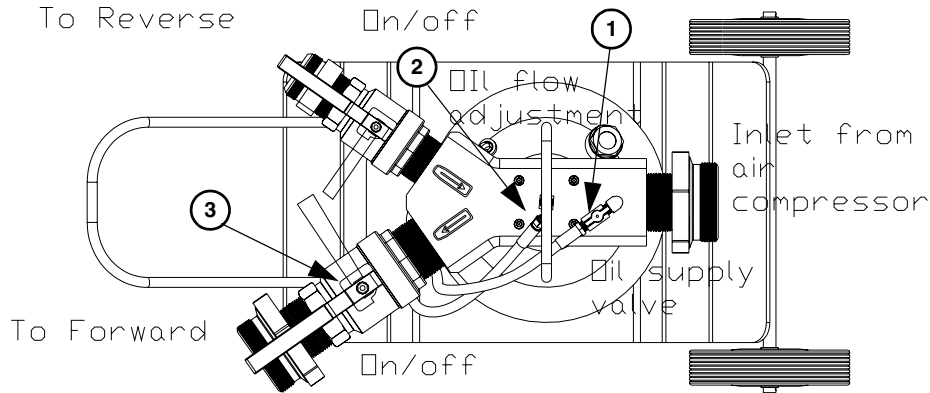
### 24" Tool

- Step 1: Open *Muffler Valve (2)*.
- Step 2: Place *Forward / Reverse Valve (3)* in FORWARD position.
- Step 3: Open *Second Forward Valve (4)*.
- Step 4: Turn on air supply at compressor to oiler.
- Step 5: Open *Supply Valve (1)* quickly until striker begins to move, then close halfway. Run tool just fast enough to lock it into collets.

**NOTE:** To help lock tool into pushing collets, pull lifting slings forward.

- Step 6: Turn *Supply Valve (1)* to OFF and remove lifting slings.

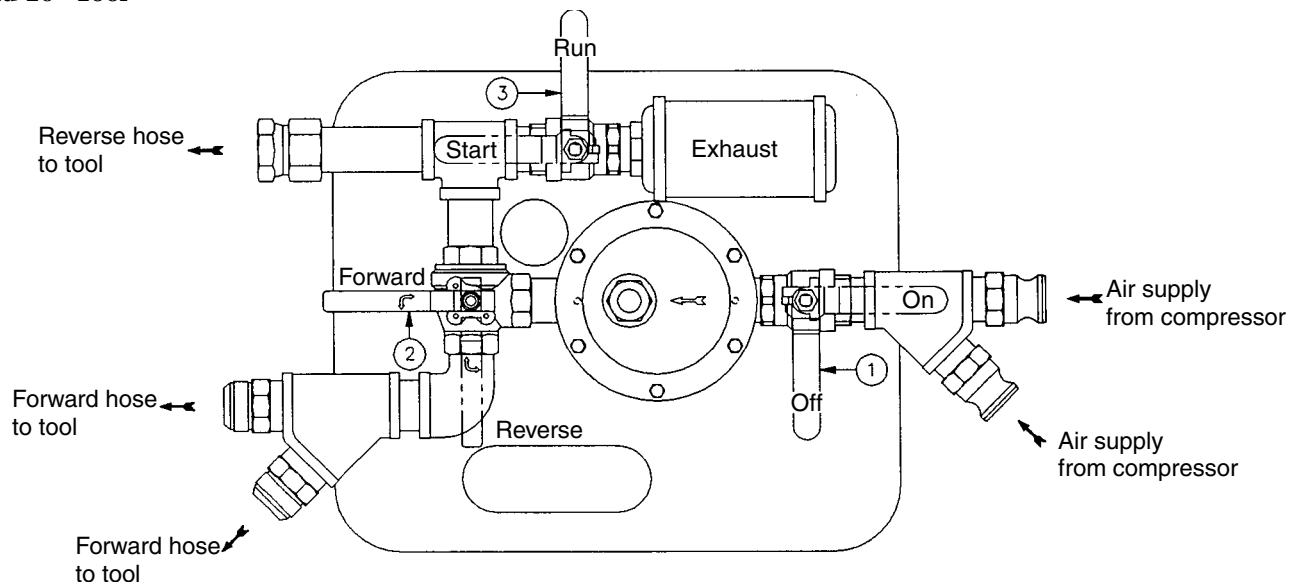




## 20" Tool

- Step 1: Open oil supply valve (1)
  - Step 2: Open Oil flow adjustment screw (2) the recommended amount "Oil Delivery Adjustment", *page 20-6*.
  - Step 3: Turn on air supply at compressor to oiler **ONLY**.
  - Step 4: Open forward valve (3) quickly until striker begins to move, then close halfway. Run tool just fast enough to lock the tool into the collets.
  - Step 5: Once tool is locked into collets, cinch kit should be retightened to remove any slack in straps.
- NOTE:** To help lock tool into pushing collets, add force by pulling lifting slings forward with a backhoe.
- Step 6: Turn handle (3) off and remove lifting slings.

## 12" and 16" Tool



Step 1: Turn handle (2) to FORWARD.

Step 2: Turn handle (3) to START.

Step 3: With handle (1) OFF, fully open compressor valves to supply air to oiler.

Step 4: Turn handle (1) toward ON until striker begins moving. Run tool just fast enough to lock it into collets.

**NOTE:** To help lock tool into pushing collets, add force by pulling lifting slings forward with a backhoe.

Step 5: Turn handle (1) to OFF and remove lifting slings.

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# Section 50: Operating the Tool

## CALL YOUR ONE-CALL SYSTEM FIRST



**WARNING:** Always contact your local One-Call system before the start of your digging project.



ONE-CALL



**Locate Utilities**  
**CALL 1-888-258-0808**

Before you start any digging project, don't forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority concerned to locate and mark the underground installations. If you don't call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

The One-Call representative will notify participating utility companies of your proposed digging activities. If you are in the U.S. or Canada and do not know the number for the local One-Call representative in your area, dial the North American One-Call number, 1-888-258-0808, for this information. Utilities will then mark their underground facilities by using the following international marking codes:

Red	Electric	Green/Brown	Sewer
Yellow	Gas, Oil or Petroleum	White	Proposed Excavation
Orange	Communication, Telephone, TV	Pink	Surveying
Blue	Potable Water		

**IMPORTANT:** Be sure to review the operating and safety instructions for the air compressor.

## LIFTING THE TOOL

**WARNING:** Tool or lifting equipment may fall and strike you.

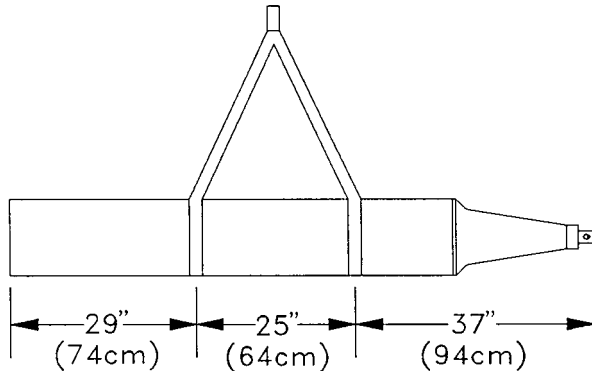


- Tool or lifting equipment may fall and strike you. Attach the lifting slings to the tool using a choker hitch to prevent the tool from sliding out of the slings.
- Securely attach the lifting slings to lift hook.
- Use lifting equipment designed and equipped specifically to lift objects with slings.
- Do not stand under raised tool or lifting equipment.
- Do not launch tool from lifting straps.

### Lifting the 12" or 16" Tool

The 12" (300 mm) tool weighs approximately 1600 lb (726 kg). The 16" (300 mm) tool weighs approximately 2700 lb (1225 kg). Attempting to lift tool by hand can result in back strain and injury.

- Attach lifting slings to tool using a choker hitch to prevent tool from sliding out of slings.
- Securely attach lifting slings to lift hook.
- Use lifting equipment designed and equipped specifically to lift objects with slings.
- Do not stand under raised tool or lifting equipment.
- Do not launch tool from lifting straps.



## Lifting the 20" and 24" Tool

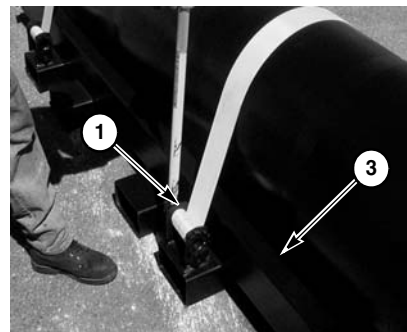
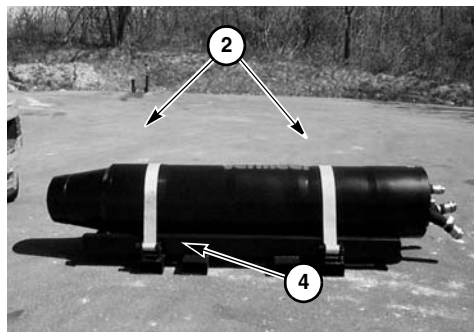
The 20" (508 mm) tool weighs 5750 lb (2608 kg) and the 24" (600 mm) tool weighs 9,340 lb (4,245 kg). Lifting straps supplied are rated at 13,600 lb (6,200 kg) when used as a choker.

**NOTE:** Only the 24" tool is supplied with a steel transport pallet.

Wrap tie-down straps (1) around tool in center of stamped sections (2), and attach to steel transport pallet (3).

Lift tool with a fork truck rated for tool's weight, using lift points (4) on steel pallet.

Disconnect tie-down straps and remove tool from transport pallet when operating this tool.



**WARNING:** Keep lifting equipment a safe distance from the entrance pit to prevent it from falling into the pit or causing the pit to cave in.



**WARNING:** Do not use lifting slings to launch tool. The tool could fall on you if:

- Tool breaks loose from the entrance wall after it leaves the lift straps.
- Operating vibrations loosen the chain or cable connection.
- Operating vibrations damage and break the lift straps.

**IMPORTANT:** Do not allow dirt or other material into air hose.

Step 6: Connect hose to a compressed air supply.

Step 7: Remove any oil or debris that may make hose slippery.



**WARNING:** To prevent the hose from whipping, do not fully open the compressor valve. Be sure to aim the hose away from yourself and other persons.

Step 8: Hold other end of hose tightly and partially open compressor valve to blow air hose clean.

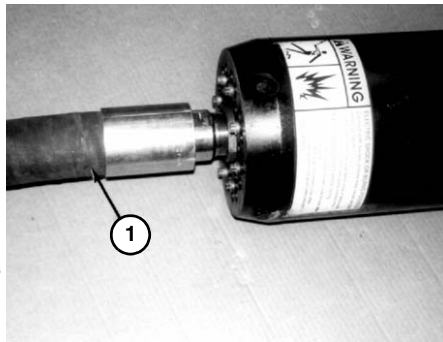
Step 9: Close compressor valve.

Step 10: Ensure air valve control handle (2) is OFF.

Step 11: Fill oiler with Hammerhead Mole oil (refer to *Controls and Adjustments* section, "Tool Oiler," page 20-4).

Step 12: Connect air supply hose to oiler and tool supply hose to tool.

Step 13: To avoid accidental uncoupling, tighten all hose locking collars against fittings or install any hose fitting retaining devices such as locking rings, clips, pins, chains, or cables.

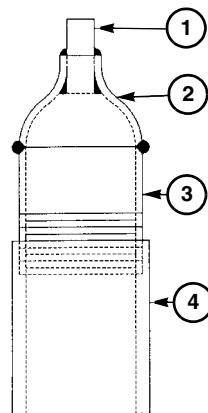


**WARNING:** If production slows to less than 1 foot (300 mm) every 15 minutes, stop tool, check for obstacles, and remove any spoil that is packed up against collets. Reinstall tool and try starting tool again. If production is still less than 1 foot /15 minutes, then conditions may be beyond the capabilities of the tool. An option would be to use the next size larger tool. **NOTE:** Exceeding this guideline could result in excessive wear or physical damage to the tool.

## PUSHING CLOSED PIPE

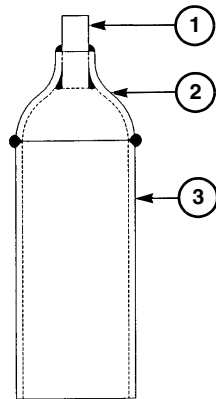
### Threaded Pipe

- Step 1: Weld a piece of steel bar **(1)** to smaller end of pipe reducer **(2)**. Weld steel bar to pipe reducer on both inside and outside of pipe reducer.
- Step 2: Weld a short section of threaded pipe **(3)** to larger end of pipe reducer.
- Step 3: Thread pipe reducer to pipe with a threaded collar **(4)**. The pipe reducer will make the front of the pipe more streamlined and easier to start the push.



### Welded Pipe

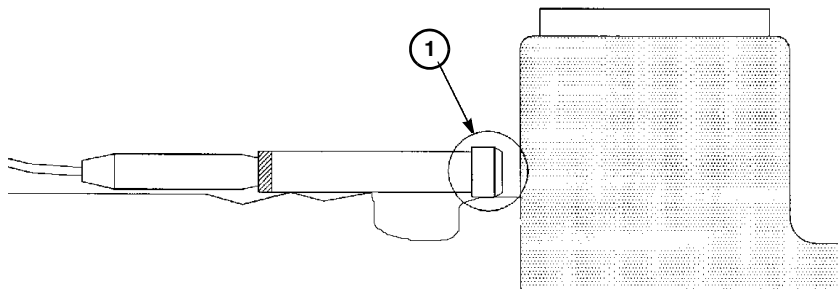
- Step 1: Weld a piece of steel bar **(1)** to smaller end of pipe reducer **(2)**. Weld on both inside and outside of reducer.
- Step 2: Weld pipe reducer **(2)** to front of pipe **(3)**. The pipe reducer can be used again. Cut pipe reducer off pipe when push is completed and use it again on the next push.



## PUSHING OPEN PIPE

Use a soil shoe when pushing open pipe. It will reduce friction on the pipe and make spoil removal easier.

Slip appropriate soil shoe (1) over front end of pipe.



## STARTING THE PUSH

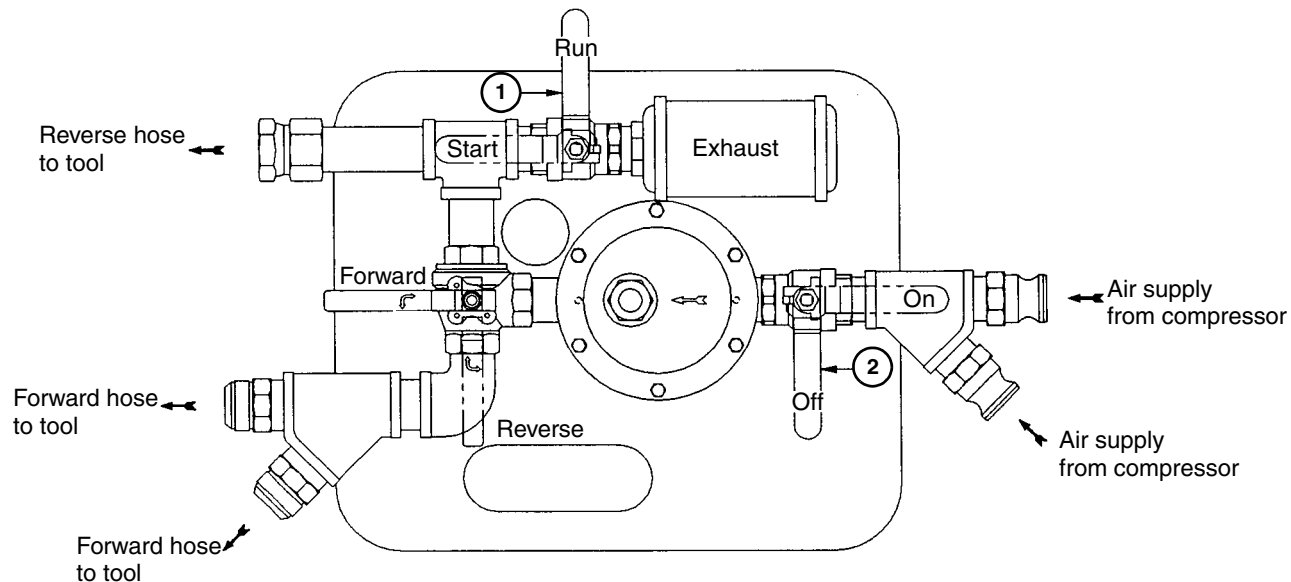


**DANGER:** Pit cave-in possible. Death from suffocation may occur. Never enter a pit where cave-in and suffocation are possible. Follow OSHA regulations for shoring or sloping of pit.



**WARNING:** Before ramming, check with qualified sources to properly locate all buried utilities in and around ramming path. Contact with buried utilities may cause serious injury or death.

## Start the Push - 12" and 16" Tools



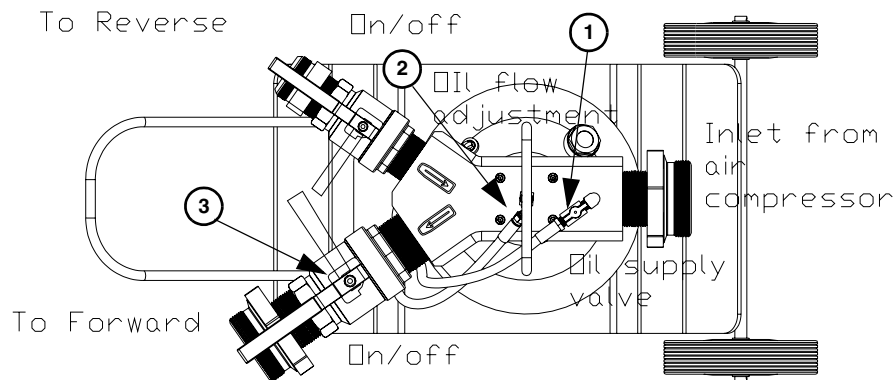
Step 1: Turn handle (1) to START and start tool by turning handle (2) fully ON.

Step 2: With tool running, slowly turn handle (1) fully clockwise to RUN.



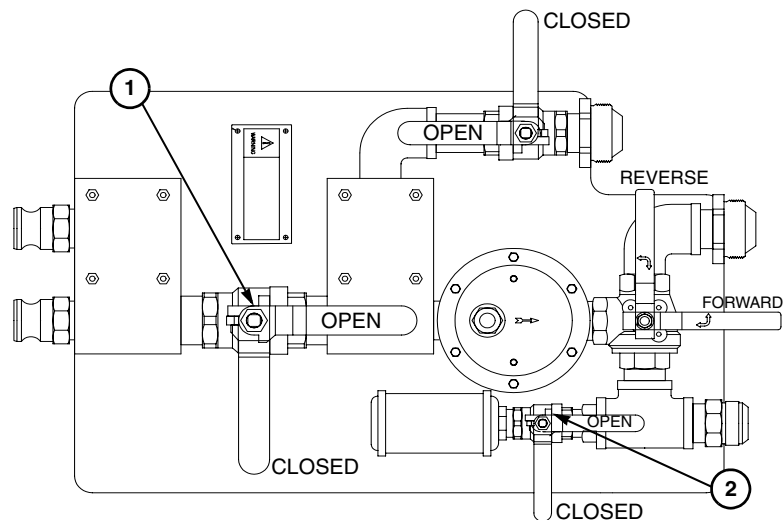
## Starting the Push - 20" Tool

- Step 1: Open oil supply valve (1)
- Step 2: Open Oil flow adjustment screw (2) the recommended amount "Oil Delivery Adjustment", *page 20-6*.
- Step 3: Turn on air supply at compressor to oiler ONLY.
- Step 4: Open forward valve (3) quickly until striker begins to move, then close halfway. Run tool just fast enough to lock the tool into the collets.
- Step 5: Once tool is locked into collets, cinch kit should be retightened to remove any slack in straps.



## Start the Push - 24" Tool

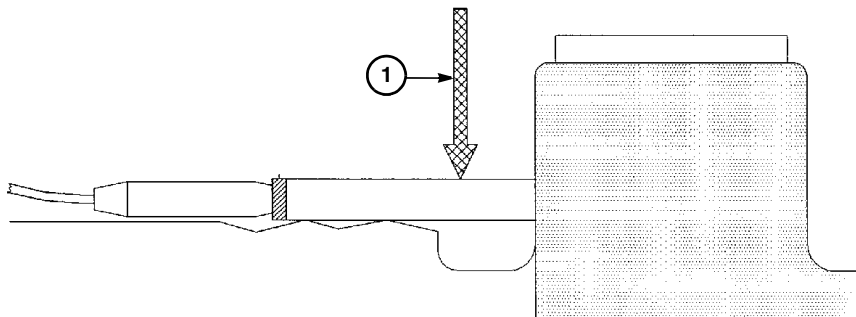
- Step 1: Open *Supply Valve* (1).
- Step 2: With tool running, slowly turn *Muffler Valve* (2) fully OFF.



## Continuing the Push

**NOTE:** When starting the push, it may be necessary to place weight (indicated by arrow (1)) on pipe to keep it from oscillating instead of advancing. Place a backhoe bucket on pipe to prevent oscillating.

Push pipe slowly for the first 6–8 ft (1.8–2.4 m) to help maintain grade. Apply weight on pipe as necessary and use a level on front of pipe to monitor grade.



## Adding Pipe

Step 1: Position and weld the next section.

**IMPORTANT:** Ensure pipe sections are welded together straight for a more accurate push.

Step 2: Insert collets and resume pushing.

## Completing the Push - 12" and 16" Tools

Remove tool from pushing collets when finished ramming or when adding more pipe.

Step 1: Turn air supply valve (1) fully clockwise to OFF.

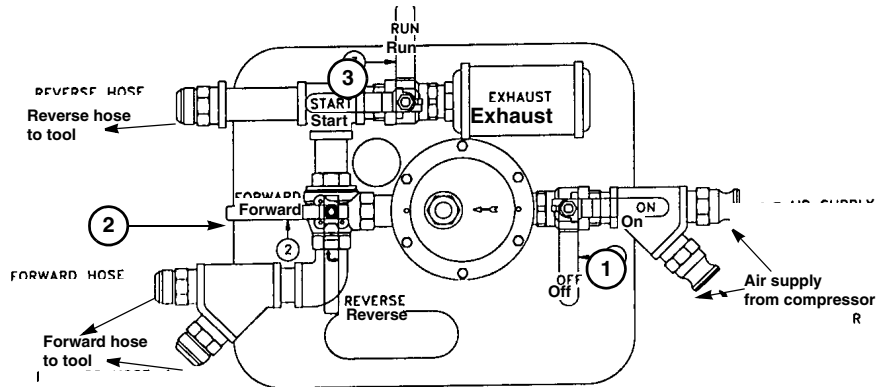
Step 2: Turn *Forward/Reverse Valve* (2) fully clockwise to REVERSE.

Step 3: *Run/Start Valve* (3) should be fully clockwise in RUN.

Step 4: Quickly turn *Air Supply Valve* (1) ON then OFF. Repeat if tool does not release from pushing collets.

Step 5: Remove collets.

Step 6: When finished, remove tool and pushing collets.



## Completing the Push - 20" Tool

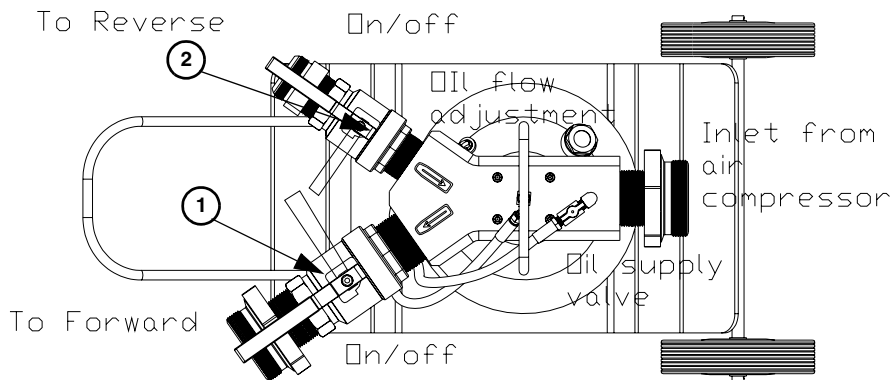
Remove tool from pushing collets when finished ramming or when adding additional pipe.

Step 1: If supplying air to tool through only 1 forward hose, turn off forward air supply valve (1). If supplying air through both forward hoses, shut off air supply to 2nd forward hose at compressor as well.

Step 2: Reattach lifting slings and support tool. Loosen or remove cinch kit.

Step 3: Turn reverse air supply valve (2) on quickly. Let the tool cycle a few times to unlock itself from the collets. Repeat if necessary.

Step 4: Remove tool and collets.



## Completing the Push - 24" Tool

Remove tool from pushing collets when finished ramming or when adding more pipe.

Step 1: Close *Air Supply Valve (1)*.

Step 2: Open *Muffler Valve (2)* to bleed air in hoses. When done, close valve.

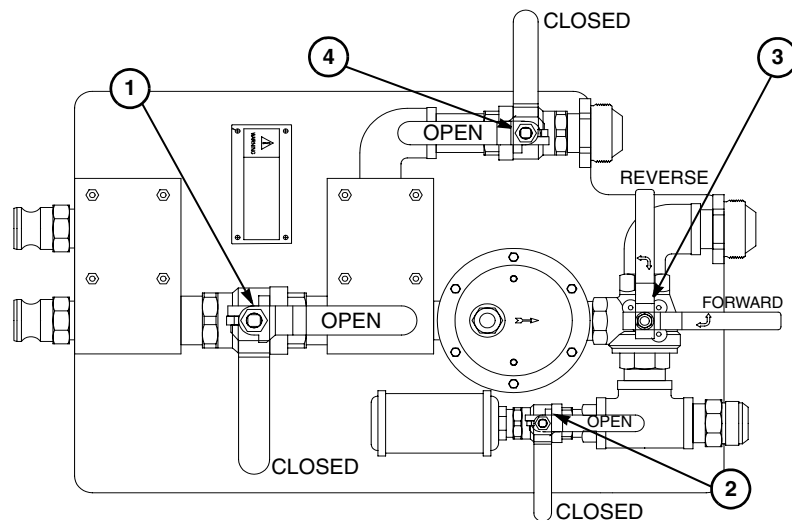
Step 3: Close *Second Forward Valve (4)* and move *Forward/Reverse Valve (3)* to REVERSE.

Step 4: Support tool with lifting straps.

Step 5: Quickly open *Air Supply Valve (1)* until tool unlocks from collets.

Step 6: Remove tool.

Step 7: Remove adapter ring and/or collets.



## After the Push

Disconnect air hoses from tool and remove tool from exit pit. Cap inlet fittings or cover with tape to prevent dirt and sand from entering tool.

## AFTER THE RAM

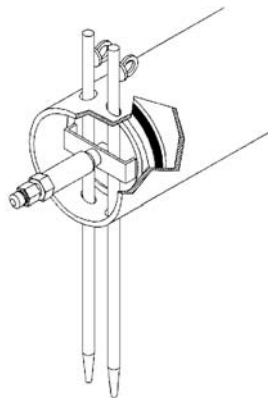
Disconnect air hose from tool and remove tool from exit pit. Cap inlet fitting or cover it with tape to prevent dirt and sand from entering tool.

## CLEANING OUT OPEN PIPE



**WARNING:** Serious injury could result if struck by an ejected pipe seal. Install stakes through the pipe, seal, and into the ground to prevent the seal from blowing out or the pipe from moving. Use only Hammerhead approved high strength steel alloy stakes.

Do not stand at either end of the pipe unless the pipe pressure has been vented.



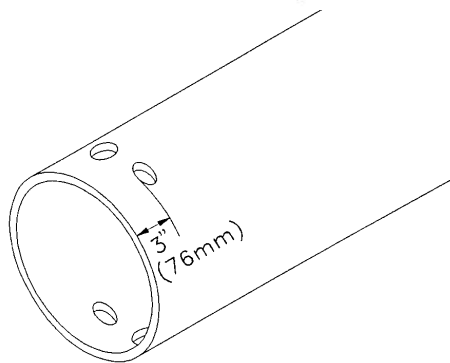
Step 1: Use a torch to cut two holes all the way through pipe for safety stakes.

- Cut holes 3" (76 mm) apart from each other and 3" (76 mm) from edge of pipe.
- For 14" (35 cm) or smaller pipe seals: Cut 1-1/2" (4 cm) diameter holes.
- For 16" (40 cm) to 30" (76 cm) pipe seals: Cut 2" (5 cm) diameter holes.

**NOTE:** Pipe diameters exceeding 30" (76 cm) will require an alternative method to remove spoil from pipe, such as hand digging, high pressure water cutting or augering.

Step 2: Remove slag from inside of pipe.

Step 3: Before installing ramming pipe seal, allow pipe to cool to prevent damaging rubber seal.





**WARNING:** If anchor stakes are not firmly secured in ground, pipe may recoil and cause severe injury or death.

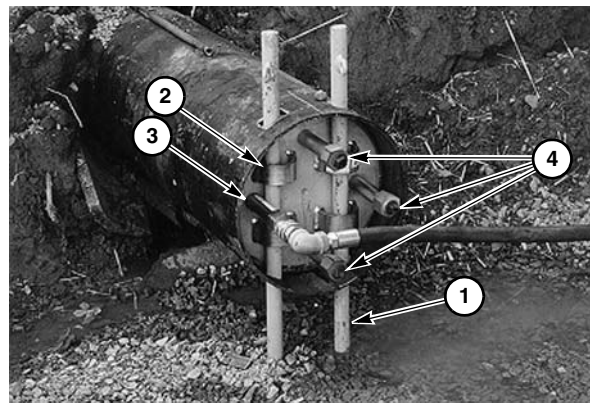
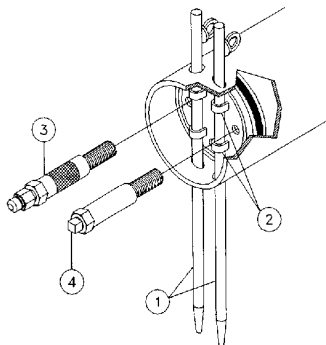
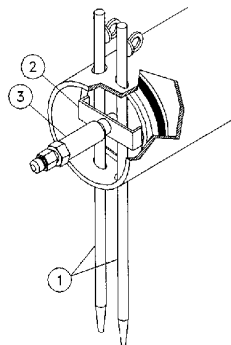
**IMPORTANT:** Ensure stakes (1) pass through U-clamp(s) (2) on pipe seal assembly.

Step 4: Insert ramming pipe seal assembly into pipe and secure with stakes (1).

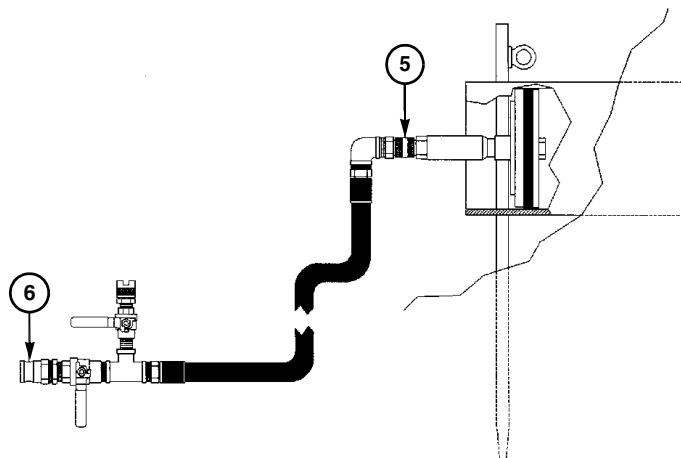
Step 5: Tighten pipe stem(s) (3) to seal pipe. Two O-rings are supplied with each completion kit. Use O-ring that provides a better seal.

**IMPORTANT:** Use only Hammerhead approved high strength alloy steel stakes.

**NOTE:** Three plugs (4) are used for 16-30" pipe.



- Step 6: Attach quick connect (5) of spoil removal line to ramming pipe seal.
- Step 7: Attach air supply line to other end (6) of spoil removal line.



**WARNING:** Spoil can be ejected at high speed. Pipe may recoil out of bore when spoil ejects. Stay away from the ends of the pipe when ejecting spoil. Serious injury or death may result if struck by ejected spoil or recoiling pipe.



**WARNING:** Do not add water to a pressurized pipe seal. Always vent pressure before adding water. Failure to relieve pressure may result in serious injury.



Step 8: With pressure set at 110 psi, turn on air. Maintain pressure for 6-10 minutes.



**WARNING:** Vent air pressure before disconnecting the air hose. Serious injury could occur if struck by hose uncoupled under pressure. Do not attempt to clean out any pipe larger than 30" (762 mm) using this method.

Step 9: If spoil does not move:

- a. Turn off air and slowly open valve (7) to bleed off pressure.
- b. Add water through valve (7) to lubricate pipe and help create a seal.
- c. Repeat step 8.

Step 10: Decrease airflow when spoil begins to move to prevent violent spoil discharge.

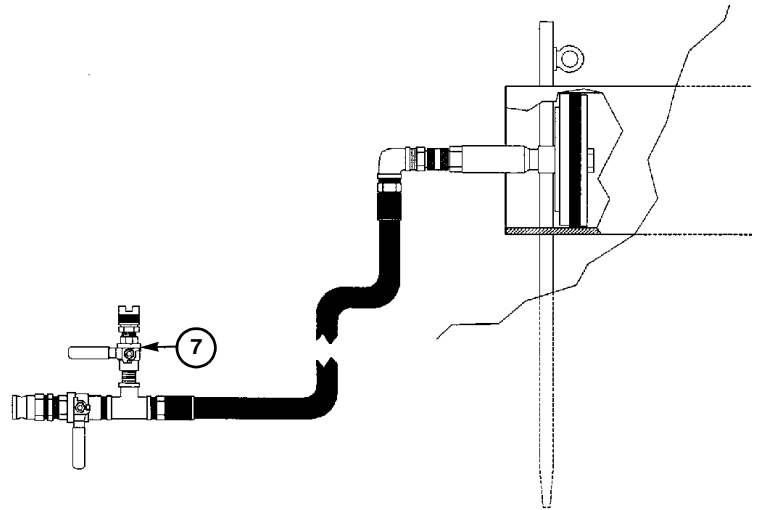
## ACCESSORIES

### Soil Shoes

When ramming steel pipe, using of soil shoes will reduce friction on both outside and inside of pipe. With reduced friction, longer lengths of pipe can be installed and spoil removal will be easier.

The soil shoe fits over end of pipe and can be used on all pipe schedules.

Soil shoes are available in 2" (5 cm) increments from 6-12" (15-30 cm).



## Pushing Collets

When pushing steel pipe, use a pushing collet to couple tool to pipe. The tool locks onto collet, which fits inside pipe. Tool impact is transferred to the pipe more effectively, resulting in more efficient pipe ramming.

Pushing collets are available in 2" (5 cm) increments from 6-24" (15-60 cm) and selected sizes up to 42" (106.7 cm).

Refer to Specifications Section for recommended pipe schedules.

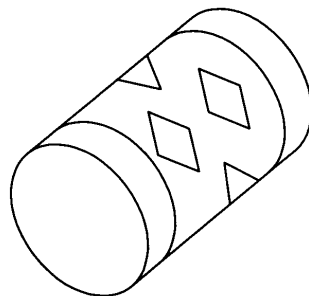


## Pipe Pigs

Use a pipe pig to remove all dirt from inside of an installed pipe.

Pipe pigs are available in 2" (5 cm) increments from 6-24" (15-60 cm) and 30" (76 cm).

**NOTE:** These pipe pigs fit standard schedule pipe. Special sizes are available. If interested, contact your dealer.



## Pipe Seals

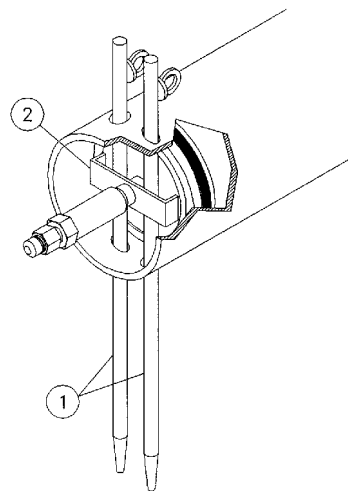
**NOTE:** Pipe diameters exceeding 30" (76 cm) will require an alternative method to remove spoil from pipe, such as hand digging, high pressure water cutting, or augering.

After ramming open pipe, use a Vermeer-approved ramming pipe seal to seal pipe for removing spoil from pipe.

Stakes (1) hold ramming pipe seal assembly (2) in pipe. Pressurized air is applied through ramming pipe seal to remove spoil.

Pipe seals are available in 2" (5 cm) increments from 6-24" (15-60 cm) and 30" (76 cm).

Refer to Specifications Section for recommended pipe schedules.



## Pipe Ram Collars

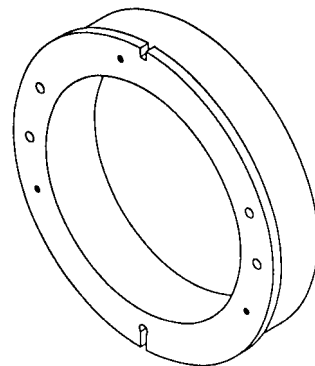
Pipe ram collars are used with 24" pushing collets to install large diameter pipe.

The tool locks into collet; collet fits inside pipe ram collar; collar fits inside end of pipe.

Due to its mass, the 23" tool may require the use of additional support to reduce strain on nose of tool and prevent tool from becoming unlocked during use. The supplied installation kit straps rear of tool to pipe, holding it tightly during ramming.

Collars are available in the following sizes: 30, 32, 36, 42, 48", 54", 60", 72" (76, 81, 91, 107, 122, 137, 152, 182 cm)

Refer to Specifications Section for recommended pipe schedules.



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# Section 60: Maintenance

## PERFORMING MAINTENANCE

This section contains maintenance instructions for the *Hammerhead Mole Pneumatic Boring Tool*. Do not attempt any maintenance which you do not fully understand, nor that you cannot do accurately and safely with tools and equipment available to you. If you encounter a problem that you do not understand or cannot solve, contact your Hammerhead dealer.

## DURING SERVICE

- Read and follow service instructions in this manual before servicing tool.
- Shut off air supply valve and disconnect air line before servicing tool.
- Use only authorized parts for repair or replacement. These replacement parts, including bolts, are specified in this manual.
- Check air supply hose periodically for damage to hose or fittings. Never use *Hammerhead Mole Pneumatic Boring Tool* with damaged or worn air lines or fittings. This will minimize chances of air line breakage while in use.
- Check and tighten loose hose clamps and tailbolts regularly.
- Do not use a torch or welder on *Hammerhead Mole Pneumatic Boring Tool*. Applying heat may damage critical parts of tool. Heating parts of tool may alter the component's strength and result in premature failure or personal injury.
- When tailcone and rear anvil are removed, be careful when elevating front of tool. The heavy striker inside tool body may slide out.

## MAINTENANCE - INITIAL 30 SERVICE HOURS

### Striker and Valve Wear Rings - Check

Instructions for checking wear rings are included in “Maintenance - 150 Service Hours or Yearly,” *page 60-2*.

- Follow instructions in “A. Tool - Disassemble,” *page 60-2*.
- Proceed to “B. Striker - Inspect - All Tools,” *page 60-9*, and “C. Valve - Inspect,” *page 60-11*, instructions to check wear rings and Bushings.
- Follow applicable instructions in “F. Tool - Assemble,” *page 60-15*.

**NOTE:** New tail bolts are not necessary at this time unless bolts are damaged.

## MAINTENANCE - 150 SERVICE HOURS OR YEARLY

These procedures are sequential. Follow instructions in Step A, then proceed to following steps in order until finished.

- A. Disassemble tool.
- B. Inspect striker.
- C. Inspect valve.
- D. Inspect bushings.
- E. Inspect rear anvil.
- F. Assemble tool.
- G. Replace tail bolts.

### A. Tool - Disassemble

**NOTE:** Contact your HammerHead Mole dealer regarding special fixtures for disassembling 24" (600 mm) and 20" (508 mm) tool.



**WARNING:** The 12" (300 mm) tool weighs approximately 1600 lb (726 kg); the striker weighs 800 lb (363 kg). The 16" (400 mm) tool weighs approximately 2700 lb (1225 kg); the striker weighs 1200 lb (544 kg). The 20" (508 mm) tool weighs approximately 5750 lb (2608 kg); the striker weighs 2070 lbs (939 kg). The 24" (600 mm) tool weighs approximately 9,340 lb (4,235 kg); the striker weighs 4400 lb (2000 kg). Attempting to lift tool or striker by hand can result in back strain and injury. Never lift tool over personnel. The tool or lifting equipment may fall, crushing anyone beneath it. Never stand under raised tool or lifting equipment.



**WARNING:** Tool or lifting equipment may fall and strike you.

- Attach lifting slings to tool using a choker hitch to prevent tool from sliding out of slings.
- Securely attach lifting slings to lift hook.
- Use lifting equipment designed and equipped specifically to lift objects with slings.
- Do not stand under raised tool or lifting equipment.

**IMPORTANT:** Before disassembling tool, raise nose of tool enough to slide striker against rear anvil. This will be beneficial when removing striker.

Step 1: Thoroughly clean tool and use lifting straps to place it on a clean surface. Lay it flat or with nose down slightly to prevent striker from falling out when inner assembly is removed.

Step 2: Remove two nuts (1) that hold valve assembly in tailcap (2).

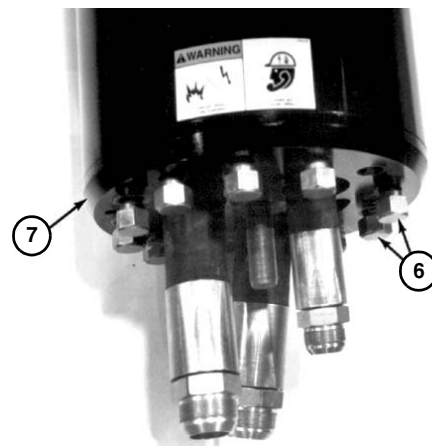
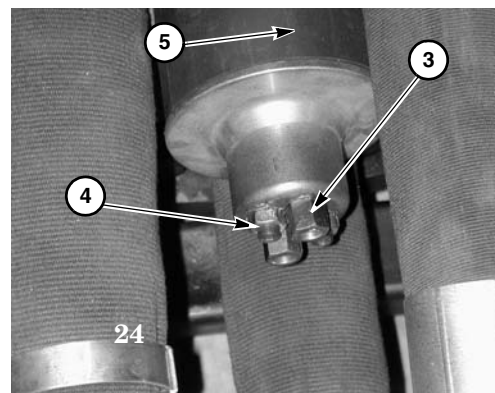
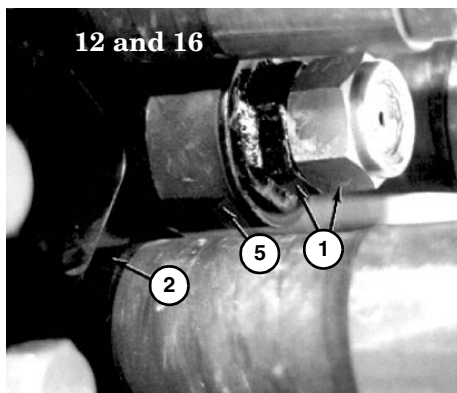
- 12" (300 mm) tool: Use 1-1/8" (29 mm) open end and 1-1/4" (32 mm) open end wrenches.
- 16" (400 mm) tool: Use 1-7/8" (48 mm) and 1-3/4" (46 mm) wrenches.
- 24" (600 mm) tool: Use a 3/4" (19 mm) wrench to remove four jam nuts on flange (3). Remove four inner Allen bolts in flange nut (4) and then remove flange nut .

Step 3: Remove outer bushing (5) from valve stem.

Step 4: Remove tailbolts (6).

- 12" (300 mm) tool: Use 9/16" 12-point socket or 7/8" hex socket to remove 16 tailbolts.
- 16" (400 mm) tool: Use 1-3/8" socket to remove 12 or 20 tailbolts.
- 20" (508 mm) tool: Use 1-3/8" socket to remove 24 tailbolts
- 24" (600 mm) tool: Use 1-3/8" socket to remove 20 tailbolts.

Step 5: Remove tailcap (7) from inner assembly.





## 16" Tool without Valve Stem and 20" Tool Disassembly

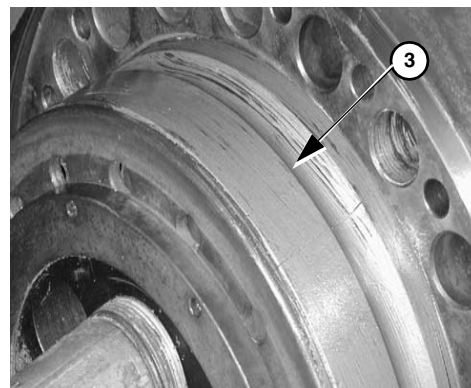
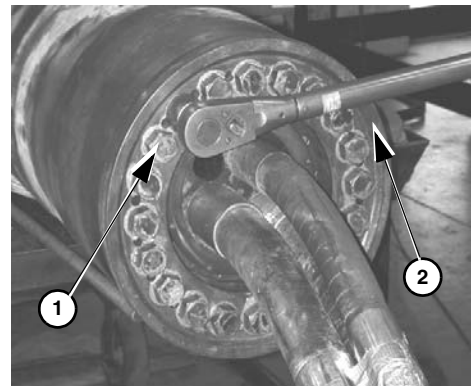
Step 1: Thoroughly clean tool and use lifting straps to place os on a clean surface. Lay the tool flat or with the nose pointed down slightly to prevent the striker when falling out when the inner assembly is removed.

**NOTE:** This style 16" tool and the 20" tool do not have a valve stem or an external bushing.

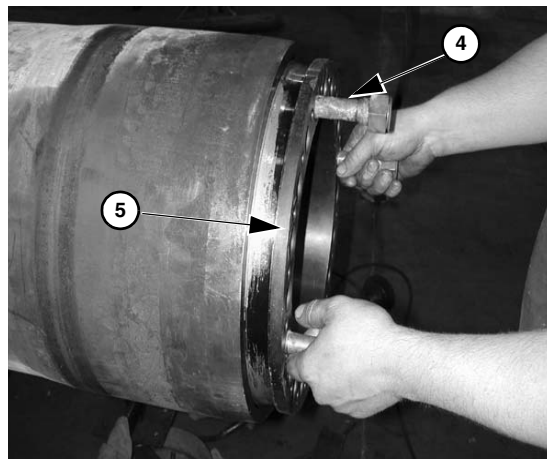
Step 2: Remove the tailbolts (1) using a 1-3/8" socket. The 16" tool has 20 tailbolts while the 20" tool has 24.

Step 3: Remove tailcone (2) from rear of tool.

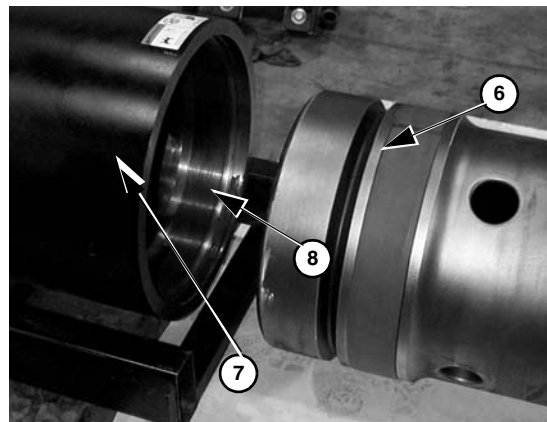
Step 4: Remove Valve Assembly (3) from rear of tool. The rear anvil will be removed in the next step.



Step 5: Install 4 tailbolts (4) into rear anvil (5) at the 3, 6, 9 and 12 o'clock positions. Unthread the rear anvil being careful not to damage the threads on the anvil or inside the body of the tool.



Step 6: Carefully remove the striker (6) from body assembly (7). DO NOT damage threads on inside diameter of the body (8).



## Final Disassembly - 12" and 16" Tools

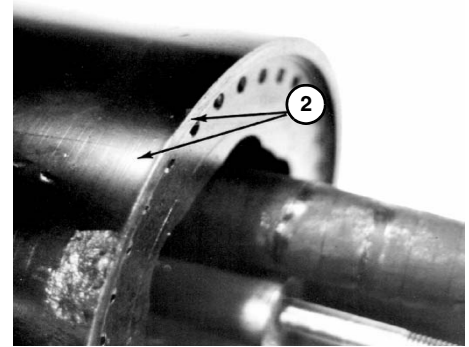
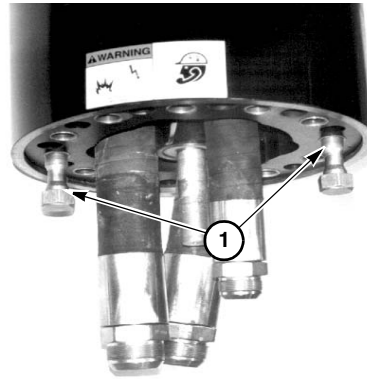
Step 1: Install two tailbolts (1) and use them to rotate rear anvil counterclockwise to unthread rear anvil from body. It will take approximately 21 full turns for 12" tool, 23 full turns for 16" tool.

Step 2: Remove rear anvil and valve assembly from body.

Step 3: Remove inner bushing assembly from valve stem.

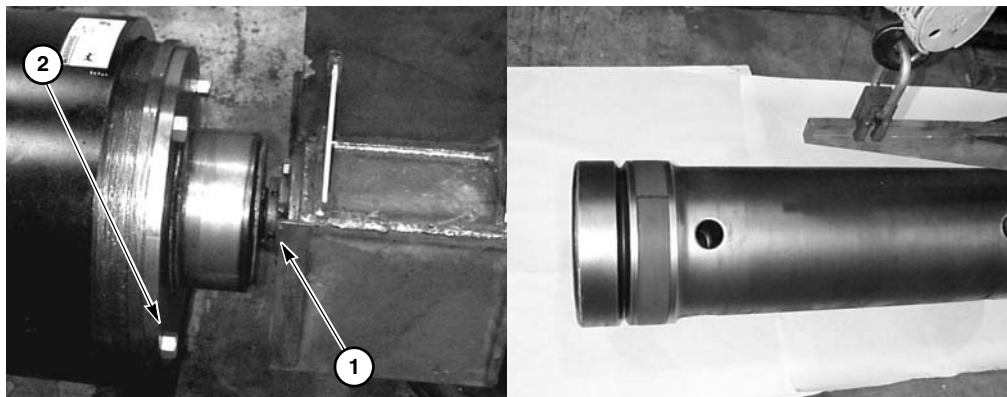
**NOTE:** Do not damage body threads when removing striker (2).

Step 4: Insert a wooden 4 x 4 into striker bore and lift slightly while pulling out striker. When striker is halfway out of tool, connect a lifting strap to striker. Remove striker with lift strap and lifting equipment.



## Final Disassembly - 24" Tool

Step 1: Attach rear anvil installation/removal fixture (1) to rear anvil using four bolts (2) supplied. The fixture must be suspended from a hoist rated to hold the combined weight of fixture and rear anvil, approximately 2,000 lb (910 kg).



Step 2: Align fixture to rear anvil and body of tool as not to bind anvil while it is unscrewed from body. Remove rear anvil.

Step 3: Remove valve assembly from striker. It may be necessary to put a strap around assembly to balance it as it is removed.

**NOTE:** Do not damage body threads when removing striker.

Step 4: Insert striker installation/removal fixture inside striker bore. The fixture must be suspended from an overhead hoist capable of supporting the weight of fixture and striker, approximately 6,000 lb (2,720 kg).

Step 5: Lift striker slightly and pull striker out of body.

## B. Striker - Inspect - All Tools

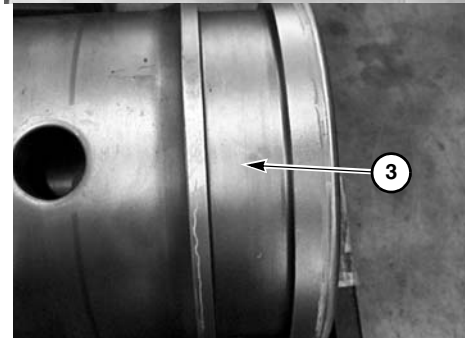
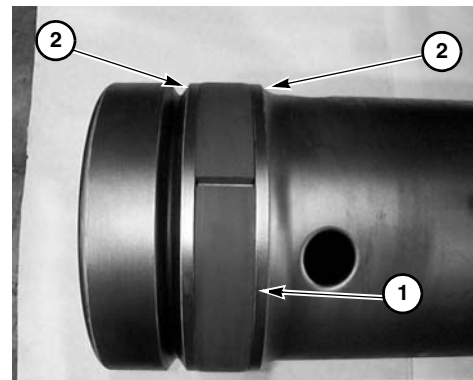
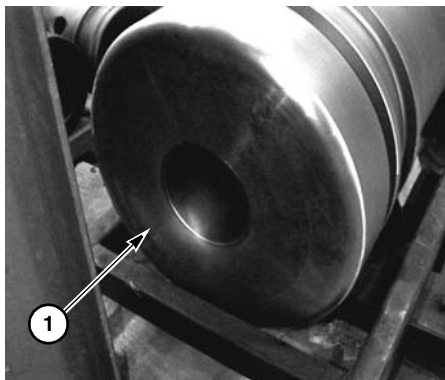
Step 1: Inspect front (1) and rear impact surfaces of striker. If more than 50% of either surface is heavily chipped or cracked, replace striker.

Step 2: Check striker ring wear with a straightedge. If striker ring (1) does not protrude above wear pads (2), replace ring.

*To replace a ring:*

- a. Clean ring groove (3).
- b. Oil all surfaces of ring with Hammerhead Mole Oil.
- c. Install ring. If ring is overexpanded, remove ring, overlap ends to make a tighter diameter, and then reinstall.

**NOTE:** The striker wear pads have been designed so tool will operate with worn-out rings. Although tool will run, steel-to-steel contact will result in increased friction and internal wear, as well as shortened body and striker life.



Step 3: Check end gap (4) of each ring with ring fully seated in striker ring groove. Gap should be:

- 12" tool: .290–.310" (7.4–7.9 mm) for front ring and .135–.155" (3.4–3.9 mm) for rear ring
- 16" tool: .380–.400" (9.7–10.2 mm) for front ring and .240–.260" (6.1–6.6 mm) for rear ring
- 20" tool: .490–.520" (12.4–13.2 mm) for front ring and .30–.33" (7.6–8.4 mm) for rear ring
- 24" tool: .545–.575" (13.8–14.6 mm) for front ring, and .370–.390 (9.4–9.9 mm) for rear ring.

If gap is less, remove ring and trim enough off one end to ensure proper gap.

**IMPORTANT:** Wear rings should be checked after first 30 hours of use. First clean ring and ring groove. Check ring gap and wear.

Step 4: Use a flashlight to inspect striker valve bore for rust, debris, and burrs. If needed, clean bore with a soft abrasive, such as a Scotch Brite scouring pad on a drill extension.

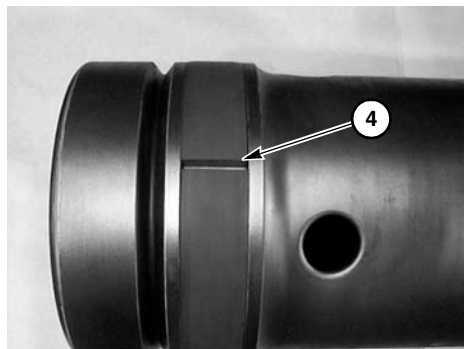
**IMPORTANT:** The use of hard abrasives, such as a wire brush or emery cloth, can damage bore by removing metal, creating a rough surface.

Step 5: Inspect bore again for burrs. Burrs and nicks can accelerate valve skirt wear. If burrs are still there, replace striker.

Step 6: Check valve bore of striker with a snap gauge. Take measurements 2" (5 cm) into bore at 12 o'clock and 3 o'clock positions.

Replacement of striker will improve power if average bore diameter is more than:

- 7.34" (186 mm) for 12" tool
- 9.59" (243 mm) for 16" tool
- 11.405" (290 mm) for 20" tool
- 13.518" (343 mm) for 24" tool



## C. Valve - Inspect

Step 1: Expand and slide valve rings (1) over valve (2) to remove them.

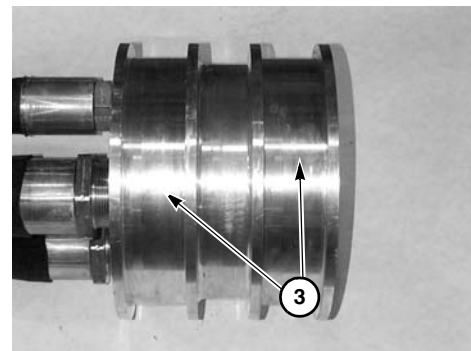
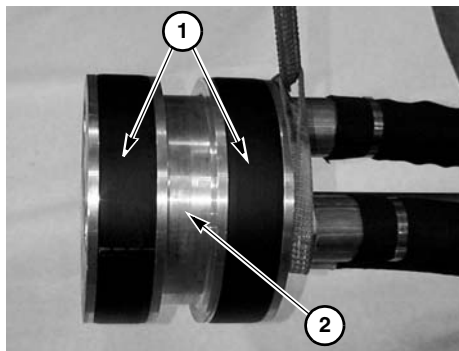
Step 2: Check for sand embedded in outer surface of ring. If you find any, replace ring.

Step 3: The inside surface has a groove designed to collect debris. Remove all debris or particles from ring.

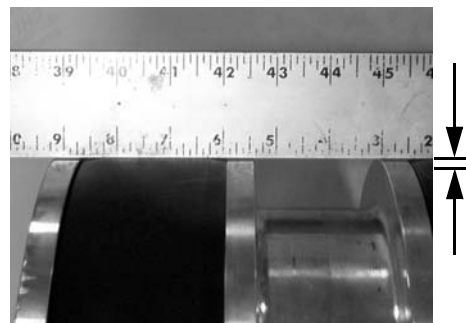
Step 4: Check ring for scratches. Light scratching on ring is acceptable. Replace a heavily scratched or scored ring.

*To replace a ring:*

- a. Clean ring grooves (3).
- b. Oil all surfaces of ring with Hammerhead Mole Oil.
- c. Install ring. If ring is overexpanded, take ring off, overlap ends to make a tighter diameter, and then reinstall.



Step 5: Check valve ring wear with a straightedge. If the space between straightedge and front edge is less than .10" (2.5 mm), replace ring. Repeat procedure for rear edge.

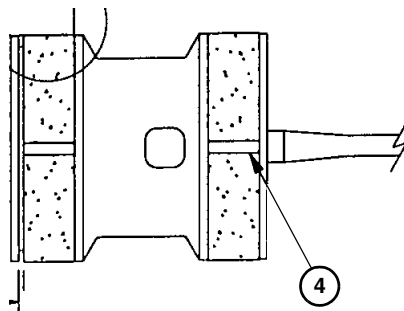


Step 6: Check valve ring end gap (4) with ring fully seated in ring groove. Gap should be:

- .100-.120" (2.5-3.0 mm) for 12" tool
- .120-.140" (3.0-3.5 mm) for 16" tool w/valve stem
- .240-.260" (6.1-6.6 mm) for 16" tool w/o valve stem
- .270-.290" (6.8-7.3 mm) for 20" tool
- .300-.320" (7.6-8.1 mm) for 24" tool

If gap is less, remove ring and trim enough off one end to get proper gap.

**IMPORTANT:** Valve ring wear should be checked initially after 30 hours of use. First clean ring and ring groove. Check ring gap and wear.



Step 7: Install a new valve ring and check valve ring groove width. Measure gap between ring and groove. If it is more than .050" (1.25 mm), replace valve.

**NOTE:** Valve groove wear will accelerate if tool is run dirty or without oil, or if valve ring does not have correct end gap.



## External Hoses - Replace

Step 1: Clamp two pins (1) in vise as shown:

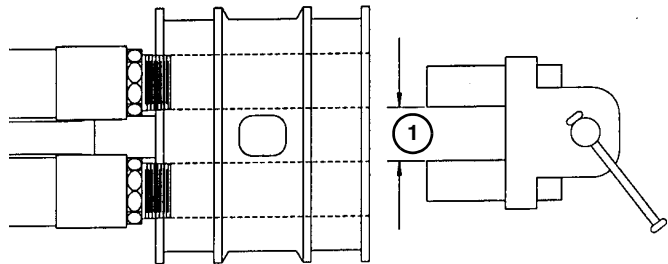
- 12" and 16" tools: 1-1/2" pins 3" (76 mm) apart
- 24" tool: 2-3/4" (57 mm) pins 5" (127 mm) apart

Step 2: Slide valve assembly over pins and remove hose whips with open end wrenches:

- 2" (51 mm) for reverse hoses
- 2-1/2" (64 mm) for forward hoses

Step 3: Install new hoses.

- Torque 12" hoses to 200 ft-lb (274 Nm).
- Torque 16" hoses to 250 ft-lb (339 Nm).
- Torque 24" hoses to 275 ft-lb (375 Nm).



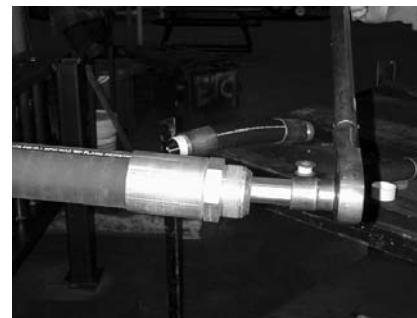
## External Hoses - Replace 16" and 20" Tool

Step 1: Apply 3 wraps of telfon tape to threads of external hose. Thread hose into valve by hand.

Step 2: Clamp valve to hold stationary being careful not to damage the valve.

Step 3: Slide external hose replacement tool into hose and tighten to 500 ft lb (678 Nm).

Step 4: Repeat for other hoses.



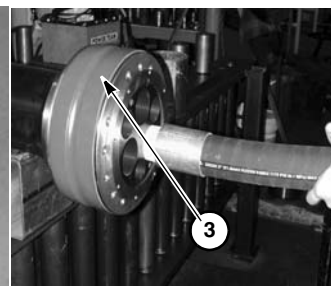
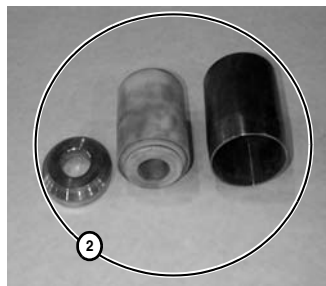
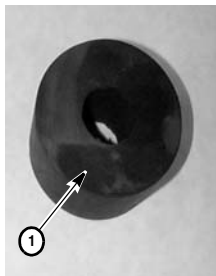
## D. Bushings - Inspect

Inspect outer (1) and inner (2) bushing assemblies for deterioration. Inspect isolator on valve (3) for deterioration on this style valve.

If plastic insert is cracked or broken, replace it.

Replace outer bushing if rubber is torn, cracked, or brittle.

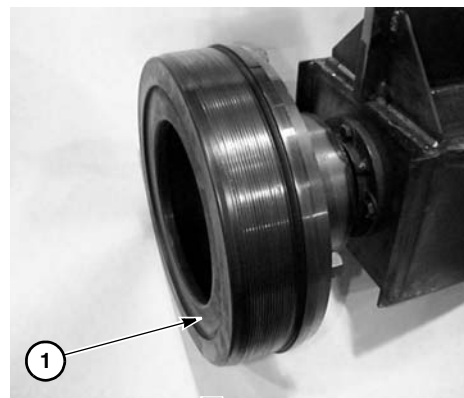
Replace isolator if rubber is torn, cracked or brittle.



## E. Rear Anvil - Inspect

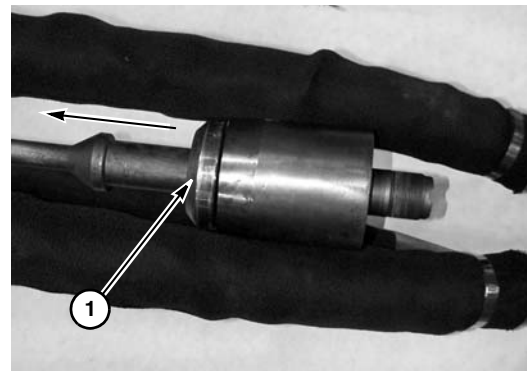
Step 1: Inspect face (1) which contacts striker. If more than 50% of the surface is heavily chipped or cracked, replace anvil.

Step 2: Thoroughly clean rear anvil. Use an approved air nozzle and carefully blow out exhaust ports and bore.



## F. Tool - Assemble

Step 1: Install inner bushing assembly over valve stem with steel plunger (1) toward valve. Ensure inner bushing is seated on shoulder of valve stem.



Step 2: Check valve assembly's critical length as shown in diagram at right. If incorrect, replace valve assembly.

- 12" tool:  $22\text{-}1/4" \pm 1/16"$   
(565 mm  $\pm$  2 mm)
- 16" tool:  $25\text{-}5/16" \pm 1/16"$   
(643 mm  $\pm$  2 mm)
- 20" tool:  $30.96" \pm 1/16"$   
(786 mm  $\pm$  2 mm)
- 24" tool:  $29\text{-}1/4" \pm 1/16"$   
(740 mm  $\pm$  2 mm)

**NOTE:** Use either Fig a or Fig b depending on the style of valve in the tool being inspected.

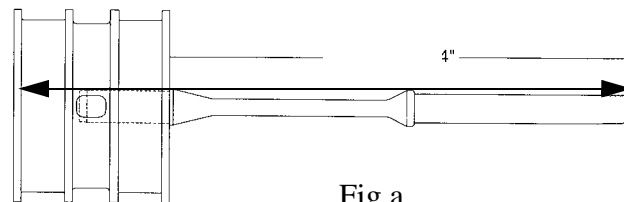


Fig a

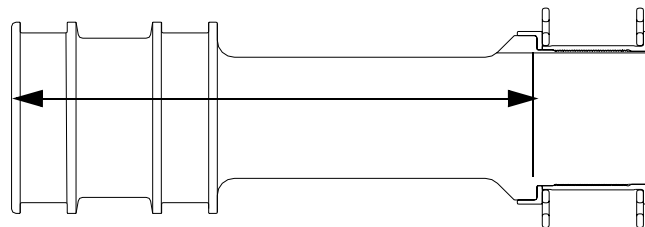


Fig b

Step 3: Test fit valve in striker bore. Valve should slide freely into striker until it completely passes rear crosshole. If it does not, determine reason for obstruction before assembling tool.

Step 4: Clean body bore thoroughly. Oil inside of body and striker.

**NOTE:** Do not damage body threads (2) when installing striker.

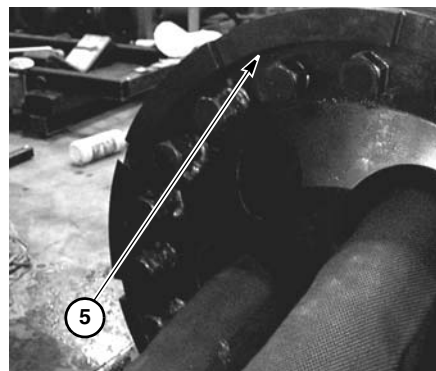
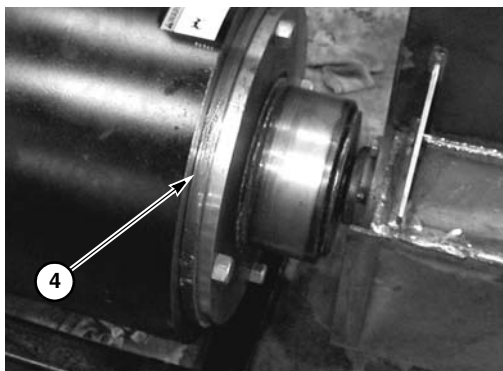
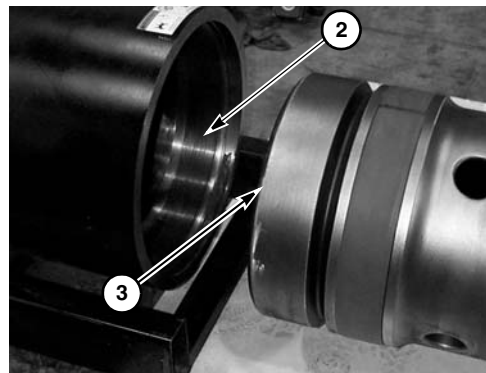
Step 5: With tool body horizontal or slightly nose down, carefully slide striker into body. The end (3) with smaller hole goes into body first.

Step 6: Slide valve assembly with inner bushing into striker.

Step 7: Coat rear anvil's external threads (4) with anti-seize lubricant.

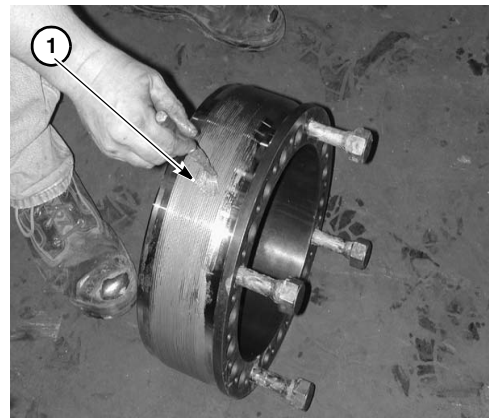
Step 8: Thread rear anvil into body. Be careful not to cross-thread rear anvil into body.  
**Tighten rear anvil until it bottoms against body, then loosen it 1/8 turn. Do not apply torque to rear anvil.**

Step 9: Place tailcap (5) over valve end hose whips.



## Tool Assemble 16" Tool without Valve Stem and 20"

- Step 1: Slide striker into body assembly carefully as not to damage the threads on the inside of the body.
- Step 2: Apply anti seize to the internal threads of the body assembly and the external threads of the rear anvil (1)
- Step 3: Install rear anvil first before installing the valve assembly being careful not to damage the threads.
- Step 4: Tighten the rear anvil until it bottoms out. **Do not over torque the rear anvil or back off 1/8 turn.**
- Step 5: Apply a generous amount of lubricant to the valve assembly bushing (2) and inside diameter of the rear anvil
- Step 6: Slide valve assembly through rear anvil and into the striker.



Step 7: Place tailcone over external hoses.

Step 8: Install tailbolts and torque to 250 ft lb (339 Nm) for the 16" tool and 300 ft lb (406 Nm) for the 20" tool in a criss-cross pattern.



## G. Tailbolts - Replace

**IMPORTANT:** Install new bolts when assembling tailcone. Tailbolts are engineered and specially designed for the Hammerhead Mole. Do not substitute other types of bolts.

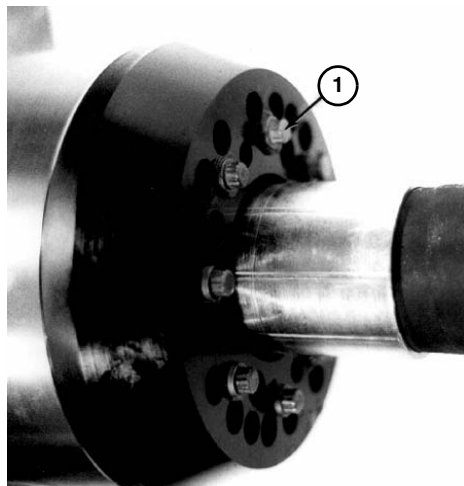
Step 1: Coat threads of tail bolts (1) with anti-seize. Start bolts.

Step 2: Use a cross pattern sequence and tighten tail bolts:

- 12" tool: 120 ft-lb (160 Nm)
- 16" No valve stem style 250 ft lb (339 Nm)
- 16", 20" and 24" tools: 300 ft-lb (407 Nm)

Step 3: Ensure valve stem threads are clean and free from burrs and contamination. Slide rubber bushing over valve stem, ensuring valve is pulled all the way back toward tailcone.

Step 4: Coat jam nut, flange nut, threads of valve stem, and mating faces of two nuts with anti-seize.



## 24" Tool

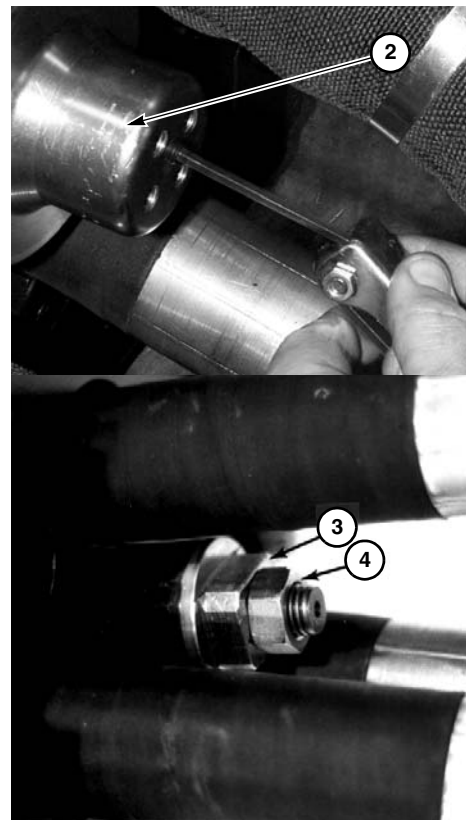
- Step 5: Tighten flange nut (2) against bushing hand tight plus one more revolution.
- Step 6: Align bolt holes in flange nut with machined slots in end of valve stem; insert Allen bolts and tighten to 60 ft-lb (81 Nm).
- Step 7: Install jam nuts and torque to 80 ft-lb (108 Nm).

## 12" and 16" Tools

- Step 5: Install flange nut (3) onto valve stem hand tight plus 3/4 turn.

**IMPORTANT:** Overtightening flange nut will over compress bushing, causing premature failure. The bushing is a wear item and will need replacement periodically.

- Step 6: Hold flange nut with a wrench and tighten jam nut (4) against flange nut to:
- 310 ft-lb (423 Nm) for 12" tool
  - 350 ft-lb (475 Nm) for 16" tool



## MAINTENANCE - AS REQUIRED

### Nose Disassembly

The nose assembly is designed to be trouble-free and does not require maintenance. Should you feel that maintenance is required, please contact your local Hammerhead dealer.

## **Storage**

With nose of tool down, pour 16 oz (1 L) of Hammerhead Anti-Rust Storage Oil into air line. Wait 30 seconds for oil to get into tool. Tape or cap tool whip hoses to prevent dirt and sand from entering tool.



# Section 61: Troubleshooting

## TOOL WILL NOT START

Step 1: Check compressor for proper air output (90-110 psi/620-760 kPa). Improper or low air pressure setting can cause starting problems.

Step 2: Ensure adequate air flow is supplied to tool:

- 12" tool: 600 cfm (16,974 L/min)
- 16" tool: 1100 cfm (31,119 L/min)
- 20" tool: 1300 cfm (36,812 L/min)
- 24" tool: 1,725 cfm (48,800 L/min)

Step 3: Check that full air pressure is available at tool and that hoses and fittings are of proper diameter:

- 12" tool: 1-1/4"(32 mm) or larger
- 16" tool: 2" (50 mm) or larger
- 20" tool: 2-1/2" (67 mm) or larger
- 24" tool: 2-1/2" (67 mm) or larger



**WARNING: High pressure air in hose. Serious injury could occur if struck by hose if uncoupled under pressure. Vent air pressure before disconnecting hose.**

Step 4: Follow these restart procedures while tool is in collets:

a. Disconnect one of forward air supply hoses to tool and inject oil directly into hose:

- 12" and 16" tool: 32 oz (946 ml)
- 20" and 24" tool: 64 oz (2 L)

b. Connect supply line. With *Run / Start* valve in START (12" and 16" tools) or with *Forward / Reverse Valve* in FORWARD (24" tool), snap open air supply valve.

c. If tool does not restart, repeat Steps 4a and 4b.

Step 5: Take tool apart and clean it. (Refer to *Maintenance* section, "Maintenance - 150 Service Hours or Yearly," page 60-2).

Step 6: If tool fails to start after above steps have been performed, return tool to your Hammerhead dealer for inspection.

## TOOL WILL NOT UNLOCK FROM COLLETS

Step 1: Check that *Forward / Reverse Valve* is in REVERSE, and *Run / Start Valve* is in RUN (12-16" tools) or *Muffler Valve* is CLOSED (23" tool).

Step 2: Check compressor for 90-110 psi (620-760 kPa) and adequate air flow:

- 12" tool: 600 cfm (16,974 L/min)
- 16" tool: 1100 cfm (31,119 L/min)
- 20" tool: 1300 cfm (36,812 L/min)
- 24" tool: 1,725 cfm (48,800 L/min)

Step 3: Check air supply lines for possible obstructions.

## TOOL RUNS BUT PIPE WILL NOT MOVE

Step 1: Check that *Forward / Reverse Valve* is in FORWARD and *Run / Start Valve* is in RUN (12-16" tools) or *Muffler Valve* is CLOSED (24" tool).

Step 2: If pipe oscillates back and forth, partially reduce air flow at oiler valve. Soft or wet ground conditions can cause a pipe to lose traction and oscillate. A broken weld in pipe string being rammed also will cause tool to "swim."

Step 3: Put a mark on pipe for reference to determine if it is moving. If pipe has hit an obstruction, use *Forward / Reverse Valve* to maximize impact force. Rotate valve counterclockwise 1/16 - 1/8 turn until tone of impact changes to provide the most impact force.

- Step 4: If pipe won't break through, remove spoil in pipe (refer to *Operating the Tool* section, "Cleaning Out Open Pipe," *page 50-14*), and repeat Step 3.
- Step 5: Check tool to see if it is receiving sufficient oil.
- Step 6: If production slows to less than 1 foot every 15 minutes, stop tool, check for obstacles, and remove any spoil that is packed up against collets. Reinstall tool and try starting tool again. If production is still less than 1 foot /15 minutes, then conditions may be beyond the capabilities of the tool. An option would be to use the next size larger tool. **NOTE:** Exceeding this guideline could result in excessive wear or physical damage to the tool.

Step 7: Tool Cycles Fast And Seems Low On Power

Soil conditions are important to tool operation.

- Dry soil may slow progress.
- Wet soil will reduce body friction allowing a pipe to oscillate, lose traction, or swim.

Avoid losing traction by reducing air flow at control valve during entire operation.

## TOOL RUNS BUT IS LOW ON POWER

- Step 1: Check compressor for proper air output and pressure.
- Step 2: Check that tool is using oil. (Refer to *Controls and Adjustments* section, "Tool Oiler," *page 20-4*).
- Step 3: Check that supply lines and fittings are properly sized (Refer to *Specifications, page 70-1*).
- Step 4: Perform striker tip test:
- a. Place a sling on one end of boring tool.
  - b. Lift at least 27°.
  - c. Listen for striker to slide forward. If it's already forward, tip tool the other way and try again.
  - d. If striker still doesn't slide, inside of tool is dirty and needs to be cleaned.

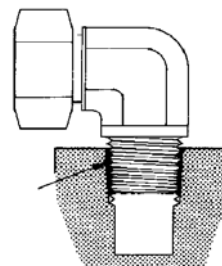
- Step 5: Check striker wear ring end gap (Refer to *Maintenance* section, “B. Striker - Inspect - All Tools,” page 60-9)
- Step 6: Check valve assembly overall length (Refer to *Maintenance* section, “F. Tool - Assemble,” page 60-15).
- Step 7: Check valve rings end gap (Refer to *Maintenance* section, “C. Valve - Inspect,” page 60-11).

# Section 65: Torque Values

## HYDRAULIC FITTINGS

### Pipe Thread Fittings

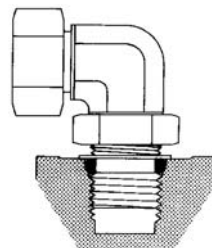
- Ensure all threads are free from nicks, burrs, and dirt.
- Use a thread sealant such as Loctite Vibra-Seal, instead of pipe dope or Teflon tape, to seal the threads. Teflon tape can plug filters and drain orifices, and can cause hydraulic system failures.
- To tighten, turn the fitting approximately three turns past finger tight.



## O-Ring Fittings

- Ensure the threads and sealing surfaces are free from nicks, burrs, scratches, or any foreign material.
- Lubricate the O-ring with a light coat of oil.
- To tighten adjustable O-ring fittings, hold the fitting and tighten the nut.
- To tighten non-adjustable O-ring fittings, tighten the fitting.

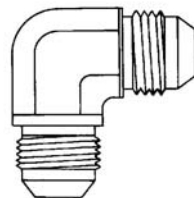
Size	Thread	Torque
#2	5/16" -24	7 - 8 ft-lb (10 - 11 Nm)
#3	3/8" -24	14 -16 ft-lb (19 - 21 Nm)
#4	7/16" -20	16 - 18 ft-lb (21 - 24 Nm)
#5	1/2" -20	22 - 24 ft-lb (29 - 32 Nm)
#6	9/16" -18	24 - 26 ft-lb (33 - 35 Nm)
#8	3/4" -16	40 - 43 ft-lb (54 - 59 Nm)
#10	7/8" -14	68 - 70 ft-lb (93 - 95 Nm)
#12	1-1/16" -12	98 - 102 ft-lb (133 - 138 Nm)
#16	1-5/16" -12	146 - 154 ft-lb (197 - 209 Nm)



## JIC Fittings

- Ensure the threads and sealing surfaces are free from nicks, burrs, scratches, or any foreign material.
- To tighten, turn the fitting until finger tight. Then turn the fitting an additional number of flats as indicated on the chart below. **One flat equals 1/6 of a turn.**

**IMPORTANT: Do not overtighten the fitting.** If overtightened, the female side of the fitting may deform or break, causing the oil flow to become restricted or a leak to form.






Flats from Finger Tight		
Size	New Fittings	Loose Fittings
#4 (1/4")	2 to 2-1/2	3/4 to 1
#6 (3/8")	2 to 2-1/4	1
#8 (1/2")	1-1/2 to 1-3/4	1
#10 (5/8")	1-1/2 to 1-3/4	3/4
#12 (3/4")	1-1/2	3/4
#14 (7/8")	2	1-1/4
#16 (1")	1-1/4 to 1 1/2	3/4 to 1
#20 (1-1/4")	1 1/2	3/4 to 1
#24 (1-1/2")	1 1/4 to 1 1/2	1 to 1 1/4
#32 (2")	1 1/4	3/4 to 1




## FASTENERS

### For SAE Grade 2, Grade 5, and Grade 8 Cap Screws and Bolts






**NOTE:** Torque values specified in text take precedence over values shown below. These values do not apply when used with lock nuts.

	Grade 2 		Grade 5 		Grade 8 	
Bolt Size	Ft-Lb	Nm	Ft-Lb	Nm	Ft-Lb	Nm
1/4" -20 NC	4	5	6	8.5	10	13
1/4" -28 NF	5	6	8	11	11	15
5/16" -18 NC	9	12	13	18	20	27
5/16" -24 NF	10	13	15	20.5	22	29.5
3/8" -16 NC	16	22	25	35	35	47
3/8" -24 NF	18	24	30	40	40	55
7/16" -14 NC	25	35	40	55	55	75
7/16" -20 NF	30	40	45	60	65	88
1/2" -13 NC	40	55	60	80	90	120
1/2" -20 NF	45	60	70	95	95	130
9/16" -12 NC	55	75	90	120	120	165
9/16" -8 NF	60	80	95	130	135	185
5/8" -11 NC	75	100	120	165	180	245











	Grade 2 		Grade 5 		Grade 8 	
<b>5/8" -18 NF</b>	80	110	145	200	195	265
<b>3/4" -10 NC</b>	130	175	210	285	300	405
<b>3/4" -16 NF</b>	145	200	240	325	340	460
<b>7/8" -9 NC</b>	150	205	320	435	500	680
<b>7/8" -14 NF</b>	170	230	350	475	560	760
<b>1" -8 NC</b>	180	245	480	650	800	1085
<b>1" -14 NF</b>	200	270	560	760	920	1250
<b>1 1/8" -7 NC</b>	240	325	700	950	1180	1600
<b>1 1/8" - 2 NF</b>	275	375	780	1060	1340	1815
<b>1 1/4" -7 NC</b>	340	460	1020	1385	1720	2330
<b>1 1/4" - 2 NF</b>	370	500	1140	1545	1900	2575
<b>1 3/8" -6 NC</b>	460	625	1360	1845	2280	3090
<b>1 3/8" -12 NF</b>	540	730	1580	2140	2620	3550
<b>1 1/2" -6 NC</b>	640	870	1840	2495	3060	4150
<b>1 1/2" -12 NF</b>	740	1000	2100	2850	3460	4690

# For Metric Grade 5.8, 6.9, 8.8, 10.9, & 12.9 Cap Screws and Bolts

	Grade 5.8 		Grade 6.9 		Grade 8.8 		Grade 10.9 		Grade 12.9 	
Bolt Size	Ft-Lb	Nm	Ft-Lb	Nm	Ft-Lb	Nm	Ft-Lb	Nm	Ft-Lb	Nm
M4	1.1	1.5	1.7	2.3	2	2.7	2.9	4	3.6	5
M5	2.3	3.1	3.5	4.7	4	5.4	6	8	7	9.5
M6	3.9	5.3	5.8	7.8	7	9.5	10	13.5	11	15
M7	6.5	8.8	9.4	12.7	11	15	16	22	20	27
M8	10	13.5	14	19	18	24	25	34	29	39
M10	20	27	29	39	32	43	47	64	58	79
M12	34	46	50	68	58	79	83	112.5	100	136
M14	54	73	79	107	94	127	133	180	159	216
M16	80	108.5	122	165	144	195	196	266	235	319
M18	114	155	170	230.5	190	258	269	365	323	438
M20	162	220	220	298	260	353	366	496	440	597
M22	202	274	318	431	368	499	520	705	628	852
M24	245	332	410	556	470	637	664	900	794	1077
M27	360	488	606	822	707	959	996	1351	1205	1634
M30	500	678	815	1105	967	1311	1357	1840	1630	2210

## For Grade B, C, F, and G Lock Nuts

	Grade B (Grade 5) 		Grade C (Grade 8) 		Grade F (Grade 5 Flange) 		Grade G (Grade 8 Flange) 	
Nut Size	Ft-Lb	Nm	Ft-Lb	Nm	Ft-Lb	Nm	Ft-Lb	Nm
1/4" -20 NC	7.5 - 10	10 - 13	10 - 14	14 - 19	8 - 10	11 - 14	12 - 16	16 - 21.5
1/4" -28 NF	8 - 10	11 - 14	10 - 14	14 - 19	9 - 12	12 - 16	12 - 17	16 - 23
5/16" -18 NC	14 - 17.5	19 - 24	17.5-22.5	24 - 30.5	15 - 20	20 - 27	19.5 - 27	27 -36
5/16" -24 NF	15 - 18	20 - 25	18 - 23	25 - 32	16 - 22	21.5 - 29	19.5 - 26	27 - 35
3/8" -16 NC	21 - 27	28.5 - 37	29 - 37	39 - 50	22.5 - 32.5	30.5 - 44	30 - 41	41 - 56
3/8" -24 NF	27.5 - 38	37 - 51.5	22.5 - 31	30.5 - 42	23.5 - 31.5	32 - 43	31 - 42	42 - 57
7/16" -14 NC	31 - 40	42 - 54	39 - 53	53 - 72	36 - 50	49 - 68	45 - 62	61 - 84
7/16" -20 NF	39 - 51	53 - 69	41 - 56	56 - 76	38 - 53	51.5 - 72	51 - 71	69 - 96
1/2" -13 NC	49.5 - 62.5	67 - 85	62 - 79.5	84 - 108	50.5 -69.5	68.5 - 94	72 - 102	98 - 132
1/2" -20 NF	50 - 65	68 - 88	67 - 87	91 - 118	56.5 -78.5	77 - 106	67 - 106	91 - 144
9/16" -12 NC	67 - 87	91 - 118	95 - 120	129 - 163	72 - 102	98 - 132	105 - 145	142 - 197
9/16" -18 NF	74.5 - 94.5	101 - 128	95 - 120	129 - 163	79 - 111	107-150.5	113 - 157	153 - 213
5/8" -11 NC	95 - 120	129 - 163	125 -157.5	169.5-214	100 - 137	136 - 186	130 - 178	176 - 241
5/8" -18 NF	97.5-122.5	132 - 166	125 - 160	169.5 -217	105 - 145	142 - 197	150 - 210	203 - 285
3/4" -10 NC	160 - 200	217 - 271	200 - 255	271 - 346	170 - 230	230.5-312	205 - 285	278-386.5

	Grade B (Grade 5) 		Grade C (Grade 8) 		Grade F (Grade 5 Flange) 		Grade G (Grade 8 Flange) 	
<b>3/4" -16 NF</b>	155 - 200	210 - 271	200 - 255	271 - 346	163 - 227	221 - 308	215 - 315	291.5-427
<b>7/8" -9 NC</b>	235 - 300	319 - 407	295-382.5	400 - 519				
<b>7/8" -14 NF</b>	250 - 320	339 - 434	295-382.5	400 - 519				
<b>1 -8" NC</b>	345 - 445	468 - 603	450-512.5	610 - 695				
<b>1 -14" NF</b>	370 - 470	502 - 637	452.5-590	617 - 800				

# Section 70: Specifications

## LUBRICANTS

Lubricant / Capacity	Specifications / Notes
<b>Mole Summer Oil</b> / as needed For temperatures above 45° F (7° C)	<b>SAE 10W / ISO 22</b> <i>Hammerhead® Lubricating Oil</i>
<b>Mole Winter Oil</b> / as needed For temperatures below 45° F (7° C)	<b>SAE 5W / ISO 46</b> <i>Hammerhead® Winter Oil</i>
<b>Mole Anti-Rust / Storage Oil</b> / as needed	<b>SAE 20W / ISO 68</b> <i>Hammerhead® Anti-Rust / Storage Oil</i>

## PART NUMBERS

Air Feed Lines should be two-wire steel braid hydraulic type supply hose.			
	Forward Hose	Reverse Hose	Mist Oiler
<b>12" Tool</b>	P/N 1030, 1-1/4" x 30 ft	P/N 1044, 1-1/4" x 50 ft with male JIC	P/N 1400
<b>16" Tool</b>	P/N 1050, 2" x 50 ft	P/N 1039, 1-1/2" x 50 ft	P/N 1600
<b>20" Tool</b>			
<b>24" Tool</b>	PN 220242, 3" x 50 ft	PN 1050, 2" x 50 ft	PN 1700

TOOL SPECIFICATIONS				
Diameter	12"(30 cm)	16"(39.4 cm)	20" (50.8 cm)	24" (60 cm)
Length	91"(231 cm)	91"(231 cm)	108" (274 cm)	132" (335.3 cm)
Weight	1568 lb (711 kg)	2700 lb (1225 kg)	5750 lb (2608 kg)	9,340 lb (4,237 kg)
Air Consumption	600 cfm (16,974 L/min)	1100 cfm (31,119 L/min)	1300 cfm (36,812 L/min)	1,725 cfm (48,800 L/min)
Internal Access	via 16 tailbolts	via 12 tailbolts	via 24 tailbolts	via 20 tailbolts
Tail Bolt Torque	120 ft-lb (162 Nm)	300 ft-lb (407 Nm)	300 ft-lb (407 Nm)	300 ft-lb (407 Nm)
Operating Pressure (maximum)	110 psi (760 kPa)	110 psi (760 kPa)	110 psi (760 kPa)	110 psi (760 kPa)
Rear Anvil Clampload	208,000 lb (94,350 kg)	380,000 lb (172,365 kg)	457,000 (207,291 kg)	630,000 lb (186,000 kg)
Reversible	Air reverse	Air reverse	Air reverse	Air reverse
Blows per Minute	256	231	190	177
Pushing Collets	6-24" (15-60 cm) in increments of 2" (5 cm)	6-24" (15-60 cm) in increments of 2" (5 cm)	24" and 30" (60 and 76 cm)	24" and 30" (60 and 76 cm)
Pipe Seals	6-24" (15-60 cm) in increments of 2" (5 cm)	6-24" (15-60 cm) in increments of 2" (5 cm)	24", 30", 36", 42" (60, 76, 91, 106 cm)	24", 30", 36", 42" (60, 76, 91, 106 cm)
Pipe Pigs	6-24" (15-60 cm) in increments of 2" (5 cm)	6-24" (15-60 cm) in increments of 2" (5 cm)	24" and 30" (60 and 76 cm)	24" and 30" (60 and 76 cm)
Pipe Ram Collars	30, 32, 36" (76, 81, 91 cm) (must be used with 24"/60 cm pushing collets)	30, 32, 36, 42, 48"(76, 81, 91, 107, 122 cm)	30, 32, 36, 42, 48, 54, 60", 72" (76, 81, 91, 107, 122, 137, 152, 182 cm)	30, 32, 36, 42, 48, 54, 60", 72" (76, 81, 91, 107, 122, 137, 152, 182 cm)
(Page 1 of 2)				

## TOOL SPECIFICATIONS (CONTINUED)

<b>Soil Shoes</b>	6-24" (15-60 cm) in increments of 2" (5 cm)	6-24" (15-60 cm) in increments of 2" (5 cm)	Refer to the <i>Preparing for Operation</i> section, "Soil Shoes - 20" and 24"Tool," <i>page 40-4</i>	Refer to the <i>Preparing for Operation</i> section, "Soil Shoes - 20" and 24"Tool," <i>page 40-4</i> .
<b>(Page 2 of 2)</b>				

<b>STEEL PIPE REFERENCE SCHEDULE</b>			
<b>Pipe Size</b>	<b>Outside Diameter Inches (Centimeters)</b>	<b>Standard Wall Thickness Inches (Millimeters)</b>	<b>Weight Per Foot Pounds (Kilograms)</b>
4	4.500 (11.43)	.237 (6.2)	10.79 (4.9)
4-1/2	5.000 (12.7)	.247 (6.3)	12.53 (5.7)
5	5.563 (14.13)	.258 (6.6)	14.62 (6.6)
6	6.625 (16.83)	.280 (7.1)	18.97 (8.6)
7	7.625 (19.37)	.301 (7.6)	25.37 (11.5)
8	8.625 (21.91)	.322 (8.2)	28.55 (13.0)
9	9.625 (24.45)	.342 (8.7)	33.90 (15.4)
10	10.750 (27.31)	.365 (9.3)	40.48 (18.4)
11	11.750 (29.85)	.375 (9.5)	45.55 (20.7)
12	12.750 (32.39)	.375 (9.5)	49.56 (22.5)
14	14.000 (35.56)	.375 (9.5)	54.57 (24.8)
<b>(Page 1 of 2)</b>			



## STEEL PIPE REFERENCE SCHEDULE (CONTINUED)

Pipe Size	Outside Diameter Inches (Centimeters)	Standard Wall Thickness Inches (Millimeters)	Weight Per Foot Pounds (Kilograms)
16	16.000 (40.64)	.375 (9.5)	62.58 (28.4)
18	18.000 (45.72)	.375 (9.5)	70.59 (32.0)
20	20.000 (50.8)	.375 (9.5)	78.60 (35.7)
22	22.000 (55.88)	.375 (9.5)	87.00 (39.5)
24	24.000 (60.96)	.375 (9.5)	94.62 (42.9)
30	30.00 (76.2)	.375 (9.5)	118.65 (53.8)
32	32.00 (81.28)	.375 (9.5)	126.66 (57.6)
36	36.00 (91.44)	.375 (9.5)	142.68 (64.7)
42	42.00 (106.68)	.375 (9.5)	166.71 (75.6)
48	48.00 (121.92)	.375 (9.5)	190.74 (86.5)

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## RECOMMENDED PIPE SCHEDULES FOR SOIL SEALS

Pipe Size	Recommended Schedules		Recommended Pipe I.D.s		Minimum Wall Inches (Millimeters)
	Standard O-ring Seal	Oversized O-ring Seal	Standard O-ring Seal Inches (Centimeters)	Oversize O-ring Seal Inches (Centimeters)	
6	STD (40)	10, 5	6.07/6.19 (15.4/15.7)	6.32/6.44 (16.1/16.4)	.109 (2.8)
8	20, 30, STD (40), 60*	10, 5	7.98/8.10 (20.3/20.6)	8.23/8.36 (21/21.2)	.148 (3.8)
10	30, STD (40)	20, 10	10.02/10.14 (25.5/25.8)	10.27/10.40 (26.1/26.4)	.250 (6.4)
12	30, STD (40)	20	11.94/12.06 (30.33/30.7)	12.19/12.32 (31/31.3)	.250 (6.4)
14	STD (30), 40	20, 10	13.125/13.25 (33.3/33.7)	13.375/13.50 (34/34.3)	.250 (6.4)
16	STD (30)	20, 10	15.125/15.25 (38.4/38.7)	15.375/15.50 (39.1/39.4)	.250 (6.4)
18	STD (30)	20, 10	17.125/17.25 (43.5/43.8)	17.375/17.50 (44.1/44.5)	.250 (6.4)
20	STD (20)	10	19.125/19.25 (48.6/48.9)	19.375/19.50 (49.2/49.5)	.250 (6.4)
22	STD (20)	10	21.125/21.25 (53.7/54)	21.375/21.50 (54.3/54.6)	.250 (6.4)
24	STD (20)	10	23.125/23.25 (58.7/59.1)	23.375/23.50 (59.4/59.7)	.250 (6.4)
30	EH		28.875/29.00 (73.3/73.6)		.375 (9.5)

\* Vermeer pushing collets will not ram this schedule pipe.

## RECOMMENDED RAMMING SCHEDULES

Collet Size	Tool	Schedules	Pipe Inside Diameter Inches (Centimeters)		Minimum Wall Inches (Millimeters)
			Minimum	Maximum	
4"	4"	STD (40)	3.97 (10.1)	4.13 (10.5)	.188 (4.8)
	5 1/8"	STD (40)	3.97 (10.1)	4.13 (10.5)	.188 (4.8)
	5 3/4"*	STD (40)	3.97 (10.1)	4.13 (10.5)	.188 (4.8)
6"	4"	STD (40)	5.95 (15.1)	6.25 (15.9)	.188 (4.8)
	5 1/8"	STD (40)	5.95 (15.1)	6.25 (15.9)	.188 (4.8)
	5 3/4"	STD (40)	5.95 (15.1)	6.25 (15.9)	.188 (4.8)
	7";8"	STD (40)	5.95 (15.1)	6.25 (15.9)	.188 (4.8)
8"	5 3/4"	20, 30, STD (40)	7.87 (20.0)	8.13 (20.7)	.250 (6.4)
	7"; 8"; 12"; 16"	20, 30, STD (40)	8.03 (20.4)	8.13 (20.7)	.250 (6.4)
10"	5 3/4"	20, 30, STD (40)	9.87 (25.1)	10.25 (26.0)	.250 (6.4)
	7"; 8"; 12"; 16"	20, 30, STD (40)	9.87 (25.1)	10.25 (26.0)	.250 (6.4)
12"	5 3/4"	20, 30, STD, 40	11.85 (30.1)	12.25 (31.3)	.250 (6.4)
	7"; 8"; 12"; 16"	20, 30, STD, 40	11.85 (30.1)	12.25 (31.1)	.250 (6.4)
14"	7"; 8"; 12"; 16"	20, STD (30), 40, EH**	13.00 (33.0)	13.38 (34.0)	.312 (7.9)
16"	7"; 8"; 12"; 16"	20, STD (30), EH 40**	15.00 (38.1)	15.38 (39.1)	.312 (7.9)
18"	7"; 8"; 12"; 16"	20, STD, 30, EH**	17.00 (43.2)	17.38 (44.1)	.312 (7.9)
20"	8"; 12"; 16"	STD (20), EH (30)**	19.00 (48.3)	19.25 (48.9)	.375 (9.5)
22"	8"; 12"; 16"	STD (20), EH (30)**	21.00 (53.3)	21.25 (54.0)	.375 (9.5)
24"	8"; 12"; 16"	STD (20), EH**	23.00 (58.4)	23.25 (59.1)	.375 (9.5)
30"	12"; 16"	EH (20)	29.00 (73.7)	29.25 (74.3)	.500 (12.7)

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**RECOMMENDED RAMMING SCHEDULES (CONTINUED)**

Collet Size	Tool	Schedules	Pipe Inside Diameter Inches (Centimeters)		Minimum Wall Inches (Millimeters)
			Minimum	Maximum	
32"	12"; 16"	EH (20)	31.00 (78.7)	31.25 (79.4)	.500 (12.7)
36"	12"; 16"	EH (20)	35.00 (88.9)	35.25 (89.2)	.500 (12.7)
42"	16"	EH	41.00 (104.1)	41.25 (104.8)	.500 (12.7)
48"	16"	EH	47.00 (119.4)	47.25 (120.0)	.500 (12.7)

\* Must be used with pushing adaptor.  
\*\* Although these schedules can be installed, Hammerhead pipe seals are not recommended for spoil removal.

## PVC PIPE TYPE I SCHEDULE 40 NSF

Nominal Pipe Size (Inches)	O.D.	Average I.D.	Nominal Wt./ft. Type I	Bell or Connecting Sleeve Min. O.D.
1/8	.405	.261	.045	.541
1/4	.540	.354	.081	.716
3/8	.675	.483	.120	.857
1/2	.840	.608	.161	1.058
3/4	1.050	.810	.214	1.276
1	1.315	1.033	.315	1.581
1 1/4	1.660	1.304	.426	1.94
1 1/2	1.900	1.592	.509	2.19
2	2.375	2.049	.687	2.70
2 1/2	2.875	2.446	1.076	3.281
3	3.500	3.042	1.409	3.94
3 1/2	4.000	3.520	1.697	4.452
4	4.500	3.998	2.006	4.974
5	5.563	5.017	2.776	6.07
6	6.625	6.031	3.536	7.185
8	8.625	7.943	5.305	9.269
10	10.750	9.976	7.532	11.480
12	12.750	11.890	9.949	13.562
14	14.000	13.072	11.810	14.87

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**12", 16", 20" and 24" HammerHead Mole**

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# Revision History

Revision	Date	Page(s)	Description
OMSE96-1R1	09/96	All	First revised edition 12" (300 mm) manual printed
OMJL96-1	07/96	All	First edition 16" (400 mm) manual printed
23_o-m1_00	09/00	All	First edition 23" (580 mm) manual printed
12_16_23_o-m2_03	09/03	All	12", 16", 23" manuals combined
12_16_20_24_o-m10_04	10/04	All	Added 20" Tool and oiler. Updated 23" tool to 24" tool

