MODEL “LS”
Auto-Lift

OPERATION AND MAINTENANCE MANUAL

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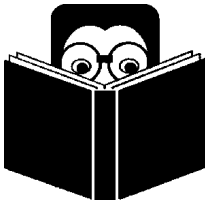
January 1999

Re-Order: 49455275A

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

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

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



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

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

NORDCO Sales:	**Milwaukee, Wisconsin** (414) 766-2180 sales@nordco.com
NORDCO Parts:	**Milwaukee, Wisconsin** 1-800-647-1724 parts@nordco.com **Oshawa, Ontario, Canada** (905) 579-4058, Ext. 224 oshsales@nordco.com
NORDCO Service:	1-800-445-9258 service@nordco.com

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

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

HAZARDOUS MATERIAL DATA

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

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

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

Fax: (414) 766-2299
Phone: (414) 766-2288

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PARTS SHEETS

MECHANICAL TAB

CONTENTS

Note: Due to the custom configuration of each machine, it is NORDCO's policy to NOT include machine hydraulic piping drawings in their operation and parts manuals. If you need a copy, contact the Service Department.

SAFETY

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

GENERAL

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

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

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.

SAFETY ALERT SYMBOLS!

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

SYMBOL	MEANING
	**DANGER** typically defines the most serious hazards. **DANGER** usually means that improper use could result in severe bodily harm or even death.
	**WARNING** means that improper use could result in bodily harm and/or extensive machine damage.
	**CAUTION** means that improper use could result in machine damage.

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.** General guidelines include:

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

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

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

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

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

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

7. Use safety-toed work boots.

SAFETY DURING WORK

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

1. Make certain that no one is in the path of this machine. Before moving this machine, whether in work or travel mode, make certain that all personnel have left the area before moving this machine.

2. **NEVER** ride on this machine while it is moving.

3. Slow down the work cycle and use slower travel speeds in congested or populated areas. Use a commonly understood signal so that others can warn the operator to slow or halt work in a possible hazardous situation.

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

5. Anyone standing near the machine is at risk of being injured. Make certain they keep away from the workheads and any other moving assembly during working operations.

6. There are standard guards in place on this machine. These are to be removed **only** when service or maintenance is being performed in that area. Reinstall guards after work has been completed.

7. 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.

8. 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.

9. Inspect safety decals and replace when they become unreadable or are damaged. (See ASafety Decals≅ at the end of this Safety section).

10. Keep the operator deck and logic box console free of tools and/or personal items.

SAFETY DURING TRAVEL

Traveling in this machine requires all steps listed above, in addition:

1. **NEVER RIDE ON THIS MACHINE!**

2. Always make certain that lockups provided on this machine are free of debris or grease and are in place prior to travel.

3. Operate the machine carefully when bad weather conditions exist. Maintain a distance between machines that will allow you room to stop.

4. Halt travel if visibility is poor. Strong rains, fog, and extremely dusty and blowing conditions can obscure visibility in your area. Wait for weather situation to improve before continuing travel.

5. Anyone standing near the machine is at risk of being injured. Make certain they keep away from the machine during travel operations.

SAFETY DURING MAINTENANCE

Alert others in the area that service or maintenance is being performed on this machine. 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.

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.

MACHINE SAFETY ALERTS

DANGER ALERTS

WORDING	FOUND ON PAGE
Improper use of this machine for any type of operation can cause serious injury or death.	14
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.	30, 33, 37
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.	31
This machine is not equipped with seats or seatbelts. Do not ride on or allow others to ride on this machine when working, travelling, or towing. Failure to comply could restult in severe personal injury or death.	14, 33
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.	49
Do not ride on tow bar between the machine and the towing vehicle. Falling from a moving vehicle may cause serious injury or death.	35

MACHINE SAFETY ALERTS

WARNING ALERTS

WORDING	FOUND ON PAGE
Failure to engage all lockup devices before propelling at travel speed can result in injury to personnel and/or extensive damage to the machine.	28, 30
Tighten fittings only when system is not pressurized. High pressure leaks can cause personal injury.	44, 63
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.	31, 37, 57, 67
Exhaust emissions caused by the use of the engine on this machine may cause cancer, birth defects, or other reproductive harm if inhaled.	26, 58
Disconnect the battery before servicing this machine. Failure to do so could result in personal injury from accidental engine startup.	37, 58, 59

MACHINE SAFETY ALERTS

CAUTION ALERTS

WORDING	FOUND ON PAGE
Before starting a new or overhauled engine that has been in storage, consult the engine manufacturer’s manual for initial start instructions. Failure to follow those instructions can result in serious engine damage.	26, 58
Never shut off battery disconnect switch with the engine running. This could cause damage to the voltage regulator, alternator, and/or electrical system.	58, 59

LOCKOUT AND/OR TAGOUT REQUIREMENTS

The following list suggests lockout procedures to use on all components of the machine that require lockout due to the storage of various forms of energy. 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!**

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**. See next page for suggested lockout/tagout procedure list.

LOCKOUT/TAGOUT - PROCEDURES

When servicing or performing maintenance on:	Energy Source to be locked out	Use this procedure:
Logic Box	Electrical	1) Ignition switch turned to the **OFF** position and cover locked 2) Battery Disconnect Switch turned to the **OFF** position and cover locked
Engine	1) Electrical	1) Ignition switch turned to the **OFF** position and cover locked 2) Battery Disconnect Switch turned to the **OFF** position and cover locked
Propulsion System	1) Hydraulic 2) Mechanical	1) Ignition switch turned to the **OFF** position and cover locked 2) Battery Disconnect Switch turned to the **OFF** position and cover locked
Battery	1) Electrical 2) Chemical	1) Ignition switch turned to the **OFF** position and cover locked 2) Battery Disconnect Switch turned to the **OFF** position and cover locked; and cables removed 2) See Above
Rail Clamps	1) Hydraulic 2) Mechanical	1) Ignition switch turned to the **OFF** position and cover locked 2) Battery Disconnect Switch turned to the **OFF** position and cover locked 2a) See Above 2b) Workhead lockups installed.
Lift Cylinder	1) Hydraulic 2) Mechanical	1) Ignition switch turned to the **OFF** position and cover locked 2) Battery Disconnect Switch turned to the **OFF** position and cover locked 2a) See Above 2b) Cyclinder lockup installed.
Wiring Harnesses	1) Electrical	1) Ignition switch turned to the **OFF** position and cover locked 2) Battery Disconnect Switch turned to the **OFF** position and cover locked

SAFETY DECALS ON THIS MACHINE

Safety 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 safety decals on them, it is your responsibility to replace the safety decals. These can be ordered from the Parts Sales Department.

Safety Decals on this Machine are:

PART NO.	DESCRIPTION	LOCATION
5642 0001	General Machine Cautions	Inside Logic Box Cover
5642 0002	Caution! Watch Your Step	Frame, by Step
5642 0004	Danger! Pinch Points	On Rail Clamps
5642 0005	Warning! Hand Hazard	On Rail Clamps
5642 0006	Danger! Before Servicing...	Logic Box Sides
5642 4501	Caution! Before Welding...	Logic Box Face Battery Box
5642 0010	Lockout Area	Logic Box Face
5642 0011	Lockout Area	Battery Box
5642 0012	Lockup Points	All areas requiring Lockups for travel.

GENERAL

This manual contains operation and maintenance information for the MODEL "LS" AUTO-LIFT manufactured by NORDCO INC., Milwaukee, Wisconsin. Information regarding the operation and maintenance of this machine can be found behind the appropriate tabs. Information regarding operation and maintenance of OEM parts not of NORDCO manufacture can be found at the back of this manual, behind the tab marked **Component Data**.

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

ABOUT THIS MANUAL

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

Operation includes all information necessary to operate the machine;
Maintenance includes lubrication, maintenance, and adjustments instructions;
Troubleshooting includes basic troubleshooting for all components on the machine;
Appendix A includes suggested and recommended spare parts for the machine;
Appendix B includes instructions for hydraulic adjustments;
Mechanical has individual parts breakdown drawings and lists for each assembly (for optional equipment that requires additional drawings, see tab **Customer Options**);
Hydraulic includes all piping and functional drawings for a standard machine (for optional equipment that requires additional drawings, see tab **Customer Options);**
Electrical, includes all electrical schematics, logic box, control box, and cable drawings for the machine;
Component Data includes parts breakdowns and service instructions for components installed on the machine that are not of NORDCO's manufacture;
Customer Options, includes parts breakdowns, lists, and drawings for all equipment on the machine that is optional.

OPTIONAL EQUIPMENT

Optional equipment are those items that are not considered a vital operating part to the machine, but the customer wants them installed. A list of optional equipment installed on your machine can be found on the first page of the "**Customer Options**" tab. Minor options such as lights and horns can be found in the mechanical section of this manual, and major options such as Parts Sheets and instructions for the **Optional Equipment** have been included behind the tab **Customer Options**. It is recommended that you know what options you have on your machine.

SPECIFICATIONS❖

GENERAL

Model	Model LS
Gross Weight*	2500 lbs
Length	92 inches
Width	72 inches
Height	
Hatz Engine	97 inches
Deutz Engine	102 inches
Wheel Base	50 inches
Working Clearance (from center of track)	5 feet 10 inches
Work Rate	10 ties/minute
Travel Speed (Variable)	4 mph

CAPACITIES

Fuel Tank (Painted Green)	10 gallons (Standard), 18 gallons (Optional)
Hydraulic Oil Tank (Painted Blue)	30 gallons (standard)
Plate Storage	35 plates on deck

ENGINE

Make/Model	Deutz F1L210
Type	Air Cooled Diesel
Continuous BHP	12.5 HP @ 2800 RPM, Under Load

Make/Model	Deutz F2L1011
Type	4 Cycle, 2 Cylinder, Air Cooled Diesel
Continuous BHP	21 HP @ 2300 RPM, Under Load

Make/Model	Hatz 2L31C
Type	4 Cycle, 2 Cylinder, Air Cooled Diesel
Continuous BHP	21 HP @ 2050 RPM, Under load

Make/Model	Hatz 2L40C
Type	4 Cycle, 2 Cylinder, Air Cooled Diesel
Continuous BHP	23 HP @ 2050 RPM, Under load
Low Idle/High Idle	1150 rpm/2140 rpm

HYDRAULIC SYSTEM

Pump Make/Model	John Deere HPR 40
Type	Radial Piston Pump
Rating	21.5 gpm @ 2000 rpm
Relief Valve Setting (High System Pressure)	3000 psi
System Pressure	2400 psi

Pump Make/Model	Parker PAVC65
Type	Piston Pump
Rating	23 gpm @ 2050 rpm
Relief Valve Setting (High System Pressure)	3000 psi
System Pressure	2400 psi

❖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.**

ELECTRICAL SYSTEM

Battery ..... 12 Vdc, 1150 Cold Cranking Amps
Ground ..... Negative
Alternator.....50 Amp

DRIVE SYSTEM

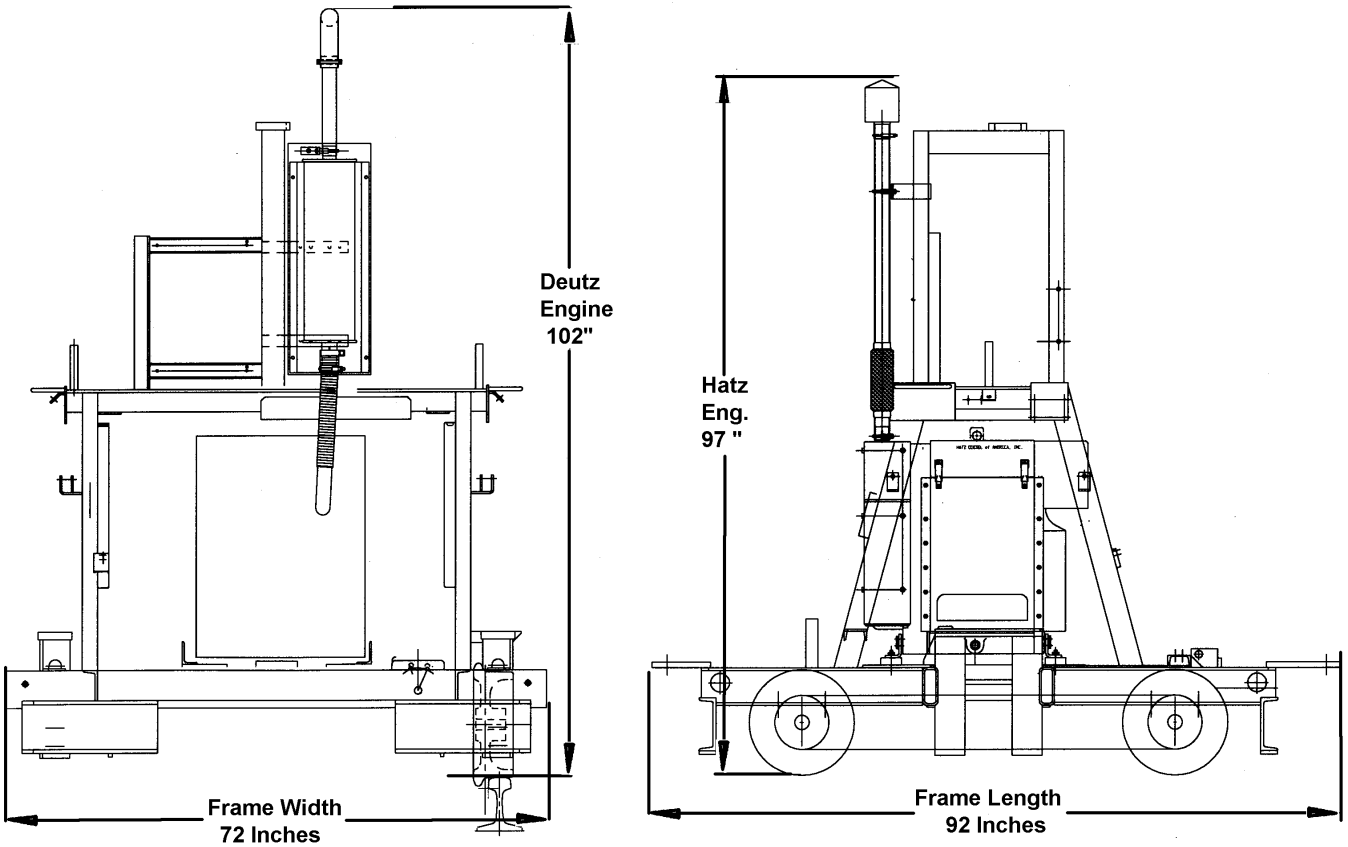
Drive Type (Serial Nos. 500-583, 586-591).....Single Axle Chain Drive
Drive Type (Serial Nos. 584-585, 592 and Above).....Dual Axle Chain Drive
Axle Type..... Stationary
Clutch Type..... Lever Activated
Propulsion Motor Type..... Hydraulic

WHEELS

Type.....Cast Steel
Size.....14 inch diameter

❖**Items or capacities may vary according to options on your machine.**

MACHINE DIMENSIONAL INFORMATION



INSTRUCTIONS FOR ORDERING REPAIR PARTS

The parts sheets identify all parts of your machine in three ways: 1) by part number; 2) by part name; and 3) by appearance as shown on the exploded view drawing.

The exploded view drawings have item numbers which are then cross-referenced to the list following the drawing. (Example, Item 17 on the drawing will be Item 17 on the list.)

You can order parts two ways, as individual parts or as one item of many in an assembly. Due to possible design changes some assemblies may have changed. Before you order, contact the Parts Sales Department to verify the items on the assembly. If you have any questions, the personnel in the Parts Sales Department will be happy to assist you in your ordering.

For your convenience, we now accept MasterCharge and Visa as a method of payment.

When ordering parts, always include the following information:

1. The Machine Make and Model, and the type of modules attached to your machine.
2. The serial number of the machine.
3. The exact quantities of assemblies or parts desired. Please identify these parts by part number and name.
4. Specify the method of shipment desired.

To reduce delays, please avoid references to other matters in letters forwarded primarily for ordering repair parts. Forward all repair orders to:

NORDCO PARTS SALES DEPARTMENT
P.O. BOX 1562
MILWAUKEE, WI 53201

Call in your orders to:

NORDCO PARTS SALES DEPARTMENT
Telephone: (414) 769-4607
Telephone: (414) 769-4608
Telephone: (800) 647-1724
Fax: (414) 769-2140

GOODS RETURNED FROM CUSTOMER (GRFC)

When returning goods, you are to call the above number and explain the reasons for returning the goods. They will issue a GRFC number that you are to use for all future correspondence on the return including the package with the item being returned. This will speed up the exchange or credit process. GRFC's are also issued by the Service Manager.

Before operating this machine, read and understand the Safety Section of this Manual.

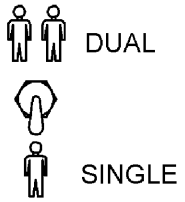
BEFORE OPERATION

It is always good practice to become totally familiar with the machines you are going to operate.

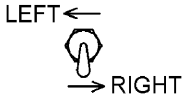
IMPROPER USE OF THIS MACHINE FOR ANY TYPE OF OPERATION CAN CAUSE SERIOUS INJURY OR DEATH.

BASIC DESCRIPTION

This machine can be run by either one or two operators. When **DUAL Operation** is selected, two operators walk alongside the machine and are both required to actuate the propel switch at the same time to move the machine. **This is done so that the machine cannot be accidently moved before the second operator has finished working.** When they have spotted the machine over the rail section to be lifted, they release the propel switch, press the cycle start button, and the machine begins the work cycle. The work cycle is as follows: first, the clamps come down and grasp the rail; next, the lift cylinders come down and lift the machine (and rail) to a predetermined height. After the tie plate has been positioned under the rail, both operators again depress the propel switch; the lift cylinder retracts lowering the machine. Then after the rail clamps open, releasing the rail, the operators propel the machine to the next tie and prepare to begin another cycle.



When SINGLE Operation is selected, the operator must select which side of the rail he or she will be working. The side of the machine that is active is determined while standing at the logic box.



THIS MACHINE IS NOT EQUIPPED WITH SEATS OR SEATBELTS. DO NOT RIDE ON OR ALLOW OTHERS TO RIDE ON THIS MACHINE WHEN WORKING, TRAVELLING, OR TOWING. FAILURE TO COMPLY COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.

This machine is not designed for passengers during work or travel operations. There are no seats or seatbelts provided on this machine. **DO NOT RIDE ON THIS MACHINE!**

HYDRAULIC SYSTEM

The hydraulic system is comprised of the pumps, motor, cylinders and various flow control devices shown on the Hydraulic Schematic located behind the Hydraulic Tab of this

manual.

The hydraulic pump is a pressure compensated, variable displacement, radial piston type, providing high flow and pressure. Refer to the **Hydraulic** Section of this manual and **Appendix B**, Hydraulic Adjustments for more information on the hydraulic system.

LOGIC BOX CONTROL PANEL

The logic box control panel houses nearly all of the operator selectable items on the machine, with the exception of the remote operator control boxes. The logic box drawing on the next page is representative of a standard machine. Become familiar with its functions.

REMOTE OPERATOR CONTROL BOXES

There are two operator stations, one on each side of the machine. At these stations are the remote operator control boxes, which control the work cycle and propulsion of the machine. (See Figure 1.)

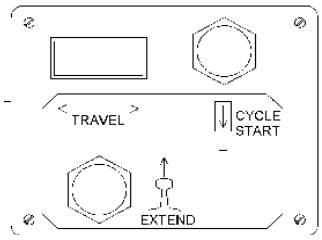
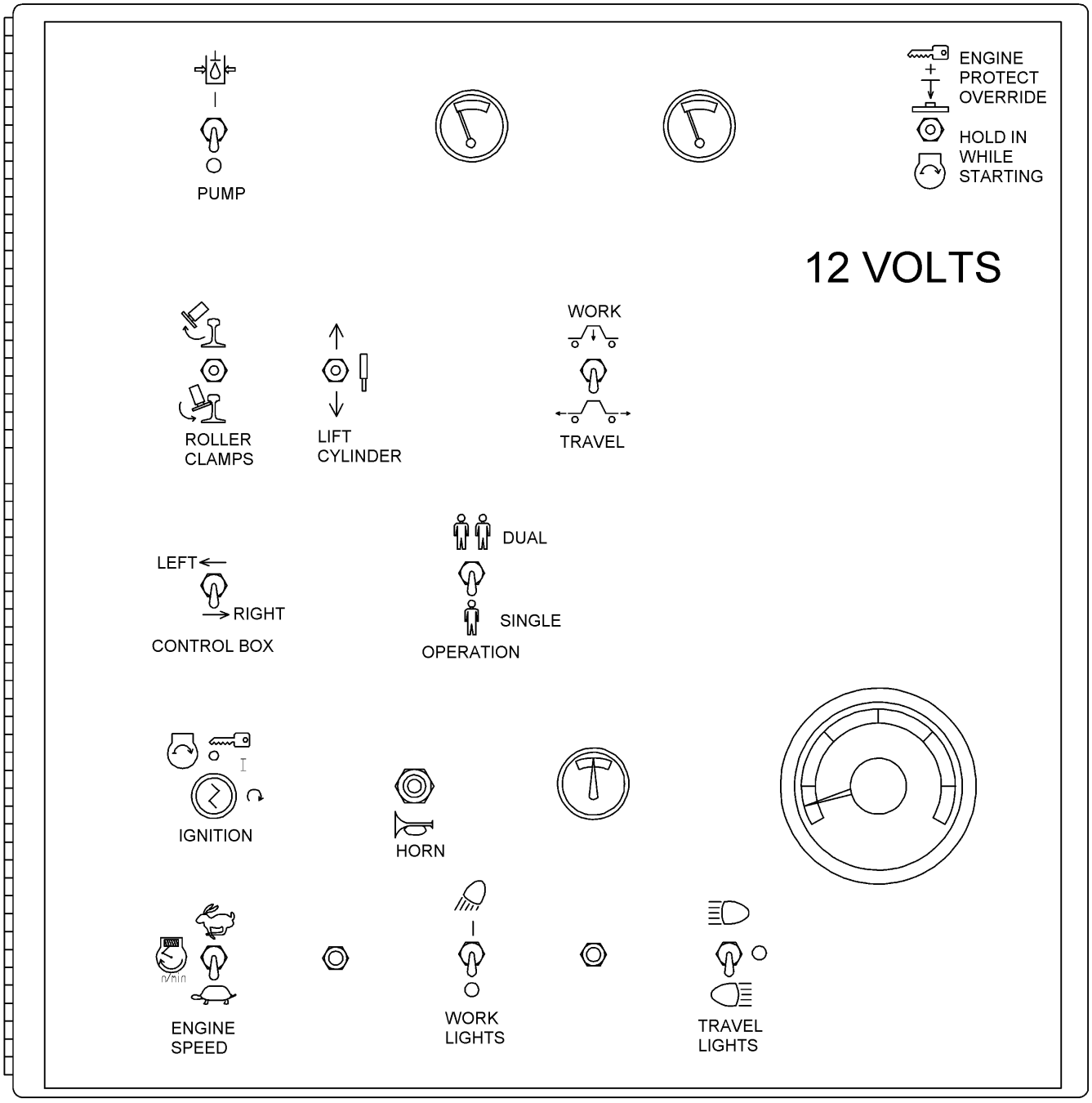


Figure 1

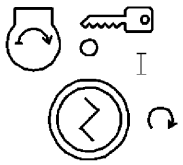
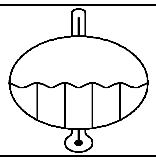
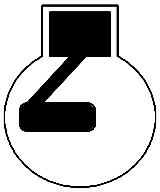
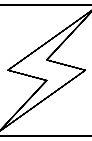
PLATE PUSHER

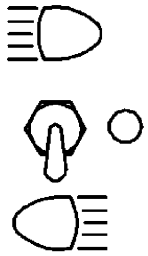
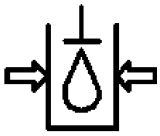
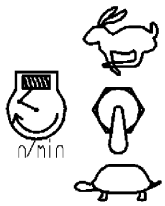
This assembly allows the operator to run the controls of the machine without having to stand next to the remote control boxes described above. The identical controls are on the plate pusher assembly.

MAIN CONTROL PANEL (LOGIC BOX)

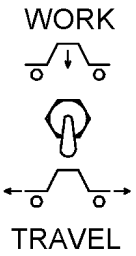
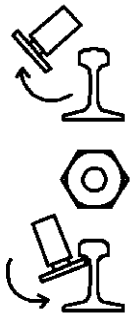
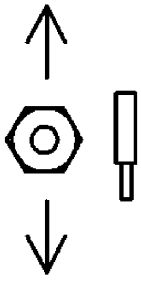
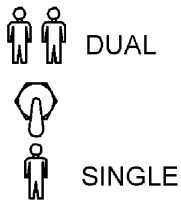
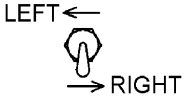


MAIN CONTROL PANEL
ENGINE AND PUMP CONTROLS AND GAUGES
(Includes Horns and Lights)

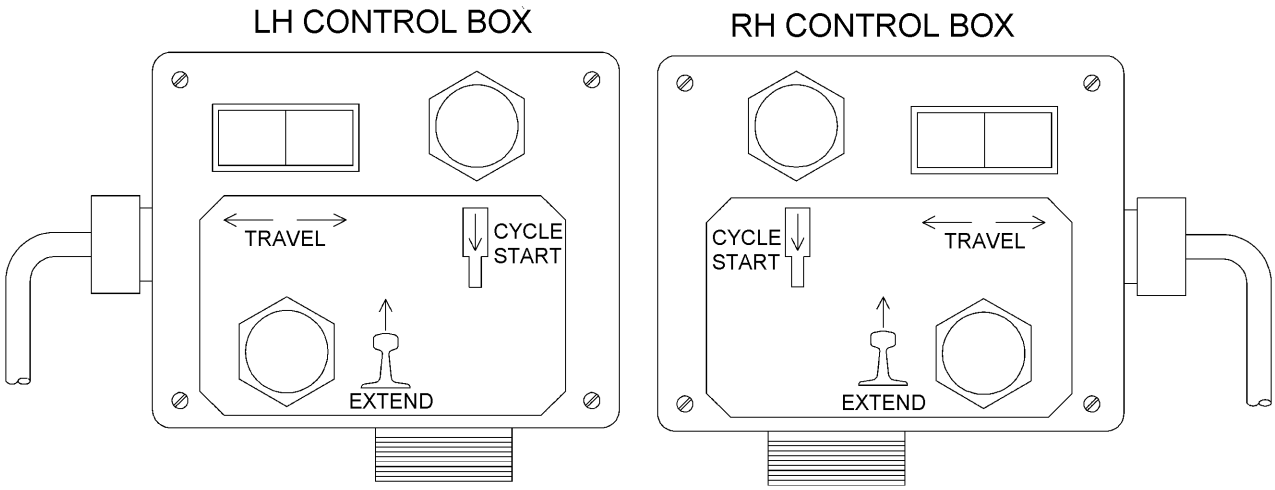
CONTROL OR INSTRUMENT	INTERNATIONAL SYMBOL	FUNCTION
Key Switch		The electrical system is energized by turning the key to the right. Electrical power is cut off and the engine will stop when the key is turned to the full left or vertical (OFF) position.
Engine OIL PRESSURE Gauge		Indicates oil pressure, not oil level. Normal reading is 60-80 psi.
Engine OIL TEMPERATURE Gauge		Indicates engine oil temperature measurement. Normal operating temperature is between 170 and 280 degrees F (76 and 110 degrees Celcius)
MAGNETIC OVERRIDE Switch		This switch must be held in until engine starts and engine oil pressure reaches 25 psi.
Engine TACHOMETER and HOURMETER		Indicates engine speed (rpms) and total hours of engine operation. Normal engine operating speed should be approximately 2800 rpm.
Engine CIRCUIT BREAKER		Must be depressed to reset engine circuit breaker (10-15 amp) if it trips
VOLTMETER		Indicates voltage of battery charge. Normal reading is 12-15 volts.
WORKING LIGHTS Switch		Two position switch to turn working lights on or off.

HORN Pushbutton		Depress switch to sound horn.
TRAVEL LIGHTS Switch		Two position switch to turn running lights on or off.
Pump Switch ON Position OFF Position		This switch controls a pump destroke valve that relieves hydraulic system pressure. Used during work or traveling. Must be OFF for starting engine.
ENGINE SPEED Switch HIGH Speed LOW Speed		Used during work, travel, and shutdown. Used during normal work and travel operations. Used for idling engine for extended periods of time, or for idling engine for machine shutdown.

MAIN CONTROL PANEL
MACHINE FUNCTION CONTROLS AND GAUGES

CONTROL OR INSTRUMENT	INTERNATIONAL SYMBOL	FUNCTION
WORK/TRAVEL Mode Selector Switch WORK Position (AUTO MODE) TRAVEL Position (MANUAL MODE)		Machine mode selector switch. Two position switch. Work position energizes the Remote Control Boxes on the Machine and on the Plate Pusher. Used when operating machine using the Remote Operator Control Box or the Control Box on the Plate Pusher to perform work operations. Travel position disables the use of the remote control boxes on the machine and plate pushers. This is only used for traveling or performing adjustments to the lift and/or clamp actions when changing rail or tie size. In the **TRAVEL** position, the clamp and lift functions can only be activated by using the **Clamps Up/Down Switch and Lift Cylinder Up/Down Switch** on the Main Control Panel (not the Remote Control Boxes). See below for more details on these switches.
CLAMPS UP/DOWN Switch CLAMPS UP CENTER POSITION CLAMPS DOWN		Used when machine is in the TRAVEL (Manual) position to extend or retract the rail clamps. Three position spring switch. Holding the switch UP will retract the clamp cylinders causing the rail clamps to close. Releasing switch will automatically stop cylinder/clamp action. **NOTE: Machine should not be travelled if the clamps are partially up or down.** Holding the switch DOWN will extend the clamp cylinders causing the rail clamps to open.
LIFT CYLINDER UP/DOWN Switch CYLINDER UP CENTER POSITION CYLINDER DOWN		Used when machine is in the TRAVEL (Manual) position to extend or retract the lift cylinders. Three position spring switch. Holding the switch UP will retract the lift cylinders causing the rail clamps to lift the rail. Releasing switch will automatically stop cylinder/clamp action. **NOTE: Machine should not be travelled if the clamps are partially up or down.** Holding the switch DOWN will extend the lift cylinders causing the rail clamps to lower the rail.
DUAL/SINGLE Switch DUAL Mode SINGLE Mode		Used for selecting one rail or two rail operation. Used when performing work operations on two rails. Used when performing work operations on one rail. Operator must select which side of machine is active. See below.
LEFT/RIGHT Switch		Determines the side of the machine that is active. Left or right position is determined when operator is standing at the LOGIC box.

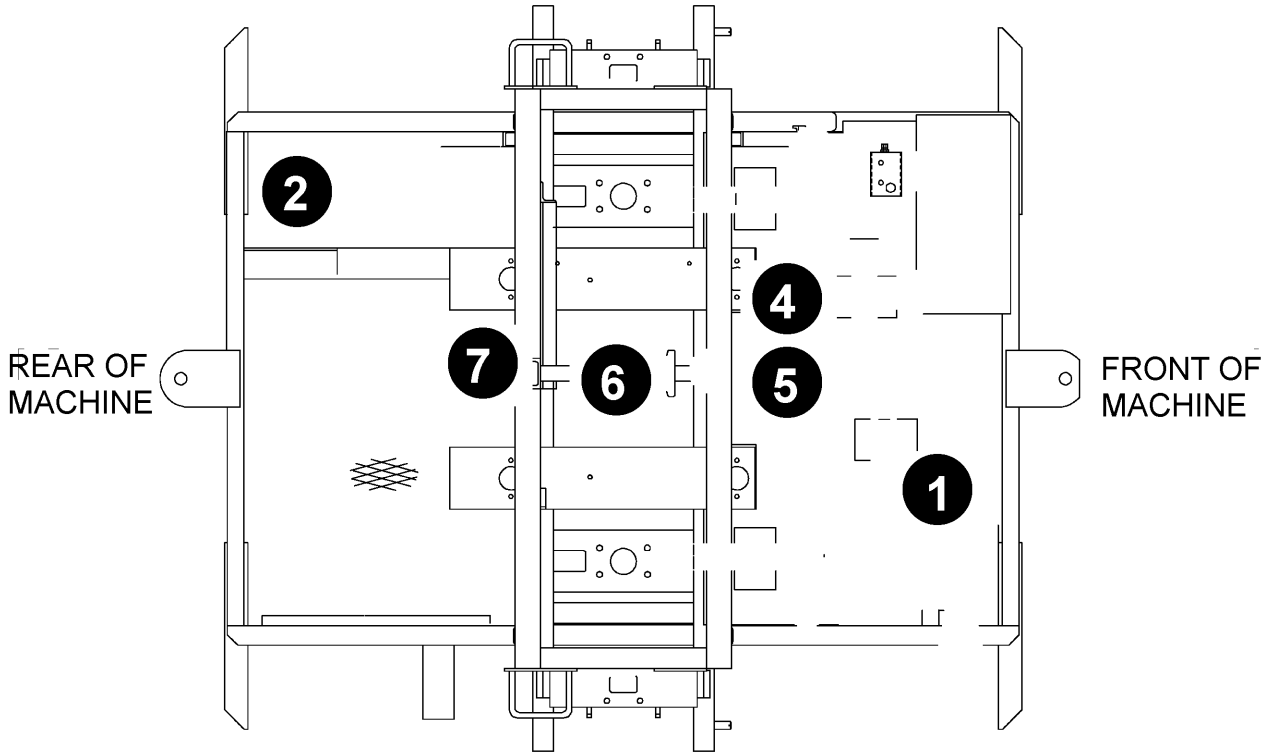
REMOTE CONTROL BOXES
MACHINE AND PLATE PUSHER



NOTE: The Left Hand remote control box is the primary control box when in TRAVEL mode (Dual or Single Operator) and for “Cycle Start” when in the DUAL OPERATOR WORK mode. Please read function descriptions below for more details.

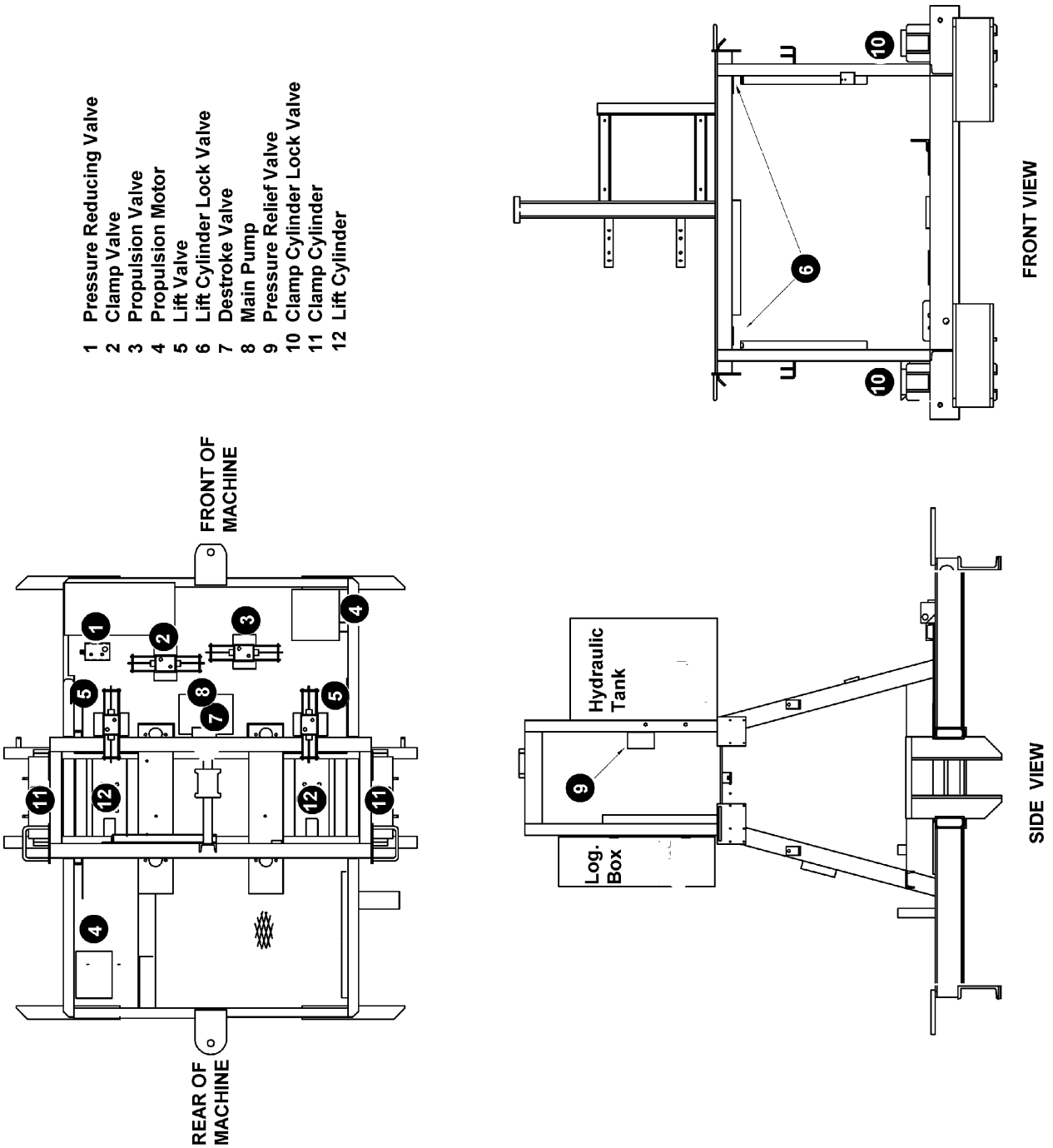
CONTROL OR INSTRUMENT	INTERNATIONAL SYMBOL	FUNCTION
FORWARD/REVERSE Propel Switch	← →	Use this switch to propel the machine forward or backward. When the machine is in **DUAL** mode, both operators must press the propel switches at the same time to operate the machine, but only the left operator controls the direction of travel. When in the **SINGLE** mode, only the propel switch on the side of the machine selected on the main control panel is active.
CYCLE START Switch	↓	Pressing this switch initiates the clamping/lifting cycle of the machine. In **DUAL** Mode, only the left operator controls the Cycle Start. In **SINGLE** Mode, whichever side is selected controls the Cycle Start.
EXTEND Switch	↑	Each time this switch is pressed, the rail lifts an additional amount (set for each side of the machine with the Extend Timing Controls - See Machine Setup later in this manual).

REMOTE CONTROLS AND INDICATORS



ITEM #	CONTROL OR INSTRUMENT	FUNCTION
1	Propulsion Speed Control	The lever on the flow control valve, located on the Propulsion valve (See Figure on next page for location), controls the oil flow to the hydraulic motor and controls the machine's propulsion speed.
2	Axle Drive Clutch Lever	This lever is used to engage/disengage the drive system (used primarily for towing). **NOTE: A second axle drive clutch lever is located on the opposite side of the machine for DUAL AXLE drive machines.**
3 (Not Shown)	Brake Lever (Optional)	Activates optional parking brake.
4	Return Line Hydraulic Oil Filter Indicator	Located on the return line filter near the oil tank, this gauge indicates when the filter is dirty and is being bypassed.
5	Hydraulic Oil Level/Temperature Gauge	Located on the oil tank, the sight gauge indicates level of oil in tank. An optional gauge has a built-in temperature gauge that indicates oil temperature in degrees F. Normal operating range is 100-180 degrees F.
6	Fuel Tank Sight Gauge	Located on the fuel tank; shows fuel level.
7	Extend Timing Controls	Controls the amount of extended lift when the EXTEND buttons (located on the remote control boxes) are depressed. See Machine Set-Up for instructions on setting these timers.

HYDRAULIC COMPONENT LOCATIONS



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 if necessary.

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

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

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

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

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

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

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

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

10. Wear proper safety clothing.

11. Determine if the machine will be operated in DUAL or SINGLE mode of operation, and set all controls on the main control panel accordingly.

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

PRE-OPERATIONAL CHECKLIST

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

TABLE OP-7 PRE-OPERATIONAL CHECKLIST

MAIN CONTROL PANEL STATUS
☐ Logic Box Cover Unlocked, removed from box and stored. ☐ Gages checked for broken glass. ☐ Emergency Stop pushbutton is pulled out. ☐ Control Panel Switches set as follows: ☐Travel Alarm switch (optional) set to direction opposite of work travel. ☐ Strobe or Beacon switch (optional) is OFF ☐ Ignition switch is in OFF ☐ Engine Speed switch is set to LOW ☐ Work Lights are OFF ☐ Travel/Working Mode Switch set to TRAVEL ☐Single/Dual Switch is in DUAL
REMOTE OPERATOR CONTROL BOX
☐ Emergency Stop pushbutton is pulled out.
MACHINE FLUID LEVEL CHECK (See recommended fluids in Maintenance Section)
☐ Hydraulic Oil Tank is full ☐ Fuel Tank is full ☐ Engine Oil Reservoir is full
MACHINE INSPECTION
☐ Inspect for Leaks. Pay particular attention to hydraulic and fuel lines. ☐ Inspect all controls, wiring and switches for secure mounting ☐ Battery Disconnect Switch OFF (Switch located inside battery box on most models)
MACHINE LOCK-UPS AND GUARDS
☐ Make certain Mechanical Lock-Up devices are in place (for traveling) SEE LOCKUPS SECTION. ☐ Propulsion Chain guard(s) in place

Engine Operation

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

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

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

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

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

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

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

   NOTE: Engine will not start if engine speed switch is in HIGH position, emergency stop pushbuttons are pushed in, or if the MO is not held in.

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

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

TABLE OP-8. STARTUP CHECKS

GAUGE READINGS CHECKED:

☐ Tachometer/Hourmeter:	2250 rpm (under load)
☐ Voltmeter:	13 to 15 Volts
☐ Engine Temperature:	160 to 185° F (71 to 85°C)
☐ Engine Oil Pressure:	40 to 60 psi, 3 to 4 bar, 276 to 414 kPa

LIGHT/HORN STATUS

☐ LIGHTS FUNCTION:
☐Travel Lights ☐ Work Lights ☐ Brake or Marker Lights

☐ HORNS/ALARMS FUNCTION:
☐Travel Alarm ☐ Horn Button ☐Horn Button (Optional Remote Switches)
☐ Backup Alarm (Optional)

☐ REMOTE OPERATOR CONTROL BOXES FUNCTION

☐ LOCK-UP DEVICES ENGAGED (See Lock-ups - Next Page)

LOCK-UPS

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

There are areas designated on the machine as lock-up points. Lock-up points are those areas required to be locked up prior to working travel through crossings, switches or other rail obstructions or during high speed travel (non-working travel). These have been painted red and have a decal located next to or on the area requiring locking up.

INSTALLING LOCK-UP PINS AND LINKS

IT IS IMPORTANT THAT YOU INSTALL THESE LOCK-UPS IN THE ORDER SHOWN!

Installing Lift Cylinder Lock-Up Pins

There is one lock-up device on each lift cylinder assembly (two assemblies per machine).

1. Place machine in the **TRAVEL** mode. This will raise the lift cylinder to allow the insertion of the lock pins.

2. Locate the lock-up devices.

3. Verify that the assembly is fully raised. Push lock pin through assembly. (You will not be able to lock in place if assembly has not been fully raised.)

Installing Rail Clamp Lock-Up Pins

There are three lock-up devices on each rail clamp assembly (two rail clamp assemblies per machine).

1. Place machine in the **TRAVEL** mode.

2. Using the Clamps UP/DOWN selector switch on the Main Control Panel, put the Clamps in the DOWN position.

3. Place lock links on the rail clamps.

4. Using the Clamps UP/DOWN selector switch, put the Clamps in the UP position.

5. Insert lock-up pins (2 on each rail clamp assembly) on both sides of the clamp assembly.

6. Leave the Clamps UP/DOWN selector switch in the UP position.

REMOVING LOCK-UP PINS AND LINKS

IT IS IMPORTANT THAT YOU REMOVE THESE LOCK-UPS IN THE ORDER SHOWN!

Removing Rail Clamp Lock-Up Pins

There are three lock-up devices on each rail clamp assembly (two rail clamp assemblies per machine).

1. Place machine in the **TRAVEL** mode.
2. Using the Clamps UP/DOWN selector switch on the Main Control Panel, put the Clamps in the UP position.
3. Remove lock-up pins (2 on each rail clamp assembly) on both sides of the clamp assembly.
4. Using the Clamps UP/DOWN selector switch, put the Clamps in the DOWN position.
5. Remove lock links on the rail clamps.
6. Put the Clamps UP/DOWN selector switch in the UP position.

Removing Lift Cylinder Lock-Up Pins

Both must be unlocked prior to adjusting the extend timing and/or performing work.

1. Place machine in the **TRAVEL** mode. This will raise the lift cylinder to allow the insertion of the lock pins.
2. Locate the lock-up devices.
3. Verify that the assembly is fully raised. Push lock pin through assembly. (You will not be able to lock in place if assembly has not been fully raised.)

TRAVEL

It is important that you read about and understand all operating controls, Cautions, Warnings, and Dangers before traveling.

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.

ENGINE SPEEDS

Engine speed is controlled by the switch on the Main Control Panel located on the Logic Box. Engine speed settings are slow and fast. When traveling either in the work or travel modes, you will have the engine speed in the Afast≅ position.

PROPELLING AND BRAKING

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

Propelling

1. Select TRAVEL or WORKING mode on the Main Control Panel.
2. Select DUAL or SINGLE operation using the switch on the Main Control Panel.
3. Use the FORWARD/REVERSE switch on the REMOTE CONTROL BOXES for propelling in the direction desired.

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.

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.

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

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.

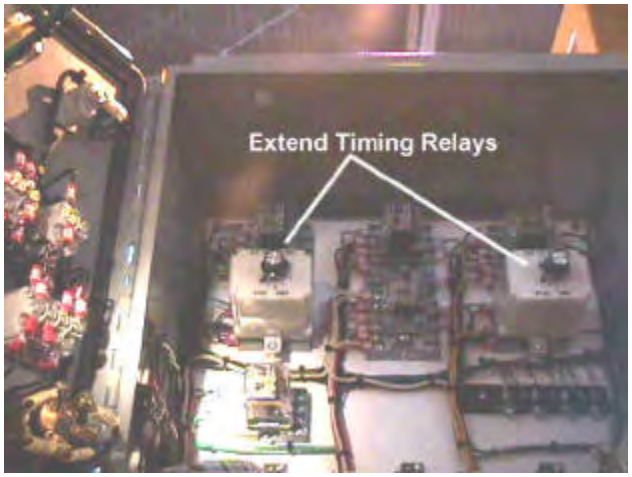
LIMIT SWITCH CAM ADJUSTMENTS

Normally the lift cylinders are adjusted to retract to a position 4 inches above the tie. In some cases, such as differing rail sizes, tie sizes, or heavy ballast conditions, the Limit Switch Cams might need to be adjusted to obtain new rail lift height as follows:

1. Place the WORK/TRAVEL switch in the TRAVEL position.
2. Position the machine over a tie where rail is to be lifted.
3. Lower the lifting cylinders to about 4 inches above the tie (so that the down Limit Switch in not in contact with the cam).

4. Place the WORK/TRAVEL switch in the WORK position. The rail clamps will grip the rail.
5. Push the CYCLE START button (on the plate pusher or on the remove operator control boxes). The machine will begin the cycle of lifting the rails.
6. The tie plate should just have enough clearance to slide under the rail. If not, adjustment to the cam is needed as follows:
7. Note the distance the rails are lifted. If the distance is too high, lower the cam by turning the Cam Adjustment Screw clockwise (CW).
8. If the distance is too low, raise the cam by turning the Cam Adjustment Screw CCW.
9. After adjustments to the cam are made, lower the rails by pushing the propel switch to end the cycle. Retest height and readjust if necessary..

“EXTEND” TIMING ADJUSTMENTS



Extend timing adjustments have been pre-set at the factory for a maximum lift of 1/8-inch each time the EXTEND button on the plate pusher controls or on the remote operator control box has been pushed. This is the recommended height and should not be adjusted unless absolutely necessary.

In the event that you need to reset this height for an extended period of work operation, you can do so by adjusting the Extend Timing Relay located inside the main control panel.

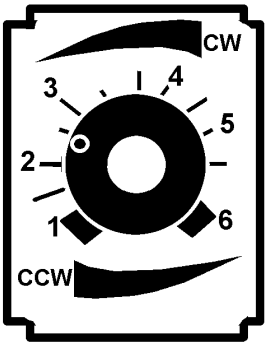
To adjust the Extend Timing Relay:

1. Open the Main Control Box and locate the Extend Timing Relay. See Figure. **NOTE: There is one timing relay for each side of machine.**

2. Turn the adjustment knob (see lower figure) clockwise to increase height or turn the knob counter clockwise to decrease height.

3. Lower the rail and re-lift. Push extend button and note new rail height. Repeat step #2 as required to get desired height.

NOTE: It is recommended that you reset the Extend Timing Relay back to the 1/8-inch setting after work operations have been completed.



Extend Timing Relay

MACHINE OPERATION

Work Operation

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.

This machine is not equipped with seats or seatbelts. Do not ride on or allow others to ride on this machine when working, travelling, or towing. Failure to comply could restult in severe personal injury or death.

1. Place the WORK/TRAVEL switch in the TRAVEL position.

2. With the PUMP switch OFF, turn the starter switch and hold the Magnetic Override switch in until the engine starts and the oil pressure reaches 30 psi.

3. Release hand brake. Engage axle drive clutch lever. Set speed switch to HIGH speed.

4. Turn PUMP switch ON. Push the Left Propel switch to the appropriate position (forward or reverse) to spot the machine over the desired location.

5. Push CLAMPS switch UP and remove lock pins on both rail clamps.

6. Push CLAMPS switch DOWN and remove lock links on both rail clamps.

7. Push CLAMPS switch UP.

8. Push LIFT CYLINDER switch UP and remove both lock pins.

9. Hold LIFT CYLINDER switch DOWN and release when lift cylinder is about 4 inches above the tie.

   NOTE: If machine needs to be adjusted for a new rail height, see LIMIT SWITCH CAM ADJUSTMENT earlier in this manual - BEFORE going to Step #10.

10. Place DUAL/SINGLE switch to desired position. If Single Operation is selected, place RIGHT/LEFT switch to side from which machine is to be operated.

11. Place WORK/TRAVEL switch in the WORK position.

12. While standing clear of machine parts, press CYCLE START button on Remote Operator Control Box (on machine or on remote plate pusher). Machine will perform a lift sequence.

13. If more lift height is required, press EXTEND pushbutton (on machine or on remote plate pusher) as needed. The lift cylinder will extend 1/8-inch to ¼-inch each time the EXTEND button is pressed. If rail does not raise enough after the EXTEND pushbutton has been pressed two times, adjustment of the extend timing switch in the

logic box may be necessary. See EXTEND TIMING ADJUSTMENTS earlier in this section.

14. Perform required work on tie/plate.

15. (One or both operators) hold PROPEL switch in desired direction. (The lift cylinders will retract, clamps will open, and machine will propel until the PROPEL switch is released.)

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.

EMERGENCY STOPPING

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

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

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

AFTER OPERATION

NORMAL SHUTDOWN

Under non-emergency situations, shut down the machine as follows:

1. Put WORK/TRAVEL switch in the TRAVEL position.
2. Hold LIFT CYLINDER switch in the UP position until lift cylinder is fully retracted. Install lock pins.
3. Hold CLAMPS switch in the DOWN position until cylinders are fully extended and install lock links on both cylinders.
4. Hold CLAMPS switch in the UP position until clamp cylinder is fully retracted. Install lock pins on both rail clamps.
5. Set engine speed to LOW position. Let engine idle for 5 minutes to allow engine to cool. Shut off engine.
6. Return all switches to their “Pre-Operational” state using the Pre-Operational Checklist as a guide.
7. Turn off battery disconnect switch. Lock battery box.

Parking or Locating Machine

1. Park or locate machine on level track area, if possible; and where it will not be exposed to excessive dust.
2. If the machine was towed, disconnect towing vehicle and engage the drive axle clutch, or set the optional parking brake. Move the towing vehicle well clear of the parked machine.

Towing

Do not ride on tow bar between the machine and the towing vehicle. Falling from a moving vehicle may cause serious injury or death.

The following steps must be taken before towing your machine:

1. Install Lock-Ups. See LOCK-UPS section and inspect the towing vehicle coupler for damage or loose parts.
2. Disengage Drive Axle(s) with clutch lever to isolate the drive motor(s) from the axle(s).
3. Follow your company’s procedure(s) for towing.

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GENERAL

Sound service and maintenance practices will ensure that the machine continues to meet your demanding requirements. At each scheduled maintenance interval, perform all previous maintenance operations in addition to the ones specified.

Refer to the Module Operating Instructions for maintenance and service related to the modules.

NOTE: Recommended service intervals are for normal operating conditions. Service more often if engine is operated under adverse conditions (See Maintenance for Extreme Conditions later in this section). Neglecting maintenance can result in failures or permanent damage to equipment.

SAFETY DURING MAINTENANCE

Alert others in the area that service or maintenance is being performed on this machine. Become familiar with, and use, your company's lockout/tagout procedures when performing maintenance on this machine. See **LOCKOUT-TAGOUT REQUIREMENTS** in the **Safety Section** of this manual.

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 the engine if the need arises.

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.

Disconnect the battery before servicing this machine. Failure to do so could result in personal injury from accidental engine startup.

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.

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.

NORDCO'S SERVICE NETWORK

Need assistance? It's only a phone call away! If you experience problems, contact your original sales representative first, he is the one listed on the front page of this manual. If you cannot reach him, we suggest that you contact the representative closest to your work area BEFORE calling NORDCO's Service Manager. See map on the next page for the alternate representative closest to your work area.

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)

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

1. The Machine Name: Model “LS” Auto-Lift
2. The Type of Machine: Whether or not upgraded from an OPTO MACHINE
3. The Serial Number: The Serial Number plaque is located next to the rail clamp housing on the lower frame.

SERVICE NETWORK

No.	Representative	Phone Number
1.	Nordco Service Manager	1-800-445-9258 or (414) 769-4603
2.	Russell Railway Supply	(612) 835-5125
3.	Simkins Company, Inc.	(310) 316-5270
4.	James H. Lynde	(913) 648-7379
5.	Stanley H. Smith Inc.	(606) 885-3353
6.	Dwayne Lambing	(770) 424-0401
7.	Eastern Railway Supplies	(716) 675-2040
8.	Eastern Railway Supplies, Ltd. – Canada	(716) 675-2040

International: American Equipment (561) 997-2080

MAINTENANCE INSTRUCTIONS

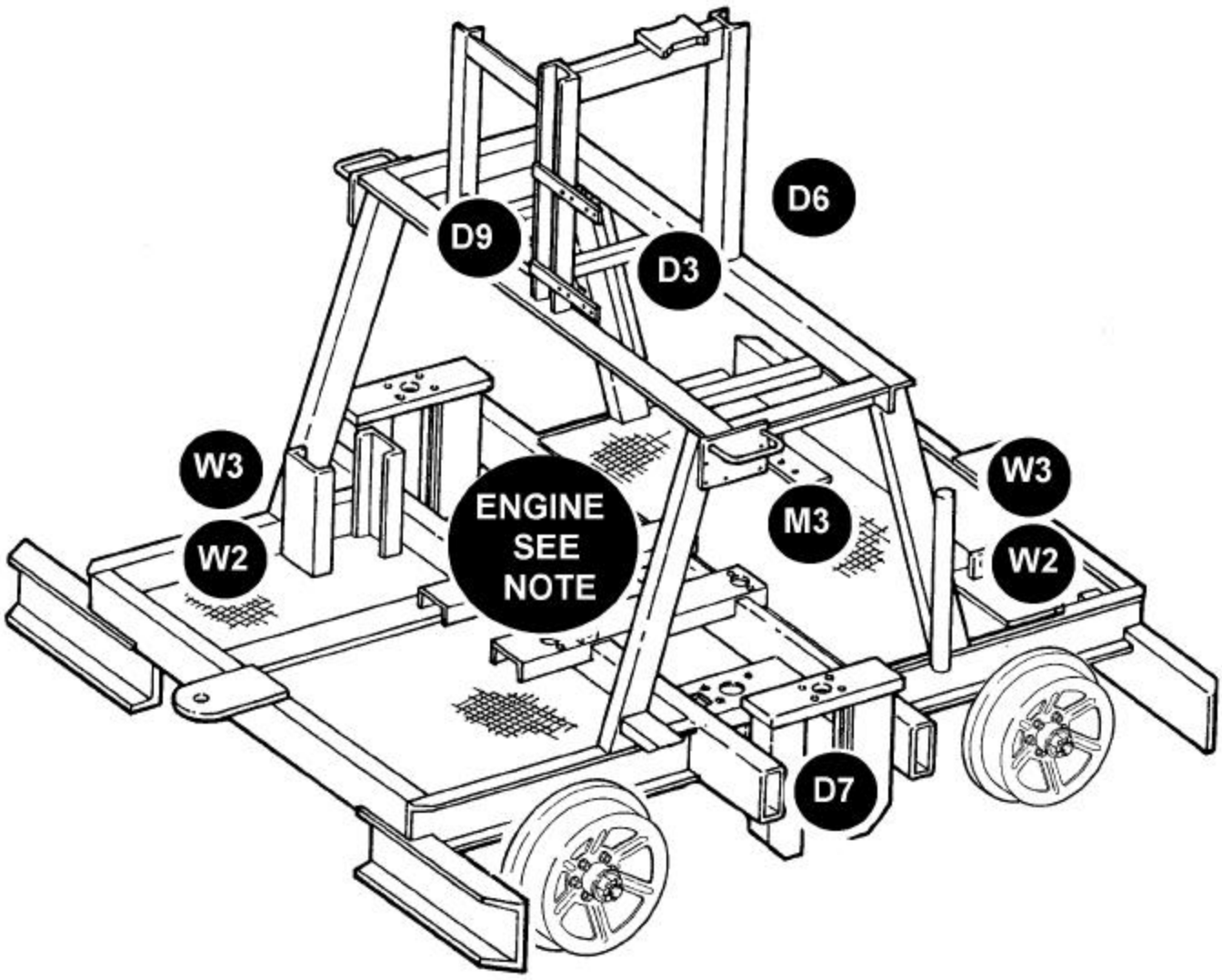
Maintenance instructions (adjustments, lubrication, inspections, etc.) are given in this manual **by assembly**. The

breakdown for each set of instructions is as follows:

Lubrication:	Tells you what parts of the assembly require lubrication and at what service intervals.
Inspection/Maint:	Tells you what parts of the assembly require maintenance or inspection and at what service intervals to keep the machine performing at optimum levels.
Adjustments:	Tells you what parts of the assembly may require adjustments that are not considered “daily” adjustments to keep the machine running.

SERVICE POINTS

Service points on this machine (adjustments, inspections, lubrication, etc.) are indicated on the following illustration. The items listed on the chart are preceded by a “D1, W1, M1, Q1 and A1" designation. These points are shown on the illustration and refer to the service interval (D=Daily, W=Weekly, M=Monthly, Q=Quarterly and A=Annually) for this point of the machine. Maintenance instructions are given for each and are separated by Service Interval.



SERVICE SPECIFICATIONS FOR ITEMS ON NEXT PAGE

SPEC		
A.	ENGINE OIL:	
	ABOVE 32E F:	TEXACO URSA SUPER PLUS (SAE40)
	UNDER 32E F:	TEXACO URSA SUPER PLUS (SAE15W-40)
B.	HYDRAULIC OIL:	TEXACO RANDO OIL HD-46 (ISO #46)
C.	GREASES:	LUBRIPLATE 3000 (NGLI #2)

(FOR OTHER RECOMMENDED BRANDS SEE **RECOMMENDED LUBRICANTS**)

NOTE:
Refer to the Engine Manufacturer’s Operation Manual for exact maintenance requirements for the engine installed on your machine.

LUBRICATION AND MAINTENANCE

INTERVAL		SPEC
Daily (8 Hours)		
D1.	CHECK ENGINE OIL LEVEL	SPEC A
D2.	CHECK AIR CLEANER INDICATOR (DEUTZ ENGINES ONLY)	
D3.	FILL FUEL TANK (END OF DAY)	
D4.	DRAIN WATER SEPARATOR ON ENGINE (DEUTZ ENGINES ONLY)	
D5.	CHECK HYDRAULIC OIL LEVEL/QUALITY	SPEC B
D6.	CHECK HYDRAULIC OIL FILTER INDICATORS	
D7.	GREASE RAIL CLAMP FITTINGS (3 EACH SIDE OF MACHINE, 6 TOTAL)	SPEC C
D8.	INSPECT HOSES AND FITTINGS FOR LEAKS	
D9.	INSPECT WIRING CONNECTIONS/HARNESSES FOR TIGHTNESS	
WEEKLY (40 HOURS)		
W1.	CHECK BATTERY CONDITION	
W2.	CHECK PROPULSION CHAIN FOR TIGHTNESS/OIL CHAIN	SPEC A
W3.	OIL PROPULSION CHAIN ADJUSTING NUT	SPEC A
W4.	GREASE WHEEL BEARINGS	SPEC C
MONTHLY (150 HOURS)		
M1.	CHECK FAN AND ALTERNATOR BELT TENSION	
M2.	CHANGE ENGINE OIL AND FILTERS	SPEC A
M3.	RUN PRESSURE CHECKS ON MAIN PUMP/PROPULSION	
M4.	INSPECT AIR CLEANER ELEMENT (DEUTZ ENGINES ONLY)	SPEC C
M5.	INSPECT AND CLEAN ENGINE COOLING SYSTEM (DEUTZ ENGINE ONLY)	
QUARTERLY (500 HOURS)		
Q1.	DRAIN FUEL TANK AND REPLACE FUEL FILTERS	
Q2.	TEST HYDRAULIC OIL CLEANLINESS	
ANNUALLY (1000 HOURS)		
A1.	CHANGE HYDRAULIC OIL FILTERS	
A2.	FLUSH AND FILL HYDRAULIC TANK	SPEC B
A3.	SERVICE STRAINERS IN HYDRAULIC TANK	
A4.	DRIVE BELTS	
A5.	ENGINE MOUNTS AND HARDWARE	

- **OPTIONAL EQUIPMENT**

Refer to the Engine Manufacturer's Operation Manual for exact maintenance requirements for the engine installed on your machine.

RECOMMENDED GREASES (NGLI #2)

BRAND	DESCRIPTION/TYPE
Lubriplate	3000
Texaco	MolyTex EP2
Mobil	MobilGrease Special
Conoco	Super Sta M
Amoco	Rykon Premium Moly 2
Chevron	Moly Grease EP2

RECOMMENDED HYDRAULIC OILS (ISO #46)

BRAND	DESCRIPTION/TYPE
Texaco	Rando Oil HD-46
Mobil	DTE-15M
Conoco	Super Hydraulic Oil #46
Amoco	Rykon Oil #46
Citgo	Hydraulic A/W Oil #46

RECOMMENDED ENGINE OILS

BRAND	NORMAL TEMPERATURE SAE40	TEMPS UNDER 32EF SAE15W-40
Texaco	URSA Super Plus	URSA Super Plus
Mobil	Delvac 1240	Delvac Super 1200
Conoco	Fleet HD40	Fleet HD Multi-Grade
Amoco	300 Motor Oil	Premier II
Citgo	Citgard 500	Citgard 500

HYDRAULIC - GENERAL

GENERAL

Hydraulic components are precision devices. Careless handling of them or other parts of the system can result in malfunction or failure. In order to ensure efficient operation of components, it is essential, if repairs become necessary, to follow the instructions supplied in the Component Data section of this manual for a particular component. Whether assembling or taking apart, it is important that the internal parts of the component be kept clean. Maintenance and operation are dependent on the conditions under which the equipment is working.

To avoid creating problems when installing or repairing hydraulic components, follow these tips:

1. Clean away the dirt in and around equipment before taking apart lines and removing parts.
2. Cap off all disconnected lines and open ports.
3. Protect the overhaul area from grinding dust, machining chips, and wind driven dirt.
4. Work only on metal or hard finished bench tops, easy to keep clean.
5. Handle parts carefully to avoid nicks and burrs.
6. Use lint-free cloths to wipe parts.
7. Use smooth burr-less tools, especially when working with O-rings.
8. Lubricate all sliding parts during assembly.
9. Cover sharp grooves and threads with thimble or shim stock when installing O-rings and other seals.
10. Discard all used O-rings to avoid re-use.
11. Make certain that seals are of the right size and material.
12. Use only recommended replacement parts.
13. Examine all prematurely worn or malfunctioned parts for clues as to the cause of the failure.
14. Test the overhauled device before reinstalling it, if possible.
15. Major component failure - have oil checked for contamination (see paragraph below) or purge system, clean tank and components, and refill with clean oil.

FLUID CONTAMINATION

Contamination comes in many forms. It may be air, water and cutting oils, rust, chips and grit. It is usually easier to keep contaminants **out** of a system rather than remove them after they are **in** the system.

Bulk handling and the re-use of oil containers almost guarantees you that "new" oil will be dirty. Make it a practice to filter all "new" oil while adding it to your system. Make it another practice to change filters on a regular basis **before** they become clogged.

Old and contaminated oil cannot be improved by topping off with fresh oil. It is more

practical to drain the system while the oil is still at working temperature, clean the reservoir and replace with fresh oil.

Contamination on the outlet side of the filters can be flushed into the system and cause malfunctions. Contamination on the inlet side reduces the life of the filter element.

INSPECT HOSES AND FITTINGS FOR LEAKS (D8)

Inspect all hoses, fittings and components for damage, wear, or leaks on a daily basis. Nordco recommends that all hose, hose assemblies, and/or fittings replaced by the customer equal or exceed the original equipment specifications.

All hoses should be replaced during major overhaul and/or after a maximum of five years of service.

When removing hydraulic hoses, fittings or components the following procedure must be followed:

Tighten fittings only when system is not pressurized. High pressure leaks can cause personal injury.

- Stop engine
- Always wear appropriate safety gear.
- Make certain locks and brakes have been applied.
- Make certain hydraulic system has been depressurized.
- Remove hoses, fittings or components slowly to release any trapped pressure.
- Do not sustain full system flow through system relief valve for more than 10 seconds. Full system flow at high pressure through relief valve will create extremely high temperatures.

ELECTRICAL - GENERAL

ELECTRICAL CONNECTIONS (D)

The electrical system on this machine is extremely sensitive and should not be subjected to unusually high currents of any kind. Remove battery cables from battery before welding on machine, to prevent damage to the electrical components.

Inspect connections on this machine on a daily basis, making certain all are correct and tight..

OPERATOR STATION/CONTROLS

MAINTENANCE

Daily inspection of the harnesses connected to the remote operator control boxes (both left and right control boxes), plate pushers, and logic box are required. Harnesses that may not have proper connection could cause problems in starting and stopping the machine.

NO LUBRICATION OR ADJUSTMENTS ARE REQUIRED

AXLES AND CLUTCH

LUBRICATION (W4)

Wheel bearings should be lubricated on a weekly basis (40 hours). Weather conditions affect the time intervals of greasing. In general, a small amount of grease should be ok. Overgreasing may cause seal failure.

INSPECTION/MAINTENANCE

Periodic inspection of the axle bearings and spacers for wear and breakdown are required to keep this machine functioning properly. Inspect hardware for proper fit and secure all loose nuts and bolts.

Grease hardens with age. When this occurs, the bearing should be taken apart, cleaned, and relubricated following the manufacturer’s instructions on the **component data** sheet.

ADJUSTMENTS

No adjustments are necessary for this assembly

DRIVE SYSTEM (PROPULSION)

LUBRICATION (W2/W3)

Propulsion chain should be lubricated on a weekly basis (40 hours) with engine oil. This will extend chain life and prevent breakage of the chain.

The propulsion chain adjusting nut should be greased on a weekly basis (40 hours) to prevent rust buildup.

INSPECTION/MAINTENANCE

Periodic inspection of the sprockets for wear and breakdown are required to keep this machine functioning properly. Inspect hardware for proper fit and secure all loose nuts and bolts.

The drive chain should be inspected weekly (40 hours). When inspecting the drive chain, the chain should be nearly taut, with 1/4" (.635 Cm) play when depressed at the center. If not, adjustment is necessary see below. If the chain is too tight, the eccentricity of the sprockets may cause the chain to stretch and/or break. If the chain is too loose, the starting and stopping of the machine will shock load the chain, resulting in short chain life or failure. A worn or stretched chain will also cause short sprocket life as the load will not be carried by all of the teeth on the sprocket - resulting in excessive load on a few teeth.

ADJUSTMENTS

To adjust the drive chain:

1. Remove propulsion chain guard.
2. Unscrew the adjusting screw locknut, but do not remove it from the screw.
3. Turn adjusting screw clockwise (CW) to tighten the chain or counter-clockwise (CCW) to loosen the chain.
4. Once the desired tightness has been reached, tighten the adjusting screw locknut.
5. Reinstall the chain guard.

BATTERIES

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.

LUBRICATION

No lubrication is required on this assembly, however after cleaning the terminals and clamps it is suggested that you coat them with grease or other suitable product to reduce corrosion.

INSPECTION/MAINTENANCE (W1)
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.

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. When battery replacement becomes necessary it is recommended that replacement battery meet or exceed original battery specifications; amps, cranking power, etc.

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.

ENGINE AND PUMP

ENGINE

Refer to the Engine Manufacturer’s Operation Manual for maintenance instructions that apply to the type of engine on your machine.

INSPECTION/MAINTENANCE

Check electrical connections and harnesses to the engine on a daily basis.

PUMP

Pressure checks should be performed **every 250 hours or monthly** after the engine and hydraulics have thoroughly warmed up (oil temperature has reached 100EF minimum). Before performing these checks, **read and understand all OPERATION instructions, warnings and cautions.**

The pressure check instructions can be found in **Appendix B**, **PERIODIC ADJUSTMENTS - HYDRAULIC** of this manual following this section. These testing procedures require at least two workers in order to be performed correctly.

ADJUSTMENTS

ENGINE MOUNTS AND HARDWARE

The engine mounts, the exhaust manifold retaining nuts, exhaust flange clamps and other connections should be checked for tightness.

RAIL LIFT ASSEMBLY

MAINTENANCE

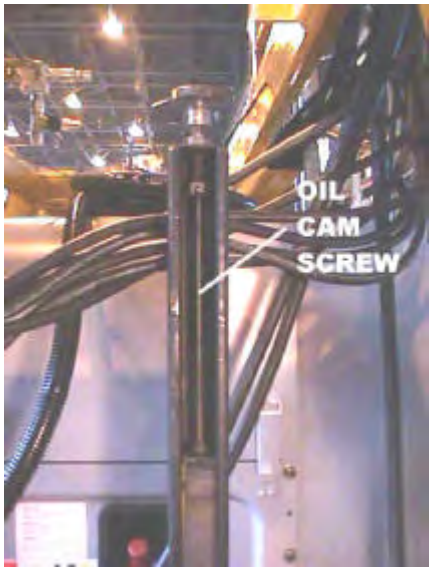
Check the limit switch lever on a daily basis to make certain that it has not become bent. Replace the lever if bent.

LUBRICATION

The Cam Screw should be lubricated on a weekly basis (40 hours) with engine oil. This will prevent rust build-up on the screw.

ADJUSTMENTS

There are no maintenance adjustments to make to this assembly. Refer to the Operation Section, LIMIT SWITCH CAM ADJUSTMENTS,
For instructions on how to adjust the cam for working operations.



RAIL CLAMP ASSEMBLY

MAINTENANCE

Make certain that the hardware holding the slide channel to the rail clamp bracket is tight.

Clean all track debris from the rail clamp housing. Any debris caught between the clamps reduces their ability to clamp tightly to the rail.

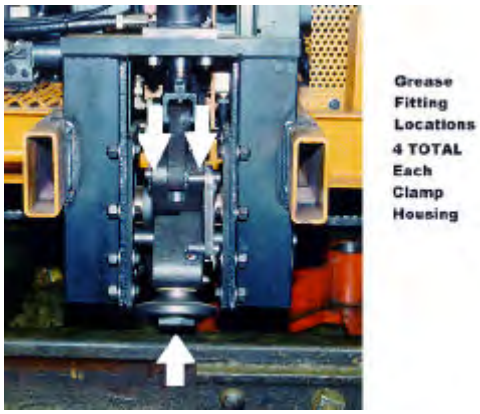
LUBRICATION

There are four grease fittings on each rail clamp assembly, eight total for the machine. Grease these fittings on a daily basis. The grease fittings are located on each roller and roller lever.

Each week, apply a coat of multi-purpose grease on the wear surface of the slide channels.

ADJUSTMENTS

No adjustments are required for this assembly.



MAINTENANCE FOR EXTREME CONDITIONS

Cold Weather

General Problems

Extreme cold generally causes fluids to thicken or gel, presents a risk of freezing and weakening the battery, can crack electrical insulation, can cause difficult starting, and causes rubber and plastic parts to become hard, brittle and easily damaged.

Lubricants

Use the correct grade of lubricants wherever they are used on the machine. Drain and refill if the lubricant is not correct for cold weather operation. See **Recommended Lubricants** earlier in this section. Cold weather also can cause moisture to accumulate in lubricants. If water is found in any lubricant, drain and refill.

Fuel System

Precautions can be taken to keep moisture out of the fuel system.

1. Keep fuel tank as full as possible to avoid condensation.

2. Remove ice and snow from the area of the filler opening before refilling. Whenever moisture does accumulate in the fuel system, drain water from tank and filters.

If fuel is seriously contaminated with moisture, drain, flush, and refill fuel tank.

Battery

Keep battery fully charged. Cranking power of battery is reduced in extreme cold.

Engine Operation

Run engine at LOW SPEED only long enough to circulate the oil through the engine, then increase speed to warm up the engine. Extended idling during extremely cold temperatures can cause incomplete combustion and heavy deposit formations on the valves.

Machine Storage

1. Park machine in a sheltered place if possible

2. Wet mud or snow should be cleaned from wheels, axles and hubs before it freezes.

3. When the machine is shut down in extremely cold weather, remove the battery and store it in a moderately warm place. Reinstall battery just prior to starting.

Hot Weather

General

Precautions must be taken to avoid overheating. Check temperature gauge frequently for indications of overheating. When overheated, allow engine to idle until temperature is reduced.

Cooling System

Deutz engines: Check condition of cooling fins frequently. Keep fins and air duct clean and free of dirt that would reduce efficiency. Replace cracked, frayed, or excessively worn belts.

Lubrication

Lubricate the machine with correct grade of lubricants according to lubrication instructions. Change filter elements at shorter intervals than specified in the Maintenance procedures.

Air Cleaners

Check restriction indicator frequently. Service air cleaner at intervals specified in the engine manual.

Rainy or Humid Conditions

Fuel Tank

Keep fuel tank as full as possible and service filters more often than normal.

Lubrication

Keep all moving parts well lubricated.

Paint

If paint is chipped or scratched, the affected area should be refinished immediately to prevent rapid formation of rust. Remove all loose paint with paint remover, sandpaper, or sandblasting equipment. Apply two coats of primer and, when dry, apply finishing coat of paint.

Dusty or Sandy Areas

General

Sand and dust are abrasives which can cause wear on many parts of the machine. Airborne sand and dust can clog the air cleaners, cooler and radiator. Try to store machine in sheltered area when not in use.

Air Cleaners

Check the air cleaner indicator frequently and reduce the service intervals for the air cleaner. Clean the air cleaner as often as necessary to prevent it from becoming clogged.

Lubrication

Lubricate the machine more often then specified in the Lubrication Chart. Clean all fittings and openings thoroughly before lubrication to keep out sand and dust. Take similar precautions with lubricant containers.

Salt Water Areas

In salt water areas, keep the machine as clean as possible. Salt water vapor in the air causes corrosion of exposed parts. After operation, wash with fresh water if available. Keep all lubrication points wiped clean and well lubricated.

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TROUBLESHOOTING - GENERAL

Troubleshooting is a matter of quickly and logically isolating the cause of a problem and taking corrective action. Operating experience, a thorough understanding of the information in this manual, and accurate maintenance and operation records are the best troubleshooting tools an operator can have. This machine is a group of rather simple systems. If you understand the basic workings of these systems individually and how they relate to each other, troubleshooting becomes a relatively simple task.

This general portion of the troubleshooting guide has been broken down into four sections, engine, hydraulics, electrical, and mechanical; and is intended to give you basic troubleshooting guidelines.

Local conditions and operating methods may result in problems, causes and remedies not covered in this guide. To use the guide most efficiently, locate a problem that matches the one being experience and, in a step-by-step method, check the causes listed until the correct remedy is found and the problem solved.

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.

ENGINE TROUBLESHOOTING

When the temperature of diesel fuel is elevated, as occurs when the fuel is circulated through an operating engine, it may pose the following hazards which should be guarded against. Refer to the engine manual for troubleshooting instructions.

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.

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

Never shut off battery disconnect switch with the engine running. This could cause damage to the voltage regulator, alternator, and/or electrical system.

The following precautions should be taken to minimize the possibilities of injuries from heated diesel fuel:

1. Whenever possible, it is recommended that the engine and fuel be given an opportunity to cool down to ambient temperature before performing service operations which could result in the spillage of fuel from the engine or machine fuel system. When this is not possible, protective clothing (face shield, insulated gloves, apron) should be worn when performing these operations.

2. Keep open flames, sparks or other potential ignition sources away and do not smoke during vehicle refueling and service operations which could result in the escape of liquid or vaporized diesel fuel.

3. Engine or machine fuel systems service operations should be performed in a well ventilated area that is kept free of bystanders.

ELECTRICAL TROUBLESHOOTING

INSPECTION

Inspect the electrical system for clues to the malfunction. Check to see if the unit can be operated without further damage to the system. Always check these items before turning on switches or running the machine:

1. Look for bare wires that could cause grounds or shorts. Shorted wires can damage the charging system.

2. Look for loose or broken wires.

3. Inspect all connections, especially battery connection points. Cleaning harness connectors or ground connections can often correct what appears to be a malfunction.

4. Check the battery electrolyte level. Continued loss of electrolyte fluid indicates overcharging or cracked battery case.

5. Inspect for overheated parts after the unit has been stopped for a while. They will often smell like burned insulation. Put your hand on the alternator. Heat in these parts, when the machine has not been operated for some time, is a sure clue to charging circuit problems.

Many electrical failures cannot be detected even if the machine is started. If your visual inspection does not indicate the possible malfunction refer to the electrical system troubleshooting guide that follows.

Disconnect the battery before servicing this machine. Failure to do so could result in personal injury from accidental engine startup.

Never shut off battery disconnect switch with the engine running. This could cause damage to the voltage regulator, alternator, and/or electrical system.

The Electrical Schematic for this machine can be found behind the Electrical tab of the manual.

ELECTRICAL SYSTEM
TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	SOLUTION
Battery uses too much water	Cracked battery case. High Ambient Temperature. Shorted Cell. Battery being Overcharged.	Replace battery. Refill with water. Check specific gravity. Alternator problem. Check, repair or replace alternator.
Cracked Battery Case	Frozen battery	Keep battery fully charged in cold weather. Replace battery.
Low Battery Output	Low water level. Dirty or wet battery top causing discharge. Corroded or loose battery cables. Broken Battery post. Wrong size replacement battery.	Add distilled water. Clean and wipe dry battery top. Clean and tighten battery cables. Wiggle battery post by hand. If post wiggles or turns, replace battery. Replace battery with type specified under "Machine Specifications".
Starting Motor will not turn.	Defective ignition switch Bad helper solenoid Battery disconnect switch turned off. Corroded battery terminals.	Repair or replace. Replace Turn switch to "ON" position. Inspect and clean if necessary.
Hourmeter does not work.	Hourmeter Hourmeter relay Wiring harness shorted Corroded or failed hourmeter groundwire. Key switch and /or Battery Disconnect switch.	Replace Hourmeter. Check relay. Replace wiring harness. Replace groundwire. Make certain they are on.
Voltmeter does not work.	Voltmeter Wiring harness Regulator	Replace meter. Repair or replace. Repair or replace.
Engine Oil Pressure Gauge does not work.	Pressure Gauge Wiring harness.	Replace gauge. Repair or replace.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Engine Oil Pressure Gauge always reads "HIGH"	High Oil Viscosity	Drain and add correct oil as specified under "RECOMMENDED LUBRICANTS"
	Wiring harness	Check wiring harness. Repair or replace
	Engine Oil Pressure Gauge defective.	Repair or replace.
	Defective pressure sensor	Replace sensor
Engine Oil Pressure Gauge always reads "LOW"	Low oil level.	Stop engine, check level. If low fill to desired level.
	Low oil viscosity.	Drain and add correct oil as specified under "RECOMMENDED LUBRICANTS"
	Wiring harness	Repair or replace.
	Gauge defective.	Replace gauge.
	Defective pressure sensor.	Replace sensor.
Horn does not sound	Wiring Harness	Check harness, repair or replace.
	Connection at horn loose.	Tighten connection.
	Horn circuit breaker blown.	Reset circuit breaker, see page 98.
	Horn broken.	Check horn, repair or replace.
	Horn Switch.	Check switch, repair or replace.
Backup Alarm does not sound.	Wiring harness	Check harness, repair or replace.
	Connection at alarm loose.	Tighten connection.
	Backup Alarm	Check alarm, repair or replace.
	Backup Alarm switch not turned on	Turn on.
	Backup alarm switch faulty.	Check switch, repair or replace.
Travel Lights do not work.	Wiring harness	Check harness, repair or replace.
	Connection at light loose.	Tighten connection.
	Light circuit breaker blown.	Reset circuit breaker, see page 98
	Light switch defective.	Repair or replace switch.

PROBLEM	POSSIBLE CAUSE	SOLUTION
	Bulb or socket in light defective.	Replace bulb or socket.
Work Lights do not work.	Wiring harness	Check harness, repair or replace.
	Connection at light loose.	Tighten connection.
	Light circuit breaker blown.	Reset circuit breaker. See page 98
	Light switch defective.	Repair or replace switch.
	Bulb or socket in light defective.	Replace bulb or socket.
Cooling Fan not working	Loose connection at back of fan	Tighten.
	Loose connection on relay.	Tighten.
Brake Lights do not work	Wiring harness.	Check harness, repair or replace.
	Connection at light loose.	Tighten connection.
	Light Circuit breaker blown.	Reset circuit breaker. See page 98
	Bulb or socket in light defective.	Replace bulb or socket.
	Switch on main logic board in wrong position.	See Periodic Adjustments - Electrical for Main Board Settings.

HYDRAULIC SYSTEM

Particularly after start-up of an installation, components should be checked regularly at short intervals for correct operation and possible leakage.

INSPECTION

Inspect the hydraulic system for clues to the malfunction. Check to see if the unit can be operated without further damage. If not, shut down machine immediately. Always check these items before starting the machine:

1. Check hydraulic oil level.

2. Look for loose or disconnected hoses. An oil spot below the machine is a good indication of a loose hose or hydraulic component.

3. Make certain shut-off valve is OPEN. Opening valve can often correct what appears to be a malfunction.

4. Inspect all vital hose connections, especially at main pump and the main pump hose connection at the manifold.

5. 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.

Tighten fittings only when system is not pressurized. High pressure leaks can cause personal injury.

While machine is running, and before working, inspect for leaks. If the machine has not been run for some time, oil may thicken causing a variety of malfunctions. If this is true, make certain that the oil tank has been properly drained, cleaned and refilled.

If your visual inspection does not indicate the possible malfunction, refer to the troubleshooting guide that follows.

FLUID CONTAMINATION

Contamination comes in many forms. It may be air, water and cutting oils, rust, chips and grit. It is usually easier to keep contaminants **out** of a system rather than remove them after they are **in** the system.

Bulk handling and the re-use of oil containers almost guarantees you that "new" oil will be dirty. Make it a practice to filter all "new" oil before adding it to your system. Make it another practice to change filters on a regular basis **before** they become clogged.

LOCATING LEAK SOURCES

Petroleum oils are used in most hydraulic application to lubricate parts as well as transmit power. As oil temperature increases, however, the lubricating film thins out. The result is rubbing parts supported by the oil film move closer together; friction and wear increase; seal materials age more quickly, become stiff and hard, and may readily permit leakage.

The first step in locating leaks is to eliminate the possibility that an over-filled reservoir or spill created the "suspected" leak. The next step would be to clean the suspected area

and watch. Leaks usually occur in fittings, hoses, O-rings, and other seals.

Most leaks occur at fittings, but too often, finding the fitting that is leaking is difficult because the fluid runs along the hose and drips off at some other point. Leaks in high pressure lines sometimes are difficult to pin-point because the fluid comes out as a mist.

Once you find the location of a leak, the specific cause has to tbe determined before it can be corrected. A scratch in a fitting seat or a cut in a seal lip that is big enough to leak excessively can still be too small to find with the naked eye. The use of a magnifying glass would assist you.

HOSE LIFE

Hose leakage or failure many times occurs where the end fitting grips the hose. Check the system for pressure spikes or surge. If bulges or bubbles occur on a flexible hose, a leak is taking place within the layers. The hose should be replaced.

High oil temperatures (over 200 degrees Fahrenheit, 93 degrees Celsius) quickly harden or stiffen a rubber hose. When pressure pulses flex a hardened hose, it fails by cracking. Every increase of 25E F (14EC) cuts hose life in half. Use a replacement hose rated for actual fluid temperatures. Keep a log of hose use so replacement can be made before failure occurs.

If a hose is installed with a twist in it, high operating pressures tend to force it straight. This can loosen the fitting or even burst the hose at the point of the strain.

The Functional Hydraulic Schematic for this machine can be found at the back of this TROUBLESHOOTING section and behind the tab entitled “Hydraulics”.

HYDRAULIC SYSTEM
TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
Hydraulic pump does not develop pressure	Pump switch turned off.	Turn on pump.
	No hydraulic oil in tank (NOTE: if pump is run without oil in tank, pump damage will occur.)	Check oil level. Refill tank.
	Shut-off valve closed. (NOTE: if pump is run with valve closed, pump damage will occur.)	Open valve completely.
	Main relief valve bypassing. (NOTE: oil blowing past any relief valve can cause oil to overheat.)	Increase pressure setting on relief valve. (See Pressure checks)
	Main pump compensator setting is too low.	Adjust compensator setting. (See Pressure Checks)
	Pump is defective.	Refer to pump manual or replace pump.
	Destroke valve stuck.	Repair or replace.
Hydraulic pump excessively noisy	Cold oil.	Allow unit to warm up.
	Low oil level.	Check and add oil.
	Oil viscosity too high (oil too thick)	Drain and add correct oil as specified under "RECOMMENDED LUBRICANTS".
	System relief valve set too low.	Increase pressure setting on relief valve (see Pressure Checks)
	Intake hose to pump restricted.	Inspect and repair.
	Defective pump.	See pump manual, repair or replace pump.
Machine will not propel	Main pump not developing pressure.	See above.
Hydraulic Oil Overheats	Oil viscosity too high (oil too thick)	Drain and add correct oil as specified under "RECOMMENDED LUBRICANTS".
	System relief valve set too low.	Increase pressure setting on relief valve (see Pressure Checks)
	Oil lines damaged causing excessive internal restriction	Inspect and repair.
Hydraulic Oil Foams	Water in oil	Inspect oil for water. Drain and

PROBLEM	POSSIBLE CAUSE	SOLUTION
		add correct oil as specified under "RECOMMENDED LUBRICANTS".
	Using wrong oil	Drain and add correct oil as specified under "RECOMMENDED LUBRICANTS".
	Low hydraulic level	Fill
	Damaged hydraulic oil lines	Inspect, repair or replace.
	Air leak in suction line to hydraulic pump or pump shaft seal leaking	Inspect, repair or replace.
Hydraulic Oil Filter Restriction Indicator Light stays on all the time (optional equipment)	Restricted hydraulic oil filter.	Replace filter.
	Hydraulic oil filter restriction switch	Replace switch.

MECHANICAL TROUBLESHOOTING

INSPECTION

Inspect the mechanical system for clues to the malfunction. Check to see if the unit can be operated without further damage.

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.

MECHANICAL SYSTEM
TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
Machine will not propel.	Pump not developing pressure.	See Hydraulic Troubleshooting.
	Drive Axle Clutch Not Engaged.	Engage clutch.
	Propulsion valve not shifting.	Check wiring connections at valve. Repair or replace valve.
	Defective motor or broken drive chain.	Repair or replace motor or chain.
Lift Cylinder does not operate.	WORK/TRAVEL switch in **TRAVEL** position.	Put WORK/TRAVEL switch in the **WORK** position.
	Circuit Breaker Tripped.	Determine cause of electrical overload and correct.
	Defect in relay logic.	Troubleshoot relays. Should be done by qualified technician. Refer to Logic Sequence Chart at end of section.
	No hydraulic pressure.	See Hydraulic Troubleshooting.
	Pressure relief valve not in adjustment.	Adjust valve. Refer to Maintenance and Service Section for correct adjustments to this valve.
	Compensator not set correctly.	Adjust compensator. Refer to Maintenance and Service Section for correct settings.
Lift Cylinder does not extend when pushing “Extend” button on Remote Control	Extend Timer not set correctly.	Check pots inside Main Control Panel Box. Adjust as required. Refer to ***Extend Timing Adjustments*** in the Machine

PROBLEM	POSSIBLE CAUSE	SOLUTION
		Set-Up Section of this Manual.
	Faulty or defective pushbutton.	Repair or replace Extend button on remote control.
Clamp Cylinder does not operate.	WORK/TRAVEL switch in **TRAVEL** position.	Put WORK/TRAVEL switch in the **WORK** position.
	Circuit Breaker Tripped.	Determine cause of electrical overload and correct.
	Defect in relay logic.	Troubleshoot relays. Should be done by qualified technician. Refer to Logic Sequence Chart at end of section.
	No hydraulic pressure.	See Hydraulic Troubleshooting.
	Pressure relief valve not in adjustment.	Adjust valve. Refer to Maintenance and Service Section for correct adjustments to this valve.
	Compensator not set correctly.	Adjust compensator. Refer to Maintenance and Service Section for correct settings.
	Pressure reducing valve not in adjustment or defective.	Adjust valve to proper setting or repair or replace valve.
Clamps do not hold rail.	Blown seal in Clamp Cylinder.	Inspect cylinder. Replace seal(s).
	Clamp cylinder lock valve not functioning properly.	Inspect wiring connections. Inspect valve. Repair or replace if necessary.

FUNCTIONAL SEQUENCE CHART

The Functional Sequence Chart shows the sequence of lit LED's as certain machine functions occur. All the LED's are listed across the top of the table. The action or function of the machine is listed, along the side of the table, in the order is which they occur.

LS AUTO-LIFT SEQUENCE CHART
S/N 500 AND ABOVE

	SWITCHES										VALVE SOLENOIDS									RELAYS					
MODE FUNCTION	CLAMPS ON (PS1)	START CYCLE (PB4/PB5)	LEFT EXTEND (PB2)	LEFT DOWN (LS1)	LEFT UP (LS3)	FORWARD PROPEL (S8/S9)	RIGHT EXTEND (PB3)	RIGHT DOWN (LS2)	RIGHT UP (LS4)	REVERSE PROPEL (S8/S9)	LEFT RAM DOWN	LEFT RAM UP	FORWARD PROPEL	CLAMPS ON	CLAMPS LOCK	RIGHT RAM DOWN	RIGHT RAM UP	REVERSE PROPEL	CLAMPS OFF	START (CR3)	PROPEL ENABLE (CR4)	CLAMPS (CR5)	LEFT EXTEND (TDR6)	LIFT (CR7)	RIGHT EXTEND (TDR8)
WORK MODE																									
PROPELLING FORWARD					●	●			●				●						●		●				
RELEASE EITHER PROPEL SWITCH					●				●					●	●										
CLAMPS CLOSED (ON)	●				●				●					●	●										
PUSH START CYCLE BUTTON	●	●			●				●		●			●	●	●				●				●	
RAMS GOING DOWN	●										●			●	●	●				●				●	
LEFT RAM DOWN	●			●										●	●	●				●				●	
RIGHT RAM DOWN	●			●				●						●	●					●				●	
PUSH BOTH PROPEL SWITCHES FORWARD	●			●		●		●				●		●	●		●				●				
RAMS GOING UP						●						●		●	●		●				●				
LEFT RAM UP					●	●								●	●		●				●				
RIGHT RAM UP - CLAMPS OPEN (OFF)					●	●			●										●		●	●			
PROPELLING FORWARD					●	●			●										●		●	●			
OVERRIDE																									
PUSH LEFT EXTEND BUTTON			●	●				●			●			●	●					●				●	
LEFT RAM EXTENDED (TIMED)				●				●						●	●					●			●	●	
PUSH RIGHT EXTEND BUTTON				●			●	●				●		●	●					●				●	
RIGHT RAM EXTENDED (TIMED)				●				●						●	●					●				●	●
TRAVEL MODE																									
CLAMPS UP														◎	◎										
CLAMPS DOWN																				◎					
LIFT CYLINDER UP												◎					◎								
LIFT CYLINDER DOWN											◎					◎									
LEFT TRAVEL SWITCH - FORWARD						◎							◎												
LEFT TRAVEL SWITCH - REVERSE										◎								◎							

"●" INDICATES VALVE SOLENOID OR RELAY COIL ENERGIZED OR SWITCH ACTUATED (LIMIT SWITCHES ARE ACTUATED WHEN SWITCH LEVER IS MOVED BY CAM - WORK MODE

"◎" INDICATES VALVE SOLENOID ENERGIZED DIRECTLY BY SWITCH ON FRONT OF CONTROL BOX - TRAVEL MODE

LIFT CYCLE IS SHOWN FOR FORWARD PROPEL. LEFT CYCLE IS THE SAME FOR REVERSE PROPEL BUT MACHINE WILL MOVE IN THE OPPOSITE DIRECTION

WHEN MACHINE IS IN THE DUAL WORK MODE, BOTH PROPELLING SWITCHES MUST BE HELD TO PROPEL MACHINE. ONLY THE LEFT START CYCLE SWITCH WILL START THE LIFT CYCLE. BOTH SIDES WILL LIFT.

WHEN THE MACHINE IS IN THE SINGLE WORK MODE, ONLY THE PROPEL & CYCLE START SWITCHES ON THE SELECTED SIDE (RIGHT OR LEFT) WILL START THE LIFT CYCLE, AND ONLY THE SELECTED SIDE WILL LIFT.

IN TRAVEL MODE, ONLY THE LEFT PROPEL SWITCH WILL PROPEL THE MACHINE.