Nordco Equipment Services

Hydraulic Switch Tamper (HST)

Operation and Maintenance Manual

Reorder Part: NES50-01
Last Revision: Rev. B
FEBRUARY 2014

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.

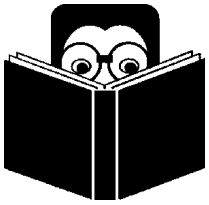
Release/Revisions

Release/Rev	Date	Change Description
Rev. A	2011	First Release
Rev. B	2/15/2014	Updates to the Work Travel and Parking Brakes section under Pre-Operation

This manual is a guide for the operation and routine maintenance of a NORDCO Equipment Services 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:

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®
Equipment Services

Customer Service
107 North US Highway 45
Arcola, IL 61910
217-268-4823

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:

Nordco®
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107 North US Highway 45
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217-268-4823

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 EQUIPMENT SERVICES (NES) is not responsible for any modifications made without authorization or written approval. Replace all NORDCO EQUIPMENT SERVICES (NES) and OEM parts with genuine NORDCO EQUIPMENT SERVICES (NES) 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 EQUIPMENT SERVICES (NES) Customer Service at 1-217-268-4823.

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.
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 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 optional 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.

SAFETY WHILE STARTING THE MACHINE

NORDCO EQUIPMENT SERVICES (NES) 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

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

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

3. Press the EMERGENCY STOP pushbutton on the LEFT ARM 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 EQUIPMENT SERVICES (NES) 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 EQUIPMENT SERVICES (NES) have welding instructions included. Welding of any components NOT of NORDCO EQUIPMENT SERVICES (NES) manufacture or failure to follow these instructions may affect the stability of this machine.

MACHINE SAFETY ALERTS

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 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.
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.
When machine is to be turned using the turntable, raise machine only high enough for the wheels to clear the rail.

MACHINE SAFETY ALERTS

CAUTION ALERTS

NEVER START THE HYDRAULIC VIBRATORS WHEN THE ENGINE IS AT FULL THROTTLE. ALWAYS START at ENGINE IDLE OR DAMAGE TO THE VIBRATOR MOTORS WILL OCCUR.
Never run vibrators with loose tools as this will cause extreme damage to the hole inside the tool holder portion of the vibrator.

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 at the Overhead control console.
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 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 by slowly cracking hose fitting (1/8-1/4 of turn CCW) at the cylinder/motor/pump of the hydraulic circuit being worked on. Service or perform maintenance on circuit after the steady flow of oil is gone.
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 **Hydraulic Switch Tamper (HST)**. Throughout this manual, reference to Right Hand (R/H), Left Hand (L/H), and Front and Rear are all determined from the operator in the normal work position.

Information is provided in this manual for operation and maintenance of the machine. Information regarding operation and maintenance of OEM parts not of Nordco Equipment Services 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

Pneumatic, includes pneumatic schematics 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 Equipment Services manufacture. (Behind "Cylinders, Valves, Motors, Pumps, Engine, and Other" tabs.)

SPECIFICATIONS

GENERAL

Weight..... 28,000 Pounds (12.700 kg)
Length .....20 feet 6 inches (6.2 meters)
Width.....10 feet 6 inches (3.18 meters)
Height.....10 feet 4 inches (3.10 meters)
Travel Speed on Rail ..... In excess of 35 mph (56 km/h) maximum
Rated Draw Bar Pull (On Rail) .....15,000 lbs. (6803 kg)
Turntable..... Hydraulically Operated - Rail to Rail
Wheel Base .....
Towing Speed.....35 mph (56 km/h) maximum (See towing procedure)

CAPACITIES

Fuel Tank(Dual Connected Tanks) (two fify or two 75) .....160 Gallons (605 liters)
Hydraulic Oil Tank..... (180 or 220 gallons) 185 gallons (700 liters)
Oil Cooler ..... 30 gpm (114 L/mn)

ENGINE

Make/Model .....John Deere PE6068HF485◈
Continuous BHP ..... 175 HP @ 2200 RPM
Oil Capacity.....32.5 Liters

HYDRAULIC SYSTEM

Pressure Settings:
Relief Valve - Track Drive .....5000 psi (345 bar)
Main Pump (22 GPM) Mfr.....
Relief Cartridge (Valve Banks) .....2700 psi (bar)

PNEUMATIC SYSTEM

Engine Mounted Compressor .....14 cfm @ 120 psi
Unloading Valve.....90 psi/110 psi
Relief Valve..... 150 psi
Tanks .....2 @ 6.5 gallons
Air Dryer.....C/R Turbo 2000, with Heater

ELECTRICAL SYSTEM

Battery.....24V dc (Two 12-Volt Batteries), 1150 Cold Cranking Amps
Ground .....Negative
Main Disconnect ..... Positive Disconnect

DRIVE SYSTEM

Drive Type.....Dual Axle Drive
Propulsion Type .....Hydraulic Motor Driven, 4-Speed Transmission

AXLE/WHEELS

Axle Size 5-inch
Wheel Size and Type.....24 inch (60 cm) diameter, Forged Steel
Brakes
Indexing ..... 4 Wheel Hydro-Dynamic
Traveling .....Four Wheel Clasp Type with Fail Safe
Emergency & Parking .....Fail Safe Spring Take-Over

Items or capacities may vary according to options on your machine.
*** Approximate weight. Actual weight may vary according to options on your machine. Actual weight of your machine is as stenciled.**

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 Equipment Services (NES) Customer Service at 1-217-268-4823.

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

The HST is designed to tamp ballast both inside and outside the rails, as well as through switches.

The HST is a workhorse designed for speed, accuracy and dependability. The HST tamper enables you to tamp the entire switch area and chase production machines very quickly and accurately.

The HST utilizes electric over hydraulic controls, ergonomic operator station, four wheel drive and air operated clasp type brakes with failsafe feature on all four wheels.

The tamping cycle can be done either manually or automatic. In the automatic mode of operation the tamping cycle is as follows: vibrator on, workhead down, tools close, tools open, workhead up, and traction. Workheads can operate separately or simultaneously.

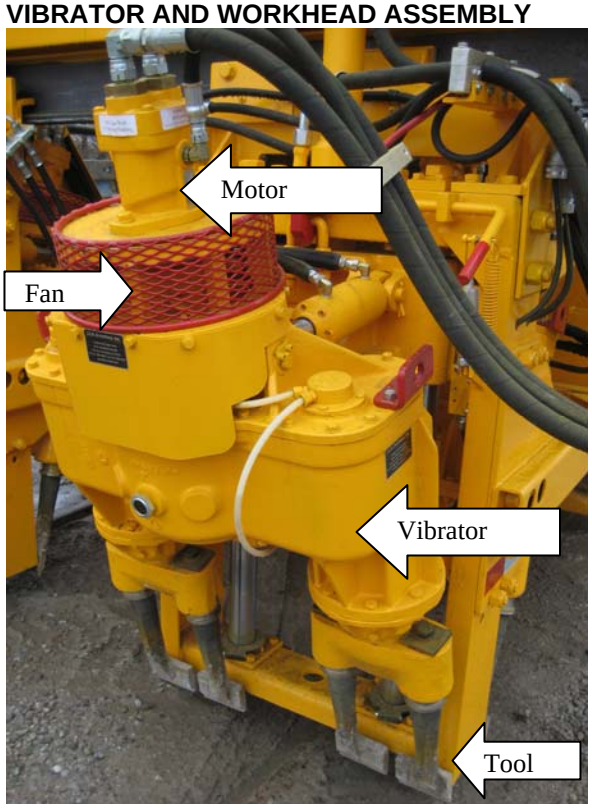
OPERATOR'S STATION

Almost all the controls for running this machine are located inside the cab. This includes but is not limited to, the overhead control panel, the left and right arm controls, the main control panel, and propulsion and braking controls.

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 **Cab Controls and Indicators** later in this section.

VIBRATOR AND WORKHEAD ASSEMBLY



Each workhead consists of a vibrator unit that houses four tools. Each side of the machine has a front and rear workhead that operates in sync with each other. The operator can select whether he wants to run just the left or right sets or both at the same time.

Once the machine hydraulics have warmed up, the vibrator units can be turned on.

CAUTION

Start and stop vibrators at IDLE only. Failure to do so will damage vibrator motors.

The vibrators will vibrate the tools at approximately 3200 vibrations per minute (3200 vpm) with a maximum movement range of 3/8" (9.5mm). As the tool vibrates it lowers into the ballast to a depth preselected by a DOWN limit switch setting. (See Down Limit Switch in the Setup Section of this Manual for more information). When the maximum depth has

been reached, the front and rear workhead tools "close" and compact the ballast under the tie.

ENGINE

Your machine is equipped with an automatic shutdown system when low engine oil pressure and high engine coolant temperatures have been reached. Before the machine reaches its shutdown levels, it will activate an audio and visual alarm.

Your machine is also equipped with a shutdown override system, which will allow you to override a shutdown in the event of an emergency. This will give you time to move the machine to a different location before shutting down the machine and attempting to troubleshoot the engine problems. USE THIS SWITCH ONLY IN THE EVENT OF AN EMERGENCY!

ELECTRICAL SYSTEM

The hydraulic functions of the machine are controlled by the electrical system. The relays, limit switches, micro switches and timing modules 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

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.

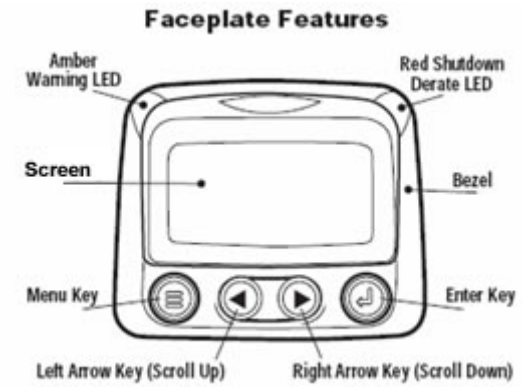
NOTE:
Your machine may not have all the optional controls and instruments that are described in this section.

Figure 1. Cab Controls and Indicators Upper Front Console

Items may vary in location due to options installed

INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
TRAVEL LIGHTS	Light will illuminate in the direction selected when switch is in the ON position and will remain lit until switch or machine has been turned off.
WORK LIGHTS	Light will illuminate when switch is in the ON position and will remain lit until switch or machine has been turned off.
PERIMETER LIGHTS	Light will illuminate on the side of the machine selected when switch is in the ON position and will remain lit until switch or machine has been turned off.
WIPERS	On/Off, turns respective wiper assembly on or off.
HYDRAULIC TEMPERATURE GAUGE	Indicates temperature of oil in hydraulic reservoir. Normal operating temperature is 80° to 180° F (49° to 72° C). Anything above that indicates possible problem with oil cooler.
AIR PRESSURE GAUGE	Measures air system pressure. Normal reading is 105 to 120 psi.
SPEEDOMETER	Indicates travel speed of machine in both kilometers and miles per hour.
HOURMETER	Block numbers on gauge indicate engine hours.
IGNITION SWITCH	The electrical system is energized by turning the 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.
ALARM	Buzzer sounds on low oil pressure, and high coolant temperature.
THROTTLE (ENGINE SPEED SWITCH)	Momentary switch used during work, travel, and shutdown. Hold switch in position until desired engine RPM has been reached and then release switch.
ELECTRICAL INTERLOCK	Shuts off Travel Power and all work power. You will still have lights, horns, radio functions, etc.
MURPHY DIAGNOSTIC DISPLAY	See Next Page for more details. Refer to engine manual for error codes.

Figure 1A. Cab Controls and Indicators
Upper Front Console
ENGINE DIAGNOSTIC GAUGE
(Upper Portion of Console)



Turn the ignition switch to the first detent (power will come on, but engine is not started) and wait.

The Powerview will come on, and a “WAIT TO START-PREHEAT” message will appear on the screen. A light (Wait to Start) directly beneath the Powerview will turn on.

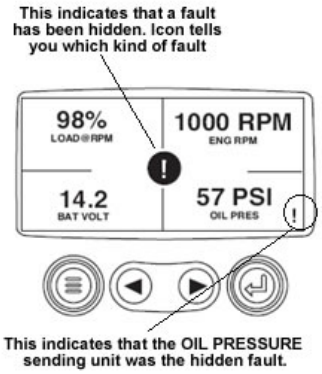
When the message disappears and the light goes out, it is safe to start the engine.

Instrument or Control	Type of Control	Functional Description
	Menu Key	The Menu Key is touched to either enter or exit the menu screens. The **Menu** key is only used during factory setup procedures. (See Component Data Section for additional operation and setup instructions.)
	Left Arrow	Use the **left to move to the left or upward in a 4-Up screen.** You can use the left arrow at any time to return to the previous screen.
	Right Arrow	Use the right arrow key to move to the right or downward in a 4-Up screen, or to move to the next set of 4 controls.
	Enter Key	**The enter key is used when a fault occurs. Generally, any fault that occurs will come up on the screen at the time it happens. In order to go back to the original status screen you have to push the enter key once. NOTE: This will hide the fault screen until you 1) correct the fault, or 2) you press enter again.**

Instrument or Control	Type of Control	Functional Description
Warning Light	Amber LED **LED** status lights are located on the upper left and upper right sides of the powerview. When they are lit, the screen will tell you the fault, the code number for the fault, and the method to correct the fault.	**The Amber Warning LED signals an ACTIVE FAULT code. When the light comes on, an abnormal condition exists. It is not necessary to shut down the engine immediately, but problem should be corrected as soon as possible. This light will remain on until all faults are corrected. Note: There may be more than one fault if <NEXT or MORE> appears at the bottom of the screen. You can also hide the faults by hitting the ENTER key. (Hitting the enter key again will take you back to the fault).** **NOTE: Ignoring active fault codes (warnings or shutdown) could result in severe engine damage.**
Shutdown Derate Light	Red LED **LED** status lights are located on the upper left and upper right sides of the powerview. When they are lit, the screen will tell you the fault, the code number for the fault, and the method to correct the fault.	**The Red Shutdown Derate LED signals a fault has occurred that requires immediate action. Shutdown the engine, but do not turn the switch to the off position. You must go through the codes on the screen and correct the problems prior to restarting the engine. (The Powerview remembers the errors).** **NOTE: Ignoring active fault codes (warnings or shutdown) could result in severe engine damage.**
Screen Display		Used to monitor engine and engine controls.

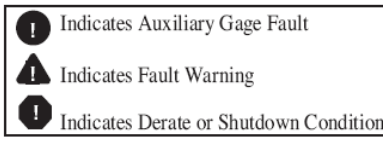
HIDING FAULTS AND WARNINGS

If you have hidden (hit the ENTER key at any fault condition), and have returned to the original 4-Up (or 1-Up) screen, the screen will now show icons in the upper right hand corner of a 1-UP screen or in the middle of the 4-UP screen (see figure below) to show you where the faults occurred. (In the 4-up shown below, the exclamation point appears in the middle and at the status that is showing a fault – the oil pressure.) Remember, the screen will show a <NEXT or MORE> if more than one error has occurred.



Scroll through the screen until you find the individual component that has a fault. Highlight the component and press the ENTER key to read the fault.

Each fault icon has a different meaning and different methods to correct. These are:



NOTE: Faults can only be cleared when the fault has been corrected.

SHUTDOWN MACHINE as soon as possible when you have encountered a Shutdown Fault.

Figure 2. Cab Controls and Indicators
Left Arm Console

NOTE: Emergency Stop Button Has Been Added to the LEFT ARM CONTROLS. This is to be used during emergency situations only and should not be used as a method to routinely shutdown the machine. PRESS to stop machine. PULL to begin machine startup procedures.

INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
TRAVEL/WORK MODE SWITCH	Two position rotary switch. When in travel mode, machine work functions are disabled. Travel Gears only 1st and 2nd. Work Mode gets you low low. Machine MUST be in WORK mode during work operations.
TRAVEL DIRECTION SWITCH	Three position rotary switch. Selects the desired direction of travel. In addition,
GEAR SELECT SWITCH	Three position rotary switch. Used only when in TRAVEL position. 1st Gear: Used for normal working operations. 2nd Gear: Used for high speed track travel.
CAUTION STOP AND START VIBRATORS WHEN AT IDLE SPEEDS. FAILURE TO FOLLOW THIS WILL CAUSE DAMAGE TO THE VIBRATOR MOTORS.	
LEFT VIBRATOR SWITCH	Two position rotary switch. Turns left vibrator ON or OFF.
RIGHT VIBRATOR SWITCH	Two position rotary switch. Turns right vibrator ON or OFF.
UPFEED BYPASS BUTTON	Bypasses the UP limit switches of the workhead. Used to store the workheads in their locked position. Also used to clear rail when using traversing mode.
WORKHEAD LOCK SWITCH	Two position rotary switch. Used along with the Travel/Work Mode Switch. Used with upfeed bypass switch to raise the workheads prior to locking up. When workheads are to be locked up, place machine in work mode and turn on the locks.
SIDE AND FRONT CONTROLS	
SERVICE BRAKE LEVER	Forward releases brakes
PARKING BRAKE BUTTON	Push/Pull. Must be applied at all times when the machine is stopped.
WARMUP SWITCH	ON/OFF switch.

Figure 3. Cab Controls and Indicators
Right Arm Console

INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
WORK CONTROL JOYSTICK	Used with the Travel/Work Switch in the WORK position: Forward: Travel forward Reverse (left): Reverse travel Upfeed (right): Workheads come to "UP" position Cycle (back) (or footswitch in Auto)
LEFT Traverse SWITCH	Two position momentary switch. Controls the left to right movement of the left vibrator workhead. Release switch once workhead has reached the desired position.
RIGHT Traverse SWITCH	Two position momentary switch. Controls the left to right movement of theright vibrator workhead. Release switch once workhead has reached the desired position.
WORKHEAD SELECTION SWITCH	Three position rotary switch. Allows the operator to use either single workhead functions or both workheads simulataneously.
INDEX SWITCH	Allows manual or auto cycling of machine workheads.

Figure 3. Cab Controls and Indicators
Main Control Panel
(Right Cab Wall Behind Operator)

INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
12 VDC Power	Provides source of 12V power to customer supplied equipment.
DOUBLE TAMP SWITCH ON/OFF	If double tamping is required, place this switch in the ON position and double tamping will always occur. Normal operation is with the switch in the OFF position.
TRACTION DELAY SWITCH ON/OFF	Traction delay is for Automatic Operation Only and can be initiated by turning on the traction delay switch. This switch works with T1 inside the control panel (see next page).
ALARM AND LEDS	Alarm will sound when any of the four alarm states occur (turntable down, low hydraulic oil, high hydraulic temps). These are separate from the alarm states issued on the Murphy Diagnostic gauge. Green LED for turntable indicates Turntable is raised.

Figure 3. Cab Controls and Indicators Inside Main Control Panel (Right Cab Wall Behind Operator)

INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
CYCLE COUNTER	Used to keep track of daily work cycles.
TIMER 1 (T1) TRACTION DELAY	Adjusts the time delay from the time the workheads leave the lower limit switches during up-feed in automatic mode and machine forward travel starts. This option is provided so the operator can adjust his indexing from tie to tie when working the machine down a steep grade to allow the workheads to clear the ties. This timer only works when the Traction Delay Switch is in the ON position.
TIMER 2 (T2) DOUBLE TAMP	Adjusts the time delay between when the workheads go to an up position before starting the cycle again. This timer relay is energized by the squeeze pressure switch. This timer only works when the Double Tamp Switch is in the ON position.
TIMER 3 (T3) PUMP TIMER	When activated it energizes CR6 turning on the pumps. When power is taken away, the timer runs the determined time, then dropping out P1 and P2. Normal setting of this timer should be around 3 seconds. (Timer is adjustable to 6 seconds).

TABLE OP-7
REMOTE CONTROLS AND INDICATORS

Item	Control or Instrument	Function
1	Emergency Pump 	Located on frame between hydraulic tank and engine. Control switch is located in box mounted to engine shroud above the Turbo 2000 Air Dryer. Pump is used when there is a loss of system pressure and movement of hydraulic cylinders is necessary. System pressure is supplied by electric pump.
2	Top Off Pump 	The top off pump can be either an electric or manual pump that is used for filling the hydraulic tank. Control switch for the electric pump is located in box mounted to engine shroud above the Turbo 2000 Air Dryer. (Called Transfer Pump on Decal)
3	Battery Disconnect Switch 	Located next to the battery box. Two position switch marked with "ON/OFF" plaque. This must be OFF and cover locked during service.
4	Hydraulic Oil Tank Sight Level	Located on hydraulic oil tank, it indicates the level of hydraulic oil in the tank.
5	Air System Controls	Air System Drain, Air Tanks Water Drain, Purge Tank Drain. Pull cord to release.
6	Air Dryer	Removes moisture from air in air system.
7	Fuel Filler	Fill machine with fuel through opening.
8	Turntable Control Valve	Used to lift the machine off track. Up/Down directional control valve. Note: When turntable is raised, it MUST be locked up at all times.

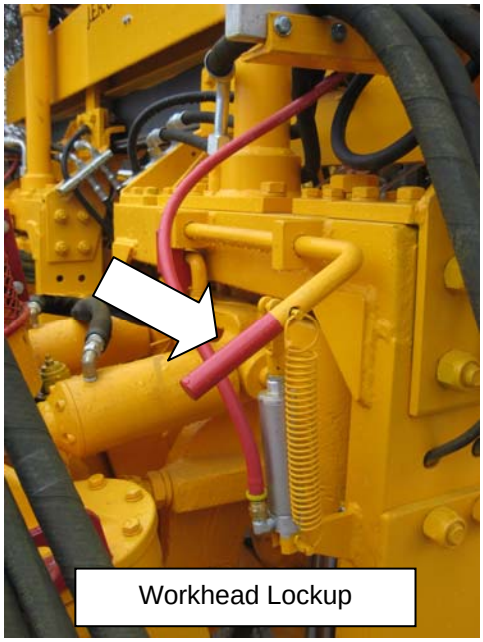
WORKHEAD LOCK-UPS (REMOVAL)

⚠ CAUTION

FAILURE TO REMOVE ALL LOCKUP DEVICES BEFORE WORKING OPERATIONS CAN RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO THE MACHINE.

This machine Is equipped with a number of locking devices to insure the proper operation of the machine. For the most part, these devices are used to make sure that certain moving parts remain secure while the machine is track traveling. Engage all component lockups prior to track travel and through crossings, switches and frogs.

WORKHEAD LOCK


Workhead Lockup

Traverse Extension

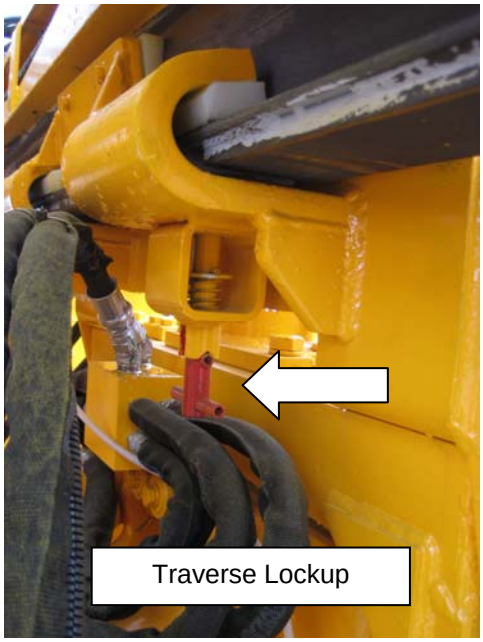
UNLOCK WORKHEADS

a) At the Right Operator Seat Console, select "both" on the vibrator selector switch.
b) At the Left Operator Seat Console:
1. Push the "Up-feed By-pass" Pushbutton.
2. Place the Workhead Lock switch in the OFF position.

d) Activate the cycle lever which will cause both workheads to drop into the ballast.
e) At the Right Operator Seat Console, Move the joystick to the right to cause both workheads to "up-feed" and stop on their respective upper limit switches.

NOTE: The HST's are equipped with traverse extensions which permit the workheads to tamp the area outside of each rail. Remove pin, swing out and insert pin for work position.

TRAVERSE LOCKUP



LOCKUP	PROCEDURE	USED
	Pull down, twist 1/4 turn and run machine until workhead is centered. When workhead is properly centered pin will enter and lock in correctly.	When transporting on truck. When tamping through super-elevations so that creep doesn't occur.

TURNTABLE LOCK-UPS (REMOVAL AND INSTALLATION)

⚠ CAUTION

FAILURE TO ENGAGE ALL LOCKUP DEVICES BEFORE PROPELLING AT TRAVEL SPEED CAN RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO THE MACHINE.

DO NOT CLIMB UNDER MACHINE WHEN IT IS RAISED ON TURNTABLE! THIS IS TO BE USED AS A METHOD OF TURNING THE MACHINE AND IS NOT INTENDED TO BE USED FOR MAINTENANCE OF ITEMS UNDER THE MACHINE.

Use the following procedures to install lock-ups. Note: With the exception of the suspension lockout, all lockups are to be in place during track travel.

LOCKUP	PROCEDURE	USED
	1. Machine must be in WORK mode and Warmup switch on front of LH arm console must be in the ON position. 2. Locate the Turntable Valve and Turntable Lockup Box on the left hand rear side of the machine (below the air dryer). 3. Remove the red lockpin. 4. Pull black knob to unlock the cylinder. 5. Lift handle slowly to raise the machine, lower handle slowly to lower machine. Machine will remain in position when handle is released. 6. Verify that the Turntable is in the full UP position. 7. When turning is complete, lower the machine to the rails, push in the cylinder lock knob, and apply the lock pin.	At any time when turntable is NOT being used.

Preparing the Machine for Work

As with any machine, pre-operational checks and preventative maintenance should be performed before using the machine. We suggest that you follow the guidelines listed below before actually operating the machine.

1. Position the machine on level track so fluid levels can be accurately checked and filled as necessary:
    a. Check Engine Oil and Coolant Levels, fill as necessary
    b. Check Diesel fuel level. Tanks are located on either side of the machine. Each tank holds approximately 50-75 gallons each depending on option installed and are connected to each other. Fill as required.
    c. Check the hydraulic oil level, making certain that the tank is over 3/4 full, but not filled to top.
    d. Check the oil level in each vibrator housing using the sight glass on each vibrator. Oil should be to the top of the sight glass. Note: The vibrators MUST be in a vertical position in order to accurately read the level of oil. Fill as required.
2. Check the status of the lockups. Lockups MUST be installed for travel purposes and only unlocked during work operations.
3. Make certain that you know and understand the use of all machine controls as outlined earlier in this section.
4. Perform preventive maintenance procedures as required (daily/weekly/monthly, etc).
5. Make certain you check for hydraulic or other fluid leaks PRIOR to operating this machine.
6. Be ready to operate the machine with an alert and safety-conscious attitude.
7. Make certain that the machine is setup for the rail size being worked on. Adjustments, if required, are described under MACHINE SETUP AND OPERATION.
8. Wear proper safety clothing.

MACHINE STARTUP

CAUTION

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

⚠ WARNING

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

ENGINE OPERATION

NOTE: Avoid unnecessary idling.

1. Ensure the suction strainer valves on the hydraulic oil tank are open. Suction strainers are located at the base of the hydraulic tank, between the tank and the engine.
2. Open the battery box cover (part of the RH walkway behind cab) and turn the Battery Disconnect Switch to the ON position. This is full clockwise position if not identified.
3. Make certain that the TRAVEL/WORK switch on the Left Arm Console is in the TRAVEL position.
4. Make certain that the Gear Selector Switch on the Left Arm Console is in NEUTRAL position.
5. Make certain that the Parking Brake Switch on the left side of the Left Arm Console has been applied.
6. Make certain that the Forward/Reverse Travel Selector Switch on the Left Arm Console is in the NEUTRAL position.
7. Turn the ignition switch on the front overhead console clockwise until the engine starts. Never activate the starter for longer than 10 seconds, and if the engine fails to start after three tries consult the engine manual or a local John Deere representative.
8. Release the ignition switch (will spring back to centered position) and allow 5-7 minutes of warmup if first start of the day.
9. If the outside ambient temperature is below 70 degrees Fahrenheit:
    a. Turn the TRAVEL/WORK switch on the Left Arm Console to the WORK position.
    b. Turn the WARMUP switch on the front of the Left Arm Console to the ON position until the Hydraulic Oil Temperature Gauge on the Front Overhead Console reads 70+ Degrees Fahrenheit.

CAUTION

RUNNING THE HYDRAULICS AT TEMPERATURES BELOW 32° F (0° C) MAY CAUSE EXTENSIVE DAMAGE TO THE MACHINE.

10. Allow engine to idle until it warms up, then bring engine slowly to full RPM by pressing the Engine Speed Switch UP until the desired RPM's have been reached and then release switch.

TRACK TRAVEL

1. Make certain that all lockups are installed prior to track travel:
    a. Workhead Locks
    b. Traverse Locks
    c. Traverse Extensions
    d. Turntable (Centerjack)
2. Release failsafe and parking brake switch.
3. Put TRAVEL/WORK switch in the TRAVEL position.
4. Put the Forward/Reverse Travel Selector Switch on the Left Arm Console in the desired direction of travel.
5. Using the Gear Selector Switch, select Low (1st) or High (2nd) gear. **DO NOT SWITCH GEARS WHEN MACHINE IS IN MOTION.** Allow machine to come to a complete stop before attempting to change gears.
6. Depress and continue pressing the foot switch to engage pumps for travel. The machine will move under power for as long as your foot is on the switch.
7. Let off footswitch to allow the machine to coast.
8. To apply service brakes, pull lever on the left side of the LEFT Arm Console.

WORK TRAVEL

1. Make certain that all lockups are installed prior to track travel:
    a. Workhead Locks
    b. Traverse Locks
    c. Traverse Extensions
    d. Turntable (Center jack)
2. Release failsafe and parking brake switch.
3. Put TRAVEL/WORK switch in the WORK position. Transmission will be LOW LOW during all work operations.
4. Using the electric joystick on the right arm console, select the direction of travel.
5. Braking during work travel is set by the Work Deceleration Valve located behind the Operator seat, next to the Turntable Cylinder Cover. Tightening knob (CW) is harder/faster deceleration; loosening knob (CCW) is slower deceleration.

CAUTION

Over adjusting the decal valve to where the wheels slide will result in driveline and other drive train failure!

6. To apply service brakes, pull lever on the left side of the LEFT Arm Console.

DECELERATION VALVE

PARKING BRAKES

The parking brake is activated by a valve located on side of the left arm console. This valve exhausts air from the spring brake chambers, permitting spring force to apply the service brakes. To operate the parking brake:

1. Push valve to apply brakes.
2. Pull valve to release brakes.

Always apply the parking/emergency brake before leaving the cab and when stopping for extended periods.

Machine Setup

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.

DANGER

SERIOUS INJURY OR DEATH CAN RESULT FROM REACHING INTO MOVING COMPONENTS WHILE THE MACHINE IS RUNNING. MAKE OBSERVATIONS FROM A SAFE DISTANCE.

WARNING

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.

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

CAUTION

NEVER START THE HYDRAULIC VIBRATORS WHEN THE ENGINE IS AT FULL THROTTLE. ALWAYS START AT ENGINE IDLE OR DAMAGE TO THE VIBRATOR MOTORS WILL OCCUR.

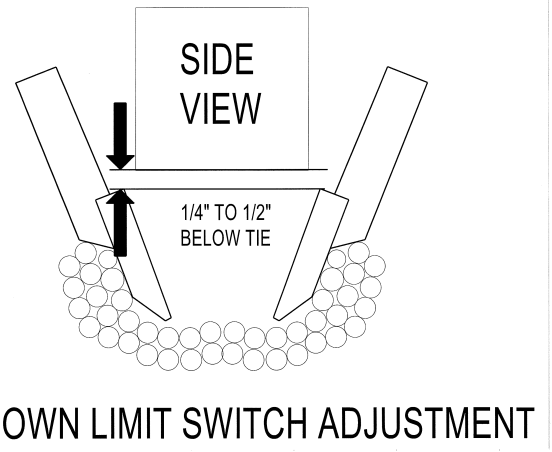
DOWN LIMIT SWITCHES

NOTE: The DOWN (lower) limit switches must be adjusted for the size of rail you are working on and must be re-adjusted every time you change rail sizes or tie sizes.

When the DOWN limit switch is triggered it stops the down movement of the workhead and the tools begin to close under the tie. If not properly adjusted, you will be closing on the sides of the tie and not the ballast under the tie - or the ballast under the tie will not be fully compacted.

To adjust the limit switch, loosen the two bolts holding the switch mounting bracket to the frame and slide up or down as required, and tighten bolts. Up will lessen the depth, Down will increase depth.

The proper setting will have been attained when the top blade of each tamping tool is ¼ to 1/2 inch below the bottom of the tie being tamped. This will require removing the ballast between a tie on each side and adjust depth so this condition exists. Should rail or tie sizes change, another depth adjustment is required.



DOWN LIMIT SWITCH ADJUSTMENT

UPPER LIMIT SWITCHES

The upper limit switch determines the UP position of the workhead during any cycle (manual or auto). Normally, they should be adjusted to allow the tamping tools to clear the top of the ties so that the rear tamping tools will not strike a tie when you move to the next tie. When working very hard ballast (called cemented), it might be advisable to set these switches higher to permit each tamping tool to hit the ballast with more velocity and allow better penetration of the ballast.

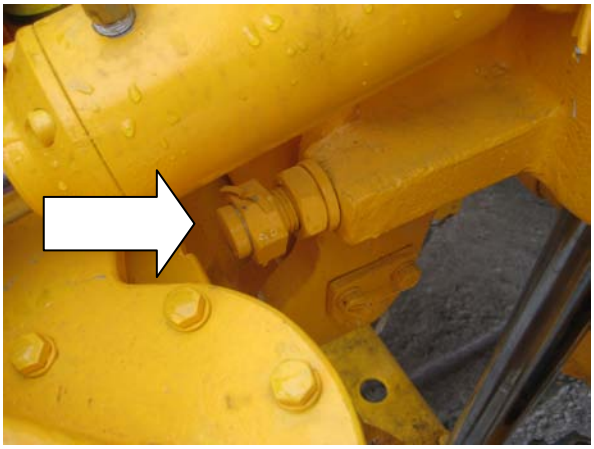
To adjust the limit switch, loosen the the two bolts holding the switch mounting bracket to the frame and slide up or down as required, and tighten bolts. Up will lessen the depth, Down will increase depth.

WORKHEAD OPENING

Each workhead is fitted with resilient bumpers Which control the maximum opening of the tools. They are found to be especially useful when close tie spacing is encountered. They help to prevent the tools from hitting the ties ahead of, or behind the tie being tamped.

They are located behind the vibrator housing fastened to the workhead carriers, and are fitted with locknuts to secure the setting. These should be kept locked at all times. Turning the bumpers counter-clockwise will decrease the distance between opposing tools.

The operator will familiarize himself quickly with these bumpers and their adjustments to suit the spacing and slewed conditions of the ties.



TRACTION DELAY

Traction delay is for Automatic Operation Only and can be initiated by turning on the traction delay switch which can be found on the side of the electrical cabinet to the rear of the L/H console. The purpose of traction delay is to introduce time delay (adjustable). from the time the workheads leave the lower limit switches during up-feed in automatic mode until travel starts.

This option is provided so the operator can adjust his indexing from tie to tie when working the machine down a steep grade.

Traction delay should not be used during normal operations as it will increase the time it takes to tamp one tie thus reduce overall production.

CLOSE PRESSURE CONTROL

Close Pressure Control Switch (Located in front corner of LH Walkway)

This item controls the ballast compaction between the opposing tamping tools. When the preset pressure is reached, the tamping tools automatically cycle "UP" and "OUT".

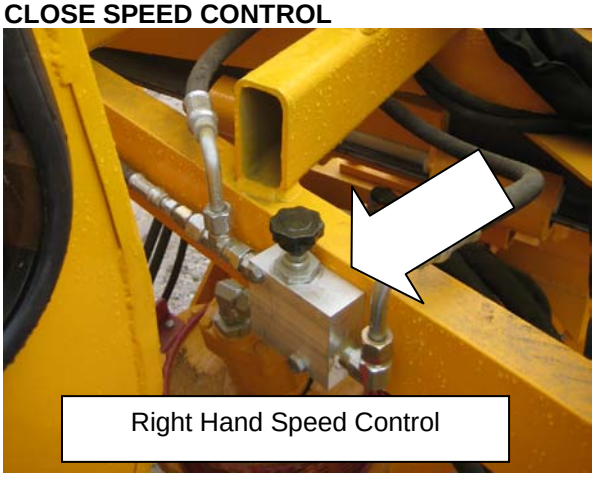
This adjustment should be set between 800-1200 psi and is set by using a screwdriver and turning the set screw. A cross bar is visible through the window of the pressure switch and indicates the increased or decreased setting.

Pressures within the 800-1200 psi range will give better results than higher pressure provided the "Squeeze In" speed control is properly set. (See Below.)

NOTE: For each 100 psi set on this pressure switch, an opposing thrust of 1260 lbs between the tools on the workhead will result. Most machines use a 1000 psi setting.

See Hydraulic Section Preface for more information.

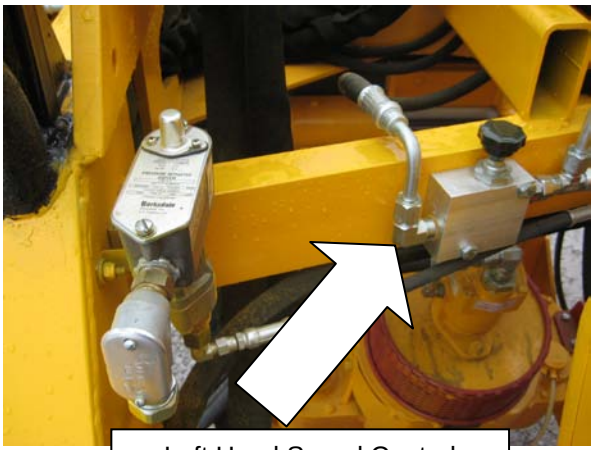
CLOSE SPEED CONTROL



The flow control valves control the rate of speed at which the tamping tools will close in when they have reached their set depth. The right hand controls the right hand workhead, and the left hand controls the left hand workhead. A locking nut is provided for securing the setting and should be kept locked after each setting.

These controls are located on the front cross beam in front of the cab. The Left control is accessed from the left walkway, and the right control is accessed from the right walkway.

Under all conditions both controls should be opened the same amount, i.e., both workheads should squeeze at the same speed when operated individually or simultaneously and should be checked daily.

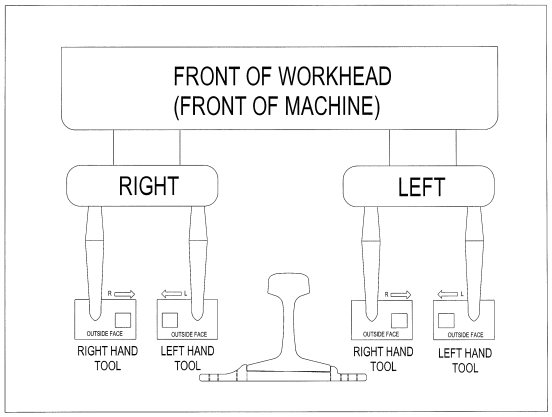


See Hydraulic Section Preface for more information.

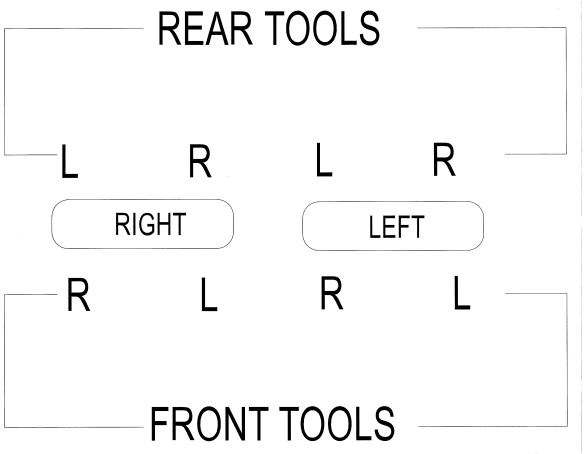
Tamping Tools

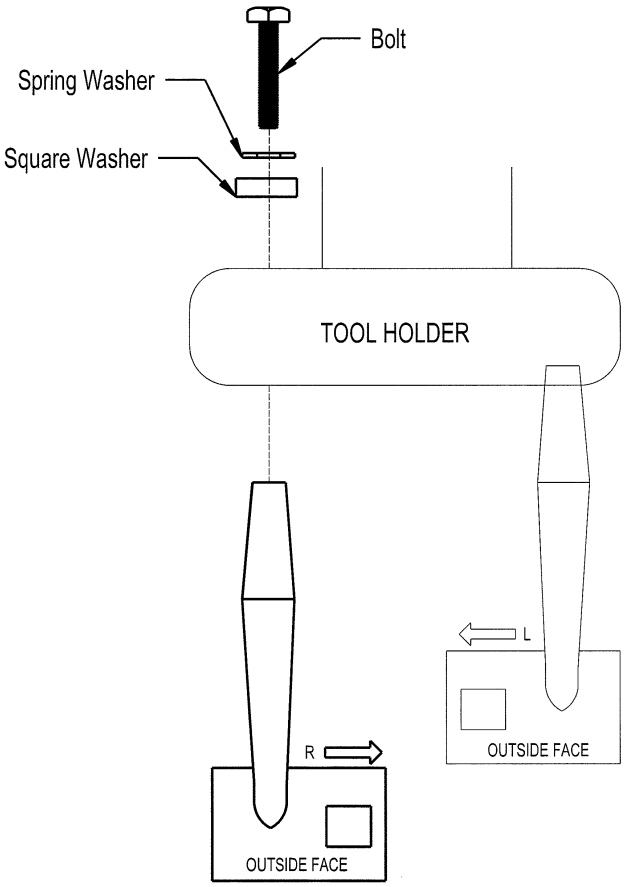
Tamping tools are made in three different patterns. straight, left hand and right hand. The terms straight, left hand or right hand, refers to the position of tamping tool face in respect to the tool shank. Stand the tool up on end just like it fits into the Vibrator and then rotate the tool until the keyway in the upper end of the shank is away from you. Now look down at the back side of the tool face or blade. If the tool shank appears to be in the middle of the blade, the tool is a "straight". If the blade is offset to the left, then it is a left hand. Likewise, is a right hand if the blade is wider on the rightside.

The HST Tampers use no straight tools. The set is made up of 8 left hand and 8 right hand. In all cases, the tool next to the rail is offset away from the rail.



TYPICAL WORKHEAD
(FOUR SETS OF TOOLS)





To Install:

1. Remove all the grease from the hole in the vibrator.
2. Install the key in the key way of the tamping tool.
3. Slide the tamping tool in the hole of the vibrator, making sure the key lines up with the keyway in the tool holder.
4. Install the square washer, spring washer, and bolt in to the top of the tamping tool.
5. Tighten tamping tool bolt while hitting tamping tool with hammer until bolt is tight.

MACHINE OPERATION

DANGER

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.

CAUTION

FAILURE TO ENGAGE ALL LOCKUP DEVICES BEFORE PROPELLING AT TRAVEL SPEED CAN RESULT IN INJURY TO PERSONNEL AND/OR DAMAGE TO THE MACHINE.

GENERAL OPERATION

1. Make certain all STARTUP procedures have been followed before beginning working operations.
2. Make certain all lockups have been removed and stored (as required).
3. Make certain that the hydraulic oil has been warmed. See Startup earlier in this section.
4. Engage parking brake.
5. Reduce engine to idle speed slowly.
6. At the Left Arm Console, move the Left and Right Vibrator ON/OFF switches to the ON position. If the vibrators do not achieve full speed in less than 2 seconds, move switch to OFF position.
7. Travel/Work Switch on the Left Arm Console is in the WORK position.

MANUAL OPERATION

The Operator is responsible for locating the machine over each tie.

1. At the Right Arm Console, move the Index MANUAL/AUTO switch to the MANUAL position.
2. Pull the joystick on the Right Arm Console to the CYCLE position and hold. This will:
   a. Move the workhead DOWN to a depth preset by the DOWN limit switch
   b. Close the tools at the speed set by the RH and LH speed control valves and at the pressure set on the Close Pressure Control Switch.
   c. Open the tools and bring the workhead back UP to a height preset by the UP limit switch.
   d. Operation will then stop waiting for you to propel to the next location using the joystick FWD or REV position, and actuate the joystick CYCLE again.

AUTOMATIC OPERATION

The Operator is responsible for locating the machine over each tie.

1. At the Right Arm console, move the Index MANUAL/AUTO switch to the AUTO position.
2. When the joystick is moved to the CYCLE position and held, or if the footswitch is pressed and held, the workheads will go through the entire cycle as follows:
   a. Move the workhead DOWN to a depth preset by the DOWN limit switch
   b. Close the tools at the speed set by the RH and LH speed control valves and at the pressure set on the Close Pressure Control Switch.
   c. Open the tools and bring the workhead back UP to a height preset by the UP limit switch.
3. The machine will automatically move forward. At the next tie, you MUST repeat Step 2.

DOUBLE TAMPING MANUALLY

If double tamping is required return the control lever on the right arm console to the vertical position. then move it backwards again and the operation will repeat on the same tie.

Emergency Procedures

1. If a hydraulic hose fails, shut down the machine immediately, determine cause of failure, correct condition.
2. If indications on gauges are not within the normal range, shut down the engine. Repair before further operation.
3. Emergency cylinder actuation requires the electric emergency pump. See below.

Emergency Pump (Optional)

Depress emergency pump switch in the control console panel and then operate the required valve handle to move the attachment as required. Operate the pump in intervals, for a maximum of 15 seconds at a time. The pump is designed for emergency use only and should not be used for extended periods of time.

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 and stop all machine functions, push the EMERGENCY STOP pushbutton located on any of the control boxes.

DO NOT USE THIS METHOD AS A SHORTCUT TO TURNING OFF THE ENGINE!!

AFTER OPERATION

Machine Shutdown

1. Locate machine on level track if at all possible.
2. Make certain that the two cutterhead booms are properly settled on their storage cradles.
3. Apply parking brake.
4. Reduce engine speed to idle speed and allow to idle for 1 minute (turbocharged engines should be allowed to idle for 5 minutes).
5. Install lockups
6. Turn ignition key counter-clockwise (CCW) to the OFF position.
7. Turn battery disconnect switch to the OFF position.

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

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.

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

1. Machine must be in WORK mode, and the Warmup switch on the front of the LH Arm console must be in the ON position.

2. Center turntable base across two solid and level ties.

3. Unlock Turntable valve handle located on the back of the cab at the LH steps. Pull black knob and slowly lift handle to lower turntable until it comes into contact with the ties.

4. Move the Turntable Valve hand lever upward and hold until the machine is fully raised off the track. Move lever down on click, Release the lever.

5. **Use manpower** to rotate the machine. The wheels should be directly above the track after rotating the machine. (Wheel flanges are properly aligned with the rails.)

6. Slowly move the Turntable Valve hand lever downward. The Turntable Cylinder will retract and the machine will lower onto the track

Towing

Maximum towing speed is 35 mph. Reduce speed accordingly as dictated by weather or track conditions. Remember that the machine weight may approach the weight of the towing vehicle. Maintain increased stopping distance accordingly.

It is strongly recommended that the drive shafts be removed before towing the machine. If this is not possible, limit towing to a maximum of 10 miles.

In an emergency situation, where removal of the drive shafts is not possible, and providing that the distance to be towed is LESS THAN 10 MILES, it is possible to simply neutralize the gearbox before towing. NOTE: When the transmission is in neutral, the gearbox bearings receive no lubrication and it is very possible that damage may occur to the transmission. This should only be used in dire emergency situations and not as a method to avoid disconnecting the drive shafts for towing.

MAINTENANCE AND SERVICE

REQUESTING ASSISTANCE

If you have any questions regarding maintenance and service on this machine, please call your local Nordco Representative or:

Nordco Service Manager
(414) 769-4603 (Wisconsin)
1-800-445-9258 (USA and Canada)

LUBRICATION AND MAINTENANCE

The following are suggested notes and guidelines when performing maintenance on this machine.:

1. Always make certain that the engine has been turned off and the battery disconnect has been turned to the OFF position and box locked out before performing maintenance on this machine.

2. NEVER clean, adjust, repair, or lubricate the machine while it is running unless specifically required and providing all necessary precautions have been taken.

3. When performing maintenance on the brakes, exercise caution if the spring brake is to be disassembled. Follow the brake manufacturer's instructions on the outside of the canister before attempting to disassemble the brake housing. The springs in the brake chamber are under tremendous compression.

4. Use caution when draining hot fluids from the machine. Splashing hot fluid can cause serious burns.

5. Never open the engine radiator cap while engine coolant is hot.

6. **NEVER** attempt to work under the machine while it is raised on the turntable unless special support blocks provided by Nordco are utilized.

7. Always ensure that all lubricating oils, fluids, and filters are clean and maintained as outlined in this section. It is important that lubrication is performed at the time intervals stated, or else machine damage could occur.

8. Always ensure that the engine radiator and oil cooler are kept clean and free of debris. Also ensure that the cooling fins are in good shape and not bent over.

9. Always ensure that the pump suction lines and ball valves are open and not blocked, closed or collapsed.

10. Before starting the machine, inspect it for obvious defects and correct any problems discovered.

11. Inspect brake shoes for ice, and remove if present, before operation of the machine. If ice is allowed to build up on brake shoes, braking efficiency is greatly reduced.

12. Replace glass in cab if nicks or damages occur to the outside.

MAJOR OEM MAINTENANCE SPECS

FUNK TRANSMISSION	
Break-In Period	50 Hours
Oil Change Schedule	First 50 Hours, every 6 months thereafter
Lubricant Type	API GL-5
Capacity	2 Quarts
Lubricant Grade Weather Dependent	
Below -10° F (-23° C)	75W
-10° F to 100° F (-23° C to 37.8° C)	80W-90
Above 100° F (Above 37.8° C)	85W-140

FUNK PUMP DRIVE	
Break-In Period	50 Hours
Oil Change Schedule	First 50 Hours, every 6 months thereafter
Lubricant Type	API GL-5
Capacity	2 Quarts
Lubricant Grade Weather Dependent	
Below -10° F (-23° C)	75W
-10° F to 100° F (-23° C to 37.8° C)	80W-90
Above 100° F (Above 37.8° C)	85W-140

JOHN DEERE ENGINE	
Break-In Period	50 Hours
Oil Change Schedule	First 50 Hours, every 6 months thereafter
Lubricant Type	API GL-5
Capacity	2 Quarts
Lubricant Grade Weather Dependent	
Below -10° F (-23° C)	75W
-10° F to 100° F (-23° C to 37.8° C)	80W-90
Above 100° F (Above 37.8° C)	85W-140

DAILY (OR 10 HOURS, WHICHEVER COMES FIRST)			
Key:  = Refer to Mfr's Manual in Component Data  = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
ENGINE	**D1.**		Check Engine Oil Level, Add SAE 15W40 as needed
	D2.		Check Engine Coolant Level and add antifreeze, (Ethyl Based) as required
	D3.		Check Fuel Filter & Fuel Water Separator
	D4.		Inspect V-Belt for proper tension and condition
	D5.		Check Visual Air Filters Indicators, Replace elements as needed
	D6.		Inspect Engine Exhaust and Intake System for leaks and rain cap for fit.
	D7.		Check Air Pressure with Engine Running – Should maintain 120 PSI
	D8.		- Reserved for Future Use -
HYD.	**D9.**		Check Hydraulic Oil Level. Maintain at least ¾ Full. Add ISO 46 Oil as necessary.
	D10.		Inspect Hoses and Fittings for Leaks
	D11.		Check Hydraulic Oil Return Filter Indicator when running, replace elements if needed
	D12.		Check Hydraulic Oil Pressure Filter Indicator when running, replace elements if needed
	D13.		- Reserved for Future Use -
MISCELLANEOUS	**D14.**		Inspect Electrical Connections/Harnesses for Tightness
	D15.		Drain Air Tanks, checking for excessive water or oil
	D16.		Fill Fuel Tank - End of day – Maintain at Least ¼ Tank
	D17.		Clean Windows on
	D18.		Inspect wheels, wheel nuts, brake shoes and check gap between brake shoes and wheels
	D19.		Check all brake chamber for caging bolts
	D20.		Check machine for cracks or other structural damage
	D21.		Check that all lights (brake, marker, work, travel, strobes) are functioning
	D22.		Clean debris/trash from machine
	D23.		- Reserved for Future Use -
	D24.		- Reserved for Future Use -
	D27.		- Reserved for Future Use -
Work Heads	**D31.**		Check oil level in vibrators, Should be in sight glass, Fill with SAE 15W40 as needed
	D32.		Grease work head pivot pins, 2 on horizontal pin and 1 on top of vertical pin
	D33.		Verify that Guide Rods Drip Style Oilers are working
	D34.		- Reserved for Future Use -
	D35.		- Reserved for Future Use -

Detailed Daily Instructions

D1. Check Engine Oil Level

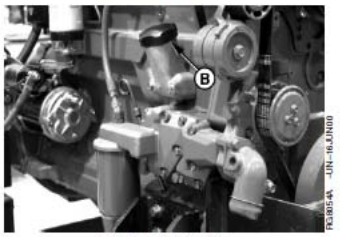
Check the oil level daily with the engine stopped. If necessary, add sufficient oil to raise the level to the proper mark on the dipstick. All diesel engines are designed to use some oil, so periodic addition of oil is normal.

If the oil level is constantly above normal and excess lube oil has not been added to the crankcase, contact the engine maker's authorized service outlet listed in the Engine Manual. Fuel or coolant dilution of lube oil can result in serious engine damage.

Never operate the engine with the oil level below the "L" (low) mark or above the "H" (high) mark on the oil dipstick. Wait at least 15 minutes after shutting off the engine to check the oil. This allows time for the oil to drain to the oil pan.

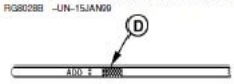
DO NOT add makeup oil until the oil level is BELOW the ADD mark on dipstick. John Deere ENGINE BREAK-IN OIL (TY22041) should be used to make up any oil consumed during the break-in period.

Left Side Oil Filler Cap



Right Side Oil Filler Cap

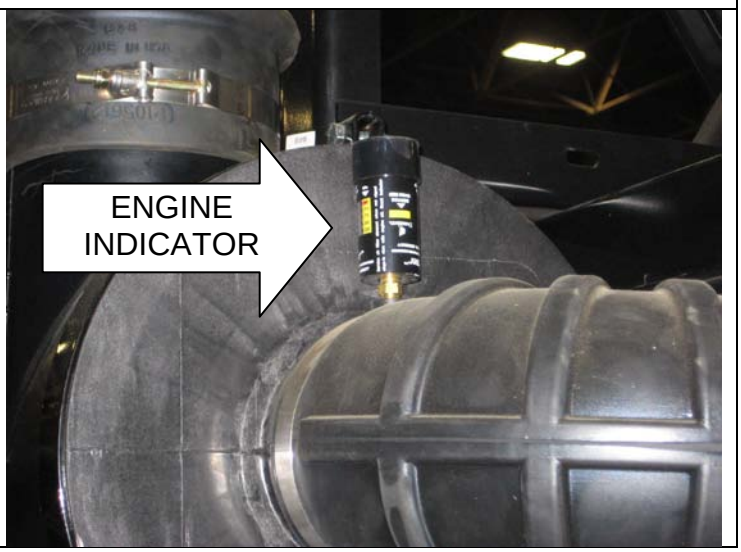
Rocker Arm Cover Filler Cap



Crosshatch on Dipstick

D3. Drain Water Separator/Fuel Water Trap on Engine (if equipped)

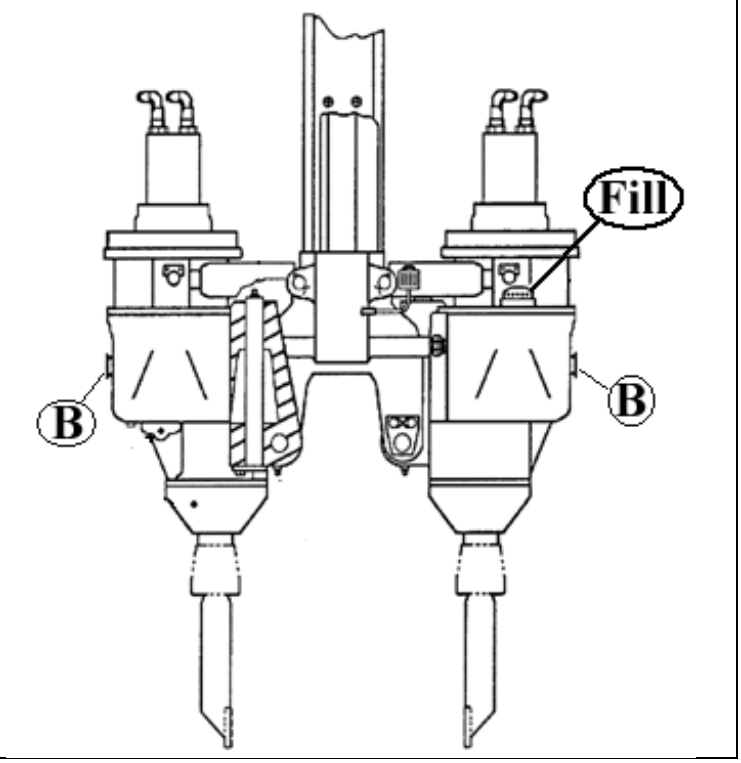
If the engine is equipped with a fuel/water separator, drain off any water that has accumulated. Water in fuel can seriously affect engine performance and may cause water damage.

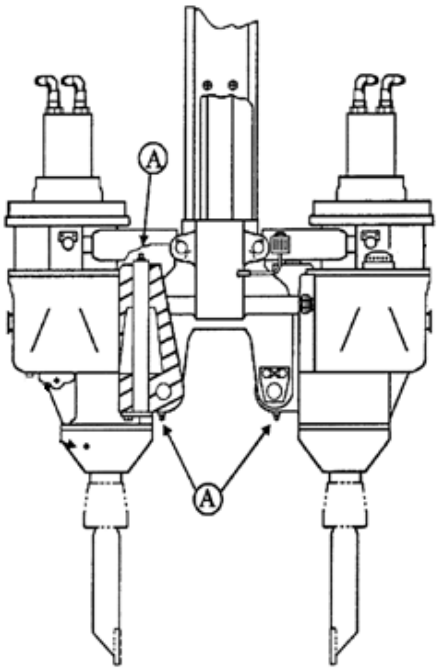
D5. Check Air Cleaner Indicators	
Do not allow air inlet restriction to exceed 20 inches of water (5.0 kPa) under any operating conditions. Inspect the entire air system for leaks daily. Look for torn air inlet piping or boots and loose or damaged clamps. Have worn or damaged parts repaired or replaced, as required. Retighten any loose connections.	

D9. 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. 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. If equipped with option always use hydraulic tank top off pump assembly. NOTE: Always add hydraulic oil to reservoir through a filter. NEVER OVERFILL RESERVOIR. Never use hydraulic brake fluid in lieu of hydraulic oil.	

D10. Inspect Hoses and Fittings for Leaks	
1. Look for loose or disconnected hoses. An oil spot below the machine is a good indication of a loose hose or hydraulic component. 2. Make certain shut-off valve on suction strainer is OPEN. Opening valve can often correct what appears to be a malfunction. 3. Inspect all vital hose connections, especially at main pump and the main pump hose connection at the manifold. 4. Look for cover damage and/or indications of twisted, worn, crimped, brittle, cracked, or leaking hoses. Hoses with their outer cover worn through or otherwise damages should be considered unfit for further service.	

D14. 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.	

D31. Check oil level in vibrators	
Check oil level daily. Should be 1/2 to 3/4 full in sight glass (B in diagram) with workhead in upright position. **Fill with SAE 10W40 XHD.**	

D32. Grease Work Head Pivot Pins	
Grease workhead pivot pins ("A" in diagram) daily with EP grease. **Grease with components warm (end of day) to ensure positive grease flow.** **Grease in raised and lowered positions until new grease displaces old grease.** **There is one top and two bottom grease zerks per vibrator, four vibrators total per machine).**	

WEEKLY (OR 50 HOURS, WHICHEVER COMES FIRST)			
Key:  = Refer to Mfr's Manual in Component Data  = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
	W2.		Check Battery electrolyte level adding distill water as needed and inspect/clean contact points and cables
	W3.		Check oil in transmission adding SAE 80W90 as needed
	W4.		Check oil in pump drive adding SAE 80W90 as needed
	W5.		Check oil in differential using SAE 80W90 as needed
	W6.		Clean Engine Air Filter Dust Collector
	W7.		Visually Inspect Hydraulic Tank Air Breather for COLOR change
	W8.		Inspect Engine Fan for Condition
	W9.		Check tamping tool tightness and wear
	W10.		Check brake shoes and adjust as needed
	W11.		Apply light motor oil to left/right traverse chains
	W12.		Grease universal joints on front/rear drive shafts (Moly EP2)
	W13.		Check Fire Extinguisher Charge
	W14.		After First 40 Hours of Machine Use. Remove & Inspect Suction Strainer Element (Yearly There After)
	W15.		- Reserved for Future Use -
	W16.		- Reserved for Future Use -

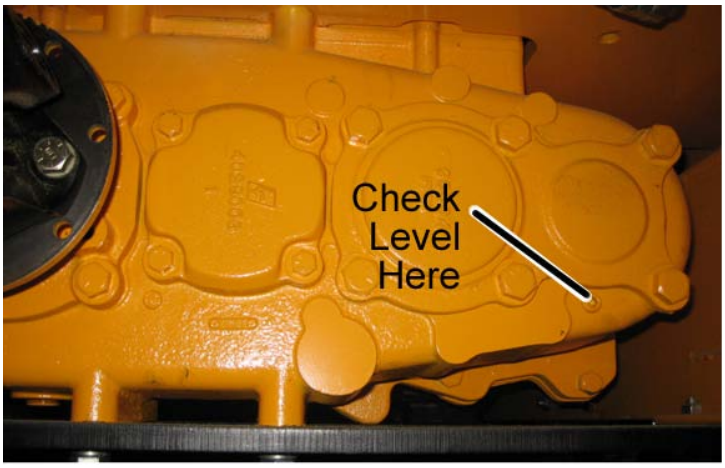
W2. Check Battery Condition, Clean terminals	
The battery requires periodic servicing. **Check the electrolyte level on a weekly (40 hour) basis.** Add distilled water if necessary, but **do not overfill**. Overfilling can cause poor battery performance and/or early failure. **DANGER** **Shut off engine 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.** **Make certain that the Battery Disconnect Switch is in the OFF position.** Inspect the terminals and cable clamps regularly. Clean battery terminals and cable clamps when corrosion is visible. Have excessively corroded or damaged parts replaced. To get best performance out of the battery, make certain that the terminal side of the battery (terminals and cable clamps) is kept clean. It is suggested that you coat them with grease or other suitable product to reduce corrosion. When battery replacement becomes necessary it is recommended that replacement battery meet or exceed original battery specifications; amps, cranking power, etc. Refer to the Specifications page earlier in this manual. If the machine is to be out of service for more than 30 days,batteries should be removed and stored in a cool, dry place.	

W3. Transmission level

The type of service and the operating conditions will determine the maintenance interval. However, it is recommended that the oil level be checked weekly, at the same time checking for oil leaks.

Because the lubricant system is the heart of the unit, it is especially important that the oil be kept clean.

1. Stop engine before checking or adding oil.
2. Clean around oil fill plug
3. It is recommended that lubricating oil be changed after the first 50 hours of service. (See 6 Month Schedule (X-4) for procedure)
4. **Fill with MIL-L-2105C or API-GL-5 (SAE 80W90). Transmission should hold approximately 2 quarts.**
5. Maximum operating oil temperature 180 degrees F (82.22 Degrees C).
6. Lubricate all transmission controls with a good grade of lithium base grease.



Transmission Fluid Level Check

W4. Check oil in Pump Drive

The type of service and the operating conditions will determine the service interval. However it is recommended that the oil level be checked weekly, at the same time checking for oil leaks.

Because the lubricant system is the heart of the unit, it is especially important that the oil be kept clean.

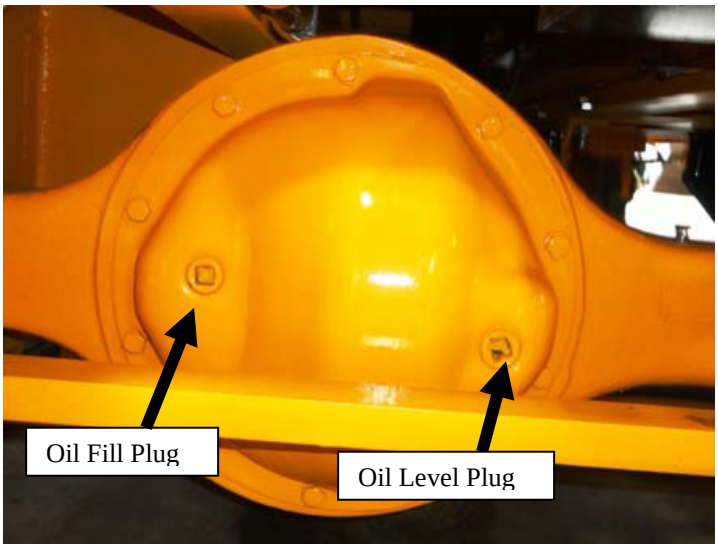
1. Stop engine before checking or adding oil.
2. Clean around oil fill before checking or adding oil.
3. It is recommended that lubricating oil (SAE 80W90) be changed after the first 500 hours of service. (See 6 Month Schedule (X-3) for procedure)
4. Do not overfill. This will result in overheating and possible malfunction of the unit.

W5. Differential Oil Level Front/Rear

The type of service and the operating conditions will determine the maintenance interval. However, it is recommended that the oil level be checked weekly, at the same time checking for oil leaks.

Because the lubricant system is the heart of the unit, it is especially important that the oil be kept clean.

1. Stop engine before checking or adding oil.
2. Clean around oil fill plug
3. It is recommended that lubricating oil be changed after the first 50 hours of service. (See 6 Month Schedule (X-5) for procedure)
4. Always use clean oil in clean containers.
5. Do not overfill. This will result in overheating and possible malfunction of the unit.
6. **Fill with 80W90 Gear Lube**
7. Maximum operating oil temperature 180 degrees F (82.22 Degrees C).



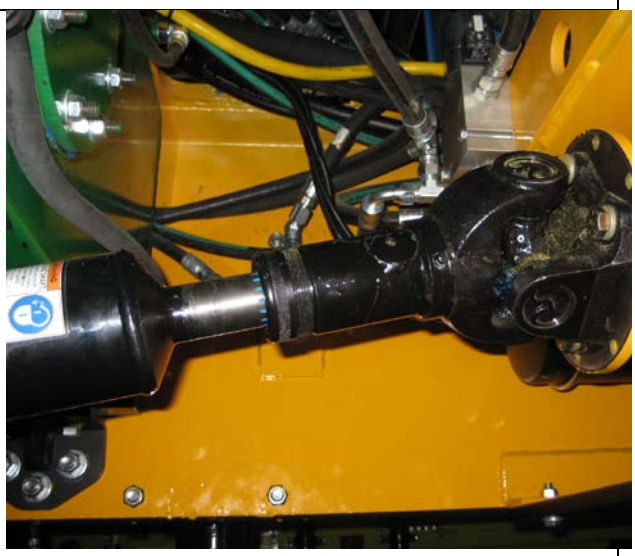
W12. Grease Universal Joints on Drive Shafts

Prior to lubricating the u joints on a drive shaft an inspection should be done. All fasteners on the joints or mating flanges should be checked for tightness. Any vibration or abnormal noise notice during operation should be located and fixed.

Proper lubrication flushes the u joint thus removes contaminates from the bearing caps. This occurs when excess grease appears at the bearing cap seals. Apply grease **until** grease appears at the seal.

Extreme pressure (EP) greases of high quality are recommended.

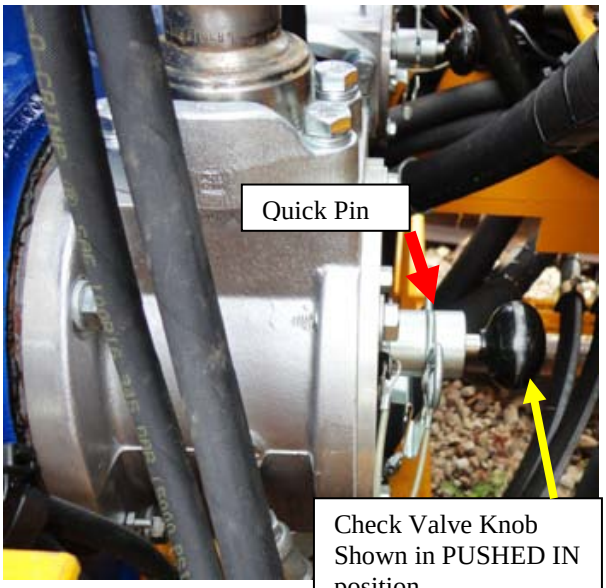
Because of the environment and working conditions weekly lubrication is recommended.



W14. 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,
2. Push the knob inward to allow the removal of quick pin and with the quick pin removed the push knob assembly will extend outward allowing the check valve to engage.
3. When the check valve is engaged the inspection and cleaning of the magnetic suction separator or (servicing hydraulic components) without draining oil from the hydraulic reservoir.
4. Remove four screws and lift off cover.
5. Clean the magnetic separator.
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 (OR 200 HOURS, WHICHEVER COMES FIRST)			
Key:  = Refer to Mfr's Manual in Component Data  = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
VARIOUS	M1.		Perform all Daily and Weekly Lubrication and Maintenance Procedures
	M2.		Change engine oil and oil filter
	M3.		Change engine fuel filter and fuel/water separator element
	M4.		Change engine coolant filter
	M5.		Inspect engine cooling system (leaks, connections, and hoses)
	M6.		Check air compressor coolant lines
	M7.		Ensure engine mounts, fuel tank mounts and hydraulic tank mounts are secure
	M8.		Check engine serpentine belt
	M9.		Check Fan, Alternator and Generator Belts
	M10.		Check hydraulic hoses on machine for wear and leaks. Repair as needed
	M11.		Check hydraulic cylinders for leaks and/or damage
	M12.		Check hydraulic valves for leaks and/or damage
	M13.		Inspect Hydraulic Tank Top Off for Damage/Cleanliness
	M14.		Check both implement pump pressure. Adjusting to 2700 PSI
	M15.		Check Propel Cross Over Relief Valves 2800 PSI
	M16.		Change oil in vibrators. Refill with SAE 15W40 (8 Quarts each)
	M17.		If Water in Air tanks, Check Air Dryer desiccant. Replace if needed
	M18.		Check Cab Pressurizer Air Filter. Replace if needed
	M19.		Lube left/right traverse chains with light motor oil
	M20.		Clean AC/Heater Vents / Filter
	M21.		Inspect Work Head Traverse Wear Pads. Top/Front & Rear Bottom
	M22		Test Emergency Pump Operation 2000 PSI
	M23		Check Brake Shoes For Wear
	M24		Check Brake Chambers – Diaphragm - Spring
	M25		Check universal joints on front/rear drive shafts for damage
	M26		Inspect Windshield Wipers. Replace if needed
	M27.		Clean Oil Cooler
	M28.		- Reserved for Future Use -
	M29.		- Reserved for Future Use -
	M30.		

Detailed Monthly Instructions

M9. 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.	

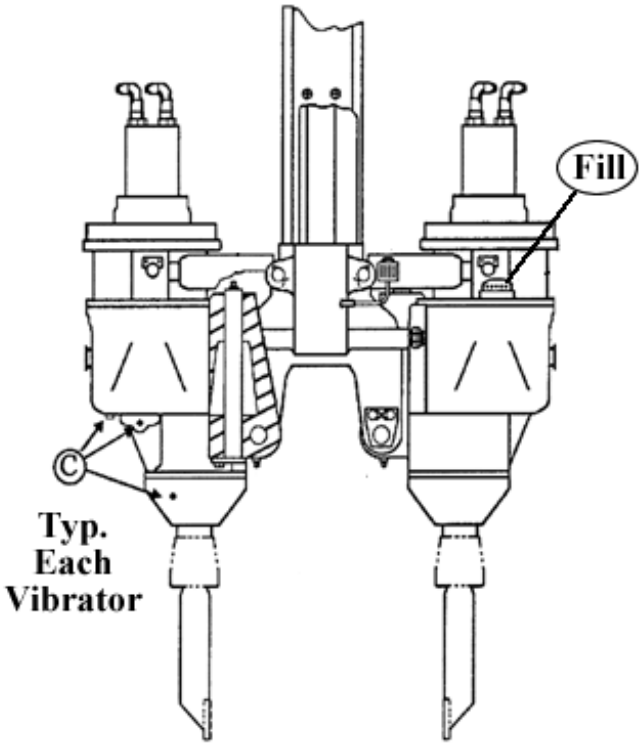
M14 & M15. Run Pressure Checks on Main Pump and Propulsion	
Pressure checks should be performed **every 250 hours or monthly** after the engine and hydraulics have thoroughly warmed up (oil temperature has reached 100°F [37.8°C] minimum). Before performing these checks, **read and understand all OPERATION instructions, warnings and cautions.**	

M16. Change Oil in Vibrators

The oil in the vibrators should be changed every 200 hours.

When changing the oil, check the magnetic drain plugs (C in diagram) for any sign of metal particles.

Fill SAE 10W40 Motor Oil



M17 Water Collecting in Air Tanks Check Desiccant Air Dryer

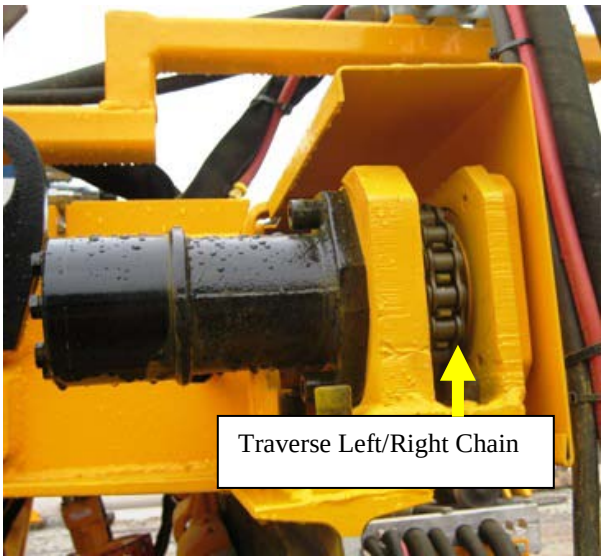
If during the daily draining of air tanks water is being drained off. Desiccant cartridge for the air dryer needs to be inspected and replaced.
See (Y7) under yearly procedures for replacement procedures.

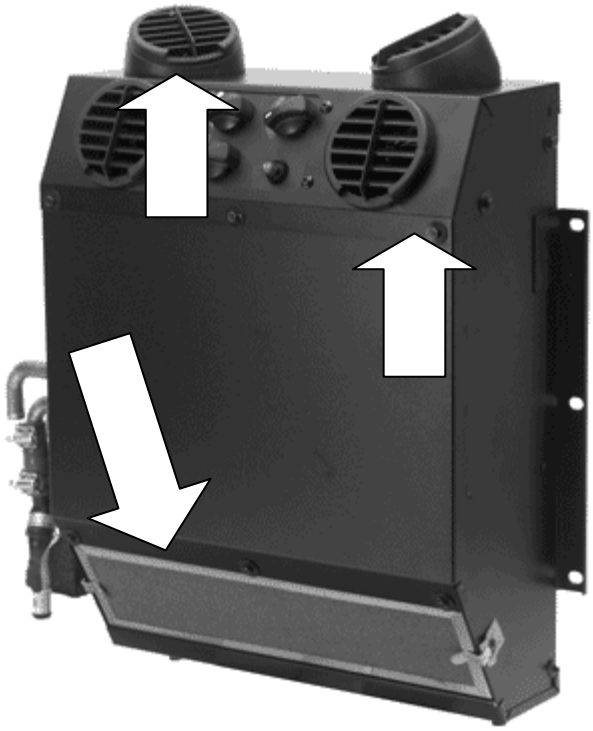
M18. Cab Pressurizer Air Filter

1. Loosen the screws which hold lid in place. The screws will remain attached to the lid after they are loosen.
2. When the lid is removed, examine the rubber gasket that seals the lid to the filter housing. If gasket is damage or missing.
3. If filter needs to be replaced, do not try cleaning it. REPLACE IT
4. Filter : EU P1/MERV8 Part # FEFF003

M19. Lube left/right traverse chains with light motor oil

Inspect chain for any damage to the chain link assemblies. Use a clean cloth soaked with 10 weight non detergent motor oil to wipe down the full length of the chain to lubricate and clean off the chain links. Note: Lubrication must get in between the each roller and the pin it turns on, to prevent damage. Light weight motor oil is best at getting into this location of the chain assembly.



M20. Check and Clean A/C Vents and Filter Screens	
Blow out the vents on a monthly basis. Clean the screen filter on a monthly basis, more often if used continuously.	

M21. Work Head Traverse wear Pads	
Inspect Left and Right work head wear pads for any damage or excessive wear. Replace as needed	 Traverse Left Side Work Head Top Front Wear Pads Shown  Traverse Left Side Work Head Back/Bottom Wear Pads Shown

M23. Check Brake Shoes for Wear

Replace brake shoes when the pad is less than 1/4 (.64 cm) thick. To replace brake shoes:

1. Remove release tool assembly (T head screw, washer, and ½" nut) from side pocket of the center brake valve chamber (figure 1).

2. Remove the tethered dust plug from the release tool key hole in the center of the spring brake chamber.

3. Insert release tool through key hole in chamber into spring piston.

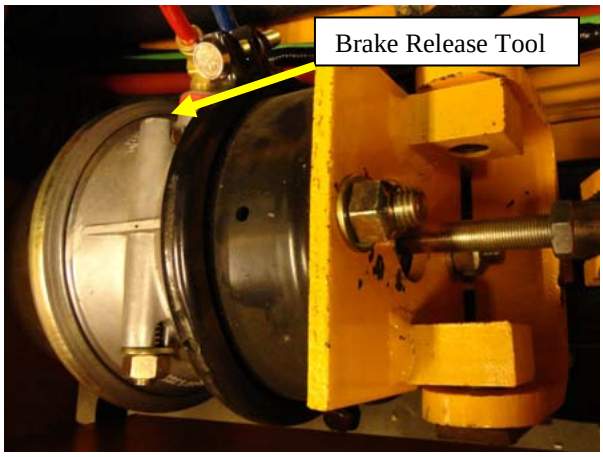
4. Turn release tool ¼ turn clockwise.

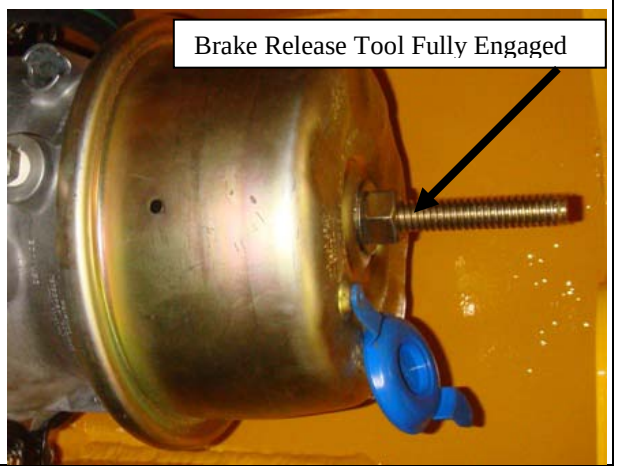
5. Pull on release tool to ensure stud cross pin is properly seated in the spring piston.

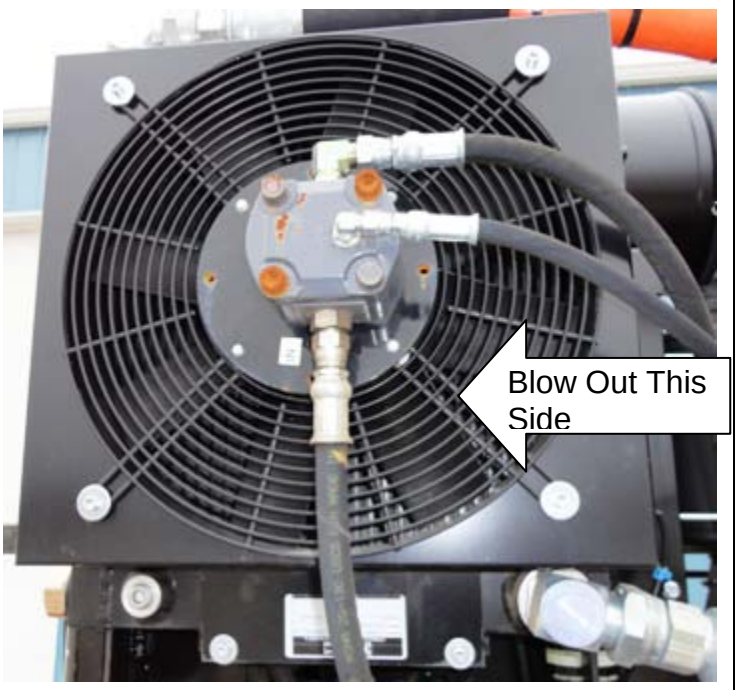
6. Assemble the release washer and nut on the release stud, finger tight only.

7. Turn release tool nut clockwise (CW) with a hand wrench until the brake shoes are off the wheel.

8. Replace brake shoe and reverse the procedure listed above.





M27. Clean the Oil Cooler	
Brush debris from outside of oil cooler with a soft brush. Inspect fins for damage or obstructions every 200 hours of operation. Blow out debris from cooler fins with low pressure compressed air as required.	

QUARTERLY (OR 600 HOURS, WHICHEVER COMES FIRST)			
Key:  = Refer to Mfr's Manual in Component Data  = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
	Q1.		Perform all Daily, Weekly and Monthly Lubrication and Maintenance Procedures
	Q2.		Replace fuel filters
	Q3.		Test hydraulic oil cleanliness, replace filters as necessary
	Q4.		Replace hydraulic and fuel tank breathers and filler screens
	Q5.		Check all wiring for wear and/or damage
	Q6.		Check switches and contacts for tightness
	Q7.		Check terminal strips for tightness
	Q8.		Check wheels lugs for tightness
	Q9.		Measure wheel diameters for uniform wear within set
	Q10.		- Reserved for Future Use -
	Q11.		- Reserved for Future Use -

Detailed Quarterly Instructions

Q3. 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.	

Q4. Replace hydraulic and fuel tank breathers and filler screens	
Proper fluid condition is essential for long and productive life of hydraulic components and fuel systems. 1. Change hydraulic tank air dryer cartridge 2. Change both hydraulic tank return filters 3. Inspect both fuel tank & hydraulic tank filler screens for contamination or damage, Replace as needed.	

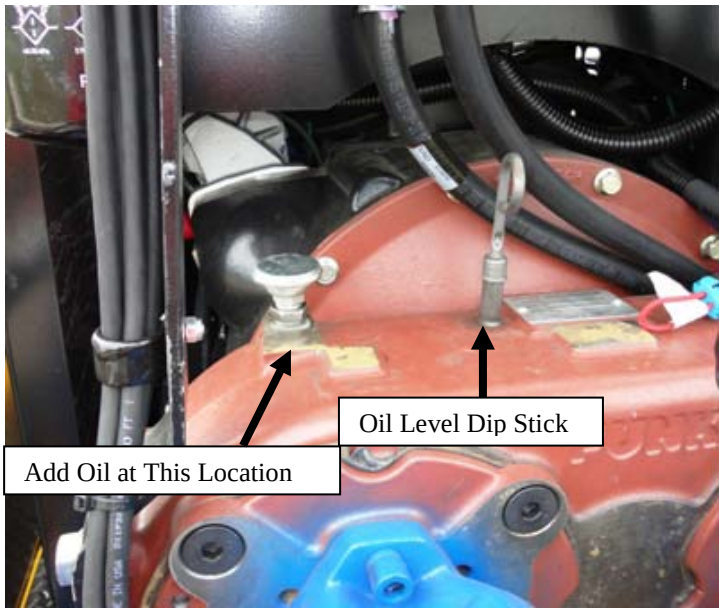
6 Month (OR 1200 HOURS, WHICHEVER COMES FIRST)			
Key: = Refer to Mfr's Manual in Component Data = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
	X1.		Perform all Daily, Weekly, Monthly & Quarterly Lubrication and Maintenance Procedures
	X2.		Check all bolts and nuts on machine for missing hardware and tightness
	X3.		Change oil in pump drive. Refill with SAE 80W90
	X4.		Change oil in transmission. Refill with SAE 80W90
	X5.		Change oil in differential. Refill with SAE 80W90
	X6.		Change Hydraulic Tank Top Off Filter (OPTION)
	X7.		- Reserved for Future Use -
	X8.		- Reserved for Future Use -

X3. Pump Drive Oil Change

The type of service and the operating conditions will determine the service interval. However it is recommended that the oil level be checked weekly, at the same time checking for oil leaks.

Because the lubricant system is the heart of the unit, it is especially important that the oil be kept clean.

1. Stop engine before checking or adding oil.
2. Clean around oil fill before checking or adding oil.
3. It is recommended that lubricating oil (SAE 80W90) be changed after the first 500 hours of service.
4. Thereafter, and under normal operating conditions, it is recommended that the oil be changed after every six months of operation. The oil in the unit should be changed whenever the oil level shows discoloration or strong odor.
5. Drain oil while the unit is still warm, examining for contamination or metal particles. The magnetic drain plug is located at the bottom tip of the pump drive.
6. Clean all magnetic drain plugs before replacing.
7. Do not overfill. This will result in overheating and possible malfunction of the unit.

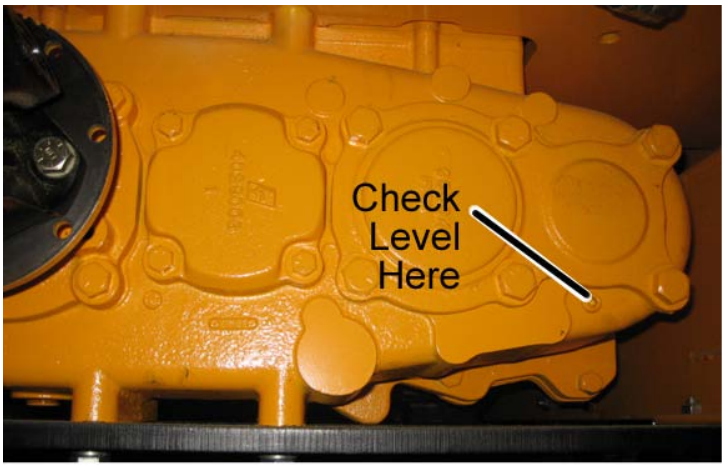


X4. Transmission Oil Change

The type of service and the operating conditions will determine the maintenance interval. However, it is recommended that the oil level be checked weekly, at the same time checking for oil leaks.

Because the lubricant system is the heart of the unit, it is especially important that the oil be kept clean.

1. Stop engine before checking or adding oil.
2. Clean around oil fill plug
3. It is recommended that lubricating oil be changed after the first 50 hours of service.
4. Thereafter, and under normal operating conditions, it is recommended that the oil be changed after every six months of operation. The oil in the unit should be changed whenever the oil level shows traces of dirt or effects of high temperature, evidenced by discoloration or strong odor.
6. Drain oil while the unit is still warm, examining for contamination or metal particles.
7. Clean all magnetic drain plugs before replacing.
8. Always use clean oil in clean containers.
9. Do not overfill. This will result in overheating and possible malfunction of the unit.
10. **Fill with MIL-L-2105C or API-GL-5 (SAE 80W90). Transmission should hold approximately 2 quarts.**
11. Maximum operating oil temperature 180 degrees F (82.22 Degrees C).
12 Lubricate all transmission controls with a good grade of lithium base grease.



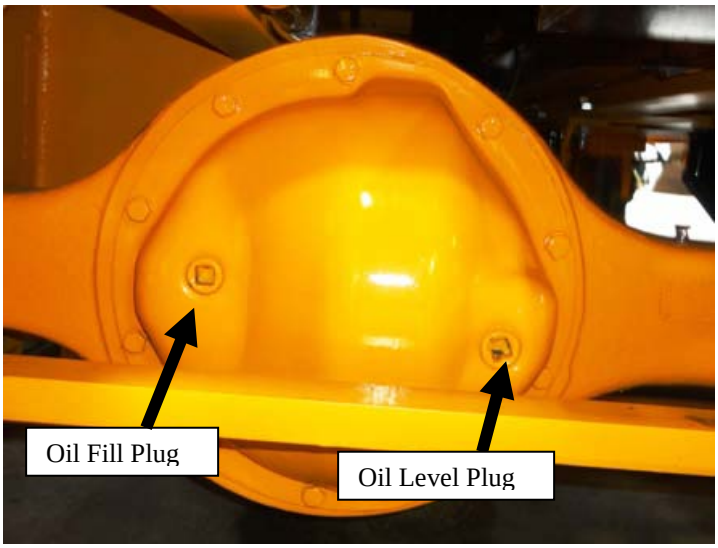
Transmission Fluid Level Check

X5. Differential Oil Change Front/Rear

The type of service and the operating conditions will determine the maintenance interval. However, it is recommended that the oil level be checked weekly, at the same time checking for oil leaks.

Because the lubricant system is the heart of the unit, it is especially important that the oil be kept clean.

1. Stop engine before checking or adding oil.
2. Clean around oil fill plug
3. It is recommended that lubricating oil be changed after the first 50 hours of service.
4. Thereafter, and under normal operating conditions, it is recommended that the oil be changed after every six months of operation. The oil in the unit should be changed whenever the oil level shows traces of dirt or effects of high temperature, evidenced by discoloration or strong odor.
6. Drain oil while the unit is still warm, examining for contamination or metal particles.
7. Clean all magnetic drain plugs before replacing.
8. Always use clean oil in clean containers.
9. Do not overfill. This will result in overheating and possible malfunction of the unit.
10. **Fill with 80W90 Gear Lube**
11. Maximum operating oil temperature 180 degrees F (82.22 Degrees C).



X6. Change Hydraulic Tank Top Off Filter (OPTION)

Proper fluid condition is essential for long and productive life of hydraulic components and systems.

The Hydraulic Tank Top Off Filter is located behind left rear wheel assembly on vibrator relief manifold.

1. Turn off engine
2. Clean area around filter
3. Change the hydraulic tank top off filter every 6 months to prevent introduction of contaminants into the system.

YEARLY (OR 2000 HOURS, WHICHEVER COMES FIRST)			
Key: = Refer to Mfr's Manual in Component Data = More Detailed Instructions Follow			
LOC	ITEM	SYM	TASK
	Y1.		Perform all Daily, Weekly, Monthly, and Quarterly Lubrication and Maintenance Procedures
	Y2.		Drain and clean hydraulic tank. Replace oil with ISO46 and clean magnetic strainers
	Y3.		Check hydraulic tank oil level sight glass and temperature gage for damage
	Y4.		Drain and clean fuel tank, Change fuel filters
	Y5.		Test/Check fuel tank gage sender
	Y6.		Test A/C performance and charge with refrigerant, if required
	Y7.		Replace air dryer desiccant cartridge, if equipped
	Y8.		Inspect Suction Strainer Element
	Y9.		Service Fire Extinguisher
	Y10.		Inspect Engine Motor Mounts
	Y11.		Inspect & Adjust Transmission Air Shift Cylinders
	Y12.		Clean the Oil Cooler
	Y13.		- Reserved for Future Use -
	Y14.		- Reserved for Future Use -

Y7. Replace Desiccant Cartridge (Every year, unless water buildup in tanks)

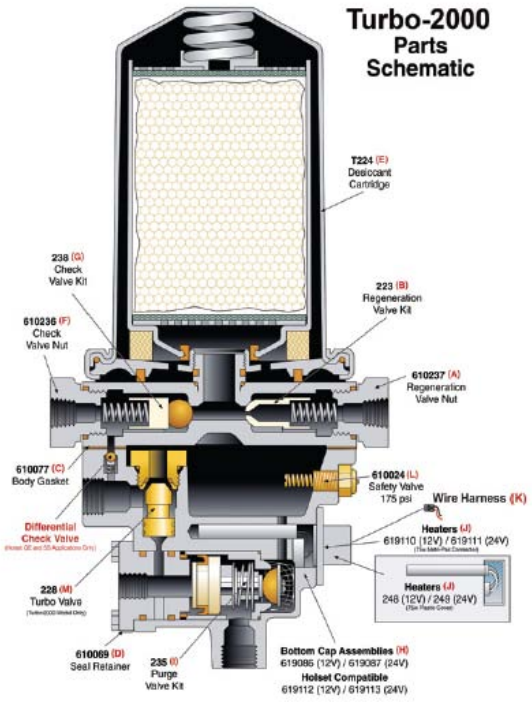
Desiccant Cartridge Replacement

1. Drain the air system.
2. Using a strap wrench, turn the desiccant cartridge counterclockwise and remove it. Discard.
3. Remove and discard o-ring from adaptor plate stud.

NOTE: If there is excessive oil in the check valve port, compressor may require servicing.

4. Clean top surface of adaptor plate and threaded stud.
5. Using grease supplied, apply a light coating on o-ring. Install o-ring on adapter stud.
6. Apply a generous coat of grease on the new desiccant cartridge gasket surface.
7. Thread new cartridge onto adaptor stud turning clockwise. When gasket contacts adaptor plate, tighten cartridge 1/2 turn. DO NOT OVER-TIGHTEN.

This is the most common service item for the Turbo 2000. For other items, like unloader valve, bleed valve, etc., refer to Component Data Section, Tab "Other" for Turbo 2000 Service Manual.



Y8. 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,
2. Push the knob inward to allow the removal of quick pin and with the quick pin removed the push knob assembly will extend outward allowing the check valve to engage.
3. When the check valve is engaged the inspection and cleaning of the magnetic suction separator or (servicing hydraulic components) without draining oil from the hydraulic reservoir.
4. Remove four screws and lift off cover.
5. Clean the magnetic separator.
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.