Nordco™
Service from the Ground Up™

Spike Puller SP2R
Model A

Operation and Maintenance Manual

Applies to S/N 310001 and Above
Reorder Part: 49453100
Last Revision: Rev. C
SEPTEMBER 2015

Read and fully understand the precautions contained in this manual before operating or servicing this machine. Refer to Section 1 for important safety information.

Component Troubleshooting can now be found on the colored pages behind each tab.

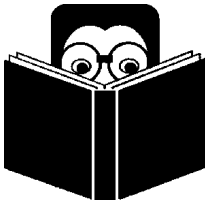
Release/Revisions

Release/Rev	Date	Change Description
Rev. C	9/25/2015	Re-write of turntable instructions.

This manual is a guide for the operation and routine maintenance of a NORDCO Railroad Maintenance Machine. It covers product technical information, basic operating and maintenance procedures, and safety information and is provided for use by the qualified personnel who will supervise, operate or service the equipment described herein.

Measurements in this manual are given in both metric and customary U.S. unit equivalents.

Personnel responsible for the operation and maintenance of this equipment should thoroughly study the manual before commencing operation or maintenance procedures.



This manual should be considered a permanent part of your machine and should remain with the machine at all times.

Additional copies of this manual are available either as a part (Operation Manual only) or a whole (operation and parts manual), at a nominal cost, through our Part Sales Department. Additional service information, parts, and application information is available through these Nordco product support resources:

NORDCO Sales:	**Milwaukee, Wisconsin** (414) 766-2180 sales@nordco.com
NORDCO Parts:	**Milwaukee, Wisconsin** 1-800-647-1724 parts@nordco.com
NORDCO Service:	1-800-445-9258 service@nordco.com

We ask that if you have any comments or suggestions about this manual, let us hear from you. We are here to be of service to you, our customers. Direct your comments and inquiries to:

Nordco™
Service from the Ground Up™

Technical Documentation Department
NORDCO Inc.
245 W. Forest Hill Avenue
Oak Creek, WI 53154

HAZARDOUS MATERIAL DATA

In an effort to provide information necessary for your employee safety training program and to meet the requirements of OSHA Hazard Communication Standard 1910.1200, we have OSHA Form 20 Safety Data Sheets available that cover the material contained in this machine.

If you are interested in receiving this information, please refer to the Name, model, and Serial Number of your machine when calling or writing, and direct your inquiries to:

Vice-President of Operations
NORDCO Inc.
245 W. Forest Hill Avenue
Oak Creek, WI 53154

Phone: (414) 766-2249
Fax: (414) 766-2289

SAFETY

Please read and comply with all of the safety precautions in this manual BEFORE operating this machine.

GENERAL

DO NOT use this machine for machine operations other than for which it was intended.

NORDCO is not responsible for any modifications made without authorization or written approval. Replace all NORDCO and OEM parts with genuine NORDCO or OEM parts. Use of non-OEM parts could compromise the safety of your machine.

FRA regulations require that a copy of this Operation Manual be kept on the machine at all times. Additional copies of the Operation Manual only can be ordered from Nordco Parts Sales at 1-800-647-1724.

FOLLOW SAFETY INSTRUCTIONS

Carefully read all safety messages in this manual. Learn how to operate the machine and how to use controls properly. Do not let anyone operate this machine without instruction. Failure to understand the contents of this manual could result in serious personal injury or death.

SAFETY ALERT SYMBOLS!

These are the safety-alert symbols. These symbols means pay attention! Your safety is at risk!

DANGER is used to indicate a definite hazardous situation which, if not avoided, **WILL** result in severe bodily harm or even death.

WARNING indicates a potentially hazardous situation which, if not avoided, **COULD** result in severe bodily harm or even death.

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

CAUTION without the safety "!" means that failure to follow the alert may result in machine damage.

SAFETY means that the following points are instructions for safely operating the machine or the specific component of the machine.

GENERAL SAFETY TIPS

Only trained and authorized personnel should be allowed to operate this machine. In addition, all personnel at the worksite (gang) should be aware of the safety concerns and their individual responsibilities **prior to working this machine.**

SAFETY

1. Handle fuel safely. It is highly flammable and prolonged breathing of fumes may cause bodily harm.

2. Prepare for emergencies. Keep a first aid kit and fire extinguisher handy.

3. Protect against flying pieces of metal and debris by wearing safety glasses or goggles.

4. Wear good-fitting pants and shirt, no baggy or loose clothing.

5. Protect your head and eyes from flying debris by wearing a hard hat and safety goggles/glasses.

6. Wear leather gloves to protect your hands from vibration or flying metal particles.

7. Use safety-toed work boots.

SAFETY PRIOR TO WORKING

All personnel at the worksite (gang) should be aware of the safety concerns and their individual responsibilities **prior to working this machine**:

SAFETY

- Review the operating instructions if you are unsure of anything.
- Use the “pre-operational checklist” to check the machine for obvious faults. Repair or replace as necessary PRIOR to operating the machine.
- Before climbing onto the machine, make certain the area around and under the machine is clear of obstructions and personnel.
- Use care when climbing onto the machine. Always use the steps and handrails provided. (If an area does not have tread grips, walkways, or other methods to access the area, then DO NOT attempt to access that area.)
- Make seat and control adjustments PRIOR to starting the machine. ALWAYS wear a seatbelt.
- Know the weather forecast and plan your work speeds accordingly.
- There are guards on this machine. These are to be removed ONLY when service or maintenance is being performed on that area of the machine. Make certain they have been re-installed PRIOR to starting the machine.
- Check and service the fire extinguisher (if so provided) at regular intervals. Make certain all personnel are trained in its use. Note - Non-use of fire extinguisher still requires that it be recharged at the interval stated on its last inspection notice.
- Keep the stairs, cab entry platform and cab interior free and clear of ice, tools and personal items. Use the accessories provided on the machine (tool box, cup holder, coat hook, etc.) to properly store your gear.
- Never climb onto the machine while it is in motion.
- There are lockups on this machine that are used for both work and travel. These should be kept clear and free of debris, grease, etc. See **Lockup** section for instructions on their use.
- Inspect safety decals and replace when they become unreadable or are damaged. (See “Safety Decals” at the end of this Safety section).

SAFETY WHILE STARTING THE MACHINE

NORDCO recommends the use of a **Command** position. This means that the machine is **never** running unless someone is **at or near** the main control panel. To prevent injury to personnel or damage to the machine, it is highly recommended to:

SAFETY

1. Only start and operate the machine from the operator's seat.

2. Use the "STARTUP Checklist" to check the machine controls and gauges to make certain all systems are operating correctly.

SAFETY WHILE OPERATING/TRAVELING

SAFETY

1. Never allow more riders than seats and seatbelts allow. This machine was designed to be operated by two people.

2. The machine is to be operated from the Operator's seats only. Do NOT stand and operate this machine.

3. Press the EMERGENCY STOP pushbutton on the center control console in emergencies and potentially dangerous situations.

4. If personnel or bystanders are near the machine during operation, give a warning signal using the air horn. If they fail to respond to this warning, stop operation immediately.

5. Slow down the work cycle and use slower travel speeds in congested or populated areas.

6. Halt work if visibility is poor. Strong rains, fog, and extremely dusty conditions can affect visibility in your work area. Wait for the weather to improve before continuing work.

SAFETY WHILE PARKED

When leaving a machine engine running, make certain that the parking brake is applied and the electrical interlock button has been activated.

NEVER stop and park this machine on an incline unless the machine wheels have been chocked.

SAFETY DURING MAINTENANCE

The following guidelines are suggested when performing maintenance:

SAFETY

1. Always chock the wheels
2. Alert others in the area that service or maintenance is being performed on this machine.
3. Become familiar with, and use, **your company's lockout/tagout** procedures when performing maintenance on this machine. See **LOCKOUT/TAGOUT REQUIREMENTS** later in this Safety Section for a chart on energy sources located on this machine.
4. Do not start the engine if repairs or work is being performed alone. You should always have at least two people working together if the engine must be run during service. One person needs to remain in the **command** position (at the controls), ready to stop the machine and shut off engine if the need arises.
5. Collect oils and fuels and dispose of them properly. There is a danger of scalding when working with engine oils.
6. Use only Nordco supplied repair parts for this machine. Use of non-OEM designed parts could comprise the integrity of this machine.
7. There are welding cautions on this machine. Pay attention to them PRIOR to welding.
8. Kits supplied by Nordco have welding instructions included. Welding of any components NOT of Nordco's manufacture or failure to follow these instructions may affect the stability of this machine.

MACHINE SAFETY ALERTS

DANGER

DANGER ALERTS

Improper use of this machine for any type of operation can cause serious injury or death.
To avoid serious injury or death, make certain that the area around and under the machine is clear of all personnel and obstructions BEFORE travelling or working.
Serious injury or death can result from reaching into working components while machine is running. Make all observations from a distance and SHUT OFF machine while making adjustments.
Shut off engine when checking battery electrolyte level. Do not check or fill battery in presence of open flame, sparks, or when smoking. Battery fumes are flammable and/or explosive and if ignited will result in severe bodily injury or death.
Do not ride on tow bar between the machine and the towing vehicle. Falling from a moving vehicle may cause serious injury or death.

MACHINE SAFETY ALERTS

WARNING

WARNING ALERTS

Failure to engage all lockup devices before propelling at travel speed can result in injury to personnel and/or extensive damage to the machine.
Remove hoses/fittings only when system is not pressurized. High pressure leaks can cause personal injury. If equipped with accumulator, isolate using ball valve.
Always turn off machine when performing maintenance, making adjustments, or whenever unintended movement of machine could occur; unless directed otherwise. Failure to comply could result in personal injury and/or damage to the machine.
Exhaust emissions caused by the use of the engine on this machine may cause cancer, birth defects, or other reproductive harm if inhaled.
Disconnect the battery before servicing this machine. Failure to do so could result in personal injury from accidental engine startup.

LOCKOUT-TAGOUT PROCEDURES

NORDCO has provided the means to lockout this machine. NORDCO cannot be held responsible for injury caused by failure to comply with your company's **Lockout/Tagout Procedures**.

The following procedures are designed to lead the operator through the steps required to shut the machine down and prepare it for performing mechanical maintenance work. These procedures are intended to release potentially dangerous stored energy forms and make the machine safe to begin repairs. It is your company's responsibility to **Lockout/Tagout Procedures** based on this list, train you in their proper and safe use, and to periodically inspect your work area to verify that you are complying with the procedures. **Lockout/Tagout Procedures must be followed!**

SAFETY PROCEDURES
LOCKOUT/TAGOUT

1. Apply the Electrical Interlock/Warmup.
2. Chock wheels to prevent accidental rolling of machine on grade.
3. If you have not already done so, determine which components are to have maintenance. Place all machine mechanical systems or workheads in the full up and locked positions.
4. When mechanical locking up of equipment is not feasible for maintenance lower the component to the ground prior to working on the equipment.
5. Turn the **ignition switch** to the **OFF** position. This turns off the power to the control circuits on the machine. Place a **TAGOUT card** in close proximity to the ignition switch.
6. Turn the **battery disconnect switch (BDS)** to the **OFF** position.
    a. For machines with the BDS on the left side of the center (front) control console: Place a **TAGOUT card** on the switch after you have switched it to the OFF position.
    b. For machines with a remotely located BDS (usually next to the battery box itself): Close the cover to the disconnect switch and place a **LOCKOUT lock** on the box after you have switched it to the OFF position.
7. Bleed off hydraulic pressure. If equipped with accumulator, isolate it by using ball valve.
8. Follow all of your company's lockout/tagout rules before proceeding. Note: When working on machine components, be aware that moving components during repairs may create energy (ie., moving a hydraulic cylinder). Proper precautions should be taken.

HAZARD DECALS ON THIS MACHINE

Hazard decals and plaques that have been placed on this machine are to be kept clean and legible. Replace any decals or plaques that have become illegible or are missing.

When repairing or replacing components that had hazard decals on them, it is your responsibility to replace the decals. Refer to Figure 6-4 in the Mechanical Section for a list of all decals and plaques on this machine.

GENERAL

This manual contains information for the **Spike Puller SP2R** manufactured by NORDCO INC., Oshawa, ON, Canada. Information is provided in this manual for operation and maintenance of the machine. Information regarding operation and maintenance of OEM parts not of NORDCO manufacture can be found at the back of this manual, behind the tab marked “Component Data”.

Become familiar with all safety instructions, controls and instruments before operating this machine. Follow all instructions carefully.

ABOUT THIS MANUAL

This manual has been broken down into sections which have been separated by index tabs:

Mechanical has individual parts breakdown drawings and lists for each assembly

Hydraulic includes adjustment instructions and troubleshooting for the hydraulic system; and all piping and functional drawings for a standard machine and optional equipment

Electrical, includes electrical schematics, distribution and control boxes, and cabling drawings for the machine; as well as troubleshooting instructions

Component Data includes parts breakdowns and service instructions for components installed on the machine that are not of NORDCO’s manufacture. For example, the engine and pump.

SPECIFICATIONS❖

SPECIFICATIONS❖

GENERAL

Machine Name.....Spike Puller SP2R
Model..... A
Gross Weight ..... 17,000 lbs/7,711 kg*
Length ..... 19 feet 6 inches/5.95 meters
Width ..... 8 feet 6 inches /2.6 meters
Height with Cab..... 10 feet 6 inches/3.2 meters
Travel Speed..... 25 mph maximum (40 km/h)
Rated Draw Bar Pull ..... 1,650 lbs. (750 kg)
Turntable.....Hydraulically Operated
Wheel Base..... 9 feet (108 inches)/ 2.7 meters
Towing Speed ..... 20 mph maximum (32 km/h)

CAPACITIES

Fuel Tank ..... 39 gallons (147.6 liters)
Hydraulic Oil Tank..... 98 gallons (370 liters)
Oil Cooler .....100 gpm (378 L/mn)

ENGINE
Make/Model ..... John Deere, 4045T
Type 4-Cylinder, 4-Stroke
Idle Speed.....1150 rpm
Continuous BHP ..... 99@2400 rpm - full load

Make/Model ..... Cummins B4.5T
Type .....4-Cylinder Inline
Idle Speed.....1150 rpm
Continuous BHP ..... 99@2375 rpm - full load

HYDRAULIC SYSTEM

Pressure Settings:
Relief Valve - Main Pump .....3,000 psi (200 bar)
Compensator - Main Pump .....2, 500 psi (172 bar)
Main Pump Make ..... Vickers PVM98 Series
Control Valves..... Vickers Manifold

❖Items listed may vary according to options on your machine. Weights and dimensions may vary according to options on your machine. Actual weight of your machine is as stenciled.

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- Continued on Next Page -

ELECTRICAL SYSTEM

Battery.....24 Vdc, 1150 Cold Cranking Amps
Ground.....Negative
Main Disconnect .....Negative Disconnect

DRIVE SYSTEM

Drive Type..... Four wheel with two solid axles
Propulsion Motor Type..... Hydraulic Chain Drive

WHEELS

Type ..... Cast Steel
Size.....16 inch (406 mm) diameter
Brake Type.....Four wheel cobra shoe type, spring actuated (deadman)

❖**Items listed may vary according to options on your machine. Weights and dimensions may vary according to options on your machine. Actual weight of your machine is as stenciled.**

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GENERAL

DO NOT use this machine for machine operations other than for which it was intended.

FRA regulations require that a copy of this Operation Manual be kept on the machine at all times. Additional copies of the Operation Manual only can be ordered from Nordco Parts Sales at 1-800-647-1724.

Carefully read all safety messages in this manual and on the decals located throughout the machine. Learn how to operate the machine and how to use controls properly.

⚠ DANGER

Do not let anyone operate this machine without instruction. Failure to understand the contents of this manual could result in serious personal injury or death.

ABOUT THIS MACHINE

It is always good practice to become familiar with the components of the machine you are using.

OPERATOR'S STATION

Almost all the controls for running this machine are located in the Operator's Station. This includes but is not limited to, the logic box, hand controllers and the propulsion and braking control pedals.

Under no circumstances are there to be more riders on this machine than seatbelts available. Always use your seat belt when sitting in the operator seat.

For additional information concerning the controls used in the Operator's Station refer to **Operator Station Controls** later in this section.

WORKHEAD

Each workhead assembly consists of the Pulling Frame (the A-shaped frame shown in Figure 1) and the Claw Housing. Two pulling claws straddle the rail and work in unision to pull line spikes, anchor spikes, and hairpin spikes (optional equipment required) without changing pattern.

Two types of workheads are available. One for standard cut spikes, and a beefier version for Lewis Bolt Spikes. Do not attempt to remove Lewis Bolt Spikes with a standard pulling frame!

The Up/Down position of the workhead is determined by limit switches mounted to the side of the pulling frame.

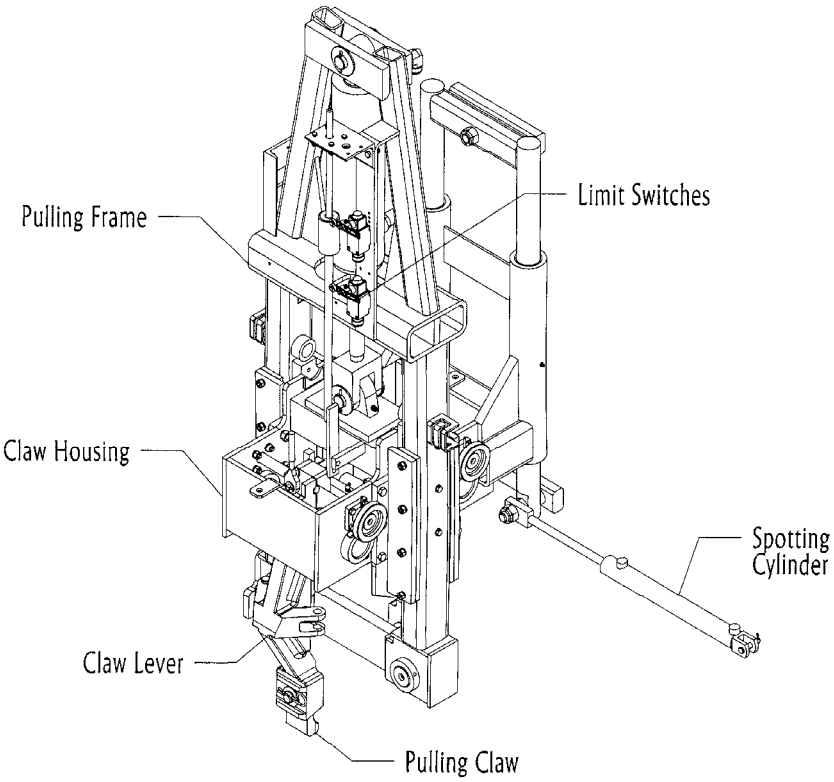


FIGURE 1. WORKHEAD

The workhead should be locked in the UP position during travel. See lockup requirements in the **LOCKUP** section of this manual.

HYDRAULIC SYSTEM

The hydraulic system utilizes manifolded hydraulics and a Vickers PVM Pump. A 2.5 gallon accumulator is optional.

ELECTRICAL SYSTEM

The hydraulic functions of the machine are controlled by the electrical system. The relays, limit switches, micro switches and timing module that make up the electrical system are shown on the schematics and wiring diagrams included in the **ELECTRICAL section** of this manual.

CONTROLS AND INSTRUMENTS

Some controls and all of the instruments are located on the Main Control Panel (Logic Box). Additional controls are located remotely on the machine. Become thoroughly familiar with the function and operation of all controls, as described in this section, before attempting to operate the machine. However, the information in this section is intended to be for descriptive purposes only. Also read carefully the instructions in the **Operation** section of this manual ***before*** attempting to operate the machine.

NOTE:
Your machine may not have all the optional controls and instruments that are described in this section.

FIG 1. MAIN CONTROL PANEL
S/N 310001 through 310112
(Reference 31440010 and 31440031 Rev. G Logic Boxes)

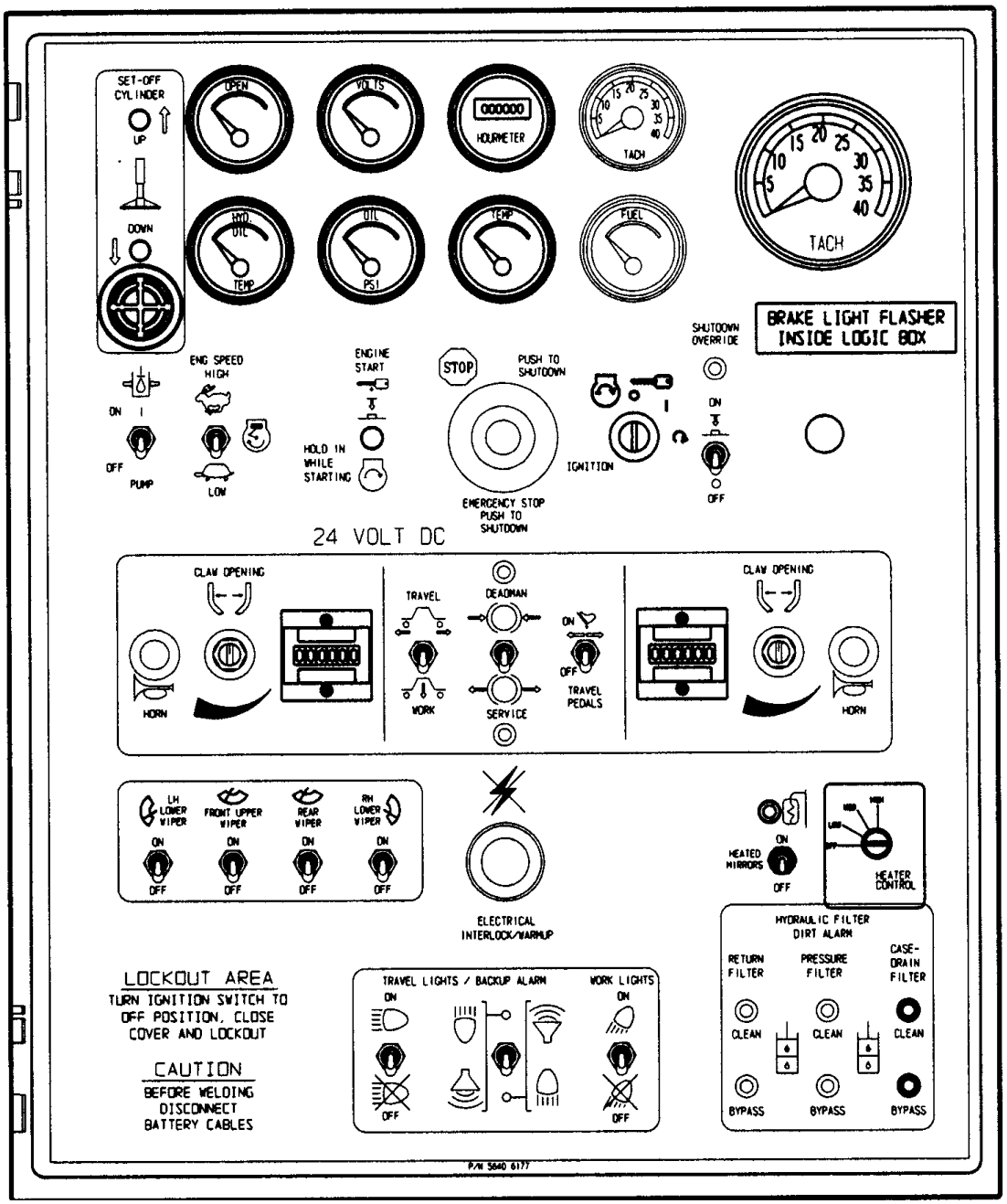


FIG 1A. MAIN CONTROL PANEL
S/N 310113 and Above
(Reference 31440031 Rev. H or Higher Logic Box)

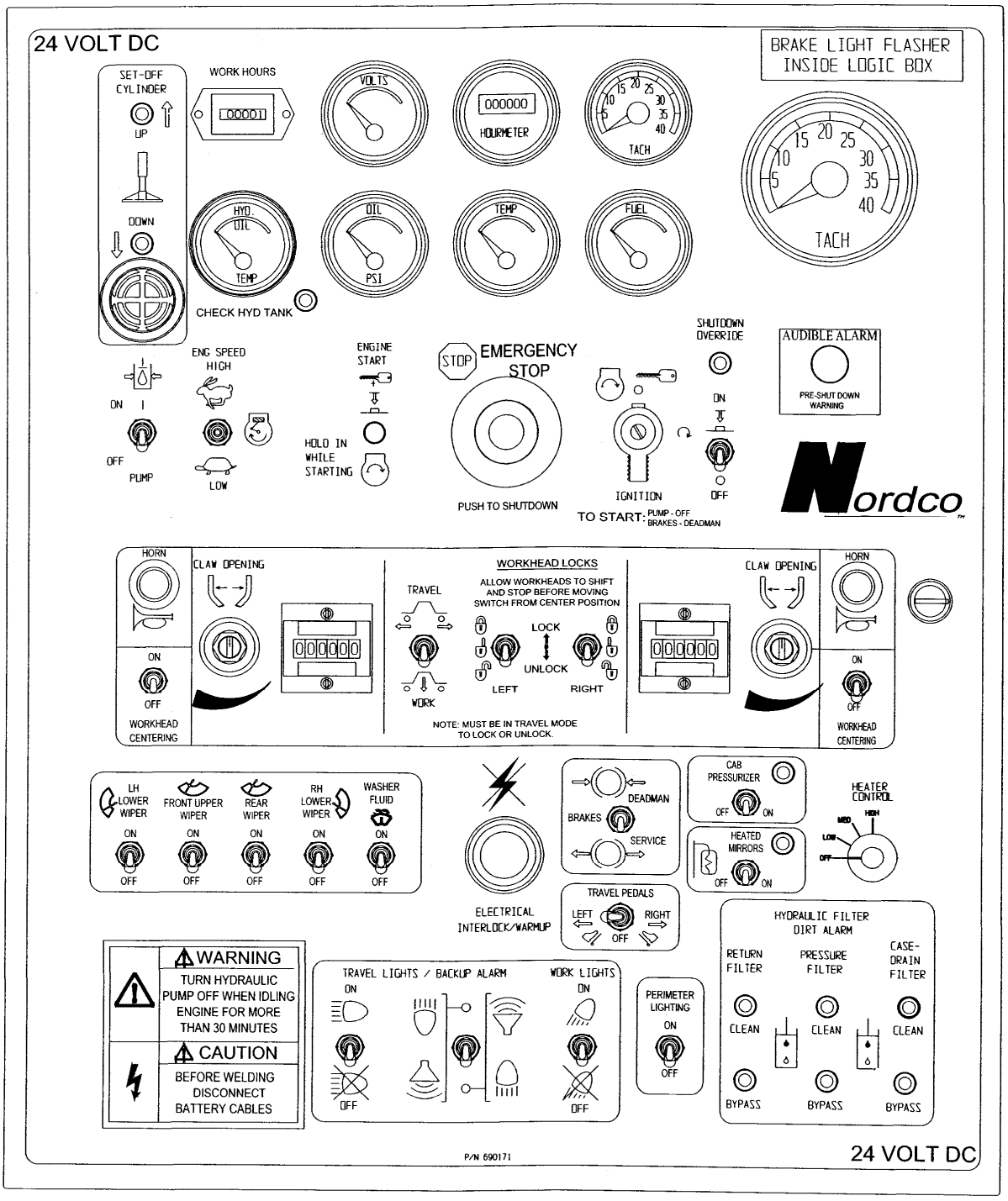


FIG 1. MAIN CONTROL PANEL
ENGINE AND PUMP CONTROLS AND GAUGES

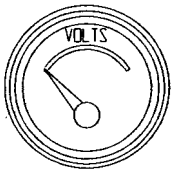
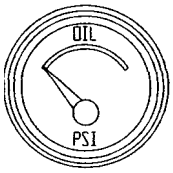
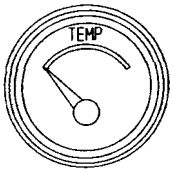
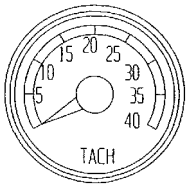
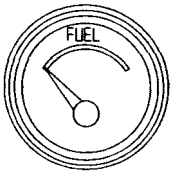
CONTROL OR INSTRUMENT	FUNCTION
VOLTMETER 	Indicates voltage of battery charge. Normal reading is 24-28 volts.
Engine OIL PRESSURE Gauge 	Indicates oil pressure, not oil level. Normal oil pressure varies according to the engine installed on your machine: John Deere Tier 2: 35-65 psi under full load, 15 psi at low idle Cummins: 45-60 psi under full load, 15 psi at low idle
EngineCOOLANT TEMPERATURE Gauge 	Indicates engine coolant temperature. Normal operating temperature varies according to the engine installed on your machine: John Deere Tier 2: Between 180° and 202**°F (82°-94°C)** **Cummins:** Between 190° and 207**°F (88°-97°C)** Note: Warning of potential shutdown of engines due to high coolant temp will occur at 217° F (± 5°F). Shutdown will occur at 230° F.
Engine TACHOMETER 	Indicates engine speed (rpm). Normal engine operating speed varies according to the engine installed on your machine: John Deere Tier 2: Between 2250 and 2400 rpm. (low idle: 1100 rpm) Cummins: Between 2200 and 2375 rpm (low idle: 1150 rpm)
Fuel GAUGE 	Indicates level of fuel in tank. (Optional).
SPEEDOMETER	Indicates speed of machine in mph and kph. (Optional)

FIG 1. MAIN CONTROL PANEL
ENGINE AND PUMP CONTROLS AND GAUGES CONT'D

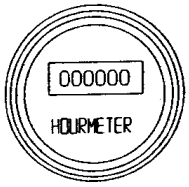
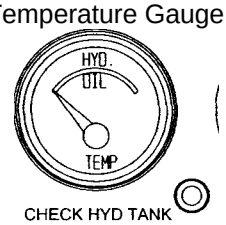
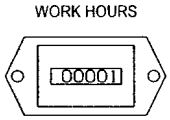
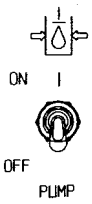
CONTROL OR INSTRUMENT	FUNCTION
Engine HOURMETER 	Indicates total hours of engine operation.
Hydraulic Oil Temperature Gauge 	Indicates total hours of engine operation.
WORKHOURS 	Indicates total hours that the pump has been on and the machine has been in the WORK mode of operation.
PUMP ON/OFF Switch 	Turns on hydraulic pump. Engine will not start if this switch is in the ON position when ignition switch is turned. This is done to reduce engine load during starting. After engine has started, turn on pump. **CAUTION** If idling for more than 30 minutes, turn off pump to prevent overheating of hydraulic oil.
ENGINE SPEED Switch 	Momentary switch used during work, travel, and shutdown. Used with the TACHOMETER and the TYPE of engine installed on your machine. Hold switch in position until specified rpm has been reached and then release switch. For normal work and travel operations hold switch in the HIGH position until the RPM reaches: John Deere Engine: 2250 and 2400 rpm Cummins: 2200 and 2375 rrpm For idling engine for extended periods or shutdown, hold switch in LOW position until specified rpm has been reached and then release switch: John Deere Engine: 1100 rpm Cummins: 1150 rpm

FIG 1. MAIN CONTROL PANEL
ENGINE AND PUMP CONTROLS AND GAUGES CONT'D

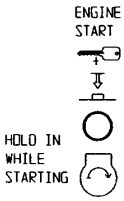
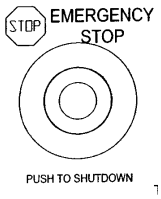
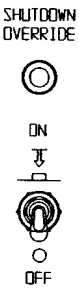
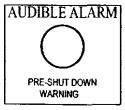
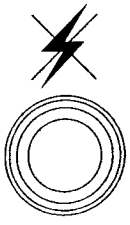
CONTROL OR INSTRUMENT	FUNCTION
MAGNETIC OVERRIDE Switch 	This switch must be held in until engine starts and engine oil pressure reaches 25 psi.
EMERGENCY STOP 	Press button to shut down engine. Pull out button to reset. See "EMERGENCY STOPPING" at the end of this OPERATION section.
Ignition Switch or Key Switch 	The electrical system is energized by turning the switch (or optional key) to the right. Electrical power is cut off and the engine will stop when the key is turned to the full left or vertical (OFF) position. When starting engine, make certain hydraulic pump switch is in the OFF position, and the brake switch is set to DEADMAN position.
SHUTDOWN OVERRIDE 	Overrides engine shutdown for **EMERGENCY** travel purposes. Red light is lit when engine shutdown override is activated. **CAUTION** For use in **emergency** situations only, when machine mjust be moved dispite engine problems. The engine is NOT protected from low oil pressure or high coolant temperature damage in this mode.
AUDIBLE ALARM 	
ELECTRICAL INTERLOCK 	Under normal machine operation, the Interlock/Warmup knob should be pulled out at all times. When pushed in, it **disables** the hand controller buttons and locks the brakes. Note: Machines with optional Joystick Disable Kit: Joystick hydraulics are also disabled when pushing this button.

FIG 2. WORK CONTROLS AND INDICATORS

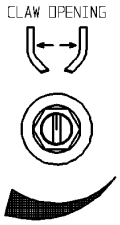
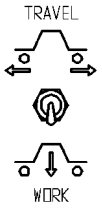
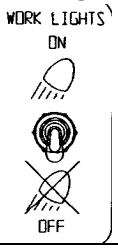
CONTROL OR INSTRUMENT	FUNCTION
Claw OPEN Potentiometer 	This switch provides the operator with the opportunity, at any time, to vary the distance that the claws of the head will open. By turning the control clockwise the distance that the claws open increases. Turning the knob counterclockwise, the distance that the claws open decreases. Once the control has been set the claws will open to the same distance whenever the upper limit switch is actuated or the joystick is released from the "Pull" position. In the even that a wider opening is required the joystick can be moved away from the operator (claws "Open" position).
Work/Travel Switch 	In the WORK position, the relay logic control system is in an automatic mode and works with the joystick controller to operate the pulling head. In the TRAVEL position, all pulling functions are disabled. **NOTE: Machine defaults to Travel at startup no matter the position of the switch.**
HORN	Press to sound horn.
WORK LIGHTS 	Place switch in ON or OFF position as needed. Note: These lights MUST be ON when working.
PERIMETER LIGHTS 	Turns perimeter lighting on or off. Option for S/N 310113 and Above
CYCLE COUNTER	Counts the number of spike pulling cycles performed from this machine. Not resettable. Used for maintenance purposes only.
WORKHEAD CENTERING 	Option for S/N 310113 and Above

FIG 3. TRAVEL CONTROLS AND INDICATORS

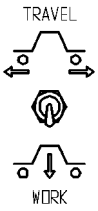
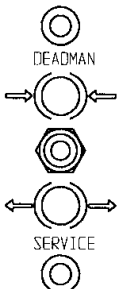
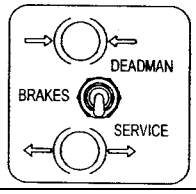
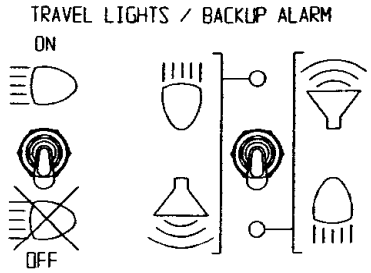
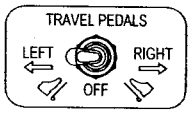
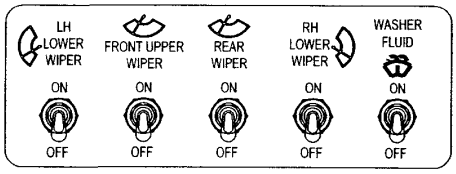
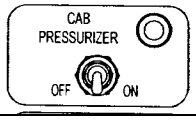
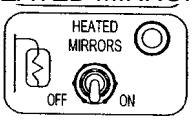
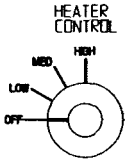
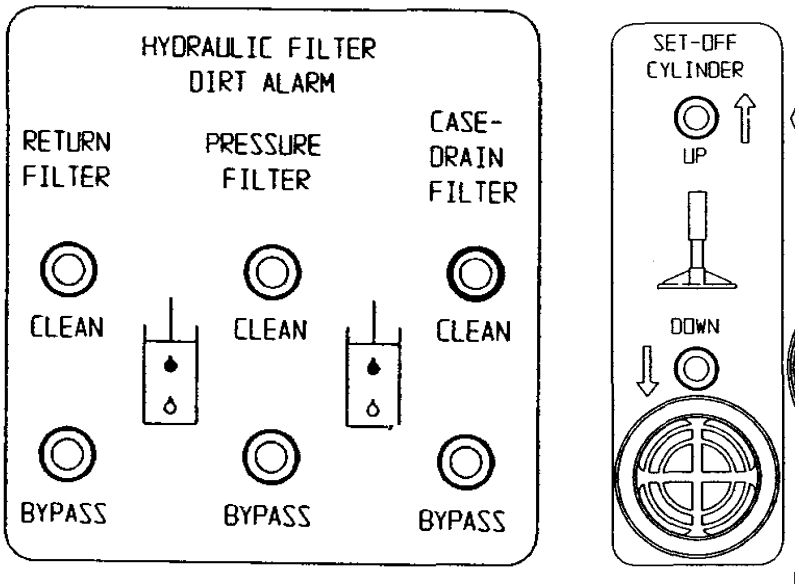
CONTROL OR INSTRUMENT	FUNCTION
Work/Travel Switch 	In the WORK position, the relay logic control system is in an automatic mode and works with the joystick controller to operate the pulling head. In the TRAVEL position, all pulling functions are disabled. **NOTE: Machine defaults to Travel at startup no matter the position of the switch.**
HORN 	Press to sound horn.
BRAKE MODE  Or 	Lights will illuminate depending on position of switch Deadman brakes have been selected when the green light is lit. When set to deadman, brakes are applied any time forward or reverse pedal is released. When set to service (yellow light is lit), brakes are applied only when brake pedal is applied. **NOTE: Machine defaults to deadman at startup no matter the position of the switch. It is recommended that the operator still place the switch in Deadman if that is the intent.** ***Lower illustration represents S/N 310113 and Above***
TRAVEL LIGHTS & BACKUP ALARM 	The ON/OFF switch must be in the ON position before travel direction selection can be made. For Forward Travel (Engine First): Move the Travel Direction switch to the **UP** position for forward travel lights and rear travel alarm to be activated when traveling in reverse. For Reverse Travel (Cab End First): Move the Travel Direction switch to the **DOWN** position for rear travel lights and front travel alarm to be activated when traveling forward.
TRAVEL PEDALS 	Begins at S/N 310113 and Above

FIG 4. CAB COMFORT AND CONTROLS

CONTROL OR INSTRUMENT	FUNCTION
WINDSHIELD WIPERS 	Washer fluid optional at S/N 310113 and Above
CAB PRESSURIZER 	Turns the Cab Pressurizer ON or OFF. Cab pressurizer assists in keeping dust and other airborne particles from entering cab.
HEATED MIRRORS 	Turns the heated mirrors ON or OFF.
HEATER 	Sets the speed of the fan on the heater.

For more information on the Optional Airtronic Heater see Figure 9.
For Air Conditioners, refer to Figure/Table 10.

FIG 5. MISCELLANEOUS CONTROLS



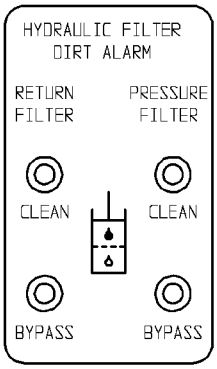
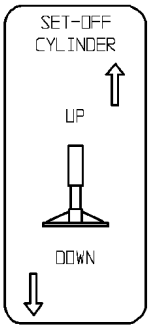
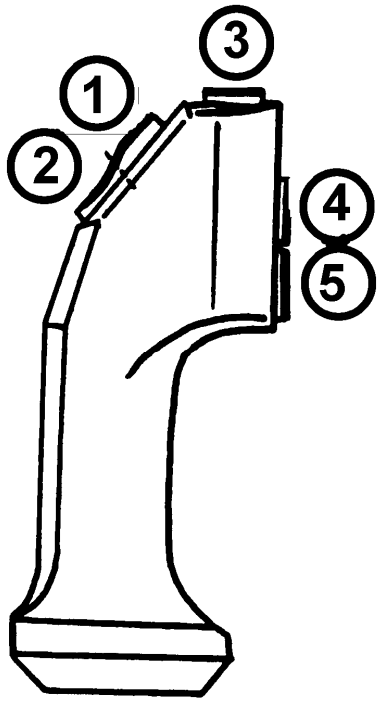
CONTROL OR INSTRUMENT	INTERNATIONAL SYMBOL	FUNCTION
HYDRAULIC FILTER STATUS INDICATOR LIGHTS		Green Light: Filter Element OK Red Light: Filter Element needs cleaning Note: Case Drain Filter is Optional.
SET OFF CYLINDER (OPTIONAL)		Switch in DOWN position raises machine. Switch in UP position lowers machine.

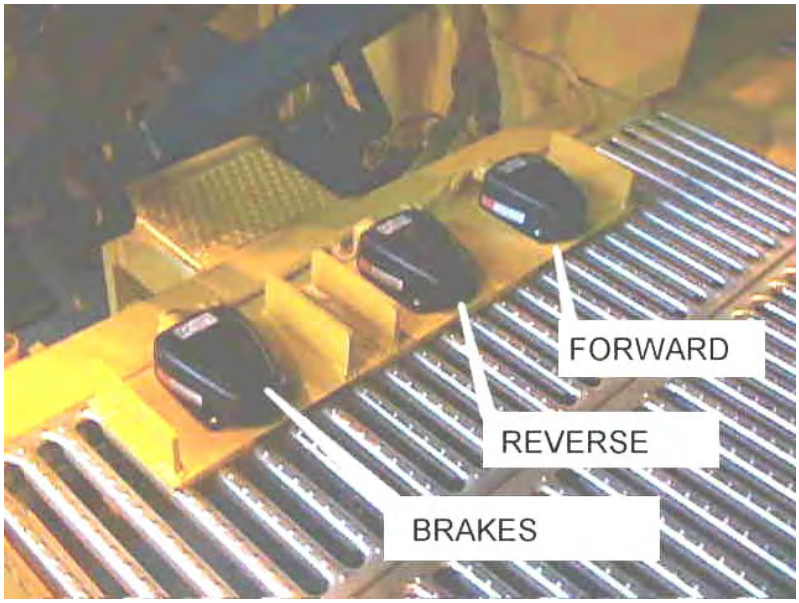
FIG 6. OPERATOR CONTROLS
HAND CONTROLS

The joystick valve attached to the right handcontroller at each work station allows the operator to position the carriage, while the buttons on the hand controller itself perform actual working operations. Refer to the item numbers listed on the figure below for cross reference in the Table.



Item	Function	Description
1.	**DOWN**	Press momentarily to lower to “Ready” position.
2.	**CLOSE & PULL**	Press to close claws and release to pull spike.
3.	NOT USED	
4.	**EXTEND**	Press to lower claws below Ready Position.
5.	**OPEN**	Press this button to open claws wider than Ready position.

FIG 7. OPERATOR CONTROLS PROPULSION AND BRAKING



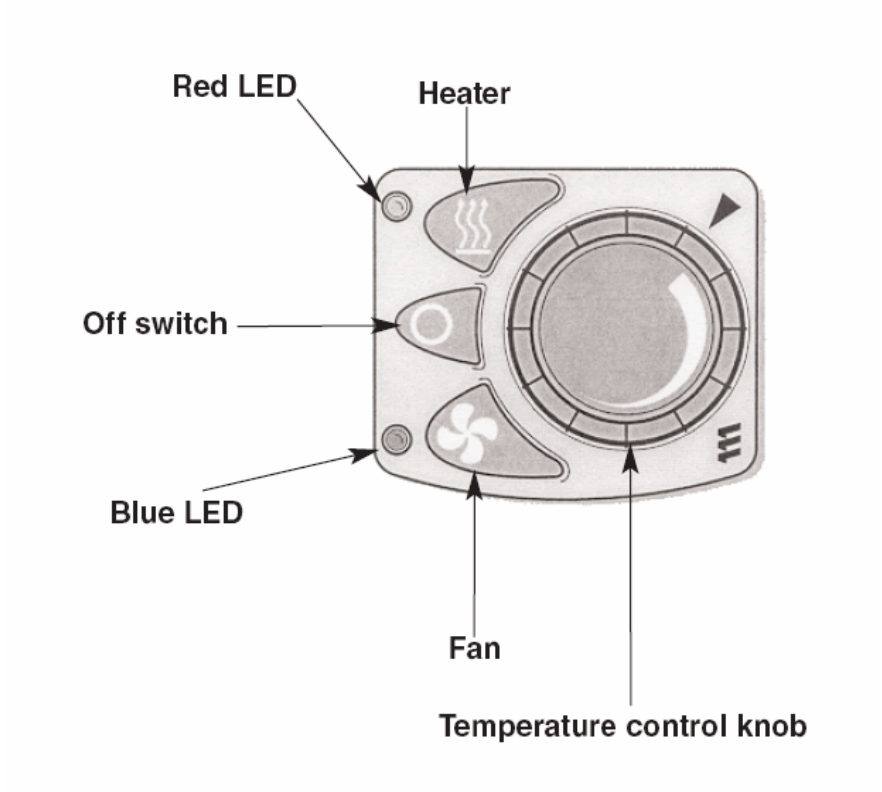
The type of braking is selected on the Main Control Panel of the Logic Box. When in DEADMAN brake mode, brakes are applied automatically when forward or reverse footswitches are released. When in the SERVICE (or Coast) brake mode, brake footswitch must be applied for brakes to function.

Brake Footswitch	Press this footswitch to apply brakes when in the SERVICE brake mode.
Reverse Propel Footswitch	Press this Footswitch to release brake and propel the machine in reverse.
Forward Propel Footswitch	Press this Footswitch to release brake and propel the machine forward.

FIG 8. REMOTE CONTROLS

CONTROL OR INSTRUMENT	INTERNATIONAL SYMBOL	LOCATION/FUNCTION
CLAW PIN/FRAME PIN Switch (Manual lockup only.)		Momentary switch. This switch is located on the machine frame near each workhead and is used to raise the workhead for removal or insertion of the workhead lockup pins. (Frame and claw housing lock pins). The switch must be held in position to be able to insert the pins. OTE: There is a specific order in which to apply or remove lockups: To Lock: Claw pin first, then frame pin. To Unlock: Frame pin, then claw pin. For more detailed lockup instructions refer to LOCKUPS later in this section.
Manual Emergency Hand Pump		Located on frame near the engine. Pump is used when there is a loss of system pressure and movement of hydraulic cylinders is necessary. System pressure is supplied by pumping hand lever.
Electric Emergency Pump (Option)		Switch on remote box turns pump on or off. NOTE: When using the electric emergency pump the ball valve at the main pump (if equipped) and/or the ball valve at the accumulator MUST be shut off for the emergency pump to function correctly. More details can be found later in this section.
Hydraulic Oil Tank Sight Level and Temperature Gauge		Located on hydraulic oil tank, it indicates the level of hydraulic oil in the tank. The temperature gauge Located on the bottom of the hydraulic oil sight level. Indicates temperature of the hydraulic oil. Normal operating temperature is 120° to 150° F (49° to 66° C).
Battery Disconnect Switch		Located next to battery box. Two position switch marked with "ON/OFF" plaque.
Set Off Valve		The lever controls the upward/downward motion of the Turntable Cylinder and the machine. Moving the valve hand lever **UP** extends the cylinder and **raises** the machine. Moving the lever **DOWN** retracts the cylinder and **lowers** the machine. Moving the lever to the center position stops cylinder movement. The valve hand lever must be down and locked whenever the cylinder is not being used.
Brake Lock Valve		Used when performing maintenance on the brakes or when towing.
Fuel Gauge		Located on fuel tank, it indicates the level of diesel fuel in the tank
Manual or electric top off		Used to fill the hydraulic tanks.

FIG 9. OPTIONAL AIRTRONIC HEATER



CONTROL OR INSTRUMENT	LOCATION/FUNCTION
HEATER BUTTON	Press button to start heater. You can adjust the required temperature by using the temperature control knob. (Note: Red LED to left will go on when heater is on)
RED LED	Indicates whether or not the Heater is the piece of equipment (heater or fan) operating. RED LED ON: Heater selected RED LED OFF: Heater not selected
OFF BUTTON	**Turns off the equipment controlled by the mini-controller (heater or fan).**
FAN BUTTON	Press button to start fan (Note: Blue LED to left will go on when fan is on) . Note: When used with the heater button, temperature control knob does not function.
BLUE LED	Indicates whether or not the fan is the piece of equipment (heater or fan) operating. BLUE LED ON: Fan selected BLUE LED OFF: Fan not selected
TEMPERATURE CONTROL KNOB	Controls the heat.

NOTE: For more information regarding the AirTronic Minicontroller, refer to the Tab "Other" at the back of this manual.

FIG 10. MACBONE A/C UNIT

Sequence	Directions
Initial Startup	After engine warm-up, bring the engine up to full operating speed. Slowly turn the BLUE control handle toward horizontal, which will control the speed of the unit. The faster the unit runs the more cooling capacity it will have. You may run the unit at any speed at any time.
Cooling	With the unit at half to full speed, push the cooling toggle switch up and turn the thermostat knob fully clockwise. As the cab cools to the desired temperature, turn the thermostat counterclockwise until you hear the compressor cycle off. The thermostat will now cycle the compressor to maintain that temperature. You may change the unit speed at any time with the blue handle.
Heating	Pull the cooling toggle switch down to off. Adjust the airflow with the BLUE handle. Move the RED control handle toward horizontal to allow hot water to pass though the coil. The thermostat does not control the heat output. Heat output is controlled manually by adjusting the red handle: vertical is off; horizontal is maximum. Again, you may change the unit speed at any time with the blue handle and change heat output at any time with the RED handle.
To Stop	Return both the red and blue handles to the vertical position to shut the unit down. Before powering down the engine, we recommend that you shut down the unit, however this is not necessary. NO OPERATIONAL SEQUENCE OF ANY SORT WILL DO ANY DAMAGE TO THE MACBONE UNIT.
Humid Conditions	On chilly, damp days or whenever humid conditions require dehumidification, operate the cooling cycle for dehumidification and, at the same time, open the heat valve to keep the temperature comfortable. This feature if of particular value when on-board equipment is sensitive to humid conditions.

Preparing the Machine for Work

As with any machine, pre-operational checks and preventative maintenance should be performed before performing work operations. Nordco suggests that you follow the guidelines listed below before performing work.

1. Position the machine on level track so fluid levels can be accurately checked and filled if necessary.

2. See TOWING section if machine is to be towed to worksite.

3. Know and understand the use of all machine controls and instruments as described earlier in this manual.

4. Perform the pre-operational inspection of the entire machine as specified on the next page. Find defects and correct them before serious damage or failure results.

5. If necessary, follow any applicable instructions under MAINTENANCE FOR EXTREME CONDITIONS.

6. Perform applicable preventative-maintenance procedures in MAINTENANCE AND SERVICE section.

7. Be ready to operate the machine with an alert and safety-conscious attitude.

8. Understand the use of the machine's Lock-Ups/Lock-outs. See LOCK-UPS section.

9. Make sure the unit is setup for rail size being worked on. Adjustments, if required, are described in the MACHINE SETUP.

10. Wear proper safety clothing.

Before you begin the pre-operational checklist you should become familiar with the controls that you will be checking. Knowing these controls and their functions may will help you in troubleshooting the machine at a later time.

TABLE OP-7: PRE-OPERATIONAL CHECKLIST

NORDCO recommends that the following checks be performed WITHOUT electrical power, due to a possible battery drain.

PREOPERATIONAL CHECKLIST

Nordco recommends that the following checks be performed WITHOUT electrical power, due to a possible battery drain.

☑ Control Box Switches and Gauges:	
ITEM	SHOULD BE
☑ Circuit Breakers (Inside Control Box)	Pushed In
☑ All Gauges	Glass not broken
☑ Emergency Stop Pushbutton	Pulled Out
☑ Work Lights Switch	OFF (down)
☑ Travel Lights Switch	OFF (down)
☑ Ignition Switch	OFF Position
☑ Engine Speed Switch	LOW (down) Note: Momentary on newer machines with Addco Throttle
☑ Hydraulic Tank Full (See Recommended Lubricants)	
☑ Fuel Tank Full (Use only Diesel Fuel)	
☑ Engine Oil Full (See Recommended Lubricants in Maintenance Section)	
☑ Inspect for Leaks. Pay particular attention to hydraulic hoses, fuel lines, and engine coolant lines.	
☑ Inspect all controls, wiring and switches for secure mounting	
☑ Make certain Mechanical Lock-Up devices are in place (for traveling)	
☑ Battery Disconnect Switch OFF (Switch located in box)	
☑ Shutdown Override Switch OFF	
☑ Electrical Interlock/Warmup Switch PUSHED IN	
☑ Pump Switch OFF	
☑ Cab Fans OFF (Center Position)	
☑ Windshield Wipers OFF (Fully counterclockwise position)	
☑ All other switches on the logic control box and remote boxes are in the OFF position.	

LOCK-UPS

WARNING!

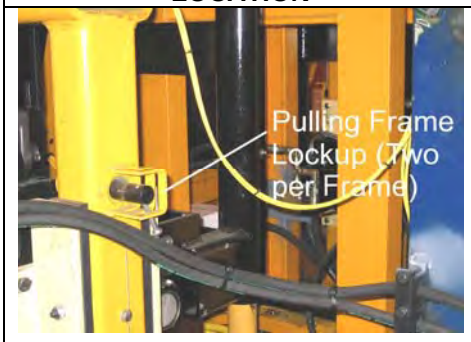
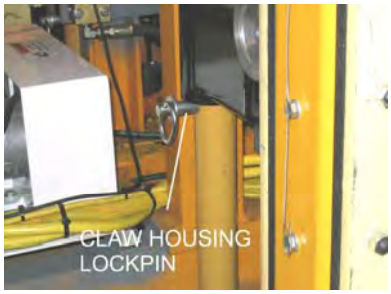
Failure to engage all lockup devices before propelling at travel speed and/or through crossings can result in injury to personnel and/or extensive damage to the machine.

WARNING!

Remove hairpin or double spike claws prior to high speed (non-work) travel or through crossings! Failure to do so can result in injury to personnel and extensive damage to the machine.

MANUAL WORKHEAD LOCKUPS

There are three (3) lock-up devices per pulling head. They must be unlocked prior to performing service to the workhead or during work operations. Use the following procedure to lock or unlock the assemblies.

LOCATION	LOCKUP PROCEDURE	WHEN USED
 **Pulling Frame Lockup**  **Claw housing Lockup**	1. Place machine in TRAVEL mode and Brake Switch in the DEADMAN position. This will raise workheads and apply brakes automatically. 2. Locate the remote control box next to the workhead. This is used to lift portions of the workhead in order to insert the lockpins. 3. Hold switch on control box in the CLAW PIN position. This will raise the claw housing and allow you to insert the lock pin. 4. Move and hold switch on control box in the FRAME PIN position. This will raise the pulling frame and allow you to insert the frame pin lockup. 5. Verify that the assembly is fully raised. Push lock pin through assembly. (You will not be able to lock in place if assembly has not been fully raised.) If the lock-up pin handle is in the inner slot, the assembly is locked in place. If the pin handle is in the outer slot, the assembly has been unlocked. To Unlock, use FRAME PIN first and then use CLAW PIN.	During working travel through crossings, at switches, frogs, and other rail obstructions; and during high speed (non-working) travel.

MACHINE SETUP

When the machine has reached the work site, certain adjustments and preparatory steps may be required. Adjustments can change the machine's operating limitations to compensate for various track area. Make certain that you have LOCKED OUT the machine before performing adjustments or maintenance.

⚠ CAUTION

Always turn off machine when performing maintenance, making adjustments, or whenever unintended movement of machine could occur; unless directed otherwise. Failure to comply could result in personal injury and/or damage to the machine.

There are some adjustments which may have to be made due to varying conditions such as rail height and base width. Adjustments must be made to compensate for these conditions before operations can begin.

Read and understand all OPERATION procedures, warnings, and cautions before making adjustments.

CLAW HEIGHT

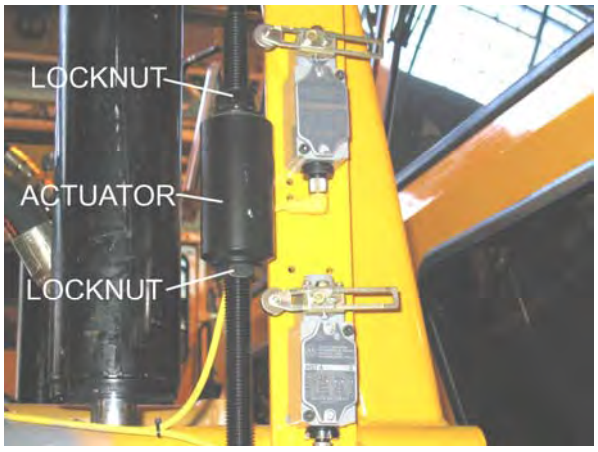
The claw height adjustment is used to control the raised and lowed positions of the spike pulling head. There are two limit switches (claws up and claws down) located on the pulling frame. These switches stop the pulling head when the actuator on the claw housing reaches the present down or up (pull) travel limits.

If necessary, the down and/or up travel limits can be adjusted as follows:

CLAW DOWN ADJUSTMENT

With the engine running, set the WORK/TRAVEL switch to the **WORK** position.

1. Spot the machine so that claws are closely aligned above the spike heads.
2. Press and release the DOWN (#1) button on the hand controller. (This will lower the pulling head until it trips the limit switch and stops.)
3. Check the location of the spike claw relative to the spike head. This distance should allow the spike claw fingers to move smoothly under the spike head. If not:
4. Push in the **Electrical Interlock/Warmup** switch.
5. Loosen locknut and move actuator up or down as required to cause limit switch to trip at the correct position.
6. Tighten locknut.
7. Pull out the **Electrical Interlock/Warmup** switch.
8. Initiate operating sequence to check adjustment
9. Repeat steps as required to obtain correct DOWN travel.



CLAW UP (PULL) ADJUSTMENT

1. With the engine running, set the WORK/TRAVEL switch to the **WORK** position.
2. Spot the machine so that claws are closely aligned above the spike heads.
3. Push and release the DOWN (#1) button on the hand controller to lower the pulling head.
4. Push and release the CLOSE AND PULL (#2) button on the hand controller. This will mimic the pulling function of the machine until the limit switch is tripped, causing claw to stop.
5. Push in the **Electrical Interlock/Warmup** switch.
6. Place a spike in one of the spike claws and check the distance between the spike tip and the tie plate. This distance should be approximately one inch. If not, reposition limit switch on the baseplate as required to obtain correct (one inch) distance between spike tip and tie plate.
7. Pull out the **Electrical Interlock/Warmup** switch.
8. Initiate operating sequence to check adjustment.
9. Repeat steps as required to obtain correct UP travel.

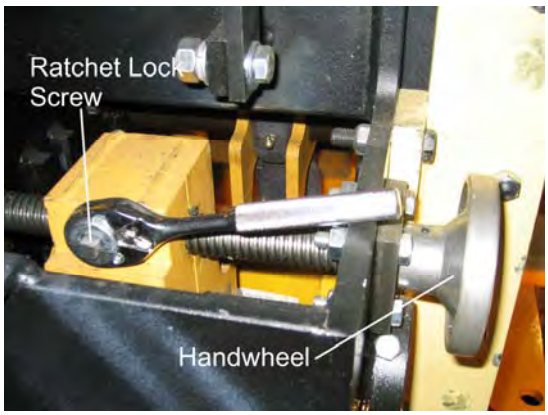
CLAW OPEN ADJUSTMENT

Claw open adjustment is made using the potentiometer located on the main control panel. By turning the potentiometer clockwise the distance that the claws open increases. Turning the knob counter-clockwise, the distance that the claws open decreases. Once the control has been set, the claws will open to the same distance each time they are activated.

SPIKE PATTERN ADJUSTMENTS

The position of the inner and outer claw levers in relationship to each other can be changed to align with different tie plate spike arrangements or new spike patterns can be selected. The levers can either be spaced wider apart, closer together or located one ahead of the other. The inner and outer levers must simultaneously align with a selected set of spikes on each side of the rail. To adjust the spike pulling pattern, see figure below and proceed as follows:

1. Spot the machine so that the levers are in approximate alignment over a typical tie plate.
2. Use the hand controller to spot the pulling head assembly so that it is approximately centered in the frame opening.
3. Loosen the ratchet lock screws for fore and aft adjustment. Turn the handwheels until the inner and outer levers are centered with the desired spikes. Turning the wheel to the right (CW) moves the levers aft and turning to the left (CCW) moves the levers forward. When the proper adjustment has been completed, tighten the ratchet lock screw.



MACHINE SETUP

When the machine has reached the work site, certain adjustments and preparatory steps may be required. Adjustments can change the machine's operating limitations to compensate for various track area. Make certain that you have LOCKED OUT the machine before performing adjustments or maintenance.

⚠ CAUTION

Always turn off machine when performing maintenance, making adjustments, or whenever unintended movement of machine could occur; unless directed otherwise. Failure to comply could result in personal injury and/or damage to the machine.

There are some adjustments which may have to be made due to varying conditions such as rail height and base width. Adjustments must be made to compensate for these conditions before operations can begin.

Read and understand all OPERATION procedures, warnings, and cautions before making adjustments.

CLAW HEIGHT

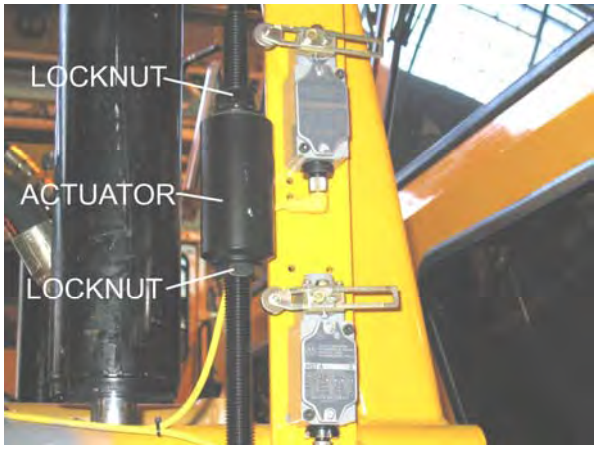
The claw height adjustment is used to control the raised and lowed positions of the spike pulling head. There are two limit switches (claws up and claws down) located on the pulling frame. These switches stop the pulling head when the actuator on the claw housing reaches the present down or up (pull) travel limits.

If necessary, the down and/or up travel limits can be adjusted as follows:

CLAW DOWN ADJUSTMENT

With the engine running, set the WORK/TRAVEL switch to the **WORK** position.

1. Spot the machine so that claws are closely aligned above the spike heads.
2. Press and release the DOWN (#1) button on the hand controller. (This will lower the pulling head until it trips the limit switch and stops.)
3. Check the location of the spike claw relative to the spike head. This distance should allow the spike claw fingers to move smoothly under the spike head. If not:
4. Push in the **Electrical Interlock/Warmup** switch.
5. Loosen locknut and move actuator up or down as required to cause limit switch to trip at the correct time.
6. Tighten locknut.
7. Pull out the **Electrical Interlock/Warmup** switch.
8. Initiate operating sequence to check adjustment
9. Repeat steps as required to obtain correct DOWN travel.



CLAW UP (PULL) ADJUSTMENT

1. With the engine running, set the WORK/TRAVEL switch to the **WORK** position.
2. Spot the machine so that claws are closely aligned above the spike heads.
3. Push and release the DOWN (#1) button on the hand controller to lower the pulling head.
4. Push and release the CLOSE AND PULL (#2) button on the hand controller. This will mimic the pulling function of the machine until the limit switch is tripped, causing claw to stop.
5. Turn off machine.
6. Place a spike in one of the spike claws and check the distance between the spike tip and the tie plate. This distance should be approximately one inch. If not, reposition limit switch on the baseplate as required to obtain correct (one inch) distance between spike tip and tie plate.
7. Turn on machine.
8. Initiate operating sequence to check adjustment.
9. Repeat steps as required to obtain correct UP travel.

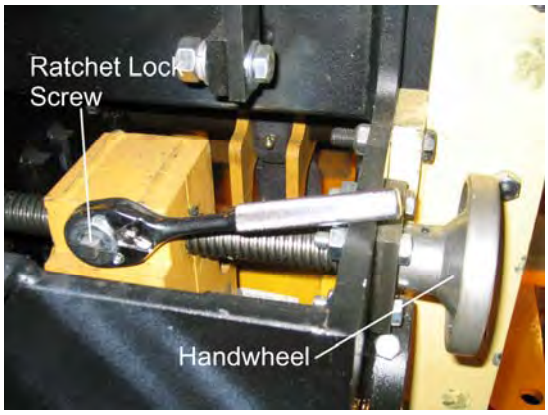
CLAW OPEN ADJUSTMENT

Claw open adjustment is made using the potentiometer located on the main control panel. By turning the potentiometer clockwise the distance that the claws open increases. Turning the knob counter-clockwise, the distance that the claws open decreases. Once the control has been set, the claws will open to the same distance each time they are activated.

SPIKE PATTERN ADJUSTMENTS

The position of the inner and outer claw levers in relationship to each other can be changed to align with different tie plate spike arrangements or new spike patterns can be selected. The levers can either be spaced wider apart, closer together or located one ahead of the other. The inner and outer levers must simultaneously align with a selected set of spikes on each side of the rail. To adjust the spike pulling pattern, see figure below and proceed as follows:

1. Use the hand controller to spot the pulling head assembly so that it is approximately centered in the frame opening.
2. Spot the machine so that the levers are in approximate alignment over a typical tie plate.
3. Loosen the ratchet lock screws for fore and aft adjustment. Turn the handwheels until the inner and outer levers are centered with the desired spikes. Turning the wheel to the right (CW) moves the levers aft and turning to the left (CCW) moves the levers forward. When the proper adjustment has been completed, tighten the ratchet lock screw.



MACHINE OPERATION

Engine Operation

WARNING

Exhaust emissions caused by the use of the engine on this machine may cause cancer, birth defects, or other reproductive harm if inhaled.

CAUTION

Before starting a new or overhauled engine that has been in storage, consult the engine manufacturer's manual for initial start instructions. Failure to follow those instructions can result in serious engine damage.

NOTE: Avoid unnecessary idling. When prolonged idling is needed, shut off pump and maintain at least 800-1100 rpm.

1. Ensure the suction strainer valve on the hydraulic oil tank is open and the Battery Disconnect Switch is on.

2. Make certain EMERGENCY STOP pushbuttons on both the main control panel and optional remote boxes have been pulled out. Set engine speed switch to LOW (on newer machines it is a momentary switch) and the pump switch to OFF. Engine will not start if the engine speed switch is set to HIGH.

   NOTE: See Emergency Stopping Procedures at the end of the OPERATION section.

3. Hold the Magnetic Override (MO) switch (labeled ENGINE START – HOLD IN WHILE STARTING) in and turn the ignition switch to the right until the engine starts. Release the ignition switch (will spring back to centered position) and continue holding the MO switch until oil pressure reaches 30 psi (2 bar or 207 kPa). Allow 5-7 minutes of warmup if first start of the day.

   NOTE: Engine will not start if engine speed switch is in HIGH position or on newer machines if the engine had been stopped when in a higher rpm, emergency stop pushbuttons are pushed in, or if the MO is not held in.

4. If the engine fails to start within 30 seconds, release the Push to Start pushbutton and allow the starting motor to cool a few minutes before trying again.

5. After the engine has successfully started, perform the startup check on the next page.

STARTUP CHECKS
GAUGE READINGS CHECKED:
☐ Tachometer 2250 rpm (under load) ☐ Voltmeter: 24 to 28 Volts ☐ Engine Temperature: John Deere Tier 2: Between 180° and 202**°F (82°-94°C)** **Cummins:** Between 190° and 207**°F (88°-97°C)** 160 to 185° F (71 to 85°C) ☐ Engine Oil Pressure: 40 to 60 psi, 3 to 4 bar, 276 to 414 kPa
LIGHT/HORN STATUS
☐ LIGHTS FUNCTION: ☐Travel Lights ☐ Work Lights ☐ Brake and Marker Lights ☐ HORNS/ALARMS FUNCTION: ☐Backup Alarm ☐ Horn Button ☐Horn Button (Optional Remote Switches)
☐ LOCK-UP DEVICES ENGAGED

WORK OPERATION

Once the machine has been propelled or towed to the worksite, work can begin as follows:

Make certain all STARTUP procedures have been followed before beginning working operations.

IMPORTANT: IN THE EVENT OF AN EMERGENCY, PRESS THE EMERGENCY STOP PUSHBUTTON ON THE MAIN CONTROL PANEL. This is the fastest way to shutdown the machine.

Remove lockups.

With engine running at full rpm, hold the "CLAW PIN/FRAME PIN" switch in the **FRAME PIN (down)** position until the frame lockpins can be removed.

Hold the "CLAW PIN/FRAME PIN" switch in the **CLAW PIN (up)** position until the claw housing lockpins can be removed.

Make any required setup adjustments as described earlier in this manual.

Push the joystick controller forward (or pull it backward) to spot the pulling head.

Press and release the DOWN (#1) button on the hand controller. This will lower the pulling head until the LS has been tripped. (If you need additional depth, press the EXTEND (#4) button and the head will continue down at a slower rate as long as the held.)

Press and hold the CLOSE & PULL (#2) button on the hand controller to close claws on spike head. When the claws are under the spike, release the button to pull the spike.

The pulling head will return to it's full up position and the claws will open.

Propel to next tie and repeat steps 4-7 as needed.

EMERGENCY STOPPING

The emergency shutdown should be used only when the engine does not respond to the normal stop engine procedure or in the event of an emergency where time is critical.

To shut down the engine, push the EMERGENCY STOP pushbutton located in the upper center of the Logic Box control panel or on either Remote Operator Control Box.

Never use the emergency shutdown system except in an emergency. **DO NOT USE THIS METHOD AS A SHORTCUT TO TURNING OFF THE ENGINE!!**

EMERGENCY PUMP PROCEDURES

CAUTION

Prior to operating the emergency pump, it is imperative that you isolate the accumulator (if so equipped) and the main pump by shutting off the ball valves at each location. Failure to do so will cause catastrophic failure of the pump.

Raising the Workhead

1. Attach the emergency pump hose to the output quick-disconnect on the emergency pump. Attach the other end to the quick-disconnect located on the bottom of the manifold. Note: If more than one component needs to be lifted, leave this hose attached.

2. Turn on or manually run the emergency pump.

3. Manually override the "UP" Pulling Cylinder function control valve on the manifold by placing a t-handle pin into the hole on the top face of the solenoid. Push in and hold until component is raised enough to allow insertion of lock pin.

4. After the lock pin has been inserted, release the UP override on the top solenoid and insert pin into hole on face of bottom solenoid (DOWN override). This will apply downward pressure on the pulling frame and will raise the pulling frame off of the rail.

5. Release the DOWN override solenoid pin.

Releasing the Brakes

A. Disconnect the emergency pump output hose from the manifold (see Step #1, above) and reconnect it to the quick disconnect at the brake shutoff ball valve under the hydraulic tank on the right side of the machine.

B. Close the brake shutoff ball valve by turning the handle until it is perpendicular to the flow.

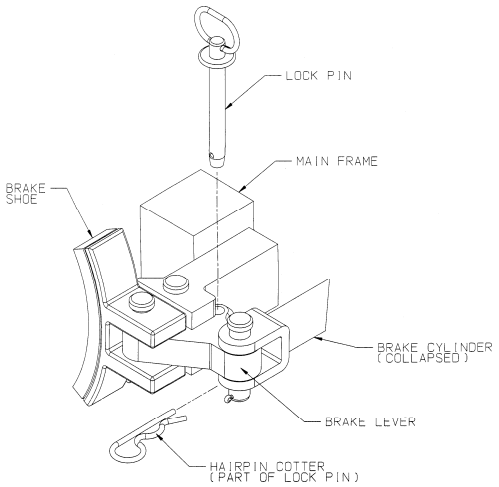
C. Turn on or manually run the emergency pump until the brakes are released.

D. Insert the brake lockup pins.

E. Turn off emergency pump, if applicable. Remove hose from emergency pump and quick disconnect at the other end. Return to toolbox.

DANGER

Be sure to release brakes and open brake shutoff valve before operating the machine. Failure to do so will leave machine without brakes and will cause serious injury or death.



AFTER OPERATION

Normal Shutdown

1. Hold the "CLAW PIN/FRAME PIN" switch in the **UP (CLAW PIN)** position until the Claw Housing lockpins can be installed.

2. Hold the "CLAW PIN/FRAME PIN" switch in the **DOWN (FRAME PIN)** position until the frame lockpins can be installed.

3. Turn ignition key to the full left (OFF) position.

4. Return all switches to their "Pre-Operational" state using the Pre-Operational Checklist as a guide.

5. Turn off battery disconnect switch. Lock battery box.

Parking or Locating Machine

1. Park or locate machine on level track area, if possible; and where it will not be exposed to excessive dust.

2. If the machine was towed, disconnect towing vehicle and set the brakes. Move the towing vehicle well clear of the parked machine.

Rotating Machine (09/2015)

The machine has a turntable which allows the machine to be lifted off of the tracks and rotated. The only function of this turntable is to rotate the machine. The turntable base is attached to the cylinder under the machine and requires that you swing out the base to use it.

Use of the Turntable and Turntable Lockup requires hydraulic power to the machine. If you do not have either, see the “Using Emergency Pump” section of the Hydraulic Preface.

To lift and rotate the machine, proceed with the following steps:

DANGER

Any machine can be hazardous when raised. Take all necessary precautions before raising the machine. Do not, under any circumstances, climb under machine when using the turntable.

To lift and rotate the machine, proceed with the following steps:

WARNING!

Any machine can be hazardous when raised. Take all necessary precautions before raising the machine. Do not, under any circumstances, climb under machine when using the turntable.

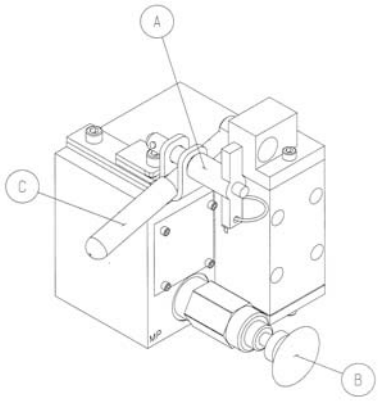
1. Make certain workheads are in their fully up and LOCKED position.

2. Locate the turntable manifold on the right hand side of the machine (in front of the workhead bay).

3. Using the pictorial below, remove the lockpin or padlock (A) to unlock the turntable valve handle (C).

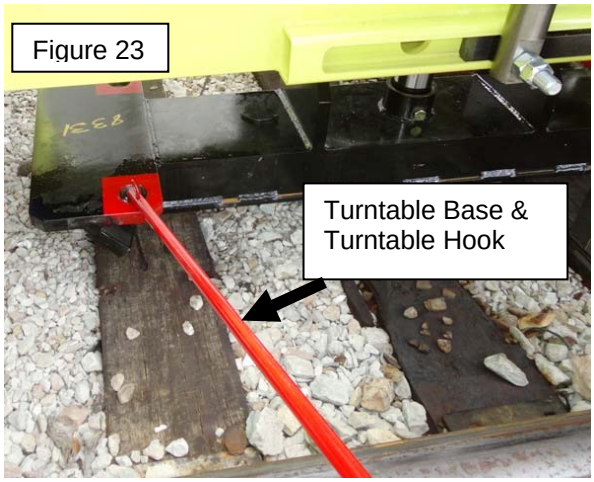
4. Pull out knob (B) in lower front of turntable manifold (this unlocks the turntable cylinder) while raising handle (C) until turntable base is approximately 2” above the rail, but below the frame of the machine, which will allow the turntable to be turned to be positioned on the rails.

5. Release knob (B) and return handle (C) to center position.



6. Locate turntable hook (stored on side of machine frame) and insert it into the turntable as shown below.

Figure 23



7. Using the hook, rotate the turntable out until it straddles both rails.

8. Remove turntable hook.

9. Slowly lift handle (C) to lower turntable until it comes into contact with the rails and until the machine is fully raised off the track. Keep handle (C) in the UP position.

10. Use necessary manpower to rotate the machine. The wheels should be directly above the track after rotating the machine.

11. To lower the machine, slowly move the handle (C) downward. The turntable cylinder will retract and the machine will lower onto the track. Make certain all four wheels are on the rail. Continue holding the handle downward until the turntable base is approximately 2" off the rail. Return handle (C) to center position.

12. Re-insert the turntable hook and turn the turntable base until it is parallel with machine frame.

13. Put handle (C) in the downward position to continue raising the turntable base until it is fully retracted.

14. Locks will automatically reapply. Raise handle to verify full engagement of lock. Turntable base should not move.

15. Return handle (C) to the the downward position and re-insert the lockpin or padlock.

Towing

Maximum towing speed is 20 mph. Reduce speed accordingly as dictated by weather or track conditions.

DANGER

Do not permit unauthorized personnel to ride in or on the machine, or on the drawbard between the machine and the towing vehicle. Falling from a moving vehicle may cause serious injury or death.

Remember that the machine weight may approach the weight of the towing vehicle. Maintain increased stopping distance accordingly.

The following steps must be taken before towing your machine:

1. Make certain workheads have been raised and locked in position.

2. Make certain turntable has been raised correctly and is locked.

3. Remove hairpin or double spike claws.

4. Lock out brakes:

   - Put machine brakes to SERVICE mode. (Brakes are applied only if footswitch is applied).
   - Close the brake shutoff valve.
   - Turn off machine.
   - Insert lock pin as shown in drawing to right.

5. Remove drive chain(s) if machine is to be towed a long distance.

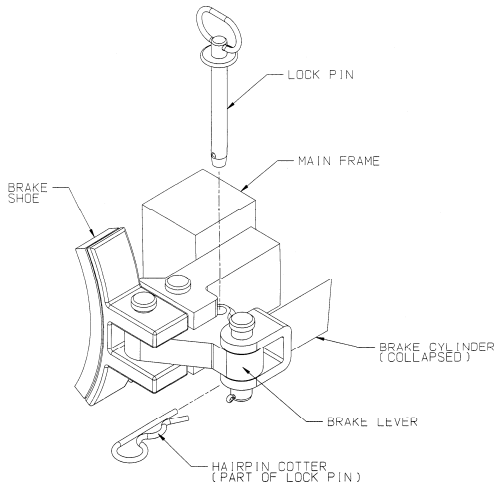
6. Inspect the tow bar for damage or loose parts. If damaged or parts are missing DO NOT TOW this machine!

7. Attach towbar to machine. Keep hands and fingers clear of all pinch points.

8. Ensure that the towbar is fully engaged, closed, and locked; and that it does not interfere with or restrict motion of the machine while towing.
9. Tow machine to destination.

DANGER

Once you have parked the machine, remember to release the brakes and open brake shutoff valve before operating the machine normally. Failure to do so will leave machine without brakes and will cause serious injury or death.



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NORDCO'S SERVICE NETWORK

REQUESTING ASSISTANCE

If you have any questions regarding maintenance and service on this machine, please call:

Nordco Service Manager
(414) 766-2342 (Wisconsin)
1-800-445-9258 (USA and Canada)

The process will be faster if you have the following information in hand **before calling**:

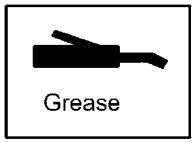
1. The Machine and Model Name: **Spike Puller SP2R Model A**
2. The Serial Number

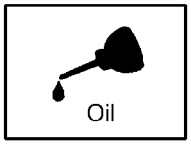
LUBRICATION GUIDELINES

The following pages show the locations of all lubrication points on this machine. Proper lubrication of all moving parts will help ensure efficient operation of the machine and will prolong the life of friction producing parts.

Frequency of lubrication will be given on each symbol on the diagrams/photos.

Lubrication Symbols





Grease: Lubricate with grease

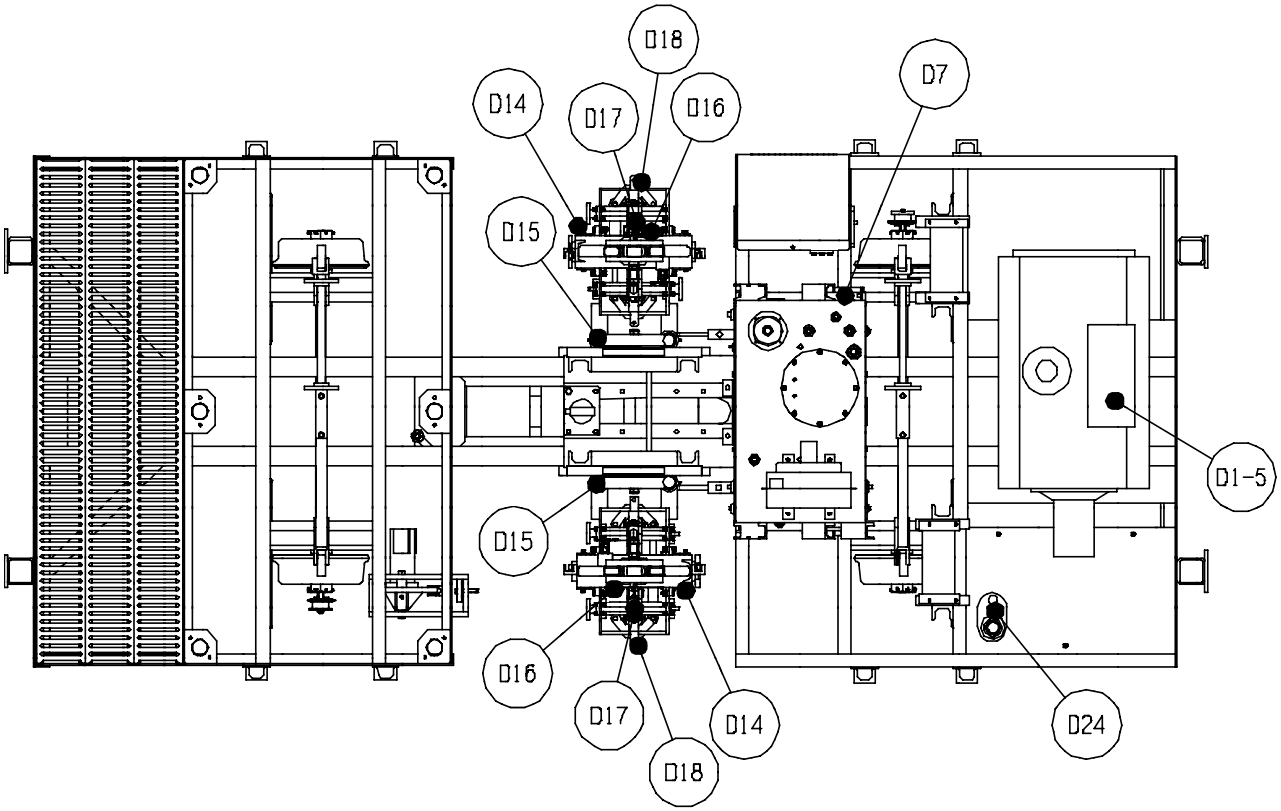
Oil: Lubricate with an oil or quality spray lubricant.

Service Specifications for Lubricants

Engine Oil
ABOVE 32°F (0° C): ..... SAE 40
UNDER 32° F (0° C):..... SAE15W-40
Hydraulic Oil..... ISO #46
Greases.....NGLI #2

(FOR RECOMMENDED BRANDS SEE **RECOMMENDED LUBRICANTS** on next Page)

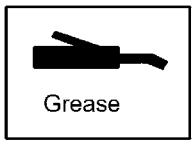
DAILY MAINTENANCE CHART

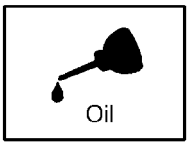


DAILY (OR 10 HOURS, WHICHEVER COMES FIRST)

Key: =

= Refer to Mfr's Manual in Component Data = More Detailed Instructions Follow

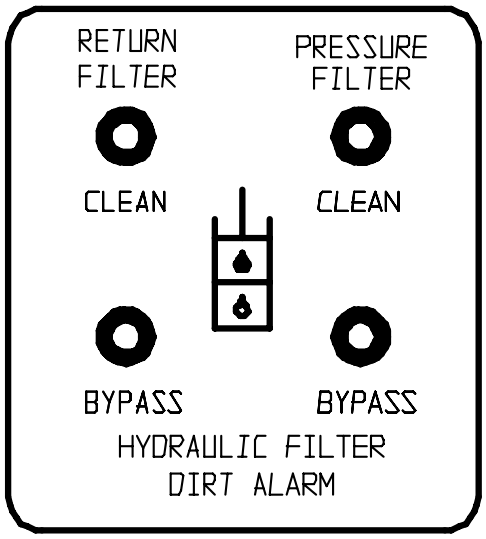




DOC	ITEM	SYM	TASK
ENGINE	NOTE: All engine maintenance should follow the instructions given in the Engine Manufacturers Operation Manual. Items below are for general reference only. **All maintenance should be performed BEFORE engine startup (Daily – AM).**		
	D1.		Check engine oil level. Oil levels within crosshatch area on dipstick is considered acceptable. Do NOT add oil unless level is below the crosshatch area. Do NOT top off!
	D2.		Check coolant level. Coolant should be at bottom of filler neck. Refill as necessary
	D3		Drain Fuel/Water Separator (if equipped).
	D4.		Clean Dust Unloader Valve (if equipped).
	D5.		Check Engine Air Cleaner Indicator (if equipped). Replace as necessary.
	D6.		
HYDRAULIC	**D7.**		Check Hydraulic Oil Level and Quality (Sight inspection at Gauge). Fill as req'd.
	D8.		Check Hydraulic Oil Filter Indicators at Front Control Panel (requires machine running and working)
	D9.		Inspect Hoses and Fittings for Leaks
WORKHEAD	**D14.**		Grease Pulling Frame Rollers (2 Each, 4 Total)
	D15.		Grease Claw Housing Tubes (2 Each, 4 Total)
	D16.		Grease Claw Housing Toggle Slide Plate (2 Each, 4 Total)
	D17.		Grease Claw Lever Toggles Links (2 Each, 8 Total)
	D18.		Grease Claw Levers (1 Each, 4 Total)
MISC.	**D24.**		Fill Fuel Tank – End of Day
	D25.		Inspect electrical connections/harnesses for tightness
	D26.		Inspect hoses/connections for leaks
	D27.		
	D28.		

Detailed Daily Instructions

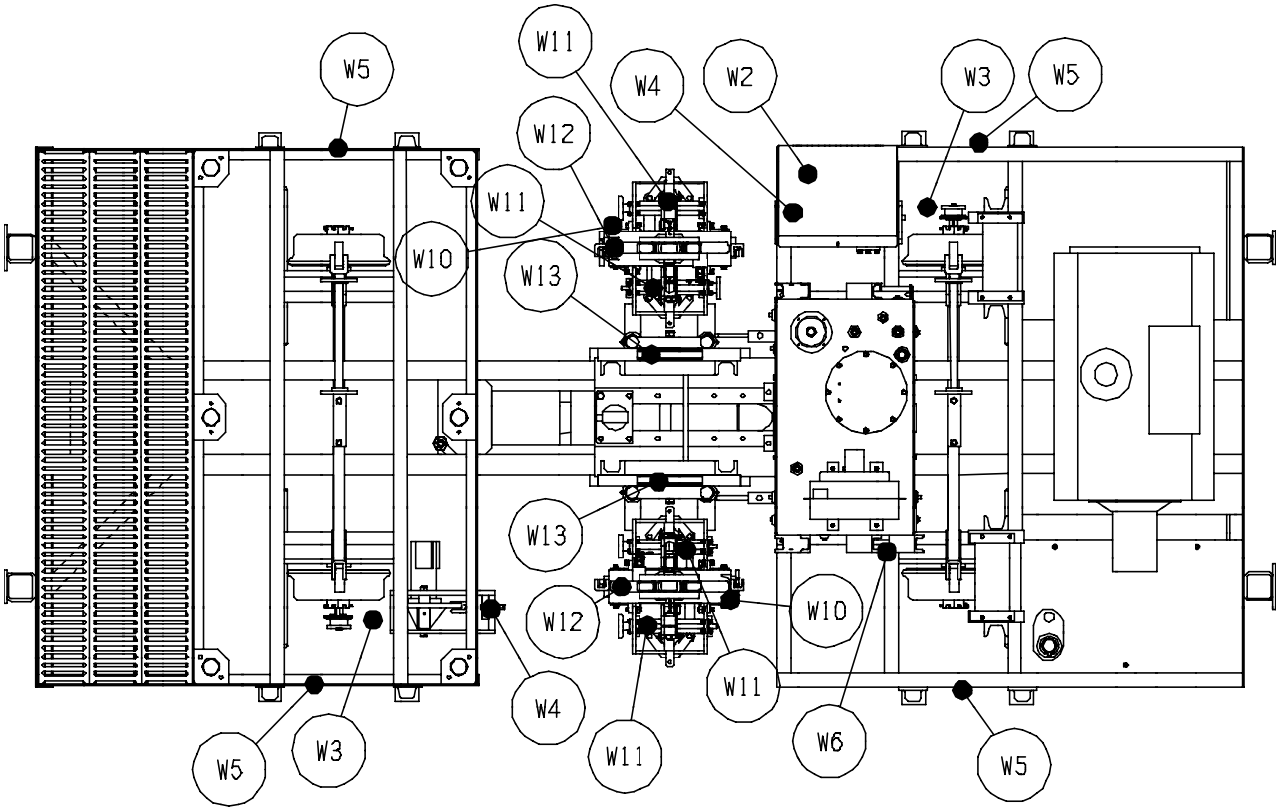
D7. Check Hydraulic Oil Level and Quality – Sight Inspection Only	
Inspect the oil level on a daily basis (or **every 10 hours** of operation) by reading the sight gauge located on the side of the reservoir. At full level, the oil should be to the top of the sight gauge. The hydraulic system uses SAE-20 (ISO 46) oil, unless otherwise stenciled on your machine. Before filling the system with hydraulic oil, be sure that the fluid is as specified and that it is clean. Do not use cloth strainers or fluid that has been stored in contaminated containers. Care should be taken to keep the hydraulic oil free of dust, water, sealing compounds and other foreign matter. While using the sight gauge, verify oil quality. If oil becomes dark or milky colored, it should be changed immediately. NOTE: Always add hydraulic oil to reservoir through a filter. NEVER OVERFILL RESERVOIR. Never use hydraulic brake fluid in lieu of hydraulic oil.	

D8. Check Hydraulic Oil Filter Indicators (Center Control Panel)	
To keep the hydraulic system clean and free from moisture, there is a return line filter and a pressure filter in the hydraulic system. The hydraulic oil filters have indicator lights on the center console to provide a visual display of filter cleanliness. The green light indicates “no service required”, the red light means “service is required”.	

D25. Inspect Electrical Connections/Harnesses for Tightness	
Daily inspection of the harnesses connected to the controllers, operator control boxes (both left and right control boxes), footswitches, and logic box are required. Harnesses that may not have proper connection could cause problems in starting and stopping the machine. In addition to harness connections, the footswitch should be inspected on a regular basis to guard against wear, deterioration, etc. If you notice excessive wear or breakdown, replace the switch.	

D26. Inspect Hoses and Fittings for Leaks	
Look for loose or disconnected hoses. An oil spot below the machine is a good indication of a loose hose or hydraulic component. Make certain shut-off valve on suction strainer is OPEN. Opening valve can often correct what appears to be a malfunction. Inspect all vital hose connections, especially at main pump and the main pump hose connection at the manifold. Look for cover damage and/or indications of twisted, worn, crimped, brittle, cracked or leaking hoses. Hoses with their outer cover worn through or otherwised damaged should be considered unfit for further service.	

WEEKLY MAINTENANCE CHART



WEEKLY (OR 40 HOURS, WHICHEVER COMES FIRST)			
Key: =  = Refer to Mfr's Manual in Component Data  = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
MISC.	**W1.**		Perform all Daily Lubrication and Maintenance Procedures
	W2.		Check Battery Condition.
	W3.		Oil Propulsion Chains
	W4.		Oil Propulsion Chain Adjusting Nuts
	W5.		Grease Axle Bearings
	W6.		Check Suction Strainer Element[a]
	W7.		
WORKHEAD	**W10.**		Oil Limit Switch Cam
	W11.		Oil Claw Housing Adjusting Screws
	W12.		Check Wear Pads
	W13.		Grease claw housing frame sliding channel (1 ea side, 2 total)
	W14.		
	W15.		
	W16.		

a. Check Suction Strainer Element first 40 hours of operation and yearly after initial inspection.

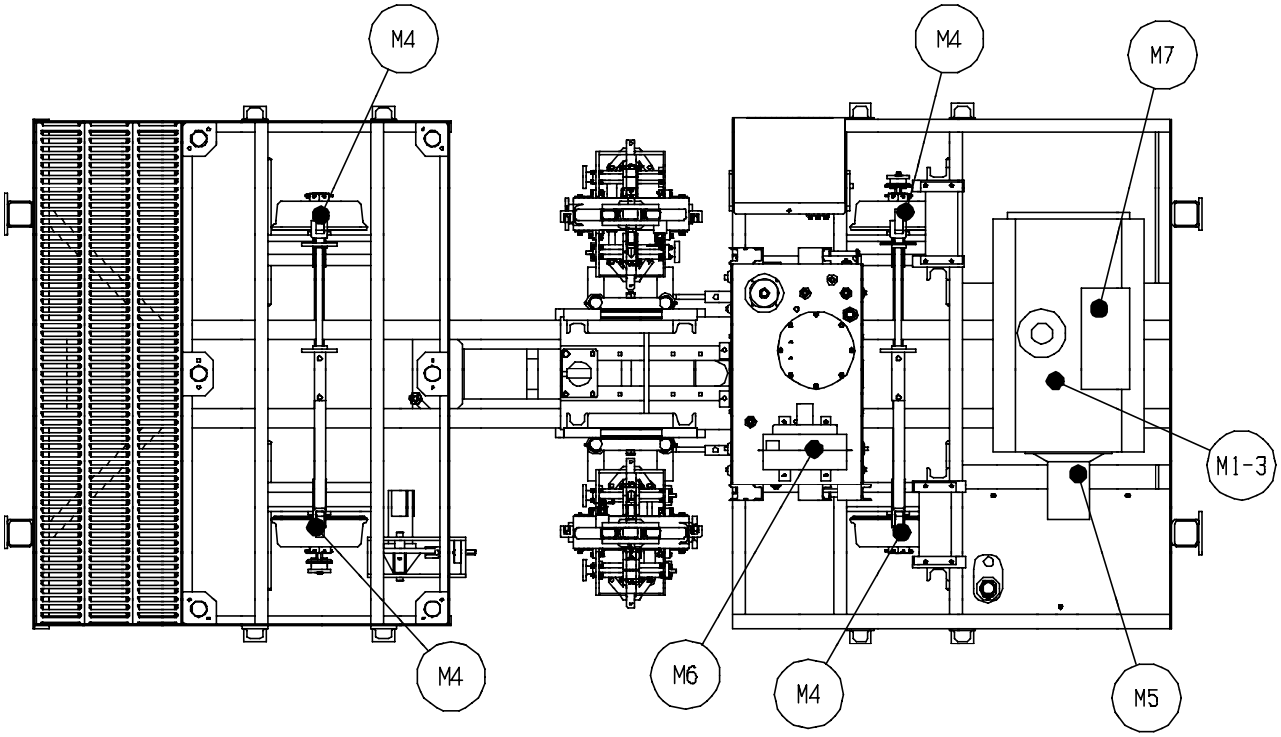
Detailed Weekly Instructions

W3. Oil Propulsion Chains	
When inspecting the drive chain, the chain should be nearly taut, with 1/4" (.635 Cm) play when depressed at the center. If not, adjustment is necessary see below. If the chain is too tight, the eccentricity of the sprockets may cause the chain to stretch and/or break. If the chain is too loose, the starting and stopping of the machine will shock load the chain, resulting in short chain life or failure. A worn or stretched chain will also cause short sprocket life as the load will not be carried by all of the teeth on the sprocket - resulting in excessive load on a few teeth. To adjust the drive chain: 1. Unscrew the adjusting screw locknut, but do not remove it from the screw. 2. Turn adjusting screw clockwise (CW) to tighten the chain or counter-clockwise (CCW) to loosen the chain. 3. Once the desired tightness has been reached, tighten the adjusting screw locknut. 4. Reinstall the chain guard.	

W6. Grease Axle Bearings	
Periodic inspection of the axle bearings and spacers for wear and breakdown are required to keep this machine functioning properly. Inspect hardware for proper fit and secure all loose nuts and bolts. Check spacers (A) for wear. The wheel bearing grease fittings are located on the underside of the pillow blocks. Remote wheel bearing grease fittings for the wheels are located on the outside of the frame. Weather conditions affect the time intervals of greasing. In general, a small amount of grease should be ok. Overgreasing may cause seal failure. Grease hardens with age. When this occurs, the bearing should be taken apart, cleaned, and relubricated following the manufacturer's instructions on the **component data** sheet.	

W7. Check Suction Strainer Element	
Located on the side of the reservoir, remove and inspect the filter after the **first 40 hours** of operation and **every year** thereafter. Clean as required. To access filter: 1. Turn off engine, Make certain suction valve is closed (off)(ccw). 2. Remove padlock (1) and pull out plug attached to cable. 3. Using Allen wrench, turn screw (2) inside of plug housing clockwise to open (counterclockwise to close). 4. Remove six capscrews and lift off front cover. Reverse process to reattach cover. NOTE:If for any reason removal of suction line filter is necessary, you must seal the hydraulic tank to prevent external contamination.	

MONTHLY MAINTENANCE CHART



MONTHLY (OR 150 HOURS, WHICHEVER COMES FIRST)			
Key: =  = Refer to Mfr's Manual in Component Data = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
MISCELLANEOUS	NOTE: All engine maintenance should follow the instructions given in the Engine Manufacturers Operation Manual. Items below are for general reference only. **All maintenance should be performed BEFORE engine startup (Daily – AM).**		
	M1.		Perform all Daily and Weekly Lubrication and Maintenance Procedures
	M2.		Check Fan, Alternator and Generator Belts
	M3.		Change Engine Oil and Filters
	M4.		Check Brake Shoes for Wear
	M5.		Run Pressure Checks on Main Pump and Propulsion
	M6.		Check Oil Cooler, clean as necessary
	M7.		Check Air Intake System
	M8.		
	M9.		

Detailed Monthly Instructions

M2. Check Fan, Alternator and Generator Belts	
Check the belts and tighten the fan drive, battery-charging alternator and other accessory drive belts. Belts should be neither too tight nor too loose. Belts that are too tight impose excess loads on the crankshaft, fan, and/or alternator bearings, shortening both belt and bearing life. Excessively overtightened belts can result in crankshaft breakage. A loose belt will slip and may cause damage to accessory components. Replace all belts in a set when one is worn. Single belts of similar size should not be used as a substitute for a matched belt set. Premature belt wear can result because of belt length variation.	

M4. Check Brake Shoes for Wear	
Replace brake shoes when the pad is less than 1/4 (.64 cm) thick. To replace brake shoes: 1. Override the brake valve cylinder on the main manifold until the cylinder collapses. 2. Once the cylinder has been collapsed, close the brake shut-off valve located behind the left main manifold. This will trap oil in the cylinder and keep the cylinder collapsed. 3. Insert the Brake lockup pins. 4. Turn off machine, following **Lockup/Tagout** procedures. 5. Remove the lower cotter pin and pin holding brake shoe bracket to brake lever. (See Item #1 in Figure). 6. Lift up the brake bracket to gain access to the brake shoe. 7. Remove brake shoe mounting hardware and replace brake shoe. Make certain you have reinstalled the mounting hardware! 8. Lower the brake bracket and reinstall the pin and cotter pin. Repeat Steps 5 through 8 for all brake shoes that need replacing. After that is done, continue on with the following steps: 9. Remove the brake lockup pins. 10. Return machine to service following the **Lockout/Tagout** procedures. Turn on machine. 11. Open shut-off valve.	

M5. Run Pressure Checks on Main Pump and Propulsion	
Pressure checks should be performed **every 250 hours or monthly** after the engine and hydraulics have thoroughly warmed up (oil temperature has reached 100°F [37.8°C] minimum). Before performing these checks, **read and understand all OPERATION instructions, warnings and cautions.**	

QUARTERLY (OR 500 HOURS, WHICHEVER COMES FIRST)			
Key: =  = Refer to Mfr's Manual in Component Data  = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
MISCELLANEOUS	**Q1.**		Perform all Daily, Weekly and Monthly Lubrication and Maintenance Procedures
	Q2.		Drain Fuel Tank. Replace Fuel Filters.
	Q3.		Check Cooling System Hoses
	Q4.		Test Hydraulic Oil Cleanliness, replace filters as necessary
	Q5.		Replace Hydraulic Tank Breathers
	Q6.		
	Q7.		
	Q8		

Detailed Quarterly Instructions

Q4. Test Hydraulic Oil Cleanliness	
Proper fluid condition is essential for long and productive life of hydraulic components and systems Thorough precautions should always be observed to insure the hydraulic system is clean: 1. Filter each change of oil to prevent introduction of contaminants into the system. 2. Maintain the proper oil level and regularly service filters, breathers, and reservoirs. 3. Take precautions to prevent moisture contamination. Change fluid whenever contamination occurs because even small amounts of water can affect system performance as well as induce corrosion and oil breakdown.	

YEARLY (OR 2000 HOURS, WHICHEVER COMES FIRST)			
Key: =  = Refer to Mfr's Manual in Component Data  = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
MISCELLANEOUS	**Y1.**		Perform all Daily, Weekly, Monthly and Quarterly Lubrication and Maintenance Procedures
	Y2.		Steam Clean Engine Radiator and Oil Cooler
	Y3.		Inspect Wheels for Excessive Wear
	Y4.		Inspect Suction Strainer Element.
	Y5.		Drain and Replace Hydraulic Oil in Tank. Replace all Filter Elements.
	Y6.		- Reserved for Future Use -
	Y7.		- Reserved for Future Use -
	Y8		- Reserved for Future Use -

Note: For Recommended Engine Service Intervals over One (1) year, refer to the Engine Manual or contact the Engine Manufacturer.