



Operation Manual

PF500



REV 4-13-19

Corporate Philosophy and Mission

Barbco Inc. and its president, Jim Barbera are dedicated to not only the success of the organization but also to the growth and fulfillment of its employees and the surrounding community. To do both requires the company to be the “best that it can possibly be”. To achieve this end, Barbco recognizes that all members of the company must be focused on a common mission and set of shared goals. Thus in September 1990 the company established the following Mission Statement and Goals

Mission Statement

Barbco Inc. is dedicated to instilling in all segments of its organization a commitment to the production of high quality earth boring equipment and accessories. We seek to be recognized as the leader in our industry in terms of quality products, customer service, innovation, and serving the needs of earth boring contractors throughout the world supported by a management philosophy which seeks employee satisfaction and involvement, customer loyalty, and maximization of productivity and profitability.

Goal 1 A Commitment to Quality which

Develops a quality focus to consistently provide our customers with products and services which meet or exceed their expectations as to reliability, construction, precision and aesthetics.

Goal 2 A Commitment to Service which

Develops an organizational philosophy which is based on the concept that “We will do whatever it takes” to provide quality service to our customers in the most efficient and effective manner.

Goal 3 A Commitment to Innovation which

Provides an organizational focus on creativity, and encouraging the development of procedures and process which add value to our products and services.

Goal 4 A Commitment to Related Activities which

Expands into areas which complement our basic operations and strengthens our communities.

Goal 5 A Commitment to Employee Development which

Creates an organizational culture that recognizes the value of the individual employee, regardless of function, in the overall success of the company, and to provide all employees with opportunities for career development and education.

Goal 6 A Commitment to Profitability and Growth which

Expands the company in a controlled manner, enabling it to build earnings and a strong capital base so as to maximize its value to shareholders.

Mission Statement

Operation Manual

PF500

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Manufacturer's Statement

The information contained in this operation manual is necessary for the safe and proper setup, operation, maintenance, and servicing of your Barbco pilot machine. Barbco Inc. has a long tradition of offering the best quality and most efficient to operate underground installation equipment in the world. Read and understand this manual completely before you use the machine and keep it with the unit at all times for quick reference.

The equipment described in this manual is subject to change. Barbco Inc. reserves the right to change equipment at any time as part of normal product improvement. Some improvements may have been made after this manual was printed. For the latest information on your equipment, contact Barbco Inc.

The illustrations contained in this manual are intended to clarify explanations in the text. The illustrations may look slightly different from your unit, but this has been allowed only if it does not fundamentally change the factual information. Some optional equipment may be illustrated that your machine is not equipped with.

How to Reach Us

If you encounter a circumstance that is not covered in this manual, Barbco's service department will be happy to assist you. Barbco's office hours are 8:00 AM–5:00 PM (Eastern Time), Monday through Friday. Our office is located in East Canton, Ohio.

Barbco Corporate Headquarters, East Canton, Ohio

Main Office..... (330) 488 - 9400

Toll Free..... (800) 448 - 8934

How to Order Parts

To place an order for spare parts, you can call either of the above numbers. Barbco's Parts department hours are Monday through Friday, 8:00 AM–5:00 PM (Eastern Time). Orders can also be accepted via fax, 24 hours a day. Next day service must be called in by 3:00 PM.

Spare Parts (fax)..... (330) 488 - 2022

When you call the factory for spare parts or service, have the model number and serial number of the machine. Write the serial number of your machine in the space provided below.

Your Machine's Serial Number

GENERAL SAFETY STATEMENTS

- **DO NOT** operate the machinery unless you have read and understand the unit's operation manual. Lack of understanding proper operating procedures could result in unsafe operation. Operation manuals are issued with each new unit. If you haven't seen a copy, ask your supervisor for one. Replacements are available from Barbco, Inc.
- **DANGER: NEVER LIFT ANY OBJECTS OVER TOP OF PERSONNEL.** The load may shift or fall.
- **WARNING:** Verify clearance between overhead obstructions and equipment.
- **WARNING:** Secure the machine against unauthorized use when the machine is ready to operate! Stay with the unit or make sure no one can start it without you. Keep keys in your pocket when not in use.
- **WARNING:** DO NOT remove hydraulic hoses while machine is in operation!
- **WARNING:** DO NOT allow welding current to travel through bearings or hydraulic cylinders. Keep ground cable on component being welded.
- **CAUTION:** ELECTRONIC COMPONENTS CAN BE DESTROYED BY WELDING CURRENT. Disconnect battery cables and unplug any electronic devices before welding on the unit.
- **CAUTION:** Hearing Loss Hazard! Wear ear plugs while standing near a working machine. Sound pressure levels may exceed OSHA standards for constant exposure.
- **NEVER** arrive at work or work on, around, or near machinery when you are under the influence of drugs or alcohol. Beware of over-the-counter drugs, many contain specific warnings about operating machinery after taking medication.
- **DO NOT** bring personal problems to work In an office setting a personal problem may be annoying to co-workers; but at the work site it can be deadly. The people around you depend on you for their safety.
- **REMOVE** snow, ice, oil , or dirt from steps and platforms.
- **USE THE 3-POINT RULE** to Mount or dismount the machine. (keep two hands and one foot or one hand and two feet in contact with a secure surface at all times).
- **WEAR PROTECTIVE EQUIPMENT** for job conditions. Always wear hard hat, safety vest, safety glasses, gloves and steel toed or protective boots.
- **KEEP SPECTATORS AWAY.** A safe distance from the equipment.
- **MAINTAIN COMMUNICATION.** Operator must maintain communication by radio, etc. with exit pit personnel.
- **KEEP THE MACHINE AND WORK AREA CLEAN.** Oil spills, grease, loose tools, and scattered accessories cause accidents.
- **REMIND YOUR CO-WORKER** ignoring safe practices about the dangers that could result. Safety is always in the hands of those on the job!

As an employer, it is required that you follow the rules and regulations set forth by the Department of Labor OSHA office.

For this piece of equipment, follow 29 CFR 1926 where required. Follow 1926.21(b)(2) regarding inspection of jobsites and 1926.20(b)(4) regarding the training required to operate this equipment

SAFE OPERATION OF EQUIPMENT

The operator is responsible for the operation of the machine. An operator is never to neglect safety. The operator is the only person on site who has the authority to ensure a safe setup.

QUALIFIED OPERATORS ONLY ARE PERMITTED TO OPERATE THE UNIT

1. Must be at least 18 years old
2. Is physically and mentally capable
3. Has been trained in the operation and maintenance of the equipment
4. Has demonstrated capabilities (to a supervisor) to operate and maintain the equipment
5. Understands the controls and functions of this machine
6. Can perform assigned duties in a reliable manner

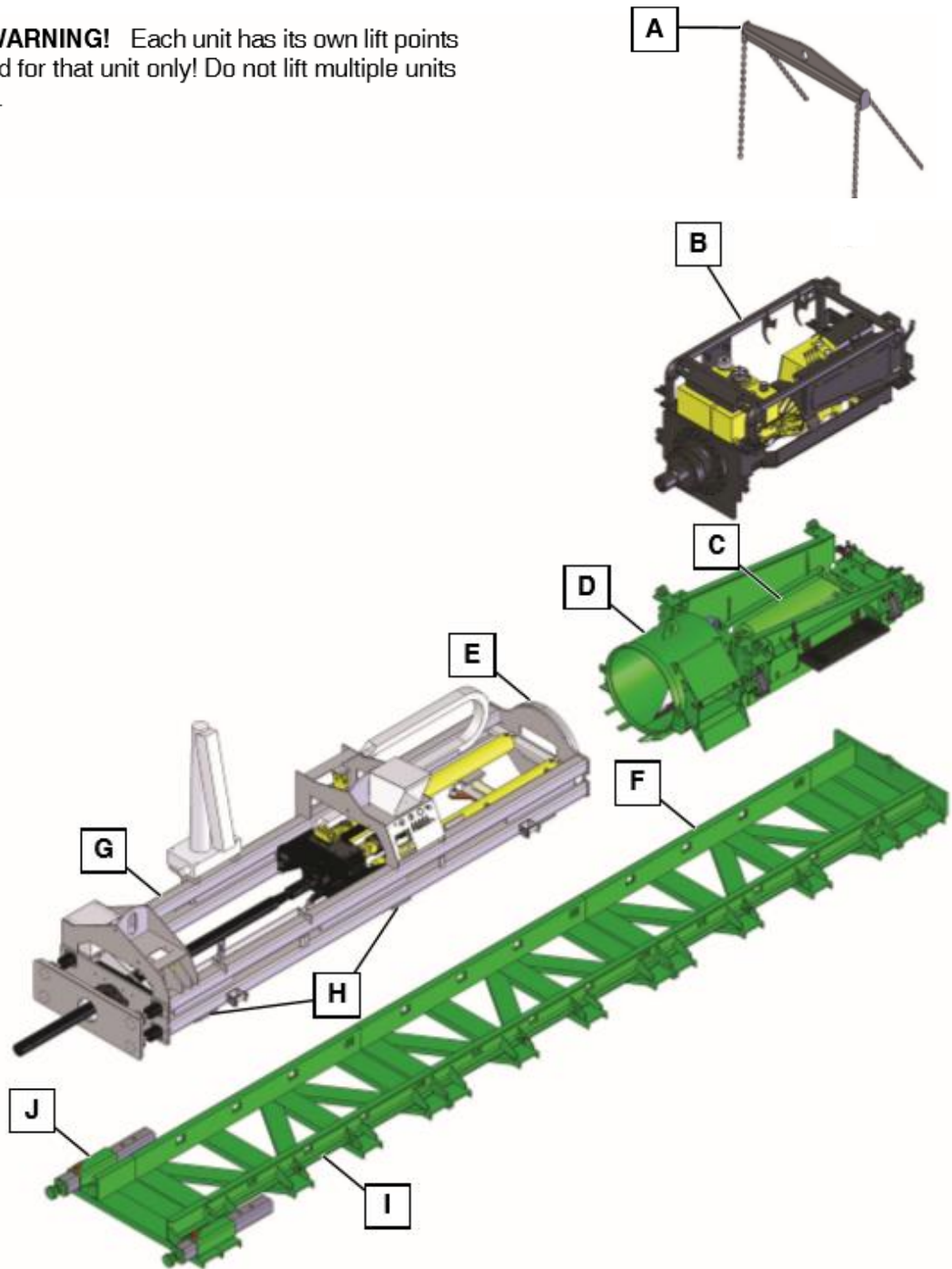
SAFETY INSPECTION OF EQUIPMENT

- Follow the operation manual and manufacturer's service bulletins regarding maintenance and inspection procedures and intervals.
- **WARNING: NEVER** make unauthorized modifications to structural members or hydraulic circuits.
- Inspect machine circuits and safety devices daily. Document inspection results. Correct problems before the unit is used. Report anything suspicious to Barbco, Inc. for consideration. Do not assume its okay.
- Report any problem found on the horizontal earth boring machine to the Barbco Inc. engineering department so proper repair procedures can be designed and used.
-
- Do NOT operate a machine that could cause an unsafe condition such as, unusual noises, vibrations, pressures, or oil leaks. Any problems must be corrected before using the machine.
- **CAUTION:** Use a piece of cardboard or wood to locate leaks. High pressure hydraulic oil leaks may not be visible and can penetrate the skin. If fluid penetrates the skin, it must be surgically removed within a few hours.
- Replace damaged hydraulic hoses or fittings.
- Replace safety decals immediately when they are faded, missing, damaged, or otherwise unreadable. Decals may be ordered individually or in sets by unit model and serial number.

MAJOR MACHINE COMPONENTS



WARNING! Each unit has its own lift points intended for that unit only! Do not lift multiple units at once.

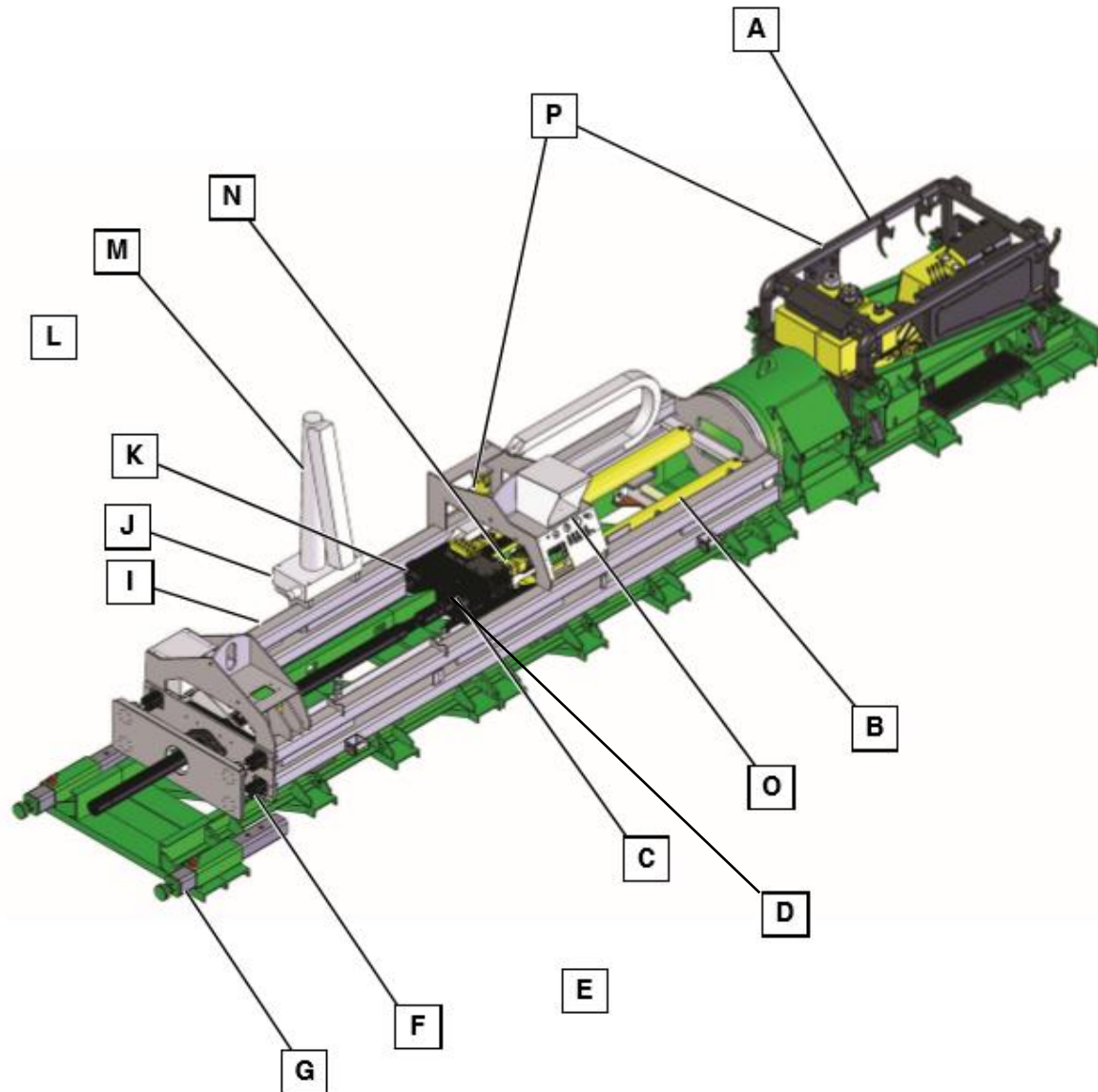


DESCRIPTION OF MAJOR MACHINE COMPONENTS OF PILOT TUBE STEERING SYSTEM INCLUDING BORING MACHINE

The location of major machine components and normal accessories of Barbco's pilot tube steering systems are shown in the diagram on the proceeding page.

- A - LIFT SLING:** Lifting apparatus used to raise or lower the Power Package, Base Push Unit or entire machine.
- B - POWER PACKAGE:** This portion of the machine contains the engine, clutch, transmission and torque hub. It also includes the fuel tank, hydraulic oil tank, filters, hydraulic pumps and operating controls, final drive, spoil paddles and optional winch.
- C - JACKING BASE:** This assembly locks into the track and houses the cylinders used to produce thrust.
- D - MASTER PUSHER:** Provides spoil chute and attaches to the casing, transferring the thrust load to the base.
- E - ADAPTER PLATE:** Puts Pathfinder on the same centerline as boring machine.
- F - MASTER TRACK:** This section of track is furnished with the machine and is always used as the rearmost track section. It has a thrust plate bolted to the end of the track. The master track is 12 ft. long and is comprised of a 10 ft. standard extension track and a 2 ft. pup track.
- G - PATHFINDER:** Pilot tube steering system.
- H - ADAPTER SADDLES:** These saddles set the centerline. They have locking dogs that tighten into the track to help hold the Pathfinder in location. A set must be present for each boring machine (size) you wish to use the Pathfinder on.
- I - EXTENSION TRACK:** These are additional sections of track to be bolted to the master track and to each other to allow installation of casing sections. Two sections of extension track along with the master track are furnished with each machine. Optional extension tracks can be added to allow for the installation of longer casing sections.
- J - TRACK PUP EXTENSION:** Designed to secure the track during the installation of the pilot string.

MINOR MACHINE COMPONENTS



DISCRIPTION OF MINOR MACHINE COMPONENTS

- A - BARBCO BORING MACHINE:** Power source for the Pathfinder.
- B - HYDRAULIC CYLINDER:** 6" Bore x 72" stroke double acting type. Mounted to rear of jacking frame and carriage for forward and reverse travel.
- C - BEARING HOUSING:** Keeps the thrusting force from penetrating the rotation motor.
- D - WATER SWIVEL:** Inlet for drilling fluid.
- E - STEERING ASSEMBLY:** Designed with replaceable steering tips. Unit holds the target display (See Parts Section).
- F - FRAME STABILIZER PLATE:** Extends out from the frame to lock the Pathfinder into place for better foothold when installing the pilot string.
- G - STABILIZER ARMS:** Extends out from the track to lock it into place, keeping it from moving.
- H - ROLLER ASSEMBLY:** Adjustable guide, helps keep the pilot string alignment with the drive end.
- I - FRAME:** Structural frame carriage rides on (See Parts Section).
- J - CRANE ASSEMBLY:** For loading and unloading pilot rod only.
- K - CAM FOLLOWER:** Sealed, eccentric (adjustable) roller. Aids in smooth carriage movement.
- L - CARRIAGE:** Fixture which retains the rotating gearbox designed to force/steer pilot string into the ground.
- M - HYDRAULIC CRANE:** Three function, self contained electric/hydraulic crane. Intended for one pilot rod at a time.
- N - HYDRAULIC ROTARY GEARBOX:** Capable of producing 19,000 ft/lbs @ 5,000 PSI, used to rotate the pilot string to make steering corrections.
- O - MONITOR BOX:** Location for monitor, swivels and helps keep sunlight off the monitor screen, for better target display.
- P - QUICK DISCONNECTS:** Spring loaded, locking hydraulic couplers used to connect and disconnect hydraulic power to the Pathfinder.

OPERATORS CONSOLE



A- PRESSURE GUAGES. *From left to right:*

- **ROTATION**- Displays the hydraulic pressure in the rotary circuit.
- **SYSTEM**- Displays the hydraulic pressure that the valves operating at.
- **THRUST**- Displays the hydraulic pressure in the thrust cylinders.

B- 7" LCD SCREEN: Monitoring system to help the operator see the tool joints in the breakout clamps. Camera has infrared capability with a magnetic base.

C- HYDRALIC LEVERS. *From left to right:*

- **BREAKOUT**- Used to make up and breakout the tool joints.
- **FRONT CLAMP**- Used to clamp on the downhole side of the tool joint.
- **REAR CLAMP**- Used to clamp on the operators side of the tool joint.
- **ROTATION**- Clockwise and counter- clockwise control of the spindle.
- **THRUST**- Forward and reverse control of the carriage.

D- ELECTRICAL CONTROL BOX: Junction box containing wiring connections

E- FUSES. *From left to right:*

- **MAIN POWER**- Protects the main electrical circuit
- **BREAKOUT CAMERA SYSTEM**- protects the LCD screen and camera.

F- MAIN POWER TOGGLE AND LIGHT: Turns ON/ OFF all the features on the electrical box.

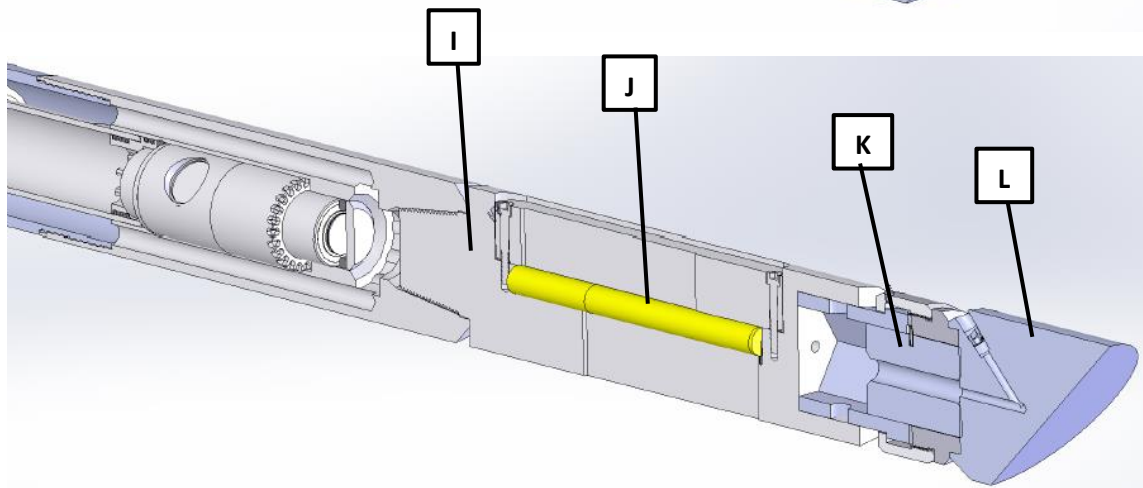
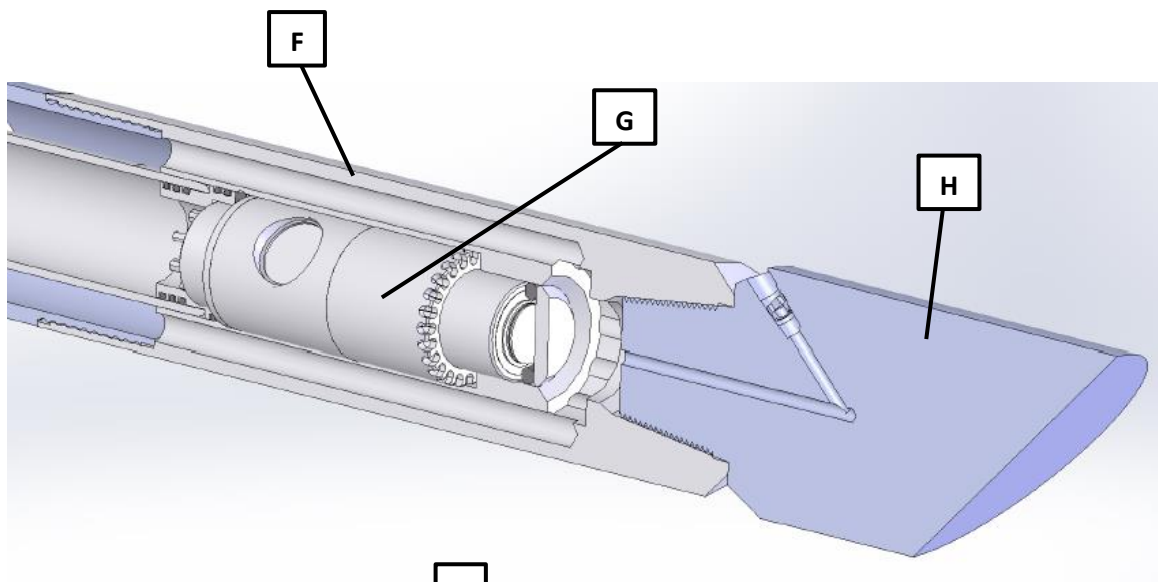
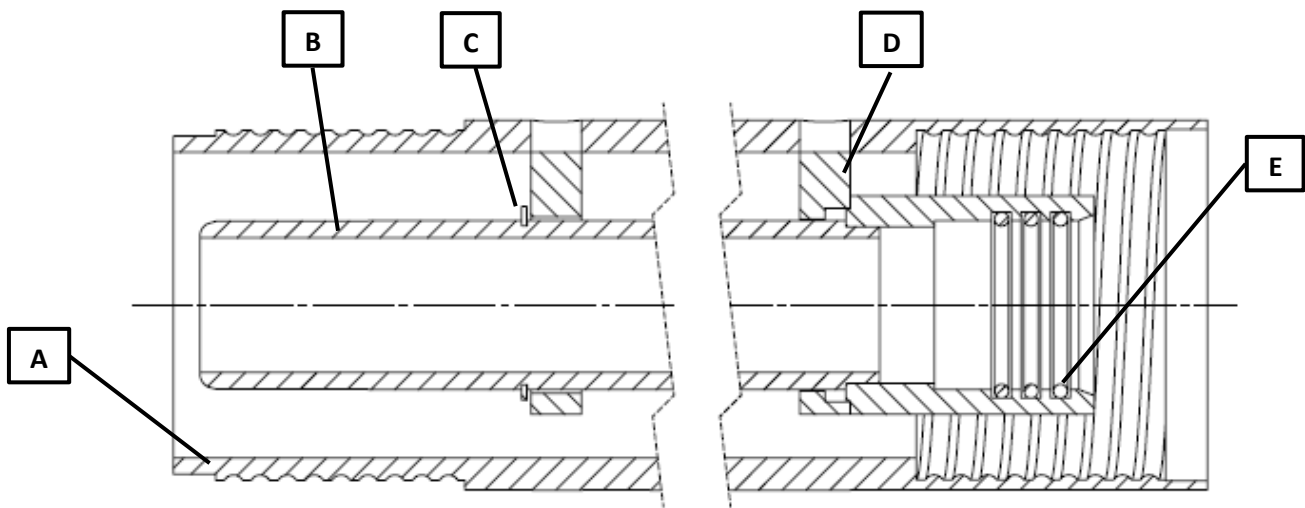
G- HI ROTATION TOGGLE AND LIGHT: High/ Low rotation speed control. High speed and low torque when on. Low speed and high torque when off.

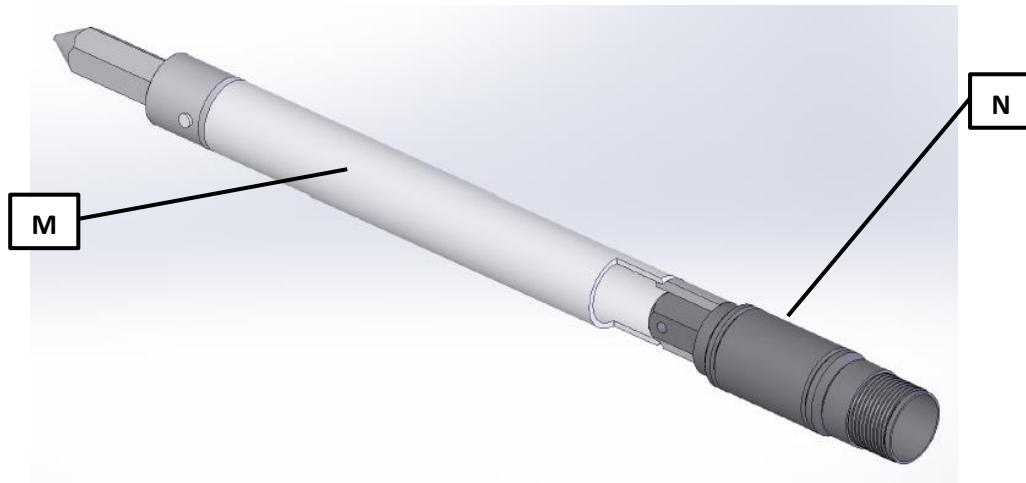
H- CLAMP INDICATOR LIGHTS: Red light illuminates when the front and rear clamp are closed.

I- RED MUSHROOM BUTTON: Master e-stop shuts off the engine if pushed. Twist CW to release.

J- FAN TOGGLE: Automatically turns on when in the "OFF" position if the hydraulic oil temperature reaches or exceeds 130 degrees.

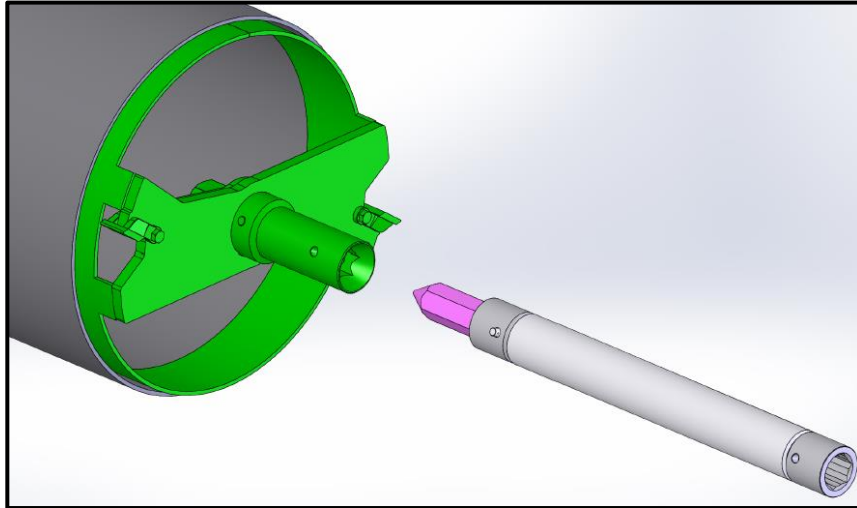
DOWNHOLE TOOLING AND PILOT ROD





- A- PILOT TUBE BODY:** One piece outer skin with male and female threads.
- B- PILOT TUBE INNER ASSEMBLY:** Inner sight tube. Keeps lubricants or air isolated in the annular space between the assembly walls.
- C- SNAP RING:** Keeps the inner tube and outer skin together.
- D- CENTRALIZER:** Welded inside the outer skin to keep the inner sight tube on center of the assembly.
- E- O-RINGS:** Seal the inner tubes together.
- F- TARGET HOUSING:** Rear entry housing made to flow fluid or air around the target to keep it cool during drilling operations.
- G- LED TARGET:** Battery operated target providing LED display for the camera to see.
- H- STANDARD STEERING TIP:** For displaceable soil. Can be supplied with 30, 45, or 70 degree approach angle. Also available with carbide cutters.
- I- TANDOM SOUNDE HOUSING:** Stackable housing allows the operator to use walkover locate when performing a long crossing. Intended as a backup only.
- J- SOUNDE:** Battery operated locating device.
- K- 3" HEX DRIVE:** Connection to the steering tip on the sounde housing.
- L- SOUNDE HOUSING STEERING TIP:** For displaceable soil only.
- M- SHOCK ROD:** Connection between the swivel and the cutting head. Helps reduce side load on the swivel and provides a slip connection to the cutting head.
- N- PILOT SWIVEL:** Keeps the pilot from turning and dropping during casing phase of the job.

CASING PHASE TOOLING



STANDARD PILOT READY HEAD-

Used in ground conditions that require the casing to be overcut. Recommended with a drift ring. Best practice to shim the inside of the casing where the ring makes contact in order to center the head.

Shock rod and swivel should be used to keep the pilot string from rotating.

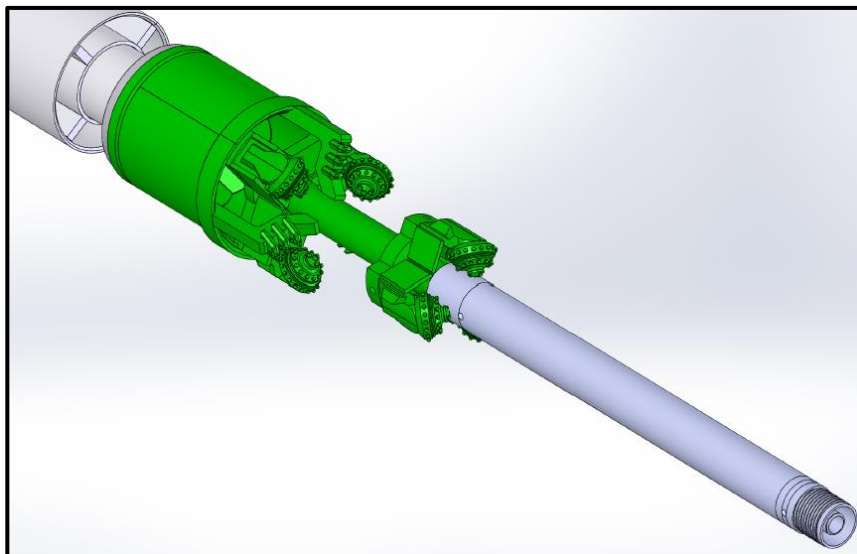
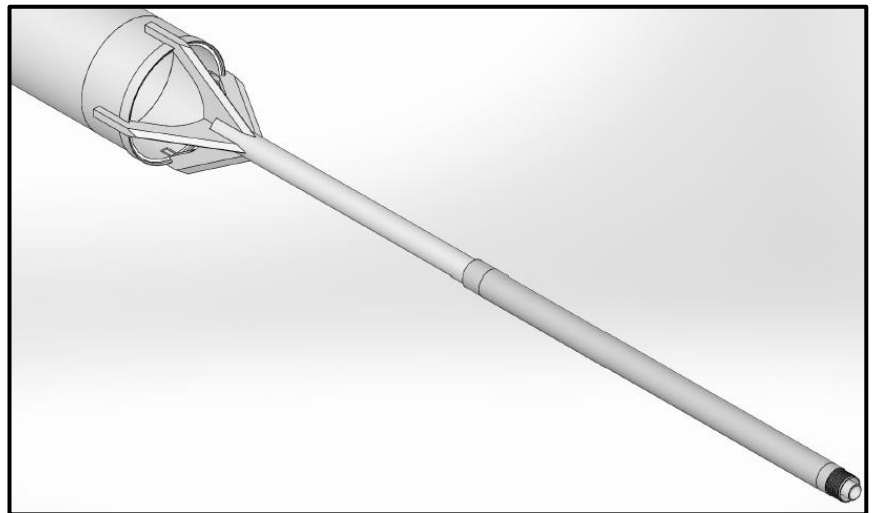
KNIFE REAMER HEAD-

Used in soft ground conditions. An auger inside the casing with or without the cutting head removes the spoil from behind the blades.



WARNING! Wing cutters must be removed from the cutting head

Direct connection to the pilot string.



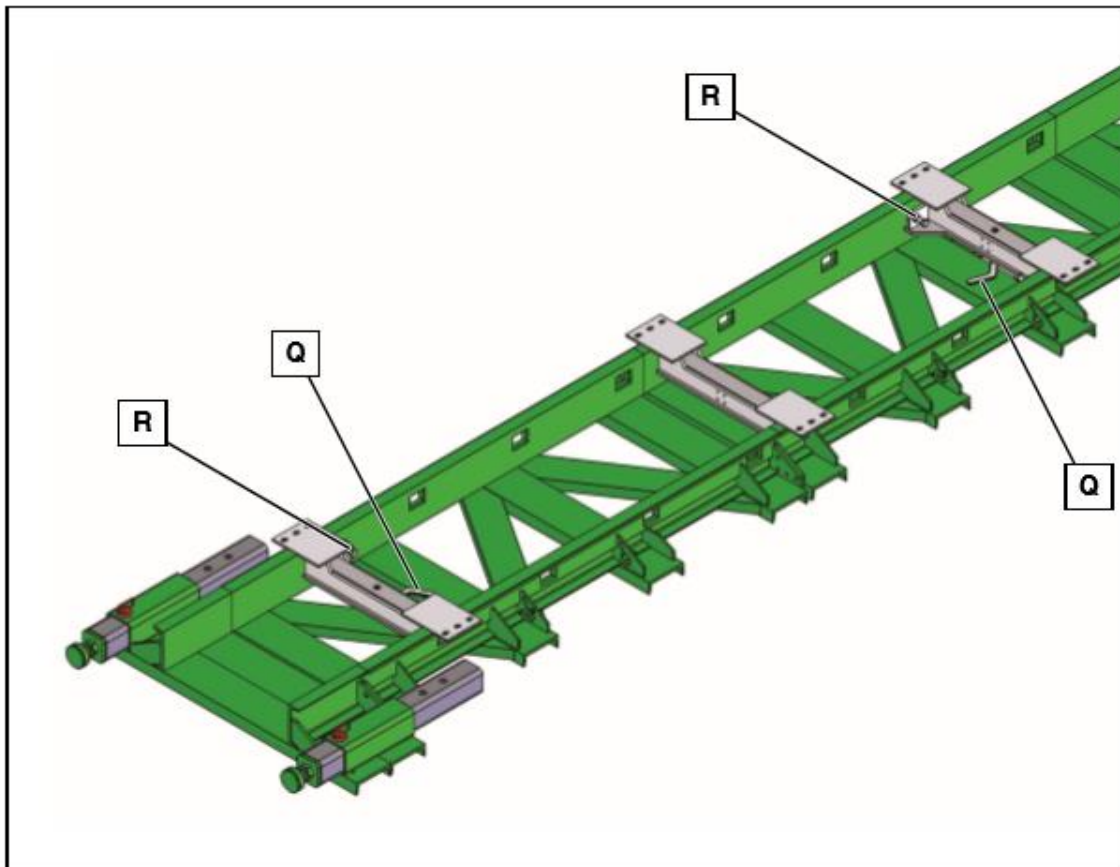
FLEXBOR HEAD-

Used in ground conditions that require the casing to be overcut in boulders or solid rock.

This method utilizes the pilot to supply pressurized air to blow the cuttings thru the cutting head into the drive casing then back to the boring machine.

Direct connection to the pilot string.

SADDLE KIT



Q - DOG LEVER: Slides track dogs into dog holes. Align the track to stop backward movement during pilot tube installation.

R - ADJUSTMENT BOLTS: Allows for centerline adjustment and locks the Pathfinder down from moving left or right inside the track.

PATHFINDER/BORING MACHINE SET UP

SETTING AND ALIGNING THE TRACK

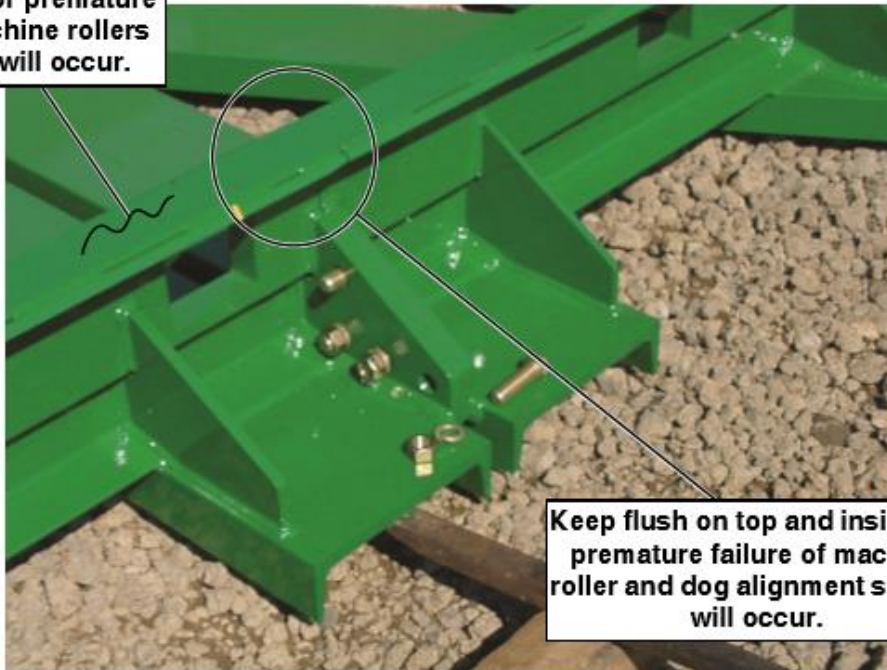
The most critical part of the bore is the setting of the machine track on line and grade. If the alignment is not right when you start, it is not likely to improve.

THE MACHINE AND THE TRACK SECTIONS ARE DESIGNED TO BE PLACED SEPARATELY. ALWAYS USE BALANCED LIFT POINTS.



WARNING! Always use correct lifting devices and NEVER hoist or transfer loads over personnel!

Keep from welding to top of track rails or premature failure of machine rollers and sensor will occur.

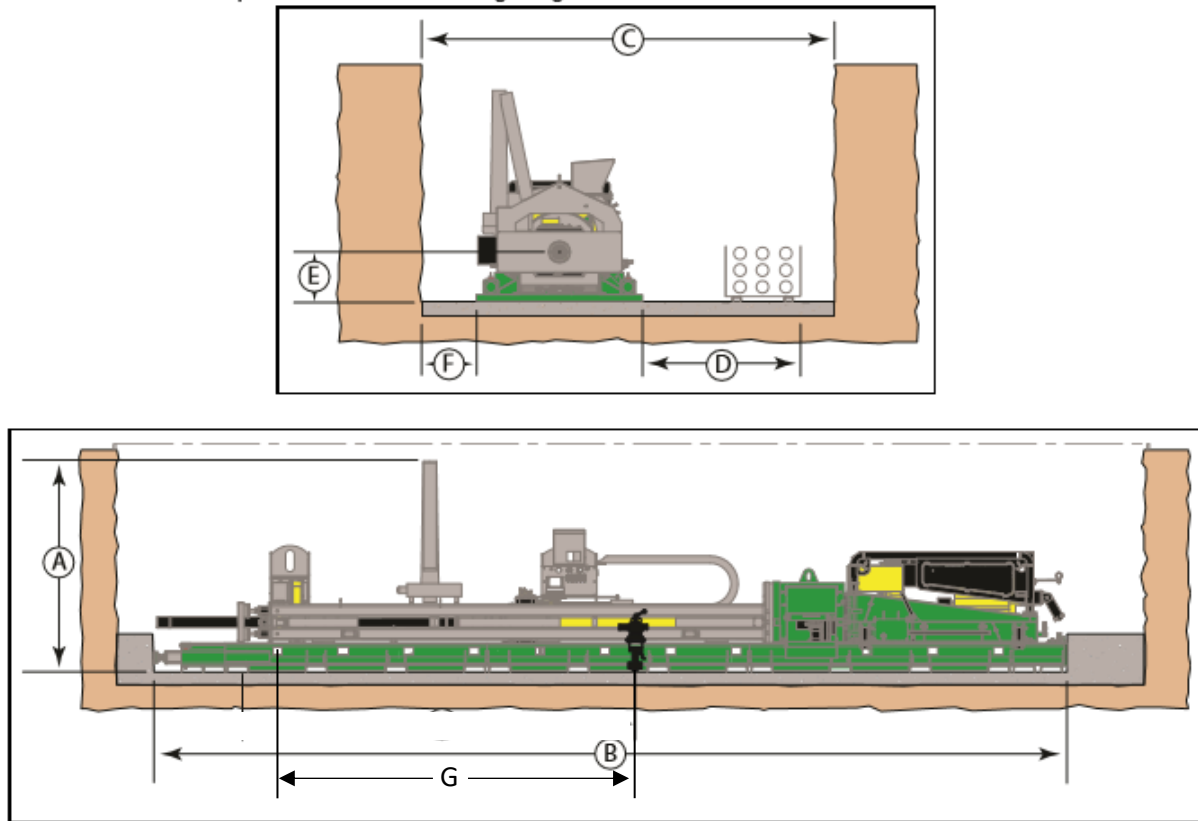


Keep flush on top and inside, or premature failure of machine roller and dog alignment sensor will occur.

1. The track should be lined up with a transit to be sure its on line with the proposed bore path. It must be tightened into place with the track jack extension pup. The rear of the track should be as squared and tight as possible against the backstop.
2. Locate the placement of the camera stake.
Remove the concrete. Create a big enough hole to where the camera stake is clearing the edges of the concrete. Then drive the stake into the ground keeping it as plum as you can to the pit floor.

NOTE: Extend the stake if need be to reduce vibration of camera.

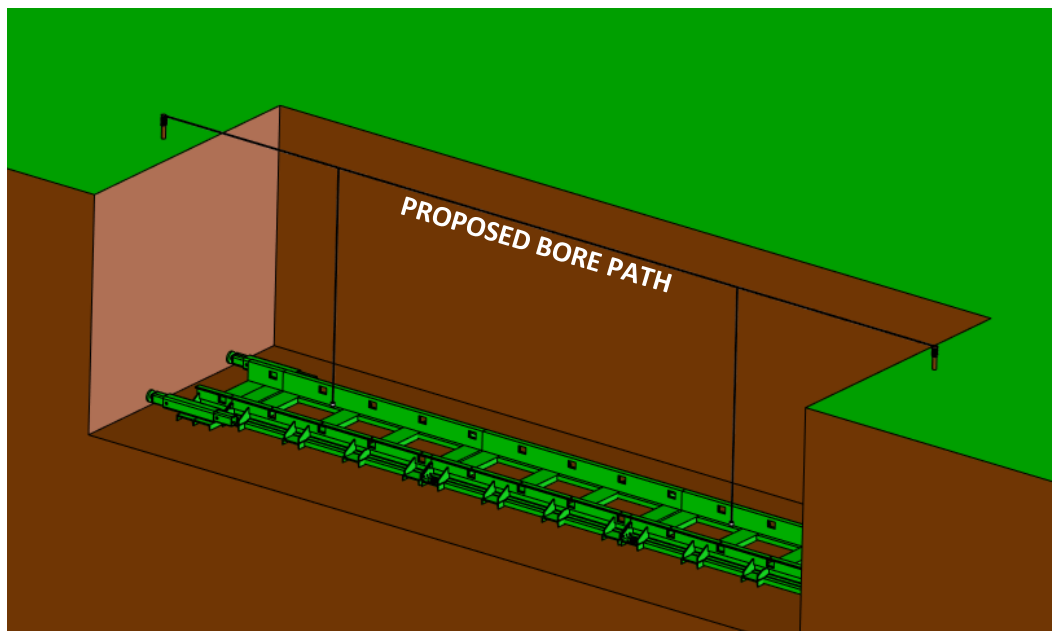
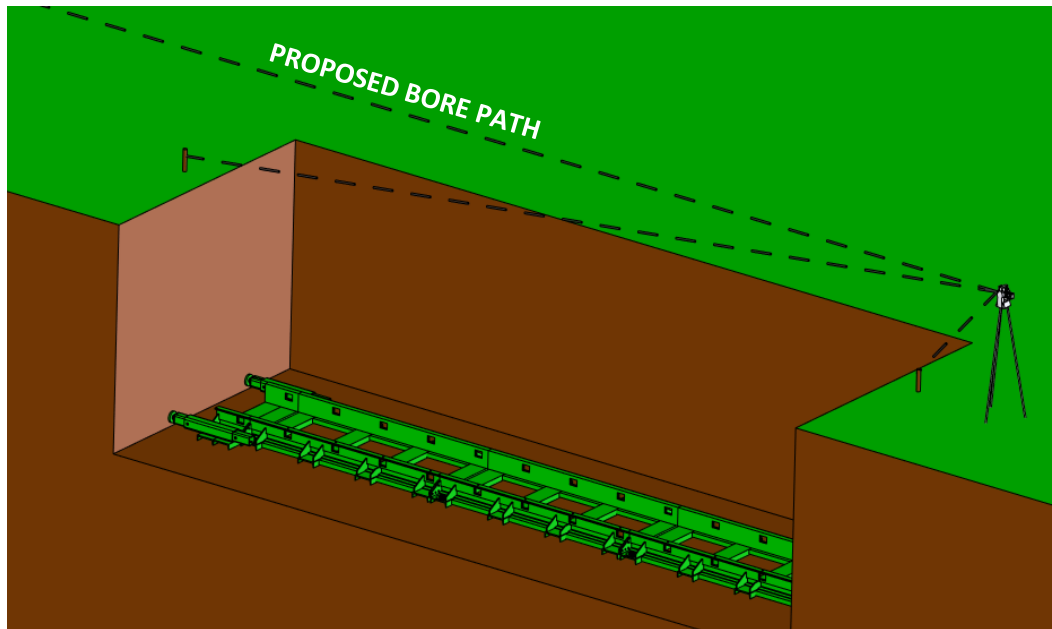
BARBCO RECOMMENDED PIT DIMENSIONS.
For installation of 5' pilot rod and 20' casing lengths



- A- 5' (60")
- B- 37' (444") Minimum
- C- 12' (144")
- D- 5' (60")
- E- Same as the auger boring machine.
- F- 2' (24")
- G- From centerline of the first dog hole to the camera. 11'-6" to 13'

15
PATHFINDER SET UP

Set Up



3. Set up a stringline above the bore pit with the transit. On the proposed bore path. Instal stakes at eather end deep enough to stretch the string tight. Do this with the ability to have the sring removed as equipment is set in the pit. You must be able to restrech the string, placing it back in the same place.



NOTE! Make sure the string line is totally independent from the pit walls/ trench box etc.

Set Up



4. Aline the front and rear of the track by dropping plumbob's down from the string line. The string must match the centerline of the track. Adjust the track as needed and retighten the track jack.

If your not using a track jack you can weld the side of the track off to the trench box. If your in a slopped pit then you can acheve this by driving long beams into the ground and weld them off to the track. **THE TRACK MUST NOT MOVE**



DANGER! Always use correct lifting devices and NEVER hoist or transfer loads over personnel!

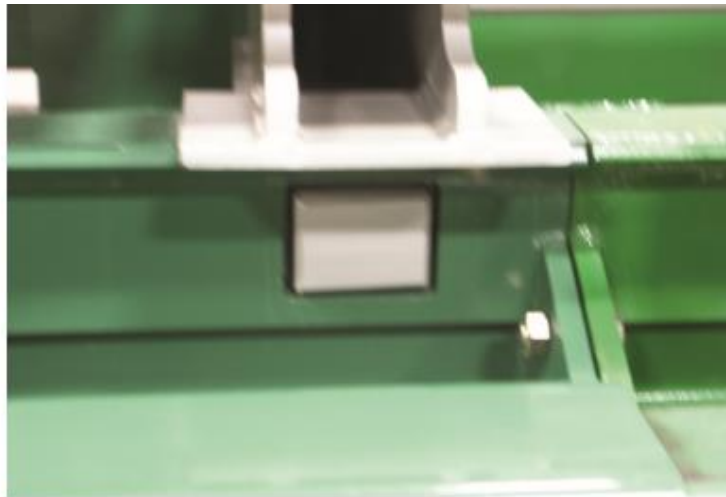
5. Set boring machine in the track. Position it back towards the backstop.
6. Use a spreader chain to lower the Pathfinder into the track. Directly in front of the boring machine.



7. Start boring unit, propel forward to lock in the Pathfinders rear adapter ring into the master pusher and secure.



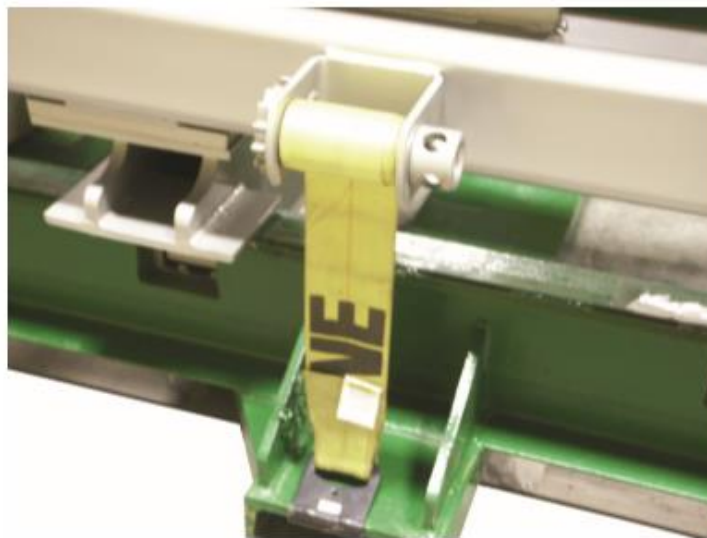
8. Push the Pathfinder forward until its front dog's line up with the extension pup tracks front dog hole.
Lock the Pathfinders dogs into the track by pulling the lever under each saddle.



9. Lock the Pathfinders front dog into place by firmly pressing down on the adapter saddles friction arm, then use the supplied handle to ratchet the dogs out tightly against the track.



10. Attach binder straps to channel end on track and securely tighten.



11. Visually inspect the rear dogs alignment with the tracks dog holes. If out of alignment loosen the saddles and mounting bolts and line up the assembly.
12. Make all power connections between Pathfinder and auger boring machine.

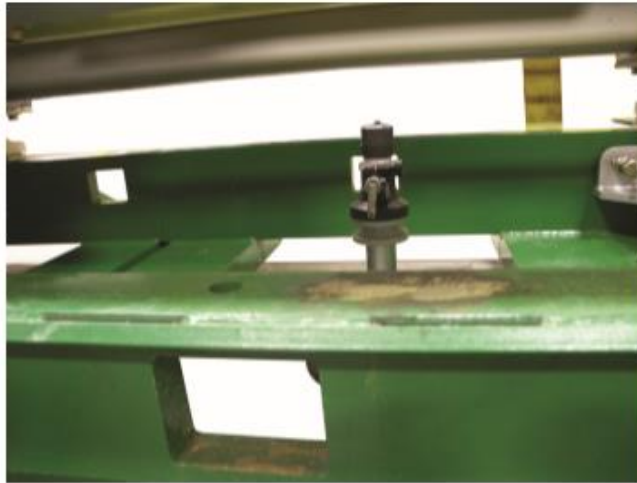


DANGER! Be sure boring machine is turned OFF.

THEODOLITE SET – UP

After the Pathfinder has been securely dogged into the track holes and the entire machine is securely anchored, then it is time to set-up the Theodolite.

1. Install the vertical adjustment shaft of Theodolite, down through the center of the stake (already driven into ground).



2. Apply and tighten three 1/4-20 bolt to secure.
3. Install horizontal adjustment of Theodolite stand. Make sure it adjusts perpendicular to the centerline of the Pathfinder. Tighten the locking knob.



4. Spin the base plate of the adjustment stand to the bottom of the Theodolite.



Place into the vertical stand



5. Place the monitor case on top of the fixture located above the operator's station. Use the supplied rubber buggies to secure the monitor to the fixture. Open the lid. The lid has a self-locking gas strut to keep it open. To close pull the lock and shut the lid.



NOTE- The monitor must be plug in to 110 AC outlet.

6. Make two monitor electrical connections to the supplied junction box.



NOTE- It's a good practice to secure the junction box down to avoid dropping it and damaging connectors.



Cables will only connect one way.

7. Make all connections at the theodolite.



8. Turn on the monitor by placing the rocker switch to the “Power” position.



NOTE- The monitor is a complete touch screen computer. Take caution when handling it. The unit has a built in heater that will automatically turn on if working in a cold environment.



The unit may be password protected. The factory password is ***“password”***

9. Use the vertical adjustment to place the pivot point of the theodolite on the centerline of the boring machine. An easy way to do this is to place a level or a straight edge across the top of the thrust frame then measure from the bottom of the level to the pivot point of the theodolite. A dimple molded into the side cover on the theodolite marks the pivot point. The measurement for the PF500 is 8-1/4". Lock the adjustment in place by tightening the thumb screw on the vertical stand.



10. Leveling the theodolite. The bottom round bubble level must first be leveled up by using the three screw adjustments. Then the top rectangle bubble level must be adjusted the same way.



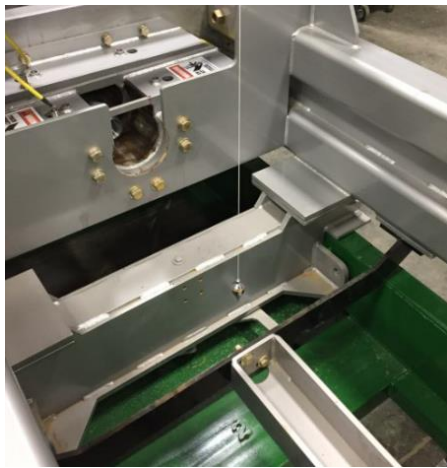
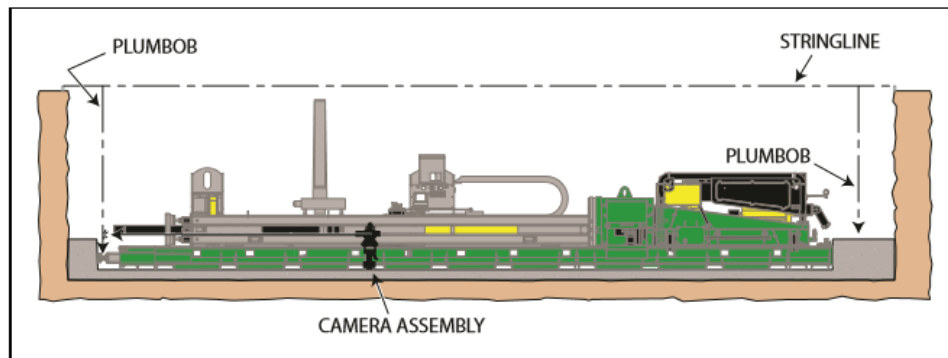
11. Use the horizontal adjustment and a plum bob hung from the string line to center the theodolite with the bore path.



Lock the horizontal adjustment down by tightening the thumb screw.

12. Check the bubble levels again if not level redo steps 10 and 11.

13. Use the peep sight mounted on top of the theodolite and right, front knob on the base of the theodolite to spin the theodolite and align to the previous installed string line. The farther away the string is from the theodolite the more accurate the camera will be.



Lock this adjustment down by tightening the larger portion of the adjustment knob.

14. Turn the theodolite on by gently pressing the yellow power button on the lower right side of the display.



15. Now that the theodolite is completely lined up press the “0 SET” button twice to set the horizontal readout to 0 as shown in the photo above. If the numbers switch from 0 to any other number you know the horizontal alignment is off and needs adjusted back to 0.

16. Setting the grade. Gently push the “V/%” button on the display. This will flip the readout from percent to degrees. Choose the appropriate setting.



NOTE- The theodolite will not display the grade if the unit is not level.



17. Use the rear knob above the display to set the grade. Lock this adjustment down by tightening the larger portion of the adjustment knob.

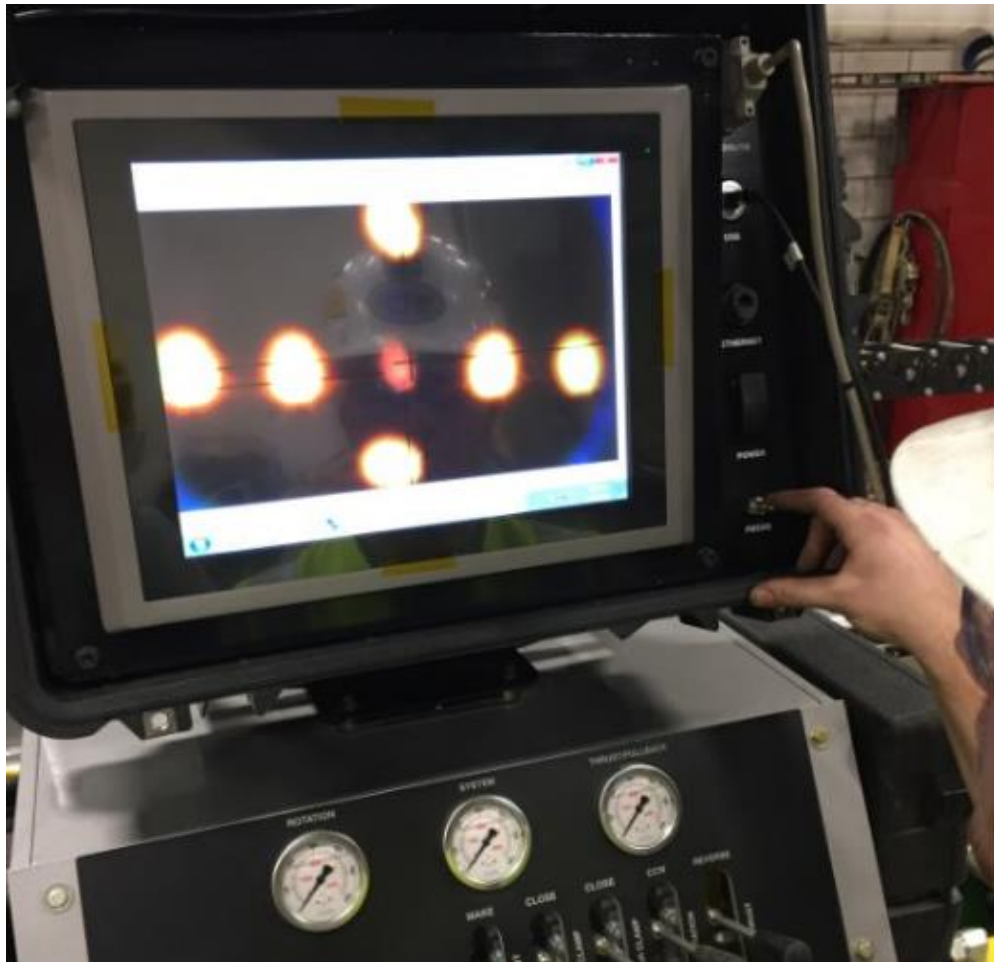


NOTE- The grade of the theodolite and the grade of the boring machines track **MUST** be the same. Inadequate alignment will drastically decrease the Pathfinders accuracy as well as increase the rotation torque required to turn the pilot rod.

The theodolite is now set up and ready to install the pilot string. The target may appear to be way off line and grade. This is common and must be fixed by penetrating the ground and steering the target to the crosshairs on the monitor.

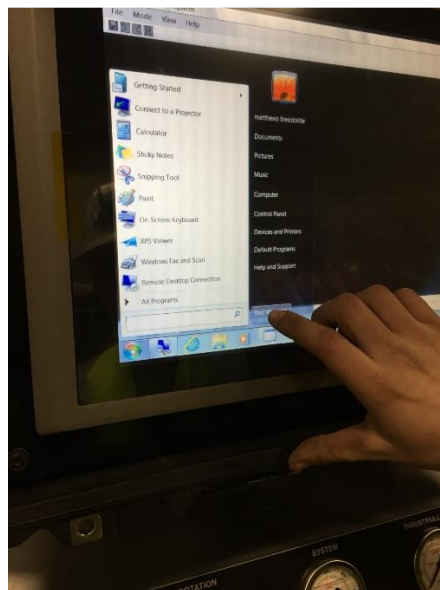


NOTE- DO NOT MOVE THE THEODOLITE IN ORDER TO LOCATE THE TARGET!



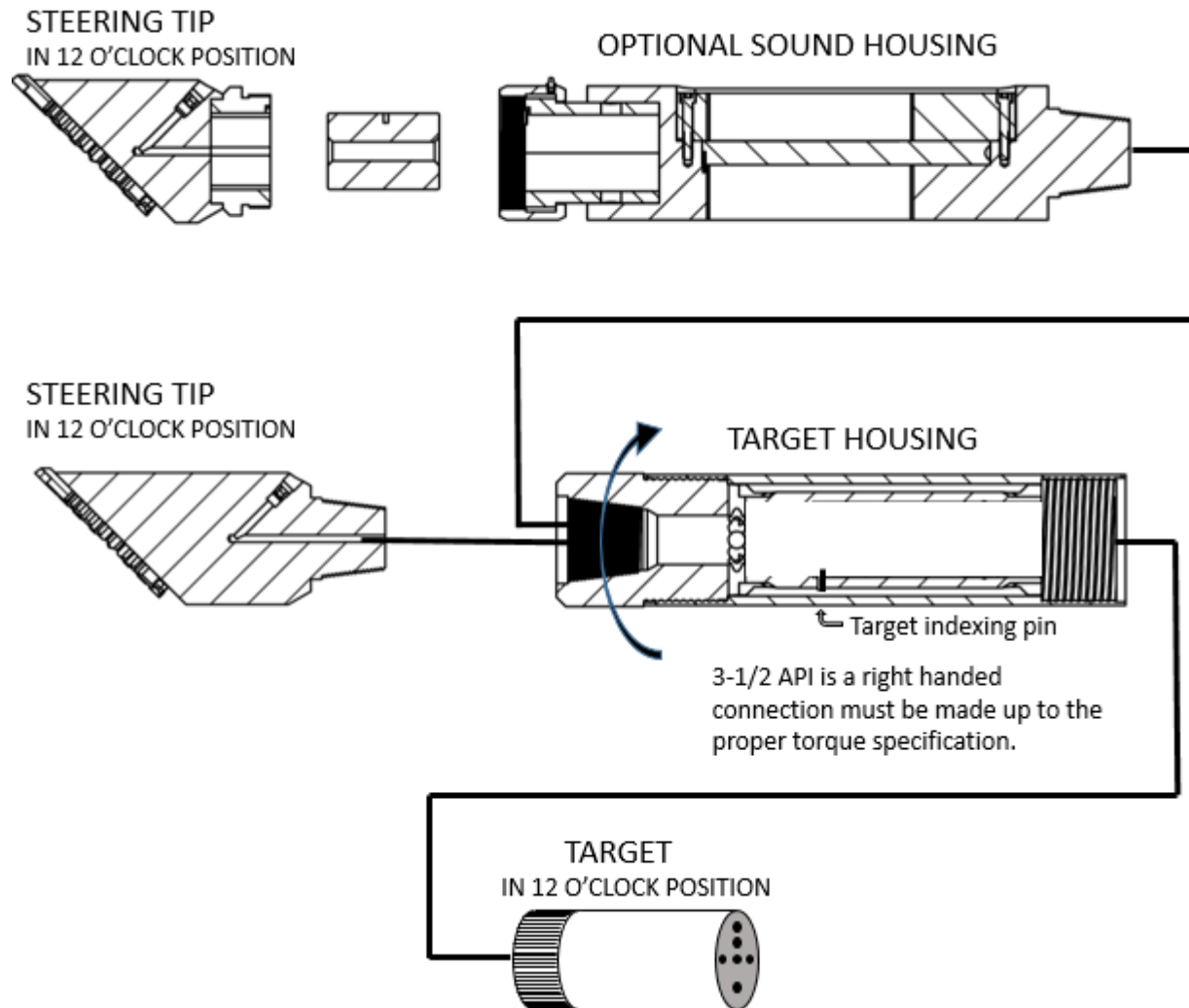
18. Focus the camera image on the screen with the toggle on the monitor in the lower right hand corner. DOWN to focus in. UP to focus out.

19. Using the magnifier on the lower tool bar to enlarged the image up to 600%. This is helpful when piloting for a long distance.



20. Shut down the monitor by clicking the windows icon and selecting "Shut down". When the unit turns off it's safe to switch the rocker switch to the off position.

TARGET HOUSING STACK UP



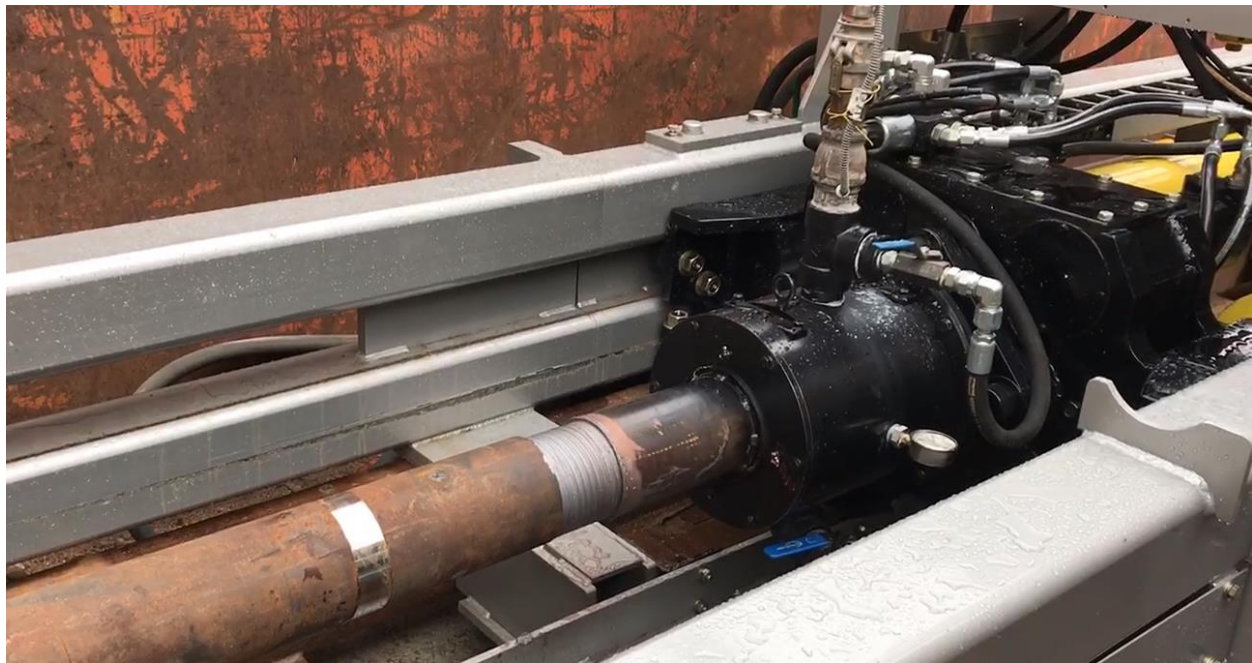
After the desired steering tip is determined and properly torqued up to the target housing. Slide LED target into the housing. Rotate it to match its 12 o'clock position with the steering tip.

Make sure the target is completely charged!

BASIC OPERATION



- 1- Using the thrust lever, completely retracted the carriage to load a rod. The rod support will raise up into position automatically. When setting a rod in place be sure to push the rod forward into the female end of the previous rod then rest it on the rod support. Prep the threads with copper cote antiseize/ lubercant.



- 2- Slowly move the carriage forward to engage the spindle into the female end of the loaded rod.



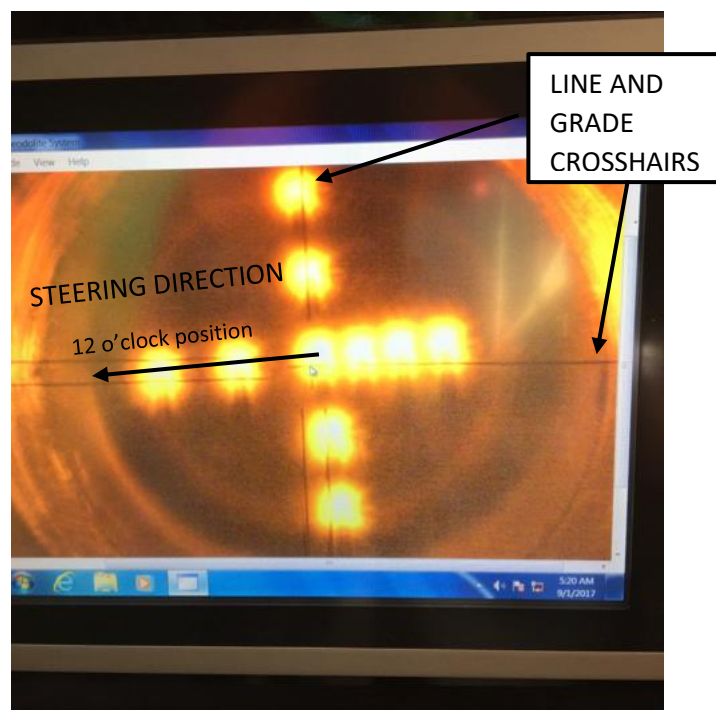
- 3- Rotate clockwise to make up the tool joints on both ends. It's always best to make up each tool joint tight enough that reverse rotation can be made without loosening a tool joint downhole.



- 4- Use the float on the piston end of the cylinders during the thread up process. This will greatly reduce the wear on the threads. This assembly is spring loaded allowing the threads to engage or disengage when rotating only without damage.



- 5- Rotate and thrust independently to steer the pilot into the ground. Excessive rotation will create heat and sometimes drop the pilot between the machine and the target housing. Causing loss of the top of the target (sag) as it's displayed on the monitor.



- 6- Rotate and point the 12 o'clock position towards the center of the crosshairs then thrust. The target will move across the screen in the direction that 12 o'clock is pointing too. In most cases the pilot is needed for grade sensitive bores. Attempt to steer the target across the crosshairs from left to right trying not to let the center LED loose contact with the intersection of the crosshairs. Steer up and down as needed aswell. The better you do this the farther you will be able to progress the pilot while keeping sight of the target.



- 7- After you've successfully inserted the rod into the ground. Close the front clamp and reverse rotate until the joint is unthreaded. Use the float from step 4.



- 8- Carefully close the rear clamp making sure not to bite onto the mail threads. Break the tool joint at the spindle and unthread, again paying attention to the position of the float.
- 9- Repeat steps 1 thru 8 until the pilots complete

LUBERCATION



Use a Barbco Bentonite Pump to mix and pump fluid to reduce torque as needed. Excessive pumping will sometimes drop the pilot between the machine and the target housing. Causing loss of the top of the target (sag) as it's displayed on the monitor. Make sure to flush out the rod when the pilots complete. When piloting downhill it a good idea to use air to push the lubricant out of the rod after injection, before a tool joint is broken. This will prevent fluid from getting into the sight tube of the pilot rod,

