

HAMMERHEADTM

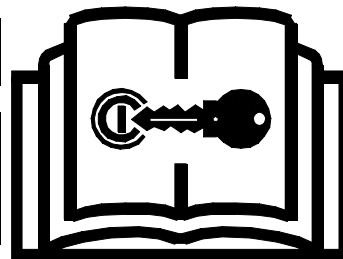
2" (45mm) - 5-3/4" (145mm)

Screw Reverse

HammerHead Mole®

Pneumatic Boring Tools

Operator's and Maintenance Manual



Screw Reverse Mole Serial # 50000 and Higher
Order No. OM1201

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 and maintenance instructions are included in the Operator's Manuals provided with the machine. The tethered (cabled) manual must remain attached to the machine for ready reference. Store it in the manual storage box when not in use.

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

Copyright© 2010 All rights reserved.
Earth Tool Company LLC
1300 Capitol Dr.
Oconomowoc, WI 53066

HAMMERHEAD MOLE® is a trademarks of	Earth Tool Company LLC, Oconomowoc, Wisconsin.
SCOTCH-BRITE is a trademark of	3M Corporation, aka Minnesota Mining and Manufacturing Co.

Screw Reverse Mole

PATENTS

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

US 5,025,868	US 5,199,151	US 5,487,430	US 5,317,953	US 5,465,797
US 5,440,797	US 5,494,116	US 5,505,270	US 5,603,383	US 5,651,639
US 5,687,803	US 5,782,311	US 6,148,935	US 6,171,026	US 6,260,634
US 6,261,027	US 6,263,983	US 6,269,889	US 6,273,201	US 6,283,229
US 6,302,410	US 6,299,382	US 5,337,837	US 6,321,858	US 6,390,207
US 6,371,223	US 6,390,087			

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

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 USA**

This page intentionally left blank.

Receiving and Delivery Report

DEALER PREP

Check or perform the following:

- ___ Check tailcone or tailbolts. For 2" Mole torque tailbolts to 10 ft. lb. (14 Nm). For 2-1/2" Mole torque tailbolts to 28 ft. lb. (37 Nm). For 3" Mole and larger, torque tailbolts to 35 ft. lb. (47 Nm).
- ___ Check for foreign material around the hose connection at the tool and exhaust ports.
- ___ Check for foreign material in the hose and around the hose coupler.
- ___ Check forward and reverse valve for proper function.
- ___ Check internal striker by tipping tool back and forth. The striker should slide freely.
- ___ Check the condition of the decals.

Review of Operation

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

- ___ Overall explanation of how HammerHead Mole pneumatic boring tool works.
- ___ HammerHead Mole safety measures.
- ___ Preparing the HammerHead Mole boring tool for operation.

Dealer/Customer Information

dealer

owner

address

address

city

city

state / province

state / province

zip / postal code

zip / postal code

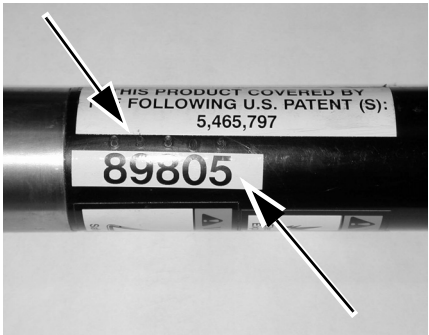
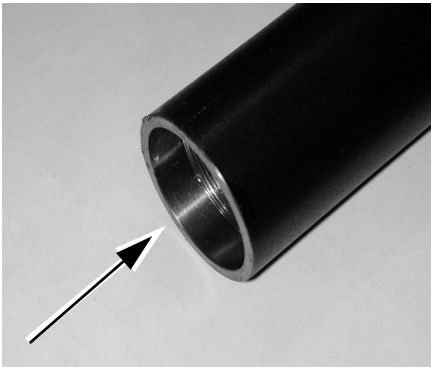
country

country

IDENTIFICATION NUMBERS - RECORD

Machine Model Number _____

Machine Serial Number _____



This page intentionally left blank.

Table of Contents

Receiving and Delivery Report	i	Entry and Exit Pits	30-2
Dealer Prep	i	Preparing to Bore	30-2
Review of Operation	i	Boring	30-3
Dealer/Customer Information	ii	After the Bore	30-4
Identification Numbers - Record	iii	Reversing Direction	30-4
Safety Messages	10-1	Accessories	30-6
Safety Decals	11-1	Tool Cable	30-6
Safety Decal Maintenance	11-1	Pulling Carrots	30-6
How the HammerHead Mole Works	20-1	Pneumatic Fitting with Eyebolt	30-7
Controls and Adjustments	21-1	Pulling Chain Assembly	30-7
Air Valve Screw Reverse	21-1	Clevis Nut	30-7
Tool Oiler	21-1	Eye Nut	30-8
Pressure Relief	21-1	Pipe Pilot	30-8
Check and Add Oil	21-2	Quick Links	30-8
Oiler - Adjust	21-2	Tap Puller	30-9
Rear Whip Hose	21-3	Pipe Puller - Die	30-9
Vari-Pitch Level	21-3	Tensioner Frame	30-10
SAE	21-4	Replaceable Head Option	30-10
Metric	21-4	Pipe Ramming	31-1
Operating the Tool	30-1	Call Your One-Call System First	31-1
Call Your One-Call System First	30-1	Preparing the Site	31-2
		Pushing Closed Pipe	31-3
		Threaded Pipe	31-3
		Welded Pipe	31-4
		Pushing Open Pipe	31-4

Starting the Push	31-5
Completing the Push	31-7
Cleaning Out Open Pipe	31-7
Accessories	31-11
Soil Shoes: 6-12" (15-30 cm) in 2" (5 cm) Increments ..	31-11
Pushing Collets - 6-24" (15-60 cm) in 2" (5 cm) Increments	31-11
Pipe Seals - 6-24" (15-60 cm) in 2" (5 cm) Increments ..	31-12
Pipe Pigs - 6-24" (15-60 cm) in 2" (5 cm) Increments ..	31-12
Maintenance - 30 Service Hours	40-1
Striker Wear Rings - Check	40-1
Valve Wear Ring - Check	40-1
Maintenance - 150 Service Hours or Yearly	41-1
A. Tool - Disassemble	41-1
B. Striker - Inspect	41-2
C. Valve - Inspect	41-5
D. Valve Removal	41-8
E. Inspect Valve End Hose Whip	41-9
F. Inspect Rear Anvil	41-9
G. Screw Reverse - Assemble	41-10
Maintenance - As Required	50-1
Storage	50-1
Troubleshooting	51-1
Tool Will Not Start	51-1
Tool Will Not Reverse Direction	51-2
Tool Runs but Will Not Move in Hole	51-2
Tool Cycles Fast and Seems Low On Power	51-3

Tool Slows Down During Long Bores	51-3
Tool Runs but Is Low On Power	51-3
Valve Whip Hose Will Not Thread Into Rear Anvil	51-4
Specifications	60-1
Lubricants	60-1
Hammerhead Mole Summer Oil	60-1
Hammerhead Mole Winter Oil	60-1
Hammerhead Mole Anti-Rust Oil	60-1
PVC Pipe Type I Schedule 40 NSF	60-3
Torque values	61-1
Hydraulic Fittings	61-1
Pipe Thread Fittings	61-1
O-Ring Fittings	61-2
JIC Fittings	61-3
Fasteners	61-4

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 procedures are not followed.

UNDERSTANDING 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.



UNDERSTANDING 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

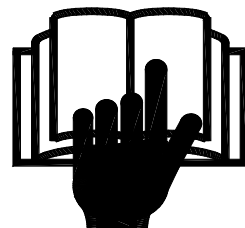
Do not operate the machine unless the instructions in the following manuals have been carefully read and understood:

- This HammerHead Mole Operator's Manual
- Air Compressor Manual

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.



CALL YOUR ONE-CALL SYSTEM FIRST

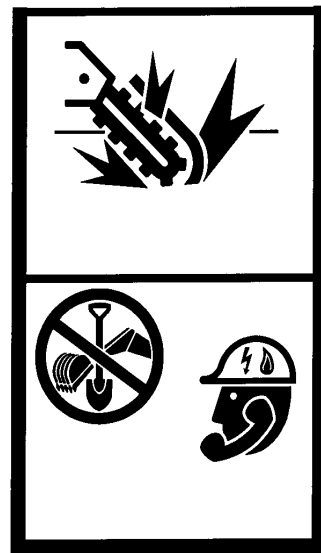


WARNING: Always contact your local One-Call system before starting a digging project

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 to locate and mark the underground installations. If you don't call, you may have an accident, 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, you can dial the North America 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.....Communicatio, 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 drilling, contact the One-Call System to locate all buried utilities in and around boring path.

- select a boring path that will not intersect buried utilities.
- Never bore 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

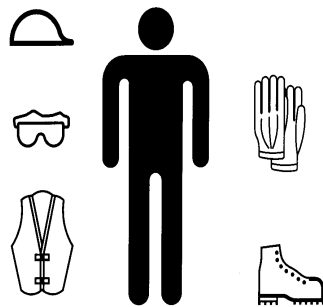
Wear required personal protective equipment.

Wear close fitting clothing and confine long hair.

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

Always wear:

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



CHECK LAWS AND REGULATIONS

Know and obey all Federal, State, and local laws and regulations that apply to your work situation.

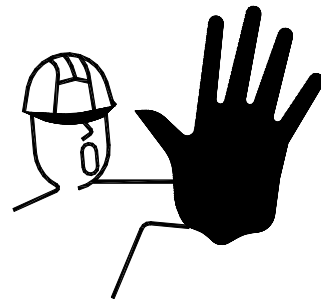
DO NOT WORK IN TRENCH

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.



KEEP SPECTATORS AWAY FROM MACHINE

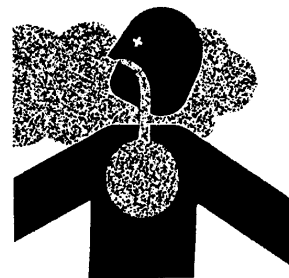
Keep all spectators and other workers away from the machine and work area while in operation



WORK IN VENTILATED AREA

Exhaust fumes can be fatal.

If operating the machine in an enclosed area, remove the exhaust fumes with an exhaust pipe extension to the outside.

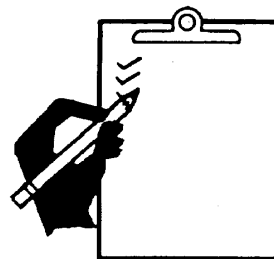


KEEP MACHINE IN GOOD CONDITION

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

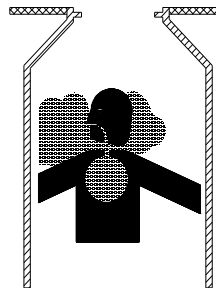
Visually inspect the machine daily before starting the machine. Refer to the daily pre-starting inspection section.

Make no modifications to your equipment unless specifically recommended or requested by Vermeer Manufacturing Company.



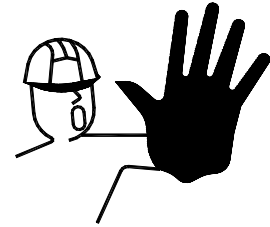
CONFINED SPACE REGULATION

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.



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.



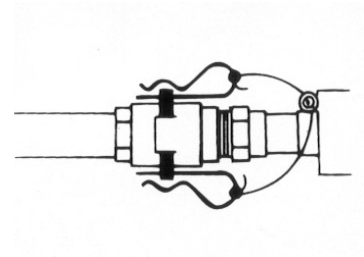
HANDLING THE BORING TOOL

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

CHECK HARDWARE

Ensure all airline 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.

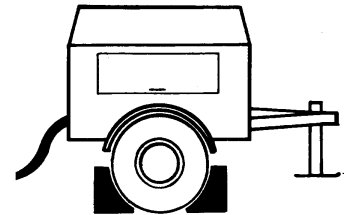
Check the tightness of the 4 tailcone bolts before use. Tailcone bolts should be torqued to the correct value.



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 (7.6 bar). 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 supply hose does not create an unsafe condition around the pit.

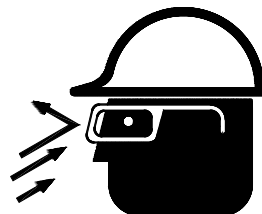
Eye protection is necessary when using the boring tool. Avoid looking into the bore hole while the boring tool is in use. High pressure exhaust can eject dirt, stones, or other materials. Be careful when blowing out the hose. Aim the hose away from yourself and other persons.

If the tool runs but does not move forward, turn off the air supply. Check to ensure the tool is not in contact with a gas line, waterline, electric 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 components strength and result in premature failure or personal injury.

When the tailcone and rear anvil are removed, be careful when elevating 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 resulting serious injury or death. This manual is to be used only for those purposes for which it was intended as explained in this Operator's Manual.

Section 11: Safety Decals

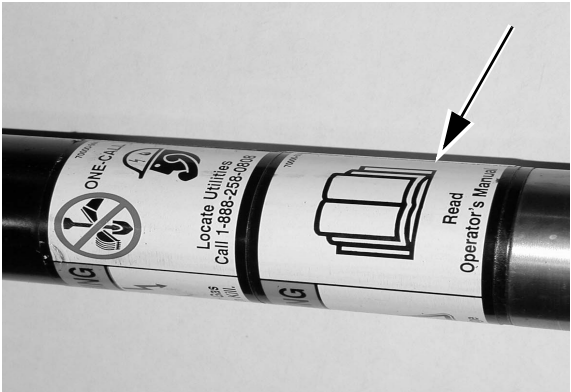
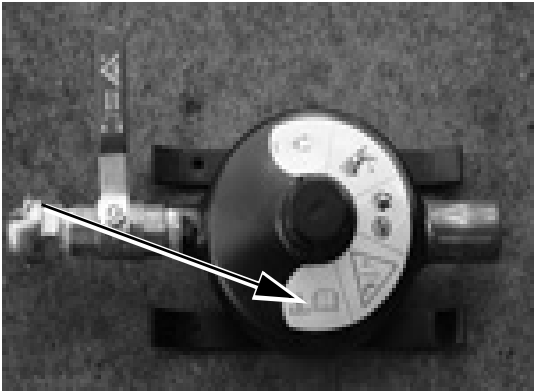
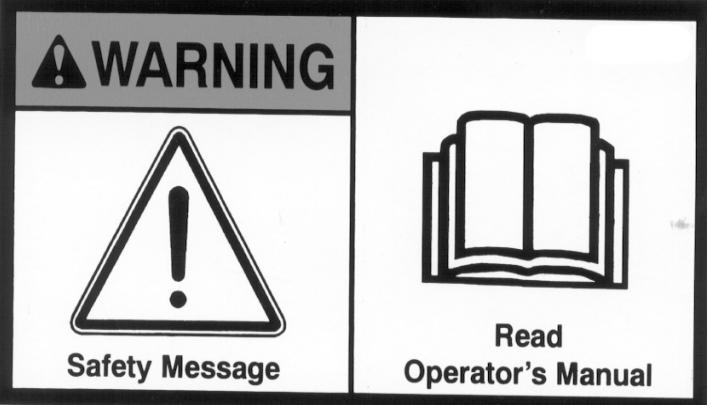
INSPECTING SAFETY DECALS

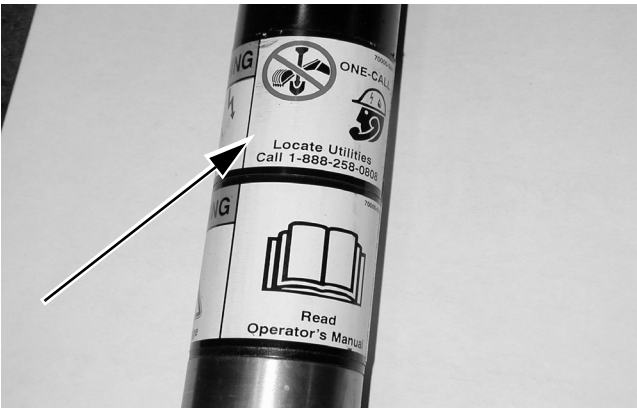
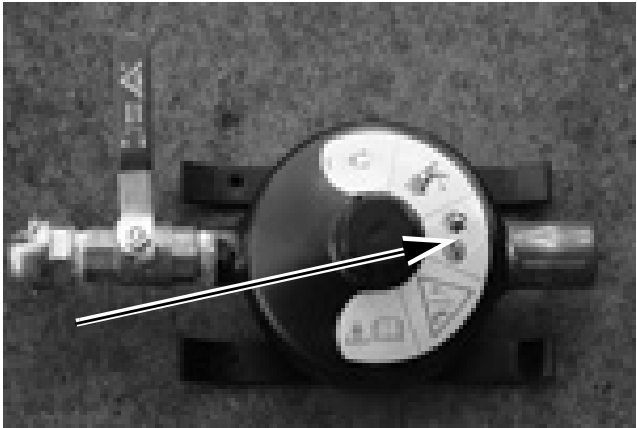
Safety decals located on your machine contain important and useful information that will help you operate your equipment safely.

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

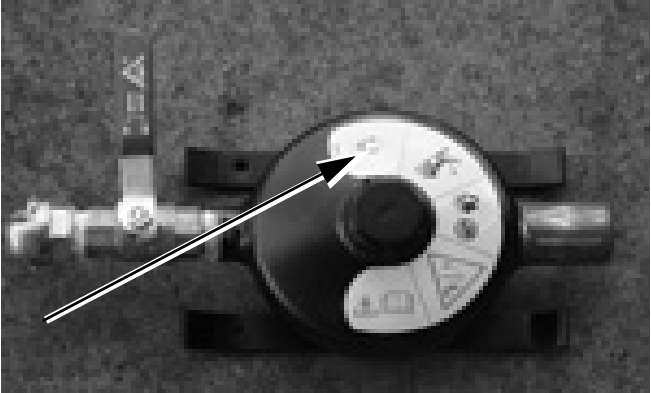
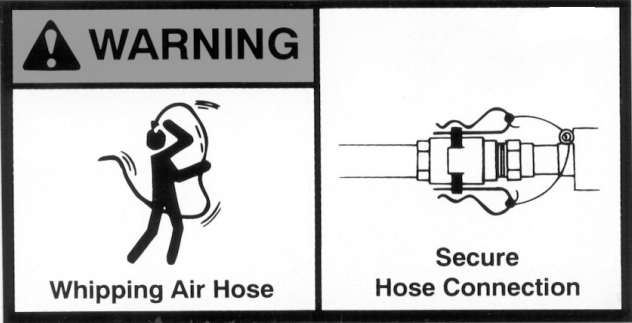
- Keep decals clean. Use soap and water - not mineral spirits, abrasive cleaners, or other similar cleaners that will damage the decal.
- Replace any damaged or missing decals except the decal (HammerHead) located on the tool body. When attaching decals, the temperature of the mounting surface must be 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.

Safety Decals





Safety Decals



Section 20: How the HammerHead Mole Works

The HammerHead Screw Reverse Moles use pneumatic power to drive the striker inside the tool forward at a very high velocity. The striker then impacts the anvil at the front of the tool driving the tool forward into the soil. As the striker travels forward, ports in the rear of the striker pass by the valve opening an air passage to the front of the tool. This allows the air to be redirected and push the striker towards the rear of the tool. Before the striker has a chance to hit the rear anvil, the striker passes the ports again and redirects the air, forcing the striker forward again.

When the tool is placed into reverse, the valve timing is changed so that the forward stroke of the striker becomes shorter and the reverse stroke becomes longer. This allows the striker to impact the rear anvil, not the front anvil, propelling the tool in the reverse direction.

This page intentionally left blank.

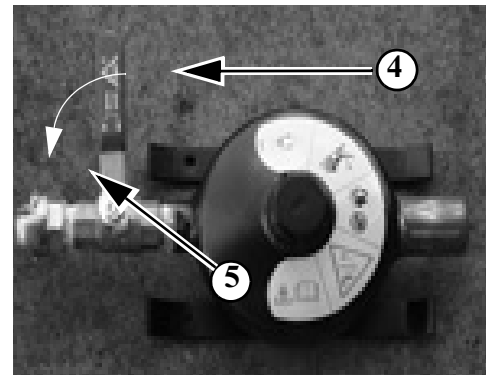
Section 21: Controls

AIR VALVE

Position (1) (shown) off

Position (2) parallel to valve body) on

Tool speed is variable; the farther the handle is turned toward (2), the faster the speed.



TOOL OILER

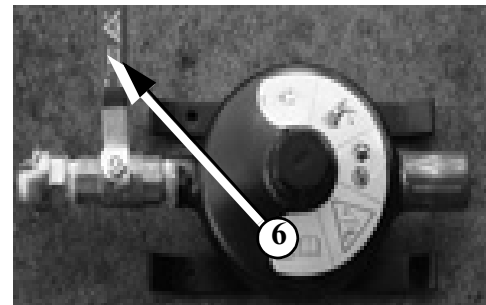
During operation, the oiler unit continuously lubricates the air power tool

IMPORTANT: When operating the tool for the first time, add 1/2 oz. (15 cc) of oil directly to the tool whip hose to provide lubrication during start-up.

Pressure Relief

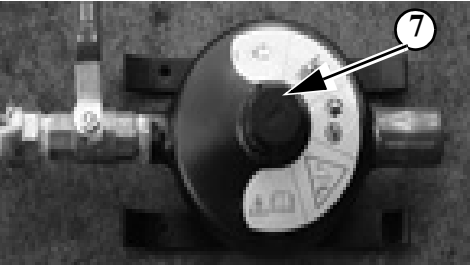
Immediately upon closing the ball valve (3) the oiler stops oiling and the tank depressurizes allowing for fill cap removal.

- at the end of each use.
- before adding oil to reservoir.
- before disconnecting hoses.



Oil - Check and Add

- Step 1: Turn off air supply.
 - Step 2: Remove fill plug (4) and check/add oil (refer to *Specifications, Page 60-1.*)
- IMPORTANT:** Do not overfill the reservoir. The oiler requires a small air space to pressurized the oiler to force the oil into the air line.

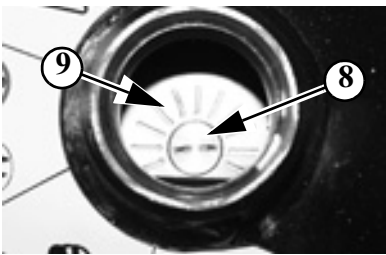


Oiler - Adjust

Screw (5) (inside the oiler) controls the amount of oil supplied to the tool. Remove the fill plug and use a screwdriver to turn the screw to adjust the rate of oil delivery.

“Fully CW”closed
“3/8 Turn CCW from closed”lowest recommended rate
“1 full turn CCW from closed”highest recommended rate
To adjust:

- Step 1: Turn of air supply.
 - Step 2: Remove fill plug (4) and turn adjustment screw (5) with a slotted screwdriver.
 - Step 3: Use the chart below for proper settings for each particular size tool.
- NOTE:** It may take up to 30 minutes before a setting change is noticed in the tool.



TOOL SIZE	Turns CCW from Closed
2" (45 mm)	1
2-1/2" (63 mm)	7/8
3" (75 mm)	7/8
4" (98 mm)	1/2
5-1/8" (130 mm)	3/8

NOTE: The adjustment screw has been set at the factory. To reset or adjust the oiler, turn adjustment screw clockwise until closed then turn screw counterclockwise 1 full turn. This setting is suitable for 1-3/4" to 3" tools. Larger tools 4" - 5-5/8" will need to have the setting at 1/2 turn CCW from closed. The hash marks (6) represent 1/16 of a turn. For example to adjust the oiler to 7/8 open, fully close the screw then open 1 full turn. Note where the slot in the adjustment screw is and then close the screw 2 hash marks. The oiler is now set to 7/8 open.

REAR WHIP HOSE

Turning the whip hose (1) controls which direction the tool travels.

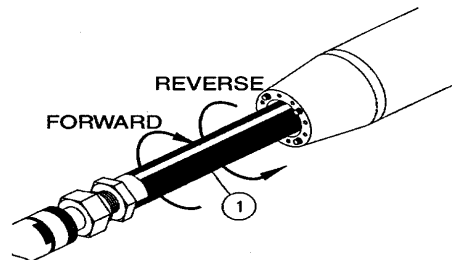
Clockwise forward travel

Counterclockwisereverse travel

IMPORTANT: Shut off the air supply to the tool before changing directions. Failure to do so will damage the valve assembly on the Air Spring Power Port Tool.

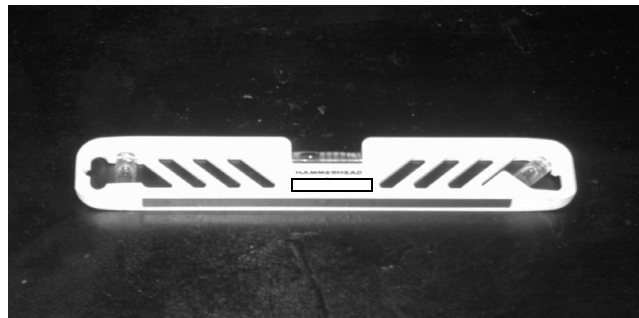
NOTE: With the optional quick Reverse swivel fitting, the air supply hose does not need to be disconnected.

The Power Port feature of the tools provides only a 1/4 turn to change direction from FORWARD to REVERSE or REVERSE to FORWARD.



VARI-PITCH LEVEL

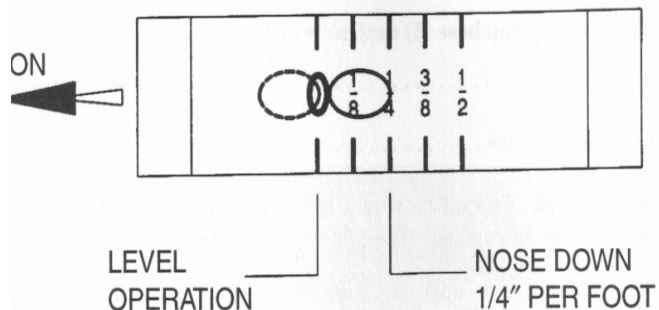
Use the level to set the boring angle of the tool



SAE

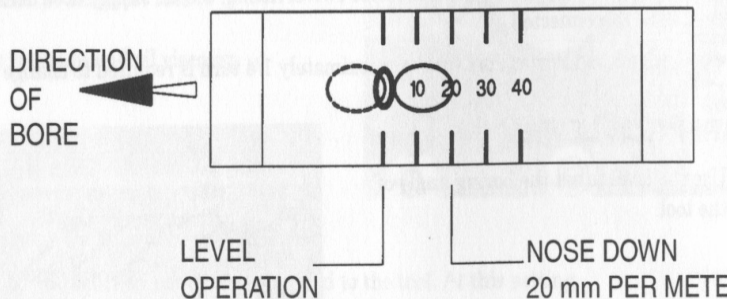
The right edge of the bubble indicates the slope or pitch in "inches per foot." The dashed bubble indicates "level."

The solid bubble indicates a 1/4" per foot pitch down.



METRIC

The right edge of the bubble indicates the slope or pitch in "millimeters per meter." The dashed line bubble indicates "level." The solid bubble indicates a 20 mm per meter pitch, down.



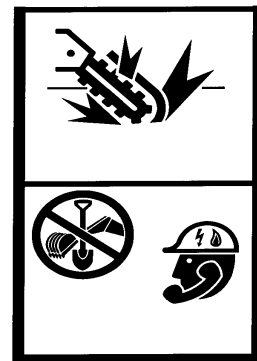
Section 30: Operating the Tool

CALL YOUR ONE-CALL SYSTEM FIRST



WARNING: Electricity or gas explosion can kill. Laser light in cut cable can result in eye damage.

Locate utilities before digging. Call 811 or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.



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. For areas not represented by One-Call systems International, contact the appropriate utility companies or national regulating authority 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 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	

IMPORTANT: Be sure to review the operating and safety instructions for the air compressor and any other support equipment.

ENTRY AND EXIT PITS

The depth of the entry pit should be approximately 10 times the tool diameter.

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

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

PREPARING TO BORE

Step 1: Determine the length of the bore.

Step 2: Starting at the tool, wrap tape over the hose every 3 - 6 ft (1 - 2 m). Do this for the length of the bore. While boring, keep track of the increments to determine the location of the tool.

Keeping track of the time will also enable you to determine how fast the tool is moving.

Step 3: Place the tool at the entry pit and aim it toward the exit pit. Place the level on the straight surface of the tool. Use a support under the tool to keep the tool aligned.

Consider the type of soil when aligning the tool. Some soils, such as topsoil and sand will cause the tool to rise. Pitching the nose of the tool slightly downward will provide a more accurate bore. The amount of downward pitch required depends upon the soil type and length of the bore.

NOTE: The Active Head model is designed for use in very hard compacted soils. When using the tool in soft loose soils, it will be necessary to throttle the tool back slightly to prevent “swimming” and insure a more accurate bore.

IMPORTANT: do not allow dirt or other material into the air hose.



Step 4: Connect the hose to a compressed air supply.

Step 5: Remove any oil or debris that may make the 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 6: Hold the other end of the hose tightly and partially open the compressor valve to blow the air hose clean.

NOTE: Be careful not to loose the rubber seal inside the hose coupling when blowing debris from the hose.

Step 7: Close the compressor valve.

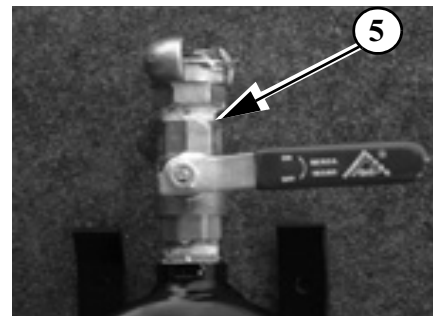
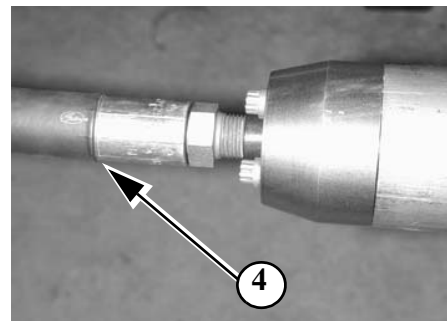
Step 8: Turn the whip hose (1) clockwise to FORWARD.

Step 9: Make sure the air valve control handle is OFF.

Step 10: Fill the oiler with HammerHead Mole oil (refer to the *Controls* section, “Tool Oiler,” page 21-1).

Step 11: Connect the air supply hose to the oiler and the supply hose to the tool.

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



BORING

Step 1: Fully open the air supply valve to start the striker moving. Do this quickly, then slow it down. This will make it easier to control the tool and start the bore.

NOTE: Launching the tool at reduced power provides time for the operator to accurately aim the tool.

Step 2: Stop the tool periodically as it enters the ground. Use a bubble level or aiming site to check the grade and aim. Adjust the direction of the tool by pushing or pulling the tool body.

Step 3: When the tool reaches the exit pit, shut it OFF.

If the tool does not reach the exit pit at the length marked off on the air hose:

Step 4: Turn air hose counterclockwise until tool is in NEUTRAL - neither moving forward nor backward.

IMPORTANT: When using NEUTRAL for an extended time, slow the tool by reducing air flow at the valve.

Step 5: Locate the tool by sound and vibration.

AFTER THE BORE

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

REVERSING DIRECTION

Reverse direction of the tool if it becomes stuck or deflected off course.

To reverse direction:

Step 1: Shut the Tool OFF.

Step 2: Disconnect the air supply hose from the oiler.

NOTE: With the optional Quick Reverse Swivel, the air supply hose does not need to be disconnected.

Step 3: Turn the hose counterclockwise to the REVERSE position.



NOTE: It may be necessary to turn the hose up to 1 full revolution extra to compensate for the flexibility of the hose.

CAUTION: Do not attempt to change direction of the tool without first shutting off the air supply to the tool. It may be possible to kink the air supply hose.

Step 4: Clean the connectors, then reconnect the air supply hose.

Step 5: Turn the tool ON.

Step 6: During operation, be sure the tool stays in REVERSE by checking that the air supply hose is turned fully clockwise.

Step 7: Pull the air supply hose as the tool is reversing. This will prevent the tool from backing over the air supply hose.

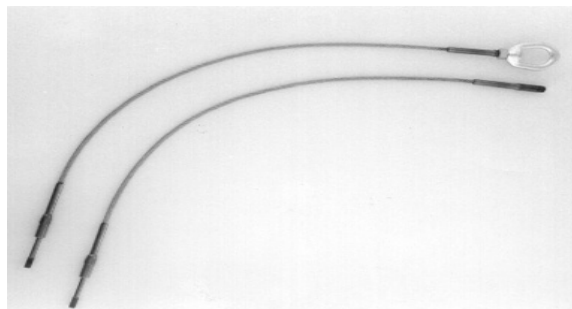
IMPORTANT: Use extra care when piercing in unstable soils, gravel, sand, or under trees. The tool cable should be used in these conditions because the probability of the bore path collapsing behind the tool or tool oscillating is increased.

Prior to piercing in unstable conditions, connect the tool cable to the back of the tool, then attach ample cable or chain to the tool cable to reach across the entire length of the shot. When reversing in these conditions, use the cable or chain to assist in pulling the tool back.

ACCESSORIES

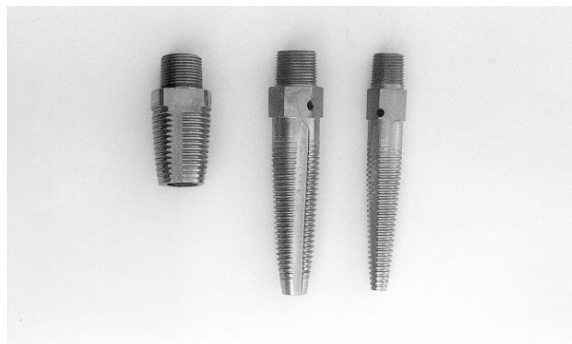
Tool Cable

The tool cable provides additional versatility. It is attached to the tool through an exhaust port and allows the operator to pull a cable, chain, or pulling carrot with the tool. It can be used in combination with the pilot to pull plastic pipe through the bore.



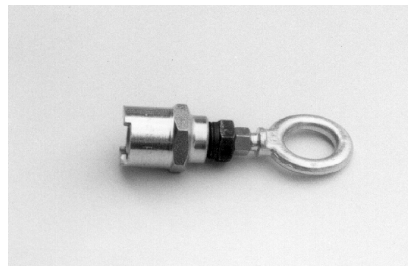
Pulling Carrots

Pulling carrots provide a simple method of installing small plastic pipe (maximum diameter 1-1/4" or 32 mm). This accessory threads into the inside diameter of the pipe. The pipe can then be pulled into place by attaching the carrot to the tool cable, or by pulling it back with the air hose after the bore has been completed.



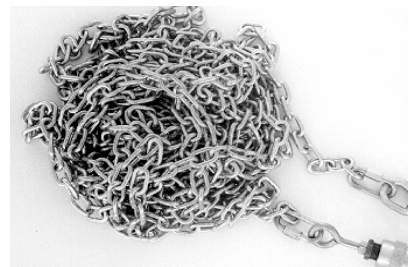
Pneumatic Fitting with Eyebolt

The pneumatic fitting with eyebolt allows the air hose to be used for feeding cable or chain through the bore or for feeding cable through plastic pipe.



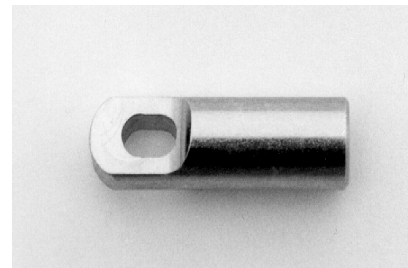
Pulling Chain Assembly - 50 ft (15 M)

The pulling chain assembly is used in combination with the tensioner frame when pulling in plastic behind the tool. It can also be used as a safety precaution when piercing in unstable conditions.



Clevis Nut

The clevis nut is used when pulling in plastic pipe behind the tool. It takes the place of the eye nut on the pulling cable and connects the pulling chain to the tool cable.



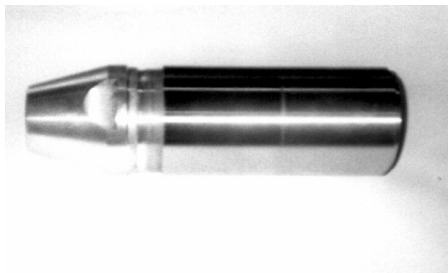
Eye Nut

The eye nut connects the tool cable to the pulling chain when using the pulling chain as a safety precaution.



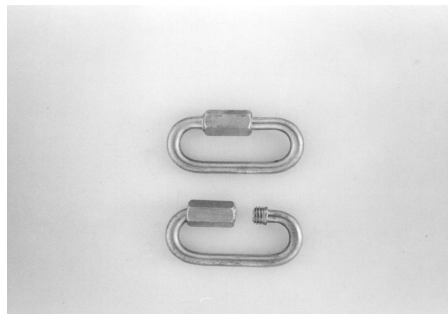
Pipe Pilot

The female pipe pilot is used for positive location of the plastic pipe. The pipe slips into the tailcone, which along with the tensioner frame, keeps the pipe coupled to the tool.



3/16" (5 mm) Quick Links

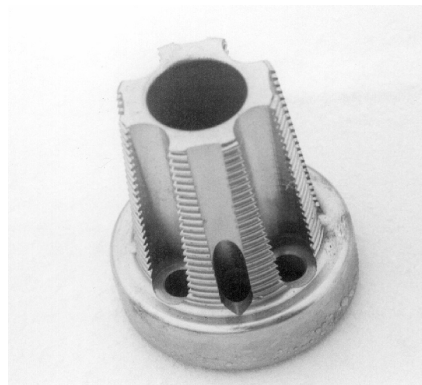
These are used to connect a pulling chain to the pneumatic fitting with eyebolt or to connect the pulling chain to the tool cable.



Tap Puller - 2" Gas Line (Polyethylene)

This accessory is used to pull 2" (50 mm) gas line behind the tool. It replaces the tailcone, and threads into the inside diameter of the plastic gas line. Threads are actually cut into the plastic which eliminates the need for a tensioner frame and pulling cables when pulling in service behind the tool.

NOTE: Special Tailbolts (P/N 30406) must be used with this puller.



Pipe Puller - Die

This accessory replaces the tailcone, and threads over the outside diameter of the plastic pipe. This threading will hold the pipe secure to the tool which will be pulled behind the tool when piercing.



Tensioner Frame

This accessory is used when pulling in plastic pipe behind the tool. Used with a pipe pilot, the tensioner frame will hold the plastic pipe secure to the back of the tool.



Replaceable Head Options

This style tool has a factory-installed threaded front anvil which will accept various replaceable heads.

NOTE: Standard and Active Head HammerHead Moles will not accept these replaceable heads, nor can they be modified to use them. Please check with your local HammerHead Dealer to find out what options are available for your model.

- Use the **standard wear face** with anvil nut to prevent excessive body wear.



- Use the **stepped head assembly** if preferred over the standard wear face.



This page intentionally left blank.

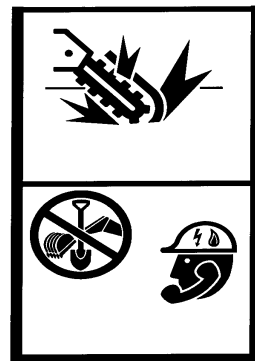
Section 31: Pipe Ramming

CALL YOUR ONE-CALL SYSTEM FIRST



WARNING: Electricity or gas explosion can kill. Laser light in cut cable can result in eye damage.

Locate utilities before digging. Call 811 or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.



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. For areas not represented by One-Call systems International, contact the appropriate utility companies or national regulating authority 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 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		

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

PREPARING THE SITE



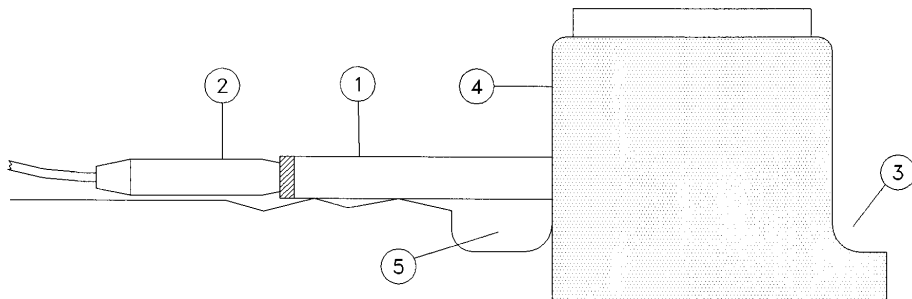
DANGER: Pit cave-in possible. Death from suffocation may occur. Never enter a pit where cave-in and suffocation are possible. Follow OSHA regulations for shoring or sloping of pit.



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.



- Step 1: Dig the entry site long enough for the 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 the trench face (4) and dig an undercut (5) so the pipe will start true and remain at a level grade without riding up.

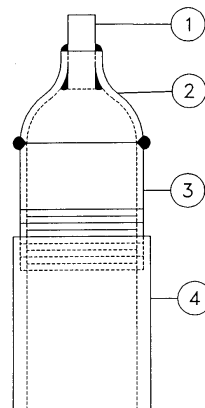


Step 4: Level bottom of trench to level the pipe. Do not use stacked wood to level pipe. The stacks will collapse from the pipe oscillating back and forth.

PUSHING CLOSED PIPE

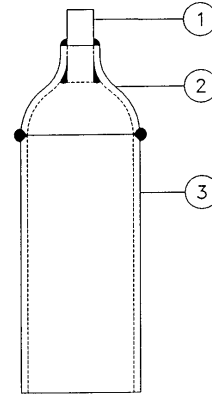
Threaded Pipe

- Step 1: Weld a piece of steel bar **(1)** to the smaller end of the pipe reducer **(2)**. Weld the steel bar to the pipe reducer on both the inside and outside of the pipe reducer.
- Step 2: Weld a short section of threaded pipe **(3)** to the larger end of the pipe reducer.
- Step 3: Thread the pipe reducer to the 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

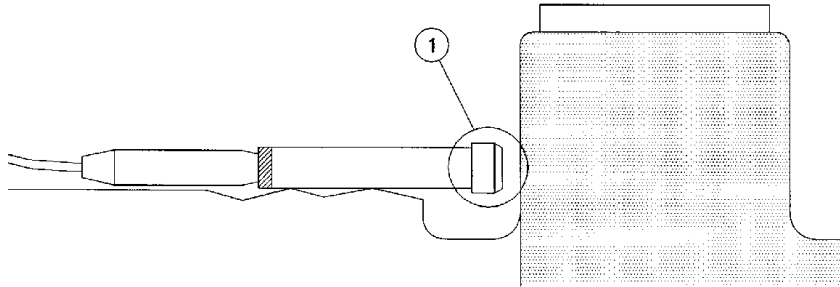
- Step 1: Weld a piece of steel bar **(1)** to the smaller end of the pipe reducer **(2)**. Weld on both the inside and outside of the reducer.
- Step 2: Weld the pipe reducer **(2)** to the front of the pipe **(3)**. The pipe reducer can be used again. Cut the pipe reducer off the pipe when the push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

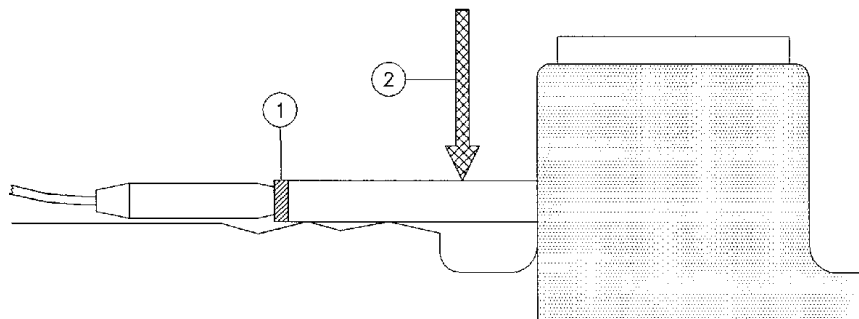


STARTING THE PUSH

Step 1: Check grade and level the pipe.

NOTE: When starting the push, it may be necessary to place weight (indicated by arrow (2)) on the pipe to keep it from oscillating instead of advancing.

Step 2: Insert the three collect segments (1) in the back end of the pipe. Push the collets in until the lip of the collet contacts the pipe edge.



WARNING: Keep lifting equipment at a safe distance from the entrance pit to prevent it from falling into the pit.



WARNING: 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 the lifting straps.



WARNING: Use of pipe schedules other than those listed in the Specifications Section may cause unsafe conditions during ramming or spoil removal.

Step 3: Use lifting slings to position the nose of the tool into the collets.

Step 4: Run the tool slowly until the taper of the nose locks into the taper on the collets.

Step 5: Remove the slings from the tool.

Step 6: Push the pipe slowly for the first 6-8 ft (2-2.5 m) to help maintain grade. Apply weight on the pipe as necessary and use a level on the front of the pipe to monitor the grade.

Completing the Push

Step 1: To remove the tool from the pipe pushing collets, turn the tool into reverse.

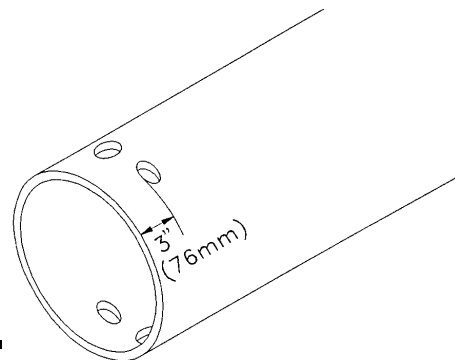
Step 2: Quickly turn tool on and off to unlock tool from collets. Remove the collets.

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

- Step 3: If adding more pipe:
- Position and weld the next pipe section.
 - Insert the collets and resume pushing.
- Step 4: When finished, remove the tool, collets, and pipe reducer(s).

CLEANING OUT OPEN PIPE

- Step 1: Use a torch to cut two holes all the way through the pipe for the safety stakes.
- For 14" (35 cm) or smaller pipe seals: Cut 1-1/2" (4 cm) diameter holes.
 - For 16" (40 cm) or larger pipe seals: Cut 2" (5 cm) diameter holes.
- Step 2: Remove slag from the inside of the pipe.
- Step 3: Before installing the ramming pipe seal, allow pipe to cool to prevent damaging the rubber seal.



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

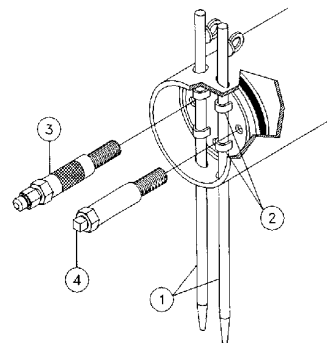
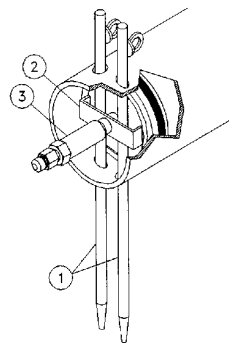
IMPORTANT: Ensure stakes (1) pass through the U-clamp(s) (2) on the pipe seal assembly.

Step 4: Insert the ramming pipe seal assembly into the pipe and secure with stakes (1). Tighten pipe stem(s) (3) to seal the pipe.

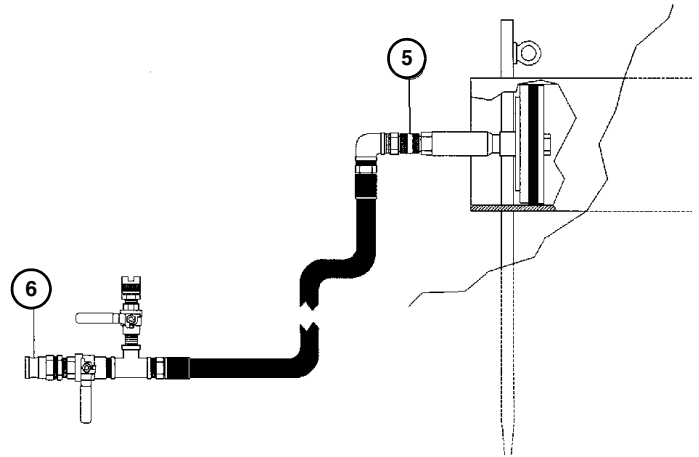
IMPORTANT: Use only HammerHead-approved high-strength alloy steel stakes.

Step 5: Insert stakes through pipe and into ground to prevent pipe from recoiling when removing spoil.

NOTE: Three plugs (4) are used for 16-24" 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.

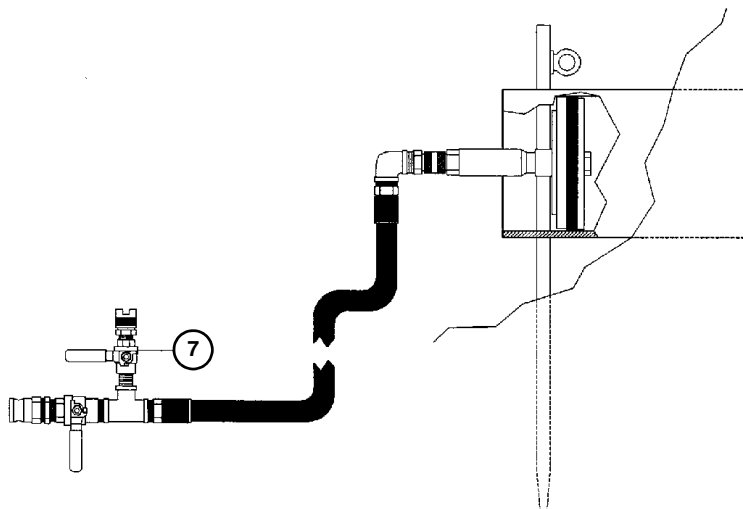
Step 8: With pressure set at 110 psi (760 kPa), turn on air. Maintain pressure for 6-10 minutes. If spoil does not move:



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

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

Step 9: Decrease airflow when spoil begins to move to prevent violent spoil discharge.

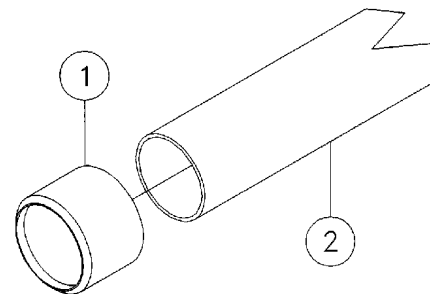


ACCESSORIES

Soil Shoes: 6-12" (15-30 cm) in 2" (5 cm) Increments

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

The soil shoe (1) fits over end of pipe (2) and can be used on all pipe schedules.



Pushing Collets - 6-24" (15-60 cm) in 2" (5 cm) Increments

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

Refer to Specifications, *page 50-1*, for recommended pipe schedules.

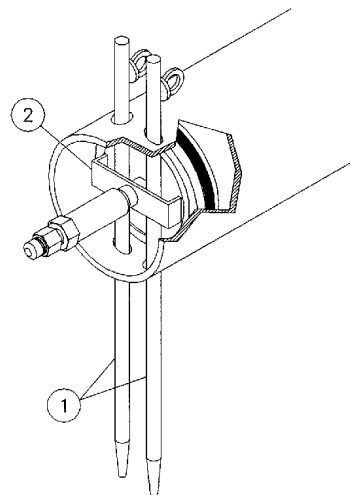


Pipe Seals - 6-24" (15-60 cm) in 2" (5 cm) Increments

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

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

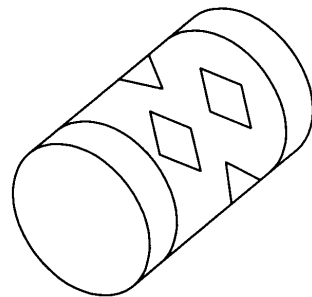
Refer to Specifications, *page 50-1*, for recommended pipe schedules.



Pipe Pigs - 6-24" (15-60 cm) in 2" (5 cm) Increments

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

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



Section 40: Maintenance - 30 Service Hours

STRIKER WEAR RINGS - CHECK

VALVE WEAR RING - CHECK

Instructions for checking the wear rings are included in the *Maintenance - 150 Service Hours or Yearly* section.

- Follow Instructions in *A. Active Head Tool - Disassemble, page 41-1*.
- Proceed to *B. Striker - Inspect, page 41-2*, and *C. Valve - Inspect, page 41-4*, instructions to check the wear rings and o-rings.
- Follow the applicable instructions in *H. Screw Reverse - Assemble, page 41-12*, and *I. Power Port Tool - Assemble, page 41-16*.

This page intentionally left blank.

Section 41: Maintenance - 150 Service Hours or Yearly

A. DISASSEMBLE

Rear Anvil

Step 1: Thoroughly clean the tool.

Step 2: Place the tool on a clean surface. Lay it flat or with the nose down slightly to prevent the striker from falling out when the inner assembly is removed.

IMPORTANT: Failure to use two wrenches when removing the rear whip hose can result in internal damage to the adjuster screw.

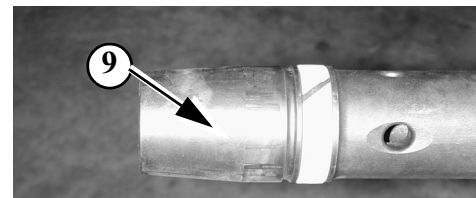
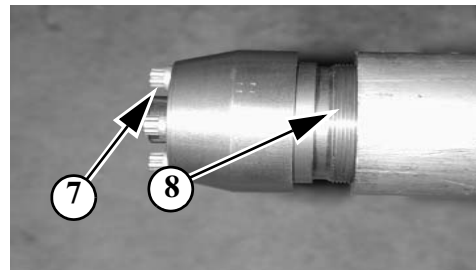
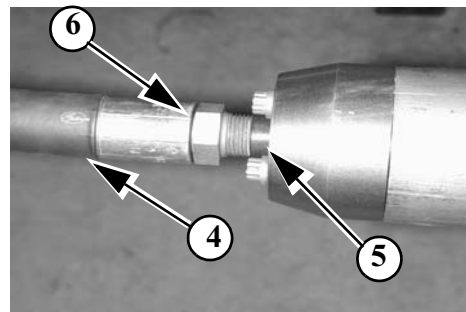
Step 3: Turn the rear whip hose (1) fully counterclockwise to REVERSE. Use two wrenches to remove the external hose; one to hold fitting (2) and one to turn hose fitting (3). Plug fittings to prevent debris from entering the hoses.

Step 4: Use a 3/8" (9.5 mm) 12 point socket or 6mm allen socket to loosen each bolt (4) five or six turns.

Step 5: Rotate the tailcone counterclockwise to unthread the inner assembly from the body. It will take approximately 30 full turns.

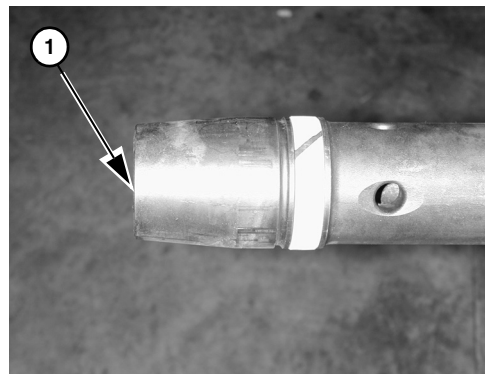
Step 6: Remove the inner assembly (5) from the body.

Step 7: Tip the body and remove the striker (6). Be careful not to damage the body threads.

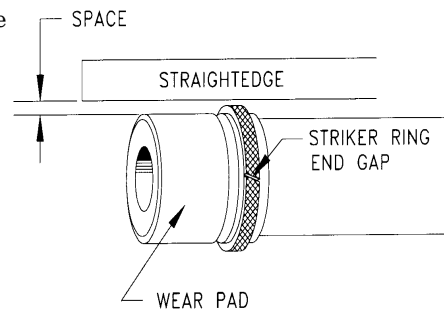


B. STRIKER - INSPECT (ALL TOOLS)

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



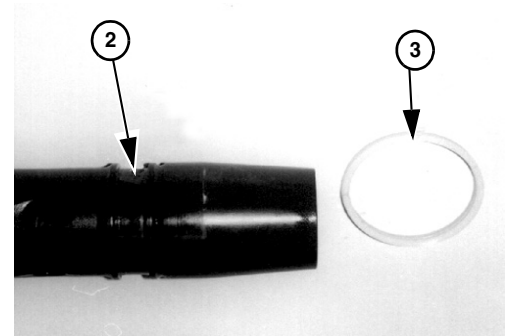
Step 2: Check striker ring wear with a straightedge. If there is no space between the straightedge and the wear pad, replace the rings.



To replace ring:

- a. Clean the ring groove (2).
- b. Oil all surfaces of the ring with HammerHead Mole Oil.
- c. Install the ring (3). If the ring is over expanded, take the ring off, overlap the ends to make a tighter diameter, and then reinstall.

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



Step 3: Check the end gap (4) of each ring with the ring fully seated in the striker ring groove. The gap should be **.100 - .120" (2.5 - 3.0 mm) for the 2" (50mm) and 2" Side Walker tool, .120 - .140" (3.0 - 3.5 mm) for the 4" LW through 5-3/4" (incl; 7-1/2") tools and .120 - .130" (3.0 - 3.25 mm) for the 2-1/2" through 5-1/2" tools**. If it is less, remove the ring and trim enough off one end to ensure the proper gap. If the gap is larger, then the rings should be replaced.

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

Step 4: Use a flashlight to inspect the striker valve bore for rust, debris, and burrs. If needed, clean the 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 the bore by removing metal, creating a rough surface.

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

Step 6: Check the valve bore of the striker with a snap gauge. Take measurements 2" (5 cm) into the bore at the 12 o'clock and 3 o'clock positions. If the average bore diameter is more than listed in the table below, replacement of the striker will improve performance.

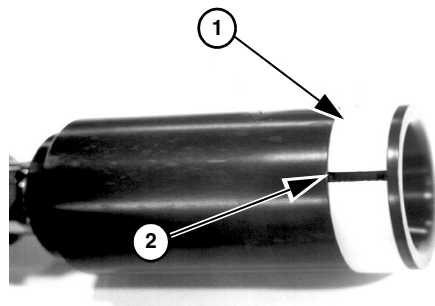
TOOL SIZE	STRIKER BORE DIAMETER
2"	1.145" (29.1 mm)
2-1/2"	1.459" (37 mm)
3"	1.52" (38.6 mm)
3-7/8", 4", 5-1/2"	2.18" (55 mm)
4" LW	2.145" (54.5 mm)
5-1/8", 5-5/8"	2.79" (71 mm)
5-3/4", 7-1/2"	3.17" (80.5 mm)

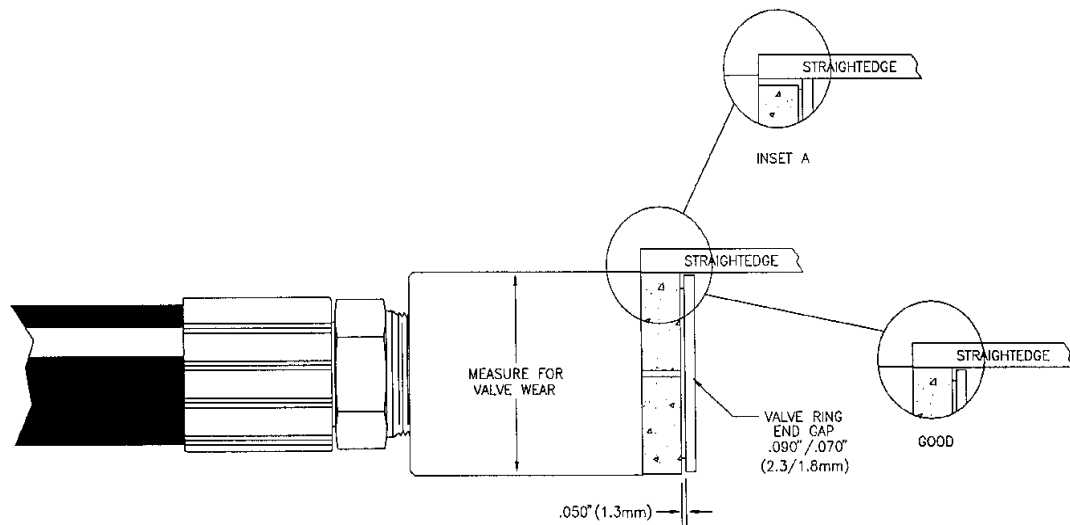
C. VALVE - INSPECT

- Step 1: Remove the valve ring (1) by expanding it and sliding it over the end of the valve.
- Step 2: Check for sand embedded in the ring. If you find any, replace the ring.
- Step 3: The inside surface (2) has a groove designed to collect debris. Remove all debris or particles from the ring.
- Step 4: Check the rings for scratches. Light scratching on the ring is acceptable. Replace a heavily scratched or scored ring.

To replace a ring:

- a. Clean the ring grooves (2).
- b. Oil all surfaces of the ring with HammerHead Mole Oil.
- c. Install the rings. If the rings are overexpanded, take the ring off, overlap the ends to make a tighter diameter, and the reinstall.





Step 5: Check valve ring wear with a straightedge. If there isn't any space between the straightedge and the front edge (**Inset A**), replace the ring.

Step 6: Check the valve ring end gap with the ring fully seated in the ring groove. **The gap should .075 - .090" (1.9 - 2.3 mm) for the 2" through 3" Moles, and .080 - .095 (2.0 - 2.4 mm) for the 4" thru 7-1/2" tools.** If it is less, remove the ring and trim enough off one end to get the proper gap.

IMPORTANT: Valve ring wear should be checked initially after 30 hours of use. First clean the ring and ring groove. Check ring gap and wear. Install a new valve ring and check the valve ring groove width. Measure the gap between the ring and groove. If it is more than .050" (1.25 mm), replace the valve.

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

Step 7: Measure valve skirt wear.

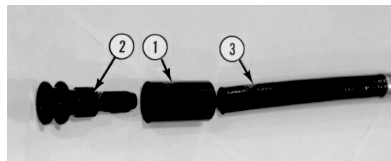
TOOL SIZE	MINIMUM VALVE SKIRT DIAMETER
2" & 2" SW	1.090" (27.7 mm)
2-1/2" STD & 3" UT	1.40" (35.5 mm)
2-1/2" SW & 3" SW	1.40" (35.5 mm)
3" WF/STD	1.46" (37.0 mm)
3-7/8", 4", 5-1/2"	2.03" (52 mm)
4" LW	2.03" (52 mm)
5-1/8", 5-5/8"	2.67" (68 mm)
5-3/4", 7-1/2"	3.03" (76.9 mm)

D: VALVE REMOVAL

2", 2-1/2" and 3" Tool

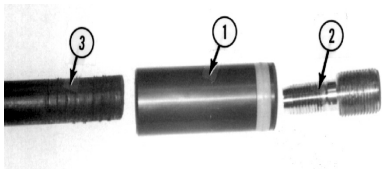
IMPORTANT: The valve (1) is covered with a hard ceramic coating. Be careful not to chip the coating.

- Step 1: Slip a piece of hose over the valve or wrap the valve in a cloth to prevent damaging the valve surface.
- Step 2: Secure the valve (1) in a vise.
- Step 3: Remove retainer (2) using hex key.
- Step 4: Turn hose (3) clockwise or fitting to remove it from the valve.



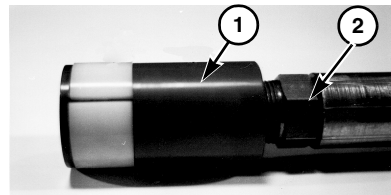
4" (3-7/8") and 5-1/2" Tool

- Step 1: Slip a piece of hose over the valve or wrap the valve in a cloth to prevent damaging the valve surface.
- Step 2: Secure the valve (1) in a vise.
- Step 3: Remove retainer (2) using hex key.
- Step 4: Turn hose (3) clockwise or fitting to remove it from the valve.



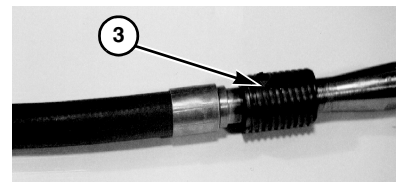
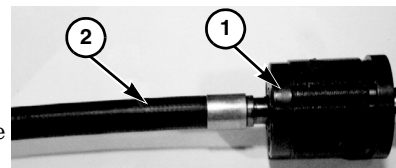
5-1/8", 5-5/8" and 5-3/4" Tool

- Step 1: Slip a piece of hose over the valve or wrap the valve in a cloth to prevent damaging the valve surface.
- Step 2: Secure the valve (1) in a vise.
- Step 3: Turn hose (2) clockwise or fitting to remove it from the valve.



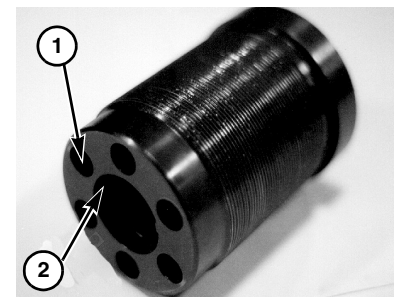
E: INSPECT VALVE END HOSE WHIP

- Step 1: Remove tailcone
- Step 2: Unscrew hose whip (2) and remove it from rear anvil (1).
- Step 3: Inspect threads (3). They should be flat on top. If threads are sharp, replace the hose whip.
- Step 4: Inspect the bond between the screw and the tubular shaft. Replace hose whip assembly if needed.



F: INSPECT REAR ANVIL

- Step 1: Inspect the face (1) which contacts the striker. If more than 50% of the surface is heavily chipped or cracked, replace the anvil.
- Step 2: Thoroughly clean the rear anvil. Use an OSHA approved air nozzle and carefully blow out the air ports and bolt holes.
- Step 3: Check the front stops on the screw thread (2) for damage. Stops should be .060" - .080" (1.5mm - 2.0mm) wide on top. If stops are less, the rear anvil should be replaced.
- Step 4: Inspect the rear anvil inner screw threads. Threads should be flat on top. If threads are sharp, replace anvil.

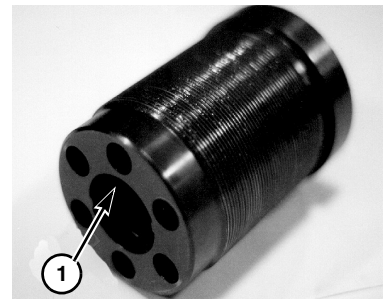


G. SCREW REVERSE - ASSEMBLE

Step 1: Using anti-seize or grease, lubricate the rear anvil inner threads (1).

Step 2: Thread the valve end hose whip (2) into rear anvil (1).

IMPORTANT: The valve is covered with a hard ceramic coating. Be careful not to chip the coating.



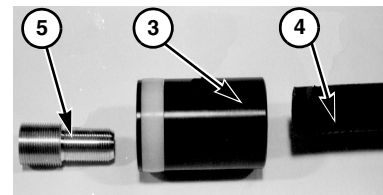
Step 3: Slip a piece of hose over the valve or wrap the valve in a cloth to prevent damaging the valve surface.

Step 4: Secure the valve (3) in a vise.

Step 5: Turn the hose (4) counterclockwise into the valve until the hose stops against the shoulder inside the valve bore.

Step 6: Lubricate the inside of the hose and valve retainer (5) with HammerHead Mole oil.

Step 7: Install the valve retainer and torque to specifications from table.

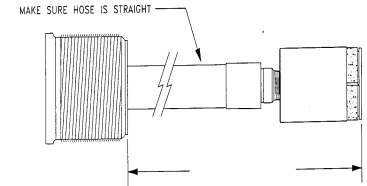


TOOL SIZE	VALVE RETAINER TORQUE
2" & 2" SW	25 ft lb. (34Nm)
2-1/2" STD & 3" UT	60 ft lb. (81Nm)
2-1/2" SW & 3" SW	60 ft lb. (81Nm)
3" WF/STD	60 ft lb. (81Nm)
3-7/8", 4", 5-1/2"	75 ft lb. (102Nm)
4" LW	75 ft lb. (102Nm)
5-1/8", 5-5/8"	N/A
5-3/4", 7-1/2"	N/A

Step 8: Turn the valve assembly fully clockwise against the stops.

Step 9: Check the valve assembly's overall length. A longer measurement than shown in table indicates the valve has not been threaded far enough onto the hose.

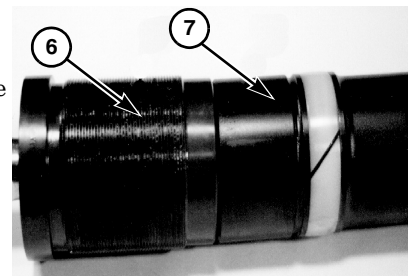
Step 10: Check for full range of motion in adjustment thread.



TOOL SIZE	INTERNAL WHIP LENGTH*
2" 2" SW	10-7/16 (265mm) 11-7/16 (290.5mm)
2-1/2" STD & 3" UT	11-1/2 (292mm)
2-1/2" SW & 3" SW	10-1/8 (257mm)
3" WF/STD	11-1/4 (286mm)
3-7/8", 4", 5-1/2"	13-7/8 (352mm)
4" LW	12-3/4 (323.9mm)
5-1/8", 5-5/8"	15-7/16 (392mm)
5-3/4", 7-1/2"	18-15/16 (481mm)

* All measurements are +/- 1/16" (1.5mm)

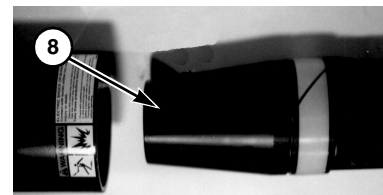
Step 11: With the rear anvil/hose whip assembly adjusted to full forward position, Test fit the valve in the striker bore. The valve should slide freely into the striker until the rear anvil (6) contacts the striker (7). If it does not, determine the reason for the obstruction before assembling the tool.



Screw Reverse Mole

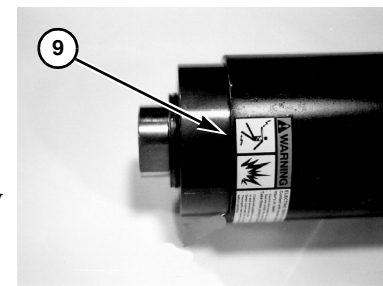
Step 12: Clean the body bore thoroughly. Oil the inside of the body and the striker.

Step 13: With the tool body horizontal or slightly nose down, carefully slide the striker into the body. The end (8) with the smaller hole goes into the body first.



Step 14: Coat the rear anvil's external threads (9) with anti-seize or grease lubricant.

Step 15: Slide the inner assembly into the striker. Be careful not to cross-thread the rear anvil into the body. Tighten the rear anvil until it bottoms against the body, then loosen it 1/8 turn. Do not apply torque to the rear anvil for the 3" Mole. For the 2" and 2-1/2" Mole tighten the rear anvil until it bottoms against the body. Do not apply torque or loosen the anvil as in the 3" Mole.

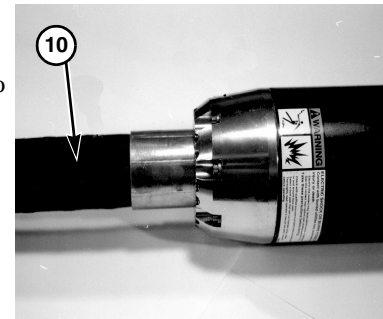


Step 16: Rotate valve end hose whip fully counterclockwise.

Step 17: Inspect the surface of the rear hose whip (10). Replace a torn or peeling hose whip to prevent reversing problems

Step 18: Slide rear hose whip through tailcone.

Step 19: Install and tighten rear hose whip according to table.



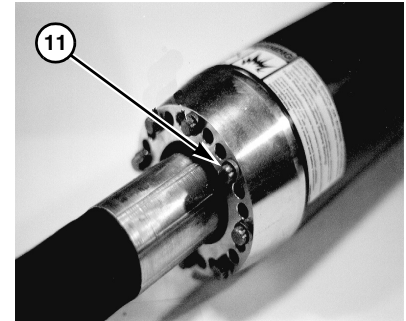
TOOL SIZE	EXTERNAL WHIP TORQUE
2" & 2" SW	30 ft lb. (41Nm)
2-1/2" STD & 3" UT	45 ft lb. (61Nm)
2-1/2" SW & 3" SW	45 ft lb. (61Nm)
3" WF/STD	45 ft lb. (61Nm)
3-7/8", 4", 5-1/2"	60 ft lb. (81Nm)
4" LW	60 ft lb. (81Nm)
5-1/8", 5-5/8"	180 ft lb. (244Nm)
5-3/4", 7-1/2"	180 ft lb. (244Nm)

IMPORTANT: Install new bolts when assembling the tailcone. The tail bolts are engineered and specially designed for the HammerHead Mole. Do not substitute other types of bolts.

Step 20: Coat the threads of the tailbolts (11) with anti-seize or grease. Start the bolts.

IMPORTANT: Do not tighten the tailbolts with the hose whip in the reverse adjustment position. The tailcone and whip hose adjuster screw will be damaged.

Step 21: Check that the hose whip is rotated fully clockwise (FORWARD).



Screw Reverse Mole

Step 22: Use a cross pattern sequence and tighten all tailbolts in accordance with table below.

TOOL SIZE	TAILBOLT TORQUE
2" & 2" SW	10 ft lb. (14Nm)
2-1/2" STD & 3" UT	28 ft lb. (38Nm)
2-1/2" SW & 3" SW	35 ft lb. (47Nm)
3" WF/STD	35 ft lb. (47Nm)
3-7/8", 4", 5-1/2"	35 ft lb. (47Nm)
4" LW	35 ft lb. (47Nm)
5-1/8", 5-5/8"	35 ft lb. (47Nm)
5-3/4", 7-1/2"	35 ft lb. (47Nm)

Step 23: Install the coupling onto the external whip and torque according to the table below.

TOOL SIZE	EXTERNAL WHIP COUPLING TORQUE
2" & 2" SW	45 ft lb. (61Nm)
2-1/2" STD & 3" UT	60 ft lb. (81Nm)
2-1/2" SW & 3" SW	60 ft lb. (81Nm)
3" WF/STD	60 ft lb. (81Nm)
3-7/8", 4", 5-1/2"	90 ft lb. (122Nm)
4" LW	90 ft lb. (122Nm)
5-1/8", 5-5/8"	90 ft lb. (122Nm)
5-3/4", 7-1/2"	N/a

Step 24: Check that the tool freely shifts from FORWARD to REVERSE.

Step 25: Place the adjuster screw in the forward position.

Step 26: Tip the tool back and forth. The striker should slide easily and freely and contact the anvils when the body is tipped from horizontal to approximately 22°.

Section 50: Maintenance -As Required

Storage

Pour 1 oz. (30 cc) of HammerHead Mole Anti-Rust storage oil into the air line. Oil should be added with the tool's nose down. Wait 30 seconds for the oil to get into the tool. Tip the tool back and forth 20 to 30 times while rotating the tool to disperse the oil. Tape or cap the tool whip hose to prevent dirt and sand from entering the tool.

This page intentionally left blank.

Section 51: Troubleshooting

Tool Will Not Start

- Step 1: Check the compressor for proper air output (90 - 110 psi or 620 - 760 kPa). Improper or low air pressure setting can cause starting problems.
- Step 2: Check that full pressure air is available at the tool and that the hoses and fittings are of the proper diameter.



WARNING: High pressure air can forcefully eject dirt or other materials. Be careful when blowing out the hose. Aim the hose away from yourself and other persons.

- Step 3: Follow these restart procedures while tool is in the ground:
- Remove the air supply hose from the oiler to the tool and inject 4 oz. of oil directly into the hose.
 - Turn air supply hose into REVERSE if in FORWARD, or into FORWARD if in REVERSE.
 - Connect the supply line to the oiler and snap open the air control valve.
 - If the tool does not start, repeat steps a, b, c.
- Step 4: Take the tool apart and clean it (refer to *Maintenance - 150 Service Hours or Yearly, page 41 - 1*).
- Step 5: Check that the internal control stem and external whip hose are free from obstruction.
- Step 6: If the tool fails to start after the above steps have been performed, return the tool to your HammerHead dealer for inspection

TOOL WILL NOT REVERSE DIRECTION

Rotate the air hose fully clockwise to FORWARD and then rotate the air hose fully counterclockwise back to REVERSE.

- Step 1: If the air supply hose will not turn into the REVERSE position while in the ground, the tunnel may have collapsed on the air supply hose. Turn the air supply hose counterclockwise while the tool is running. The impact action of the tool will help loosen a stuck supply line. This should only be done to free up the air line. The tool will not be able to be turned into REVERSE while the tool is running.
- Step 2: Reversing in unstable soil conditions, such as gravel, sand, under trees or watery slick clays, may cause a tool to oscillate or “swim”. A reciprocating hose indicates the tool may be swimming. Reduce air flow at the control valve until traction is regained.

IMPORTANT: Ensure all airline couplings are tight and lock collars in place so they don’t come loose while reversing.

- Step 3: Check air supply lines for possible obstructions.

TOOL RUNS BUT WILL NOT MOVE IN HOLE

- Step 1: Check to see if hose is in FORWARD.
- Step 2: If the tool is oscillating back and forth, partially reduce the air flow at the oiler valve. Soft or wet ground conditions can cause a tool to loose traction and oscillate.
- Step 3: Put a mark on the hose for reference to determine if the tool is moving. If the tool has hit an obstruction. The Screw Reverse Moles allow you to maximize impact force by rotating the hose counterclockwise 2 to 3 turns until the tone of the impact changes. Turning the hose in the clockwise (FOWARD) direction slightly, until this tone is gone, will provide the most impact force available to break through an obstruction.
- Step 4: If the tool is unable to break through, reverse the tool and start a new hole away from the obstruction.

IMPORTANT: When shooting a new bore, the operator should move over a distance of 10 times the diameter of the tool or the tool may cross into the other bore.

TOOL CYCLES FAST AND SEEMS LOW ON POWER

- Step 1: Check the valve assembly overall length, an excessively short dimension will cause “fast” cycling with poor progress. Striker stroke is controlled by the valve overall length “E: Inspect Valve End Hose Whip,” *page 41-9*.
- Step 2: Soil conditions are important to tool operation. Dry soil may slow a tool’s progress. Wet soil will reduce body friction allowing the tool to oscillate, lose traction, or swim. Avoid losing traction by reducing air flow at the control valve during the entire operation.

TOOL SLOWS DOWN DURING LONG BORES

- Step 1: Perform the striker tip test as follows: The striker should slide from front to back when the body is tipped from horizontal to approximately 22°. A tool with high striker friction may have ingested dirt and should be taken apart before being shot again.
- Step 2: The tunnel behind the tool may have collapsed, restricting air flow.

TOOL RUNS BUT IS LOW ON POWER

- Step 1: Check the compressor for proper air output and pressure.
- Step 2: Check that the tool is using oil (Refer to *Controls, page 20 - 1*).
- Step 3: Turn or adjust tool air service line while the tool is moving forward or reversing.
- Step 4: Check that supply lines and fittings are properly sized “General Specifications,” *page 41-9*.
- Step 5: Perform striker tip test (see above).
- Step 6: Check valve assembly overall length. “E: Inspect Valve End Hose Whip,” *page 41-9*.
- Step 7: Check valve ring end gap (Refer to the *Maintenance - 150 Service Hours or Yearly* section, “C. Valve - Inspect,” *page 41 - 7*).

VALVE WHIP HOSE WILL NOT THREAD INTO REAR ANVIL

- Step 1: Check adjuster screw for damage, burr, or nicks.

Step 2: If screw threads easily except for the last two threads, these threads may be bent. Bent threads are caused by improper rear anvil assembly (refer to the *Maintenance -150 Service Hours or Yearly* section, “F: Inspect Rear Anvil,” *page 41-9*).

Section 60: Specifications

LUBRICANTS

HammerHead Mole Summer Oil

Summer oil with a zinc and paraffin hydraulic air line additive to reduce friction and inhibit rust (SAE-10W/ISO-22) is recommended for most applications.

HammerHead Mole Winter Oil

Winter oil contains a fully synthetic base of ISO Propanol and additives that reduce corrosion, evaporation, and make it compatible with summer oil. Winter oil at full strength will prevent freeze up at temperatures as low as -10°F (-23°C) (ISO-46).

HammerHead Mole Anti-Rust Oil

Anti-Rust oil is a paraffin-based product that contains additives to inhibit rust and corrosion (SAE 20W/ISO 68). It is recommended during maintenance or between jobs

GENERAL SPECIFICATIONS

TOOL	Diameter	Length	Weight	Air Volume	Internal Access	Op Pressure	Reversible	Blows per Minute
2"	2" (50mm)	44.16" (1.1M)	24 lbs. (11kg)	22 cfm (600 L/m)	Via 4 Tailbolts	110 psi (7.6 bar)	8 turns	470
2-1/2"	2.5" (63mm)	47.5" (1.2M)	50 lbs. (23kg)	31 cfm (877 L/m)	Via 4 Tailbolts	110 psi (7.6 bar)	6 turns	385
3"	3" (75mm)	54.75" (1.4M)	69 lbs. (31kg)	32 cfm (906 L/m)	Via 4 Tailbolts	110 psi (7.6 bar)	5 turns	480
4"	4" (100mm)	60.75" (1.54M)	136 lbs. (62kg)	68 cfm (1900 L/m)	Via 6 Tailbolts	110 psi (7.6 bar)	7 turns	370
5-1/8"	5.125" (130mm)	62.25" (1.58M)	214 lbs. (97kg)	98 cfm (2800 L/m)	Via 8 Tailbolts	110 psi (7.6 bar)	7 turns	333
5-3/4"	5.75" (145mm)	71.23" (1.8M)	305 lbs. (138kg)	132 cfm (3700 L/m)	Via 8 Tailbolts	110 psi (7.6 bar)	9 turns	300

PVC PIPE TYPE 1 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	.620	.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

(Page 1 of 2)

PVC PIPE TYPE 1 SCHEDULE 40 NSF (CONTINUED)

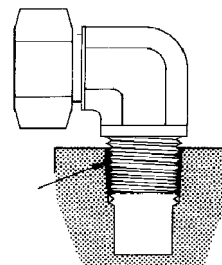
NOMINAL PIPE SIZE (INCHES)	O.D.	AVERAGE I.D.	NOMINAL WT./FT. TYPE I	BELL OR CONNECTING SLEEVE MIN. O.D.
3	3.500	3.042	1.409	3.94
3-1/2	4.000	3.520	1.697	4.452
4	4.500	3.998	2.006	4.974
5	5.563	5.017	2.776	6.07
6	6.625	6.031	3.536	7.185
8	8.625	7.943	5.305	9.269
10	10.750	9.976	7.532	11.480
12	12.750	11.890	9.949	13.562
14	14.000	13.072	11.810	14.87
(Page 2 of 2)				

Section 61: Torque Values

HYDRAULIC FITTINGS

Pipe Thread Fittings

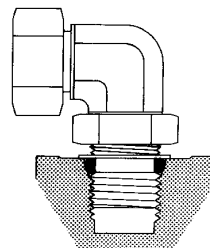
- Ensure all threads are free from nicks, burrs, and dirt.
- Use a thread sealant such as Loctite Vibra-Seal, instead of pipe dope or Teflon tape, to seal the threads. Teflon tape can plug filters and drain orifices, and can cause hydraulic system failures.
- To tighten, turn the fitting approximately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

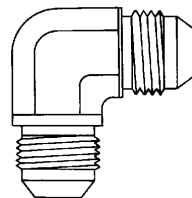
Size	Thread	Torque
#2	5/16" -24	7 - 8 ft-lb. (10 - 11 Nm)
#3	3/8" -24	14 -16 ft-lb. (19 - 21 Nm)
#4	7/16" -20	16 - 18 ft-lb. (21 - 24 Nm)
#5	1/2" -20	22 - 24 ft-lb. (29 - 32 Nm)
#6	9/16" -18	24 - 26 ft-lb. (33 - 35 Nm)
#8	3/4" -16	40 - 43 ft-lb. (54 - 59 Nm)
#10	7/8" -14	68 - 70 ft-lb. (93 - 95 Nm)
#12	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 	
5/8" -18 NF	80	110	145	200	195	265
3/4" -10 NC	130	175	210	285	300	405
3/4" -16 NF	145	200	240	325	340	460
7/8" -9 NC	150	205	320	435	500	680
7/8" -14 NF	170	230	350	475	560	760
1" -8 NC	180	245	480	650	800	1085
1" -14 NF	200	270	560	760	920	1250
1 1/8" -7 NC	240	325	700	950	1180	1600
1 1/8" - 2 NF	275	375	780	1060	1340	1815
1 1/4" -7 NC	340	460	1020	1385	1720	2330
1 1/4" - 2 NF	370	500	1140	1545	1900	2575
1 3/8" -6 NC	460	625	1360	1845	2280	3090
1 3/8" -12 NF	540	730	1580	2140	2620	3550
1 1/2" -6 NC	640	870	1840	2495	3060	4150
1 1/2" -12 NF	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) 	
3/4"-16 NF	155 - 200	210 - 271	200 - 255	271 - 346	163 - 227	221 - 308	215 - 315	291.5-427
7/8"-9 NC	235 - 300	319 - 407	295-382.5	400 - 519				
7/8"-14 NF	250 - 320	339 - 434	295-382.5	400 - 519				
1 -8" NC	345 - 445	468 - 603	450-512.5	610 - 695				
1 -14" NF	370 - 470	502 - 637	452.5-590	617 - 800				

Index

A

Accessories 31-11, 30-6
After the Bore 30-4
Air Valve 21-1

B

Boring 30-3

C

Call Your One-Call System First 31-1
Check Air Compressor 10-8
Check Hardware 10-8
Check Laws and Regulations 10-5
Cleaning Out Open Pipe 31-7
Clear Work Area 10-8
Completing the Push 31-7
Confined Space Regulation 10-7
Controls 21-1

D

Dealer Prep i
Do Not Work in Trench 10-5
During Service 10-9

E

Entry and Exit Pits 30-2

G

General Specifications 60-2

H

Handling the Boring Tool 10-8
How the HammerHead Mole Works 20-1

I

Identification Numbers - Record iii
Inspecting Safety Decals 11-1
Introduction 2

K

Keep Machine in Good Condition 10-7
Keep Spectators Away From Machine 10-6

L

Lubricants 60-1

M

Maintenance - 150 Service Hours or Yearly 41-1
Maintenance - 30 Service Hours 40-1
Maintenance -As Required 50-1
Metric 21-4

O

Operating the Tool 30-1

P

Patents 4

Personal Protection 10-5

Pipe Pigs - 6-24" (15-60 cm) in 2" (5 cm) Increments 31-12

Pipe Ramming 31-1

Pipe Seals - 6-24" (15-60 cm) in 2" (5 cm) Increments 31-12

Precautions During Operation 10-9

Preparing the Site 31-2

Preparing to Bore 30-2

Pushing Closed Pipe 31-3

Pushing Collets - 6-24" (15-60 cm) in 2" (5 cm) Increments 31-11

Pushing Open Pipe 31-4

R

Read, Understand, and Follow Instructions 10-2

Rear Whip Hose 21-3

Receiving and Delivery Report i

Reversing Direction 30-4

Review of Operation i

S

SAE 21-4

Safety Decals 11-1

Safety Messages 10-1

Soil Shoes: 6-12" (15-30 cm) in 2" (5 cm) Increments 31-11

Specifications 60-1

Starting the Push 31-5

Striker Wear Rings - Check 40-1

Index

T

Threaded Pipe 31-3

Tool Cycles Fast and Seems Low on Power 51-3

Tool Oiler 21-1

Tool Runs But Is Low on Power 51-3

Tool Runs But Will Not Move in Hole 51-2

Tool Slows Down During Long Bores 51-3

Tool Will Not Reverse Direction 51-2

Troubleshooting 51-1

U

Underground Utility Contact 10-4

Understanding Safety Alert Symbol 10-1

Understanding Signal Words 10-1

V

Valve Wear Ring - Check 40-1

Valve Whip Hose Will Not Thread into Rear Anvil 51-3

Vari-Pitch Level 21-3

W

Welded Pipe 31-4

Work in Ventilated Area 10-6

Revision History

Revision	Date	Page(s)	Description
01_03	05/03	All	First Edition Release
09_03	09/03	All	Update photo's and specifications
06_06	06/06	All	update photo's, decal and wording for CE Certification
06_10	06/10	11-2, 11-3, 11-4, 21-3, 30-9	Removed previous references

