BARBCO- REMOTE CRADLE BORING MACHINE (RCBM)

OPERATION MANUAL

FINIAL 7/12/16, REV 1/10/17

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, 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 strengthen 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.

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INTRODUCTION

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 cradle boring 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 Barbco cradle boring machine and keep it with the unit at all times for quick reference.

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, Monday through Friday. Barbco's office is located in Canton, Ohio.

Barbco Corporate Headquarters, 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. 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. See ID tag located on the lifting assembly. Write the serial number of your machine in the space provided below.

You're Machine Serial Number

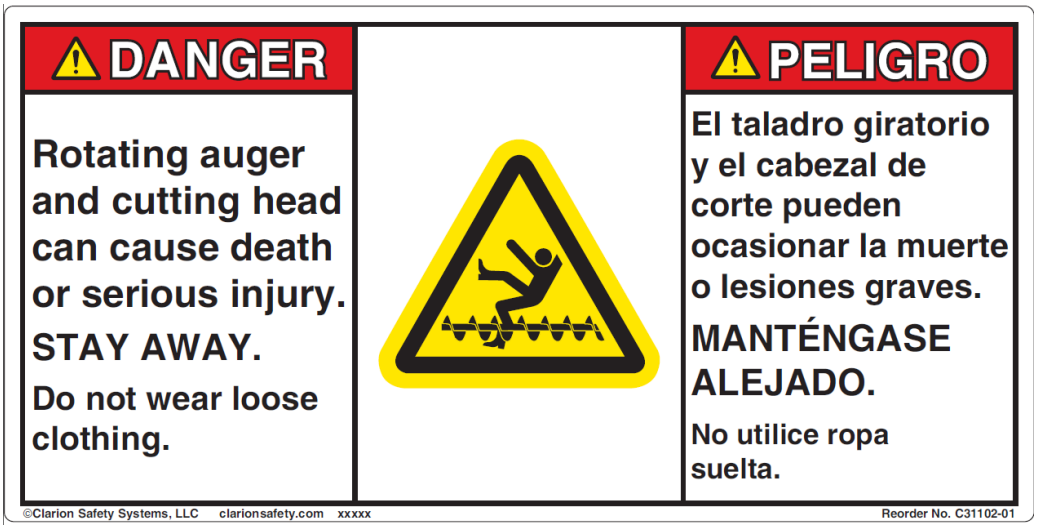
SAFETY RULES

SAFE OPERATION PRATICES

If you are the owner, operator or the helper using a Barbco Inc. Cradle Boring Machine, it is important that you recognize that your boring machine is a powerful piece of underground construction equipment. (IT MUST BE OPERATRED WITH RESPECT AND CAUTION).

The “Safety Rules” section of this manual provides safety rules for pre-start up, setup, operation and maintenance of the Cradle Boring Machine. It is written for operators, ground crew, and maintenance people.

DANGER: THIS EARTH BORING MACHINE IS CAPABLE OF AMPUTATION, THROWING OBJECTS, AND CRUSHING PERSONNEL. FAILURE TO OBSERVE THE FOLLOWING SAFETY INSTRUCTIONS COULD RESULT IN SERIOUS INJURY OR DEATH.




DANGER
Rotating blades will cause death or amputation.
Keep door closed.
Stay away from side of machine.
PELIGRO
Las cuchillas giratorias pueden ocasionar la muerte o amputaciones.
Mantenga la puerta cerrada.
Manténgase alejado del lado de la máquina.
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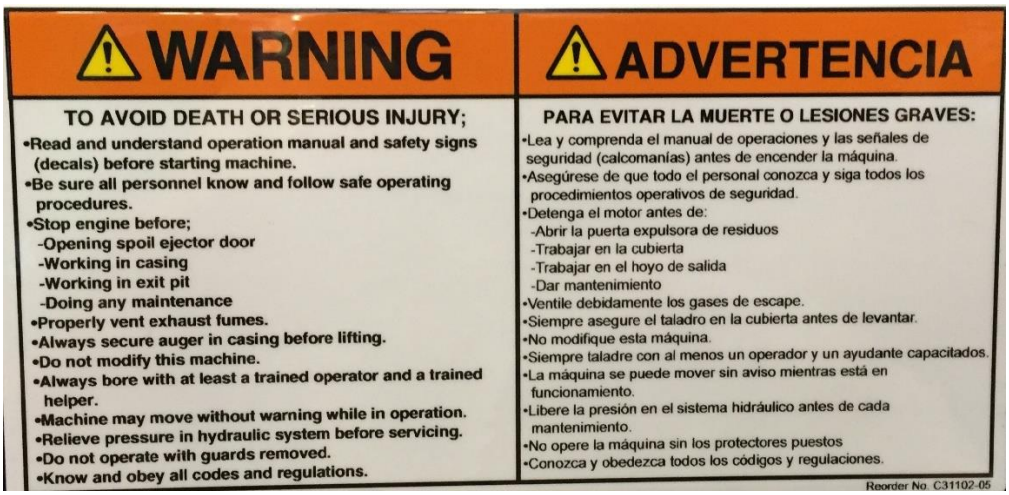
WARNING
TO AVOID DEATH OR SERIOUS INJURY;
•Read and understand operation manual and safety signs (decals) before starting machine.
•Be sure all personnel know and follow safe operating procedures.
•Stop engine before;
-Opening spoil ejector door
-Working in casing
-Working in exit pit
-Doing any maintenance
•Properly vent exhaust fumes.
•Always secure auger in casing before lifting.
•Do not modify this machine.
•Always bore with at least a trained operator and a trained helper.
•Machine may move without warning while in operation.
•Relieve pressure in hydraulic system before servicing.
•Do not operate with guards removed.
•Know and obey all codes and regulations.
ADVERTENCIA
PARA EVITAR LA MUERTE O LESIONES GRAVES:
•Lea y comprenda el manual de operaciones y las señales de seguridad (calcomanías) antes de encender la máquina.
•Asegúrese de que todo el personal conozca y siga todos los procedimientos operativos de seguridad.
•Detenga el motor antes de:
-Abrir la puerta expulsora de residuos
-Trabajar en la cubierta
-Trabajar en el hoyo de salida
-Dar mantenimiento
•Ventile debidamente los gases de escape.
•Siempre asegure el taladro en la cubierta antes de levantar.
•No modifique esta máquina.
•Siempre taladre con al menos un operador y un ayudante capacitados.
•La máquina se puede mover sin aviso mientras está en funcionamiento.
•Libere la presión en el sistema hidráulico antes de cada mantenimiento.
•No opere la máquina sin los protectores puestos
•Conozca y obedezca todos los códigos y regulaciones.
Reorder No. C31102-05


DANGER
CALL BEFORE YOU DIG.
Locate ALL underground utilities and have utility companies shut them off BEFORE starting underground work.
Do NOT drive under low hanging electrical power lines.
Verify clearance between power lines and equipment.
Know the height of your equipment.
PELIGRO
AVISE ANTES DE PERFORAR.
Localice TODAS las instalaciones subterráneas y pida a los proveedores de servicios públicos que desactiven sus servicios ANTES de empezar el trabajo subterráneo.
NO trabaje por debajo de líneas eléctricas que cuelguen muy cerca.
Verifique el espacio libre entre las líneas eléctricas y el equipo.
Conozca la altura de su equipo.
©Clarion Safety Systems, LLC clarionsafety.com xxxxx
Reorder No. C31102-07

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 Barbco cradle boring machine
6. Can perform assigned duties in a reliable manner

SAFETY INSPECTION OF EQUIPMENT

- **Follow the operation manual** and manufacturer's service bulletins regarding maintencance 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.**
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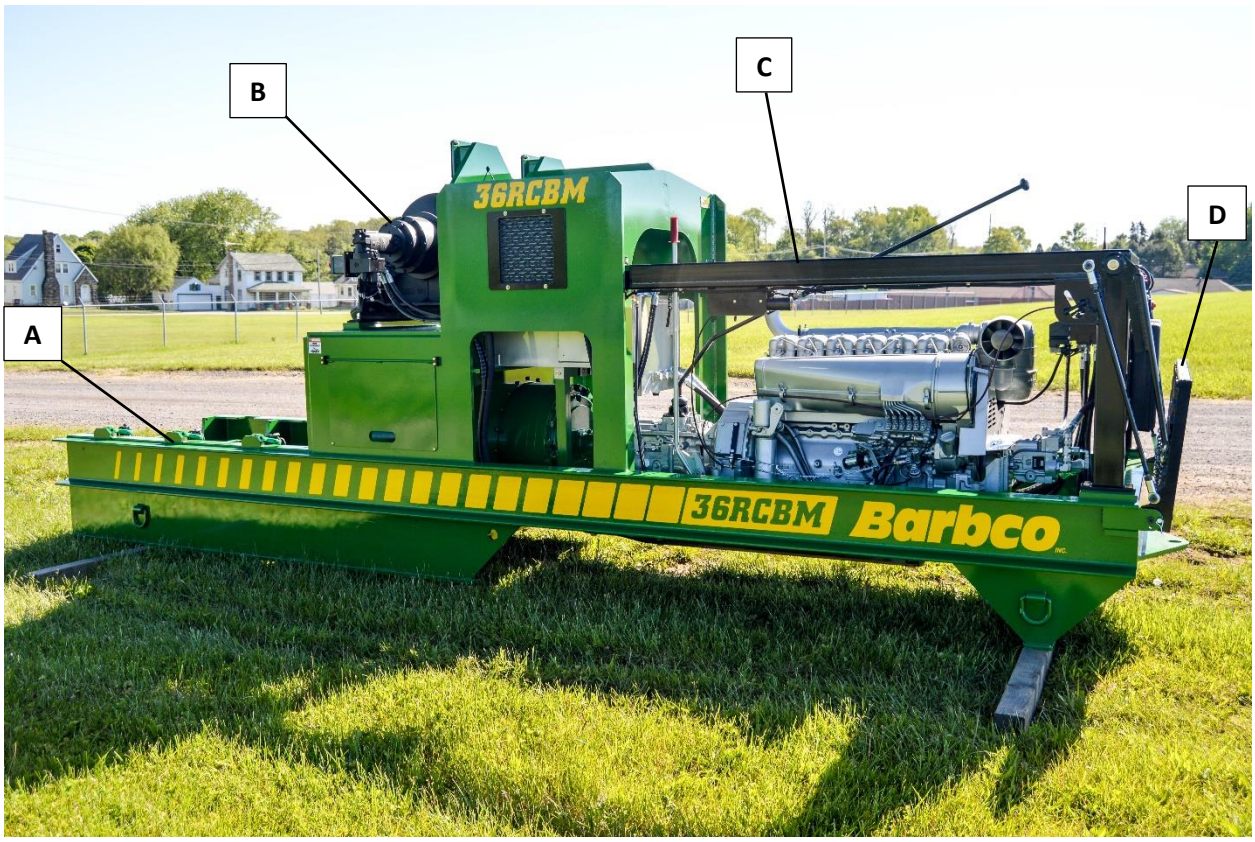
- **Do NOT operate** a machine that could cause an unsafe condition such as, unusual noises, vibrations, pressures, or oil leaks. Any problems must be coreected before using the machine.
- **CAUTION: Use a piece of cardboard or wood to locate leaks.** High pressure hydraulic oil leaks may not be visible and can penetrate the skin. If fluid pentrates the skin, it mus 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 my be ordered individually or in sets by unit model and serial number.

COMPONENT DISCRIPTION

MAJOR MACHINE COMPONENT

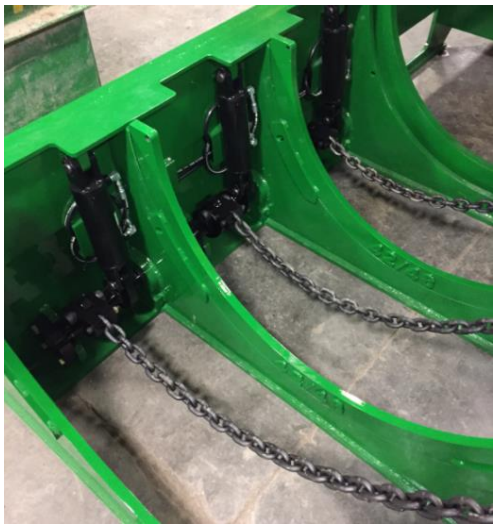


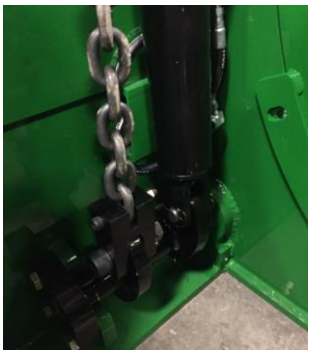
- **A- HOLD DOWN CRADLE**- location where the bore casing is secured.
- **B- WINCH** – Supplies the forward thrust force for the unit.
- **C- POWER PACK**- Contains the drive line/ power supply to the unit.
- **D- MAINTAINCE PLATFORM**- Provides an area for when performing service/ maintenance to the unit.

DANGER- Stay clear of the maintenance platform when in operation. NO RIDERS ALLOWED!

MINOR MACHINE COMPONENTS

WIRERLESS REMOTE CONTROLER- Operator interface to all functions.





LOCK DOWNS- hook and chain assembly's that pull down the casing to the saddles.

ADAPTER SADDLES- Blot in casing saddle reducers

FRONT DRIVE- Hex ID final drive and gearbox assembly.

MAIN LIFT POINT BAR- Adjustable lift points to balance the machine

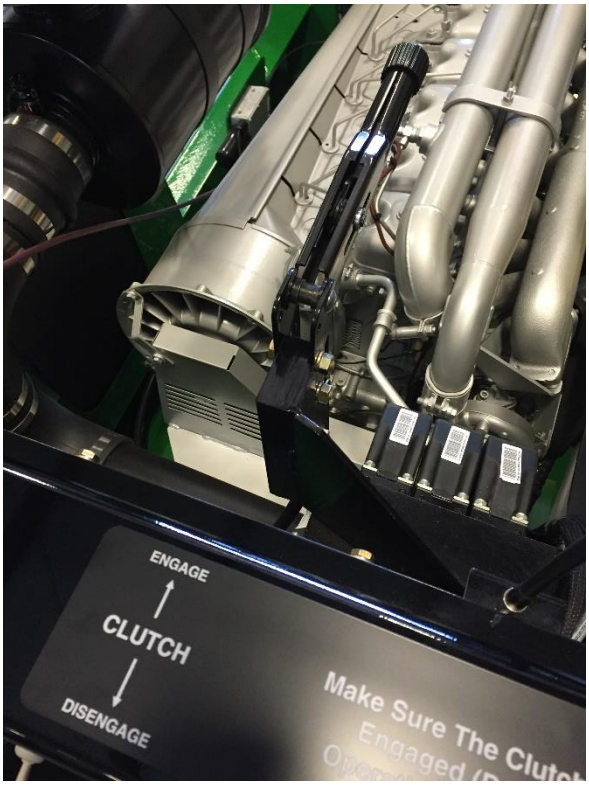
FOLD DOWN PLATFORM- Offers a place to stand on during maintenance procedures.

TANKS- Hydrolic and Diesel fuel tanks located under the main lift point bar.

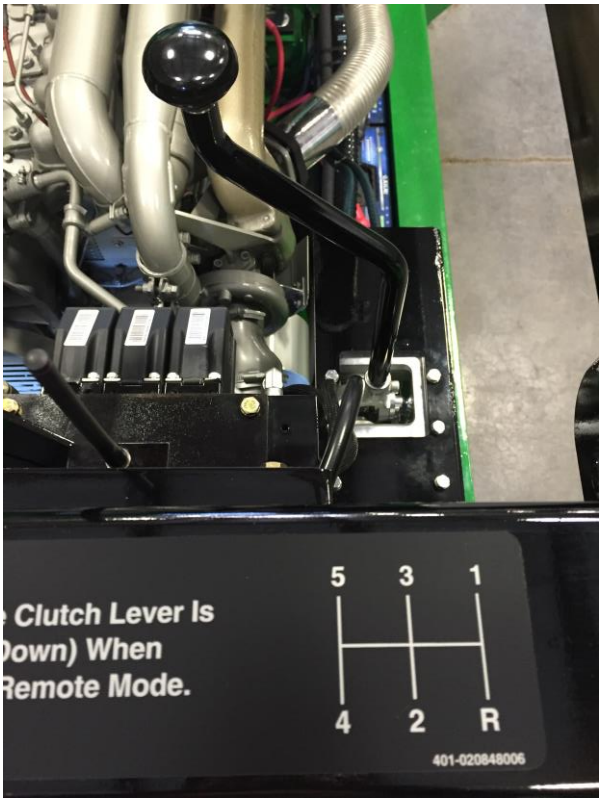
ELECTRIC, HYDROLIC OIL COOLER- On/ Auto switch located on the main console. Turns on at 135 degrees when set in auto mode.

BELLY PAN- Guard assembly located under the engine to protect the oil pan.

TRANSMITTER CASE- Weather proof storage case for the transmitter, tether and shoulder straps.



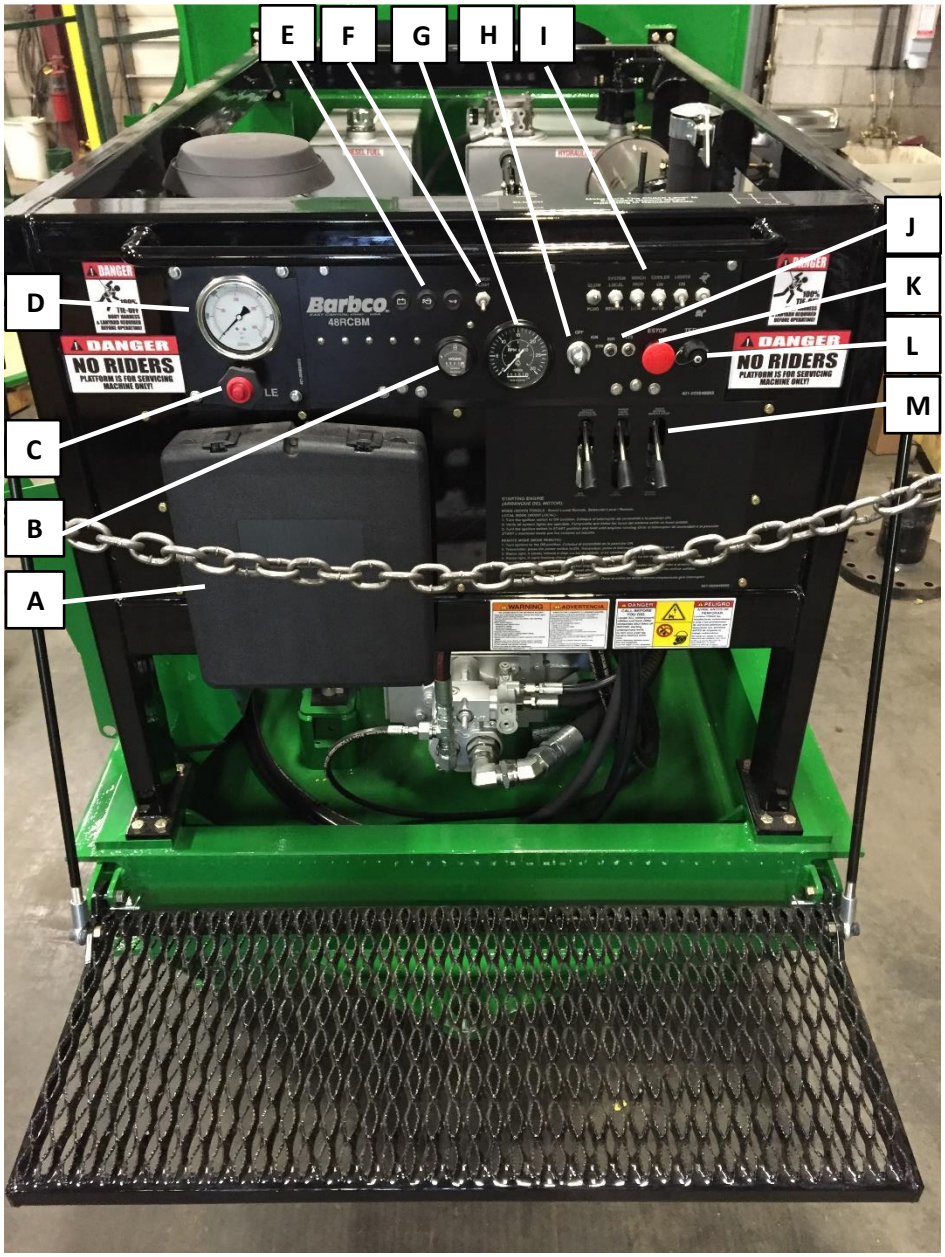
CLUTCH LEVER- Remotely located below the hydraulic valve. Lever locks up in the disengaged position.

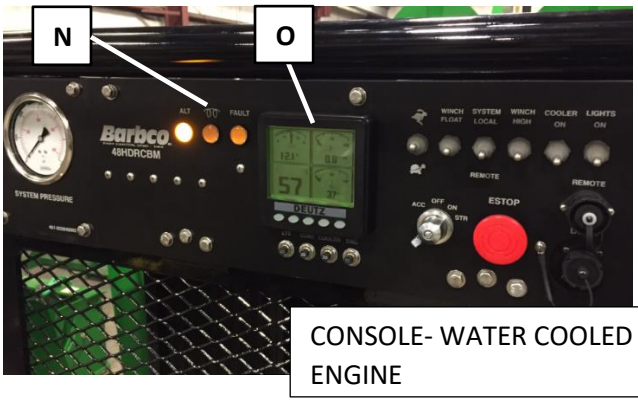


GEAR SHIFTER- Remotely located below the hydraulic valve for easy access from the side of the unit.

CLUTCH VALVE- Disengages the clutch upon starting the engine. Keeps the operator from climbing on the unit to declutch if the engine stalls.

CONTROL PANEL COMPONENTS





CONSOLE- WATER COOLED ENGINE

- **A- INFORMATION BOX-** Storage for all manuals
- **B- HOUR METER-** displays the total hours the engines been running.
- **C- MANUAL THROTTLE-** Depress the center and turn/ push pull to adjust the engine throttle
- **D- PRESSURE GUAGE-** displays the pressure in the hydraulic system during operation.
- **E- INDIATOR LIGHTS-** engine vitals
- **F- WINCH SWITCH-** allows the wench to float/ spool out as needed**.**
- **G- TACKOMITER-** Displays the engines idle speed.
- **H- ENGINE SWITCH-** power on and start positions. Keyless.
- **I- TOGGLE SWITCHS:**
    - **a. GLOW PLUG-** Cold weather start assist.
    - **b. REMOTE/ LOCAL SWITCH-** master switch to allow operation from the remote.
    - **c. WINCH SPEED-** Select Hi or Low speed range.
    - **d. OIL COOLER SWITCH-** continues on option or auto on. Auto on at 135 degrees.
    - **e. LIGHTS TOGGLE-** ON/ OFF power to the front and bottom lights.
    - **f. THROTTLE TOGGLE-** engine RPM control.
- **J- CURKET BREAKERS-** Pop out type buss fuses for ignition and lights.
- **K- E-STOP-** terminates the engine when pushed. Also engages the hydraulic clutch.
- **L- TETHER CONNECTION-** Umbilical wire connection that allows the transmitter to operate when batteries are dead. Also serves as the patch cord when linking up a new transmitter.
- **M- MANUAL HYDROLIC LEVERS:**
    - **a. WENCH-** Forward and reverse control of the wench.
    - **b. BINDER-** Controls the lock and unlock cylinders to secure the bore casing.
    - **c. CLUTCH-** Hydraulic control of the clutch cylinder.
- **N- GLOW PLUG-** Glow plug will automatically illuminate when required. Light will illuminate when ignition switch is put in the ON position then go off when the engines ready to start.
- **O- ENGINE DISPLAY-** Displays all engine vitals.

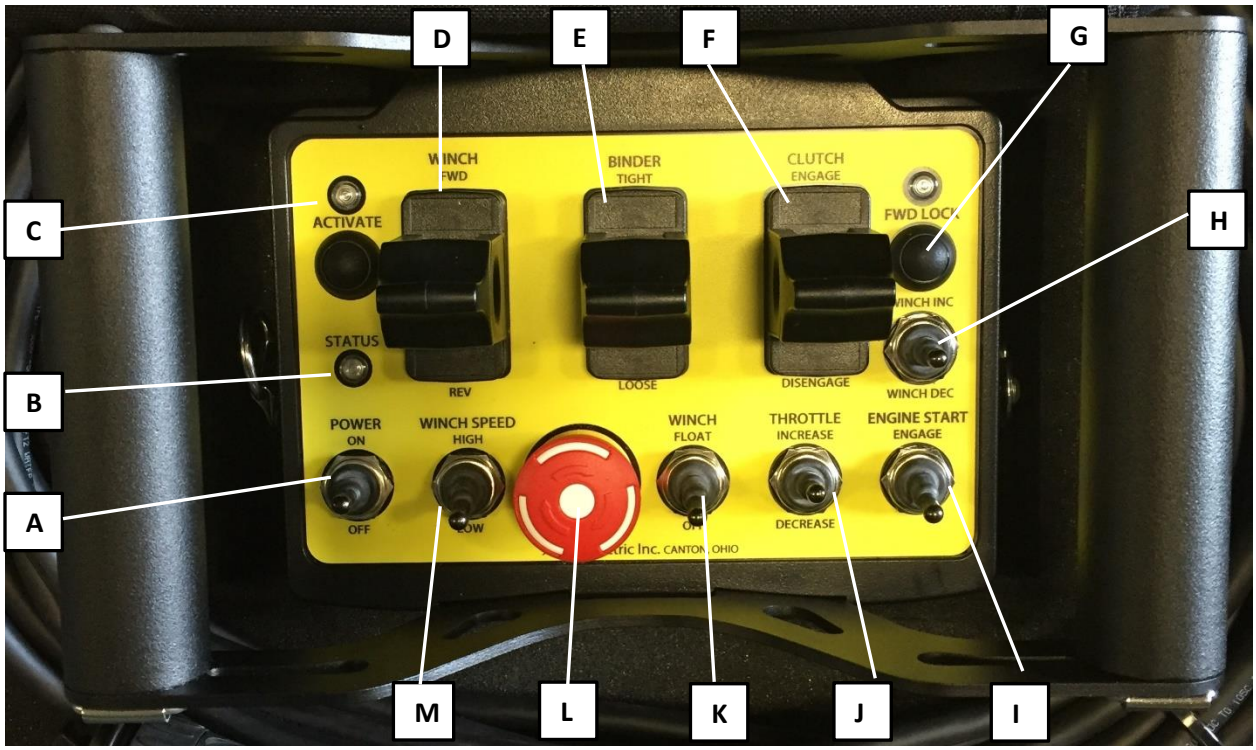
WIRELESS REMOTE DESCRIPTION

Auto shutdown features-

System will terminate the engine and power down if unused for 30 minutes.

Trip/ fall protection. The system will pull in the clutch, terminate the engine and power down if held sideways or upside down for 3 seconds.

Drop out protection. Terminate the engine and power down if radio communication is lost.



A- POWER TOGGLE- Powers up the transmitter.

B- STATUS LIGHT- Blue, blinking light when the transmitters ON and linked up to the receiver 1 blink/ sec. When batteries low 2 blink/ sec.

C- ACTIVATE LIGHT & BUTTON- Red, steady light when the buttons pushed. Allows operation of all functions when ON. Light will turn off and restrict operation if functions go unused for 30 seconds.

D- WINCH PADDLE- Proportional control of forward and reverse winch operation.

E- BINDER PADDLE- Non-proportional control of the casing lock down assemblies.

F- CLUTCH PADDLE- Non-proportional control of the clutch.

G- FWD LOCK LIGHT & BUTTON- allows the operator to lock in the desired winch speed. Push in and the yellow light will blink. Operator can release the winch paddle. To terminate push any paddle.

H- CRUISE CONTROL TOGGLE- Ramp the locked winch speed up or down.

I- ENGINE START TOGGLE- Push up to start engine.

J- THROTTLE TOGGLE- engine RPM control**.**

K- WINCH FLOAT TOGGLE- The winch will free spool when toggles in the float position.

L- ESTOP- Automatically pulls in the clutch and terminates the engine.

M- WINCH SPEED TOGGLE- Hi/ low speed control for the winch function**.**

TEATHER CONNECTION (not shown) - Located on the side of the transmitter. Umbilical wire connection that allows the transmitter to operate when batteries are dead. Also serves as the patch cord when linking up a new transmitter.

OPERATION

DANGER - Never allow untrained personnel to operate this machine. All operators must read and understand this manual before using the machine.

ENGINE OPERATION INSTRUCTIONS

A factory instruction manual for each specific engine is supplied with the machine. Operation and maintenance information is included in the engine manual. The following instructions cover only the starting and stopping procedures. All other engine-operating instructions are contained in the factory manual.

BEFORE STARTING:

1. Check engine oil level. Fill as needed with the oil required for your engine.
2. Check fuel level. NEVER LET THE DIESEL FUEL TANK RUN DRY! If the tank is dry, bleed the fuel system as outlined in the engine manual.
3. Check air cleaner gauge. Service if required.

DANGER! Clear all unauthorized personnel from the machine area and bore pit.

ATTENTION! Machine is equipped with a clutch valve that will automatically disengage the clutch when the start switch is put into the ON or ING position.

STARTING ENGINE:

SYSTEM TOGGLE- Select Local/ Remote.

LOCAL MODE-

1- Turn the ignition switch to ON position.

*Water Cooled Feature-

a- If cold weather, glow plug light will illuminate automatically.

b- Light will turn off when ready.

2- Verify all system lights are operable.

3- Turn the ignition switch to START position and hold until engines running.

4- Verify all system lights are operable.

WARNING! Only use ESTOP in case of an emergency. Do not use to turn engine OFF.

WARNING! Lower engine idle and allow system to cool down before engine shut down

REMOTE MODE-

1: Turn ignition to the ON position.

2: Transmitter, press the power switch to ON.

ATTENTION! Machine is equipped with a clutch valve that will automatically disengage the clutch when the start switch is put into the ON or ING position.

3: Status light, if steady release e-stop.

4: Status light, if rapid flashing check all paddles centered and float switch off.

5: Status light, if slow blinking proceed to start engine.

6: Press activate button to enable outputs, reset after active times out.

To shut down engine in remote mode. Allow engine to cool down and simply turn power switch off.

METHOD OF OPERATION

The Barbco Cradle Boring Machine is equipped with a wireless remote controller. Wireless remote control is the only operation method. (See *wireless remote description).* Operation of this machine can only be done thru the transmitter.

The fold down platform located in the rear of machine is designed for maintenance personal only. Standing on this platform during normal operation is prohibited.

DANGER- Do not operate this machine while standing on the platform. Death or serious injury will occur.

OPERATION SUMMARY

The wireless remote allows the operator to run the unit from a distance. The operator must have a clear view of the unit while in use. The auger rotation speed is controlled by the engine throttle and the gear selected. The direction of the rotation (Fwd.-Rev) is controlled by the transmission. The torque available at the front drive is a function of the transmission gear selected. The highest torque is in 1st gear. A hydraulic clutch is provided to engage and disengage the final drive from the engine.

DANGER- Rotating auger and cutting head will cause death or serious injury. STAY AWAY. Do not wear loose clothing.

Test all functions before operating the unit. If the system does not function properly, shut down the machine and have service performed by a qualified mechanic.

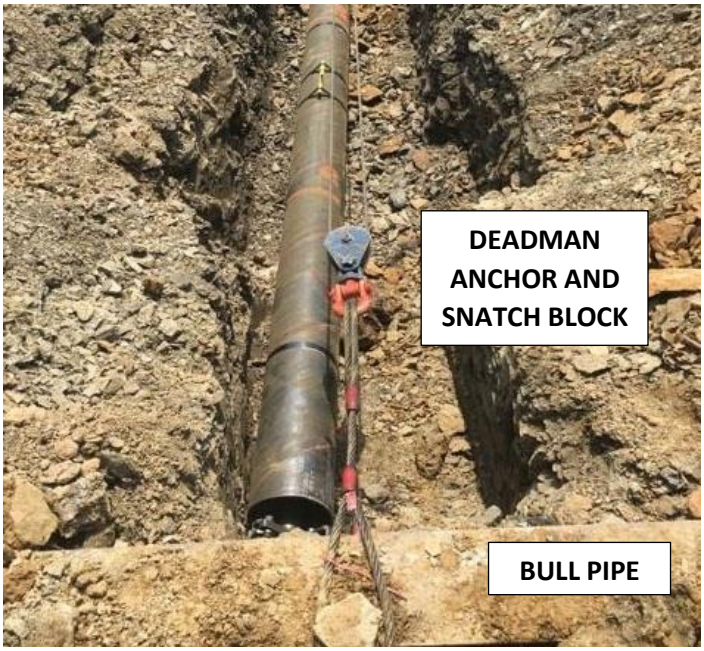
The machine is suspended during operation and force is applied to the casing by the winch pulling the machine towards the bore target. Some units are equipped with a two speed winch. To ensure smooth operation, the winch should always be in the low speed when the driveline is turning.

All units are equipped with casing lockdown assemblies. PO check valves hold pressure on the casing. The chain lengths are adjustable to provide slack before the casing lockdown's are engaged.

PREPARING THE PIT

Pit preparation for cradle boring is a key in ensuring proper functionality and safety of operator and crew during operation.

Above the bore target should be a bull pipe for the winch connection while boring. Consult with an engineer to calculate an adequate dead man anchor and snatch block mount for the proposed bore before you start.



1- Install the casing onto the cradle boring machine before lowering into the pit for the bore.
2- Rest the front of the lead section in the saddle/shoe and rotate the chuck until the hole is aligned with the hole in the auger shank pin hole,
3- ADVANCE the machine to couple the hex joint. Make sure the casing is pushed up against the thrust plate

DANGER - SHUT DOWN the engine and install an auger pin while reaching through the access door on either side of the machine.

4- Adjust casing lockdown chains. The casing lockdown linkage should be fully extended before latching chains.
5- Activate the casing lockdown cylinders.

Two pipe layers (side boom) will be required to complete the bore. One should ALWAYS be supporting the cradle boring machine and attached casing.

Second pipe layer will be used to carry the down hole end of the casing to the end of the pit to rest it on the bore bench under the bore target. Make sure both pipe layers and the cradle boring machine are safety positioned in the pit.

The unit is ready to operate.

STARTING THE BORE

The CBM operator will work in conjunction with pipe layers to get the winch cabling and snatch block positioned for pulling.

1- Turn on the Winch Float to Free spool the winch while the pipe layer is traveling to the bull pipe sling.
2- Connect the snatch block for pulling the winch cable in, to the bull pipe sling.
3- Once the connection is made the operator can then retract the winch cable uniformly to remove slack and prepare for boring. NOTE- Pipe layer will need to reattach to the casing end to help position the casing on the bore target. Ensuring that the casing is inline and on grade.

WARRNING – Never check grade while machine is boring.

Pipe layer should travel beside the Cradle Boring Machine during operation and pipe layer down hole should support casing end until the casing is into the ground enough to support itself.

4- Turn off the winch float.
5- Place the transmission in the desired gear.

WARRNING – Back away from the unit prior to operating with the transmitter

.

6- Push the Clutch Paddle to engage the clutch and start rotation.
7- Push the Winch Paddle forward slowly to advance the unit. This is a proportional paddle.
8- Slowly adjust the winch speed to accommodate the cutting rate with the soil conditions.
9- Push the FWD LOCK button to lock in the desired winch speed. The FWD lock light will illuminate. NOTE- push any paddle to terminate the locked in winch speed.
10- Increase or decrease the winch speed by moving the cruise control toggle in the desired direction.
11- Once the bore is completed, turn OFF the machine and remove the auger pin.
12- Turn the machine ON and extend the casing lockdown cylinders so the bore casing can be free.
13- Disconnect the snatch block form the bull pipe sling.
14- Retract the cable until the snatch block is safely retained in front of the winch.
15- Turn OFF the engine and power down the transmitter.
16- Use the pipe layer to move the cradle boring machine away from the casing and out of the pit.

ACCESSORIES

CUTTING HEADS

Barbco, Inc. manufactures Soft Ground and Rock Cutting Heads - with and without wing cutters. Stock heads are carried for general soil conditions. Special heads are available for specific conditions. See the Ground Conditions Chart for cutting head recommendations for specific soil conditions. A general category listing is;

Sand, Light Dirt	BBC-25	Shale, Soft Rock	BBC-35
Heavy Dirt, Clay	BBC-25	Rock to 5,000 psi	BBC-45
Hard Compacted Clay, Light Shale and Cobble	BBC-26	Rock to 12,000 psi	BBC-50
Hard Compacted Soil, Tree Roots	BBC-75	Wet, Running	BBC-Sand

EFFECT OF WING CUTTERS

The function of wing cutters on a head is to over cut the bore, allowing the casing to enter more easily. Wing cutters are used only in stable conditions as noted in the Ground Conditions Chart. Barbco, Inc. wing cutters are preset to cut one and a half inches (3.81 cm) larger than the nominal casing diameter. The use of new or built up auger in the lead section of casing is essential to maintain the proper centering of the head. Worn auger in the lead section will allow the head too much freedom and the wing cutter pattern will be erratic. Wing cutters can of course be removed for operation of a head inside or outside of the casing.

WATER LEVEL

Barbco, Inc. offers a specialized form of water level for monitoring grade during a bore. Specific instructions for its use are found in the Manual supplied with each unit. A sensing head is installed at the head end of the casing. 1/2" std. steel pipe is used along the entire length of installed casing to connect to the Water Level Indicator in the entrance pit. The sensing head must be securely welded to the casing. In rock conditions, the sensing head must be recessed into the casing and the auger flight trimmed for clearance.

APPENDEX

GROUND CONDITIONS CHART

	Wet Runny Sand	Wet Stable Sand	Dry Sand	Dry Clay	Wet Clay	Small Gravel
Auger Speed	Slow	Fast	Slow	Optional	Optional	Optional
Rate Of Penetration	Fast	Fast	Slow	Optional	Optional	Optional
Cutting Head	BBC-25 Sand	BBC-25	BBC-25	BBC-25	BBC-25	BBC-35
Wing Cutters	No	No	No	Yes	Optional	Yes
Head Position	Inside	Inside	Inside	Flush	Flush	Outside
Bentonite	Yes	Yes	Yes	Yes	Yes	Yes
Water Inside	No	No	No	Yes	Yes	Yes
Band	Yes	Yes	Yes	Yes	Yes	Yes
Bore Continuous	Yes	Yes	Yes	Optional	Optional	Optional
Clean Casing	Pack	Pack	Pack	Clean	Clean	Clean
Pit Base	Concrete	Stone	Optional	Optional	Stone	Optional
Backstop	Concrete	Concrete	Concrete	Steel	Steel	Steel

GROUND CONDITIONS CHART

	Hard Pan	Large Gravel	Small Boulders	Soft Solid Rock	Hard Solid Rock	Land or Railroad Fill
Auger Speed	Slow	Slow	Slow	Slow	Slow	Cautious
Rate Of Penetration	Medium	Slow	Slow	Slow	Slow	Slow
Cutting Head	BBC-75 BBC-CT2	BBC-35	BBC-75	BBC-35	BBC-45 BBC-50	BBC-35
Wing Cutters	Yes	Yes	Yes	Yes	Yes / No	Yes
Head Position	Outside	Outside	Outside	Outside	Outside	Outside
Bentonite	No	No	No	No	No	No
Water Inside	Yes	No	No	No	Yes	Yes
Band	Yes	Yes	Yes	Yes	Yes	Yes
Bore Continuous	Optional	Optional	Optional	Optional	Optional	Optional
Clean Casing	Clean	Clean	Clean	Clean	Clean	Clean
Pit Base	Optional	Optional	Optional	Optional	Concrete	Concrete
Backstop	Steel	Steel	Steel	Concrete	Concrete / Steel	Concrete

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