Ground Hog

Ballast Regulator

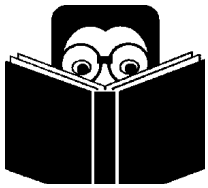
OPERATION AND MAINTENANCE MANUAL

August 2000
Re-Order: PB-81

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, 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) 769-4605 sales@nordco.com **Oshawa, Ontario, Canada** (905) 579-4058, Ext. 24 oshsales@nordco.com
NORDCO Parts:	(414) 769-4607/4608 1-800-647-1724 parts@nordco.com
NORDCO Service:	(414) 769-4603 1-800-445-9258 service@nordco.com
Customer Support:	(414) 769-4601 support@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:

Manager of Customer Support
NORDCO Inc.
P.O. Box 1562
Milwaukee, WI 53201
Or
Support@nordco.com

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.
P.O. Box 1562
Milwaukee, WI 53201

Fax:(414) 481-3199
Tele:(414) 769-4631
operations@nordco.com

CONTENTS

OPERATION

- Continued on Next Page -

CONTENTS

MAINTENANCE AND SERVICE

TROUBLESHOOTING

APPENDICES

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

4. Safety glasses, safety boots, hearing protection, and a hard hat should be worn at all times.

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. 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.

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

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

5. 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.

6. 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.

7. 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.

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

9. Keep steps, walkways, and the top of the turntable clear and free of oil, ice, mud, ballast, tools and other loose objects.

10. When mounting and dismounting the machine, use the handrails and steps provided. Do not climb onto the machine in any other manner.

11. Only the number of riders for which seats are available are allowed on this machine during work or travel operations. DO NOT ALLOW RIDERS ON THIS MACHINE IF SEATS ARE NOT AVAILABLE.

12. **Never** change the direction of work travel without first bringing the machine to a complete stop.

SAFETY DURING TRAVEL

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

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

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

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

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

5. **Never** change direction of travel without bringing the machine to a complete stop.

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

MACHINE SAFETY ALERTS

WARNING ALERTS
Failure to engage all lockup devices before propelling at travel speed can result in injury to personnel and/or extensive damage to the machine.
Tighten fittings only when system is not pressurized. High pressure leaks can cause personal injury.
Always turn off machine when performing maintenance, making adjustments, or whenever unintended movement of machine could occur; unless directed otherwise. Failure to comply could result in personal injury and/or damage to the machine.
Exhaust emissions caused by the use of the engine on this machine may cause cancer, birth defects, or other reproductive harm if inhaled.
Disconnect the battery before servicing this machine. Failure to do so could result in personal injury from accidental engine startup.
You must always use the air treadle or parking brake to stop this machine while in the Travel Mode. Failure to do so may cause personal injury or machine damage.

MACHINE SAFETY ALERTS

CAUTION ALERTS
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.

LOCKOUT AND/OR TAGOUT PROCEDURES

It is your company's responsibility to develop **Lockout/Tagout Procedures**, 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!**

This machine is completely locked out when the ignition switch and battery disconnect switch have been turned to the "OFF" position and their respective covers closed and locked. HOWEVER, some energy is stored in the hydraulic components of this machine; and these must be relieved of pressure prior to service and maintenance.

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.**

ENERGY SOURCES

The list on the following pages provides information on energy sources located on this machine and instructions for inserting manual lockups, if applicable. It is your company's responsibility to incorporate these instructions into their **Lockout/Tagout Procedures.**

IMPORTANT NOTICE!

This machine may have been equipped with both **Manual** and **Power Lockup** devices. Read the energy source information closely and DO NOT ASSUME ALL LOCKUPS ARE POWERED.

LOCKOUT/TAGOUT – PROCEDURES

When servicing or performing maintenance on:	Energy Source to be locked out:	Use this procedure:
Electrical System (Control Panel, Battery, and Wiring Harnesses,)	Electrical	1) Turn the ignition switch to the OFF position. 2) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off electrical power supply to the machine.**
Engine	Electrical	1) Turn the ignition switch to the OFF position. 2) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off electrical power supply to the machine and prevent accidental startup of engine while servicing.**
Propulsion System	Hydraulic	1) Turn the ignition switch to the OFF position. 2) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components of the machine.**
Ballast Plow	Hydraulic Gravity	1) Lower plow until it rests on solid ground. 2) Turn the ignition switch to the OFF position. 3) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components of the machine.**
Ballast Wings	Hydraulic Gravity	1) Lower wing(s) until it (they) rests on solid ground. 2) Turn the ignition switch to the OFF position. 3) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components of the machine.**
Broom	Hydraulic Gravity	1) Raise Broom. Depending on options on the machine, either insert lock pins at Up/Down Cylinder, or lock the broom in the UP position by pressing the lock valve button on the control panel. 2) Tilt broom back and lock in place with lock chains. 3) Turn the ignition switch to the OFF position. 4) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components.**
High Speed V-Plow	Hydraulic Gravity	1) Lower plow until it rests on solid ground. 2) Turn the ignition switch to the OFF position. 3) Turn the battery disconnect switch to the OFF position and close

When servicing or performing maintenance on:	Energy Source to be locked out:	Use this procedure:
		and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components of the machine.**
High Speed One-Way Plow	Hydraulic Gravity	1) Lower plow until it rests on solid ground. 2) Turn the ignition switch to the OFF position. 3) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components of the machine.**
Multi-Position Plow	Hydraulic Gravity	1) Lower plow until it rests on solid ground. 2) Turn the ignition switch to the OFF position. 3) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components of the machine.**
Side Wing (Long Reach)	Hydraulic Gravity	1) Lower wing until it rests on solid ground. 2) Turn the ignition switch to the OFF position. 3) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components of the machine.**
Snow Screw and Blower	Hydraulic Gravity	1) Raise Unit. Depending on options on the machine, either insert lock pins at Up/Down Cylinder, or lock in the UP position by pressing the lock valve button on the control panel. 2) Tilt unit back and lock in place with lock chains. 3) Turn the ignition switch to the OFF position. 4) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components.**
Stone Deflector	Hydraulic Gravity	1) Raise Unit. Depending on options on the machine, either insert lock pins at Up/Down Cylinder, or lock in the UP position by pressing the lock valve button on the control panel. 2) Tilt unit back and lock in place with lock chains. 3) Turn the ignition switch to the OFF position. 4) Turn the battery disconnect switch to the OFF position and close and lock the disconnect switch box. **This will cut off hydraulic pressure to hydraulic components.**
Transmission	Hydraulic Gravity	
Brakes	Hydraulic Gravity	

GENERAL

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

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

ABOUT THIS MANUAL

This manual has been broken down into sections which have been separated by index tabs. Contents of these sections are as follows:

TAB	CONTAINS
Operation	Includes all information necessary to set up and operate the machine.
Maintenance	Includes lubrication, maintenance, and mechanical adjustment instructions**.**
Troubleshooting	Includes basic troubleshooting for all components on the machine, as well as functional hydraulics, electrical schematics, and cabling locations.
Appendices	Contains information that is subject to periodic updating or has been pre-printed. Refer to the Table of Contents for appendices included in this manual.
Mechanical	Includes individual parts breakdown drawings and lists for each assembly
Hydraulic	Includes all piping and functional drawings for a standard machine; for optional equipment that requires additional drawings, see tab “Customer Options”.
Pneumatic	Includes all pneumatic drawings for a standard machine; for optional equipment that requires additional drawings, see tab “Customer Options”.
Electrical	Includes all electrical schematics, electrical boxes, remote control boxes, cables and cabling layout 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

The specifications that following include **Customer Selectable Features** such as the engine. This means that an engine is required to run the machine, but the customer has a choice as to what type of engine they want to have installed. This differs from **Optional Equipment** such as a remote engine drain system. Optional equipment are those items that are not considered a vital operating part to the machine, but the customer wants them installed. Sheets 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

Weight
- Ballast Regulator ..... 51,000 lbs (20,411 kg)*
- Ballast Regulator/Snow Clearing Machine (Except w/V-Plow) ..... 55,000 lbs (21,318 kg)*

Length
- Ballast Regulator ..... 33 Feet (9.44 m)
- Snow Clearing Machine with Multi-Position Plow ..... 34 Feet (9.44 m)
- Snow Clearing Machine with V-Plow ..... 36 Feet (9.44 m)

Width (with side plows retracted) ..... 10 feet 2 inches (3.12 m)
Height ..... 12 feet (3.65 m)
Travel Speed on Rail ..... 35 mph (56 km/h) maximum
Travel Speed on Rail (with Option) ..... 50 mph (80 km/h) maximum
Rated Draw Bar Pull (On Rail) ..... 15,000 lbs. (6803 kg)
Turntable ..... Hydraulically Operated - Rail to Rail
Wheel Base ..... 174 inches (4.11m)
Towing Speed ..... 35 mph (56 km/h) maximum (See towing procedure)

CAPACITIES

Fuel Tank
- Standard ..... 105 Gallons (340 liters)
- Second Optional Tank ..... 50 Gallons (144 liters)

Hydraulic Oil Tank ..... 105 gallons (432 liters)
Oil Cooler ..... 30 gpm (114 L/mn)

ENGINE

Make/Model ..... Cummins Diesel
Type M11-6
Continuous BHP ..... 300 HP @ 2100 RPM

HYDRAULIC SYSTEM

Pressure Settings:
- Relief Valve - Track Drive ..... 5000 psi (345 bar)

Main Pump (_____GPM) Mfr. .....
Relief Cartridge (Valve Banks) ..... 2500 psi (172 bar)

PNEUMATIC SYSTEM

Engine Mounted Compressor ..... 10.3 cfm @ 120 psi
- Unloading Valve ..... 90 psi/110 psi

Relief Valve ..... 150 psi
Tanks ..... 1 @ 20 gallons
Air Dryer ..... C/R Turbo 2000, with Heater

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..... Two 12 Vdc, 1300 Cold Cranking Amps
Alternator .....160 AMP
Ground..... Negative

DRIVE SYSTEM

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

AXLE/WHEELS

Axle Size.....5-inch
Wheel Type.....Forged Steel
Wheel Size.....24 inch (60 cm) diameter
Brake Type.....Cast Iron or Sintered Shoe

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.
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.

Call in your orders to: NORDCO PARTS SALES DEPARTMENT

Milwaukee:
Telephone: (414) 769-4607
Telephone: (414) 769-4608
Telephone: (800) 647-1724
Fax: (414) 769-2140
e-mail: parts@nordco.com

Oshawa:
Telephone: (905) 579-4058, Ext. 24
Telephone: (905) 579-8422
Fax: (905) 725-6887
e-mail: oshsales@nordco.com

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.

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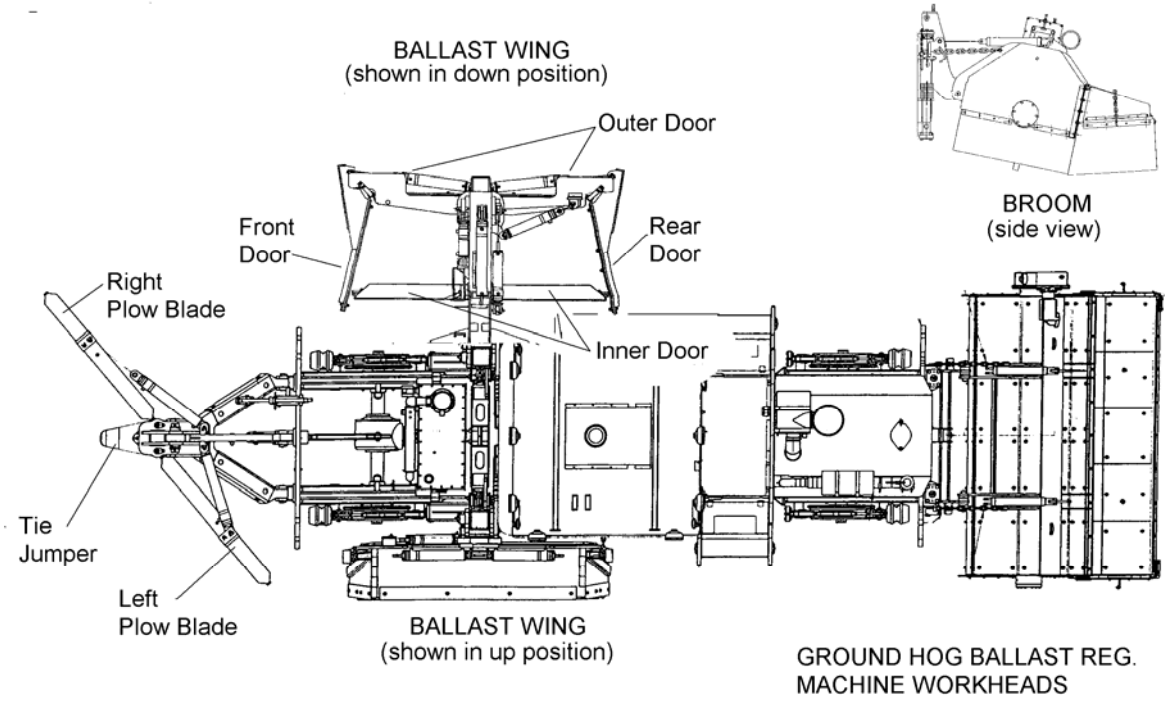
Before operating this machine, read and understand the Safety Section of this Manual.

BEFORE OPERATION

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

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



The controls for the Ground Hog are located in various areas of the Operator Cab, and in some instances are located remotely on this machine. Refer to the following pages for information and location of the controls.

BALLAST WING

The ballast wing is designed to transfer ballast from the toe line to the shoulder, the shoulder to the toe line, or carry ballast from one location to another. It consists of front, rear, outer and inner doors. The Inner and Outer doors are tiltable. The outer door rotates. The front and rear doors rotate to be able to form a box with the inner door or in-line with the outer door.

When not in use the ballast wing is pivoted up and locked in place with a mechanical lockup.

BROOM

The broom is designed to remove ballast from the top of the ties. It can be adjusted in height and tilt by separate controls in the operator cab. On some machines, as an option, the broom is bi-directional - meaning it functions in forward travel or reverse, by use of a button in the operator station.

STONE DEFLECTOR

The stone deflector deflects broomed ballast and distributes it across the track to fill in voids in the cribs.

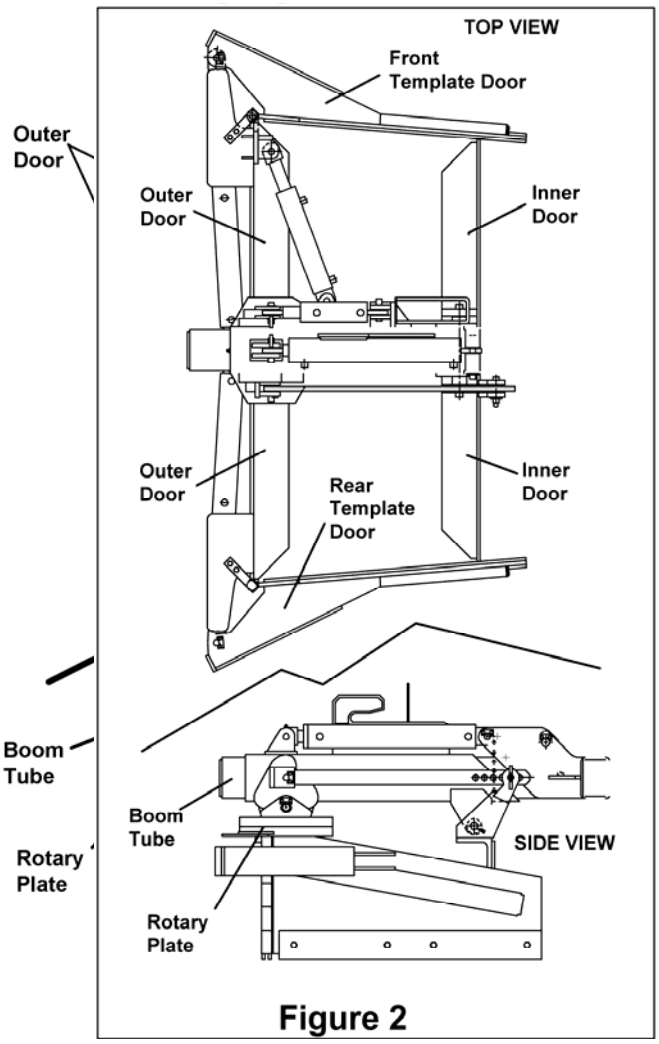
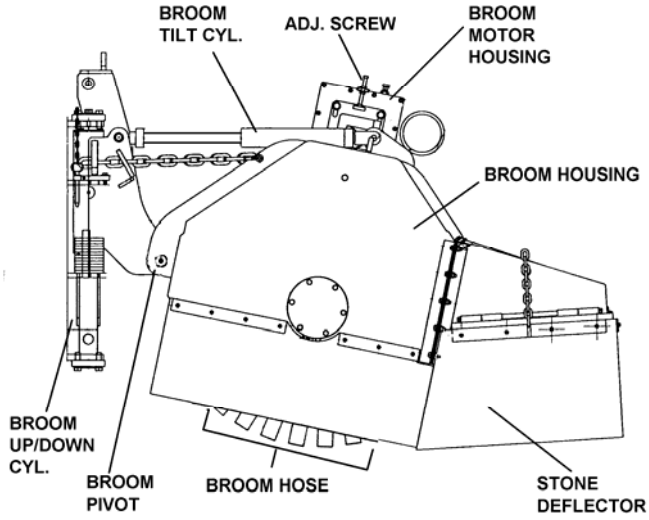


Figure 2



FRONT BALLAST PLOW

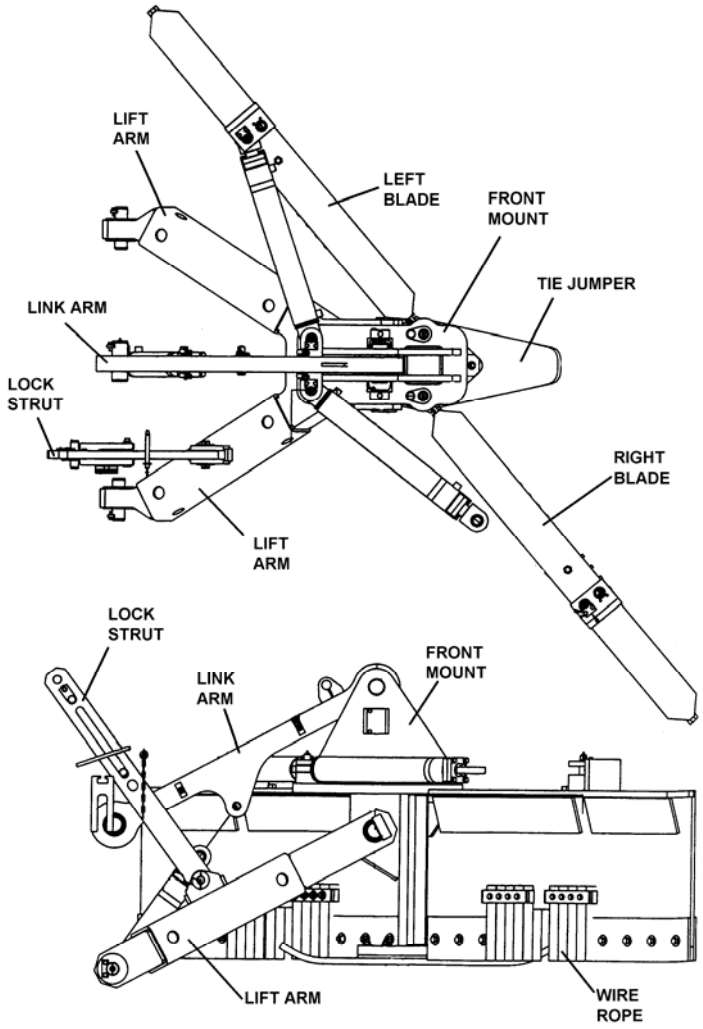
The purpose of the front ballast plow is to 1) transfer ballast from one side of the track to the other; 2) transfer ballast from the inside of the rails to the outside of the rails (or outside to inside); or 3) eliminate windrows. It consists of a left and right plow blade, the position of each blade is individually set by controls in the operator cab.

A lift cylinder controls the height of the plow and does not allow for separate control of the height for the left and right blades.

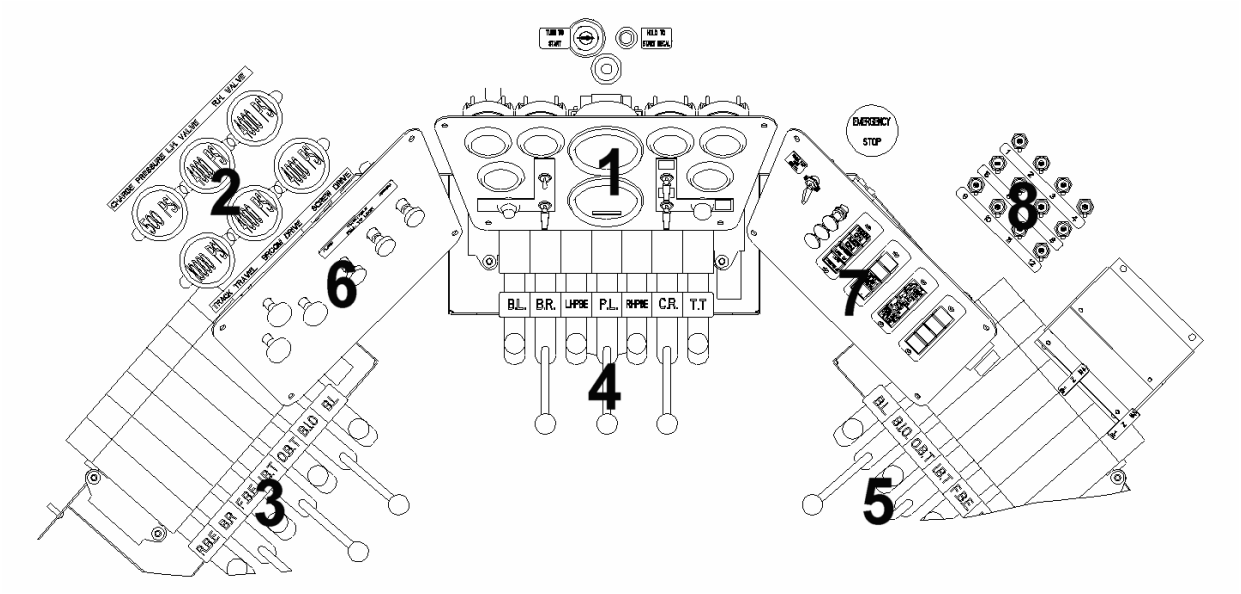
The rubber hoses on each of the blades are designed to sweep ballast away from the rail base and tie plates.

The tie jumper allows for smooth travel over ties during the ballast plowing operation.

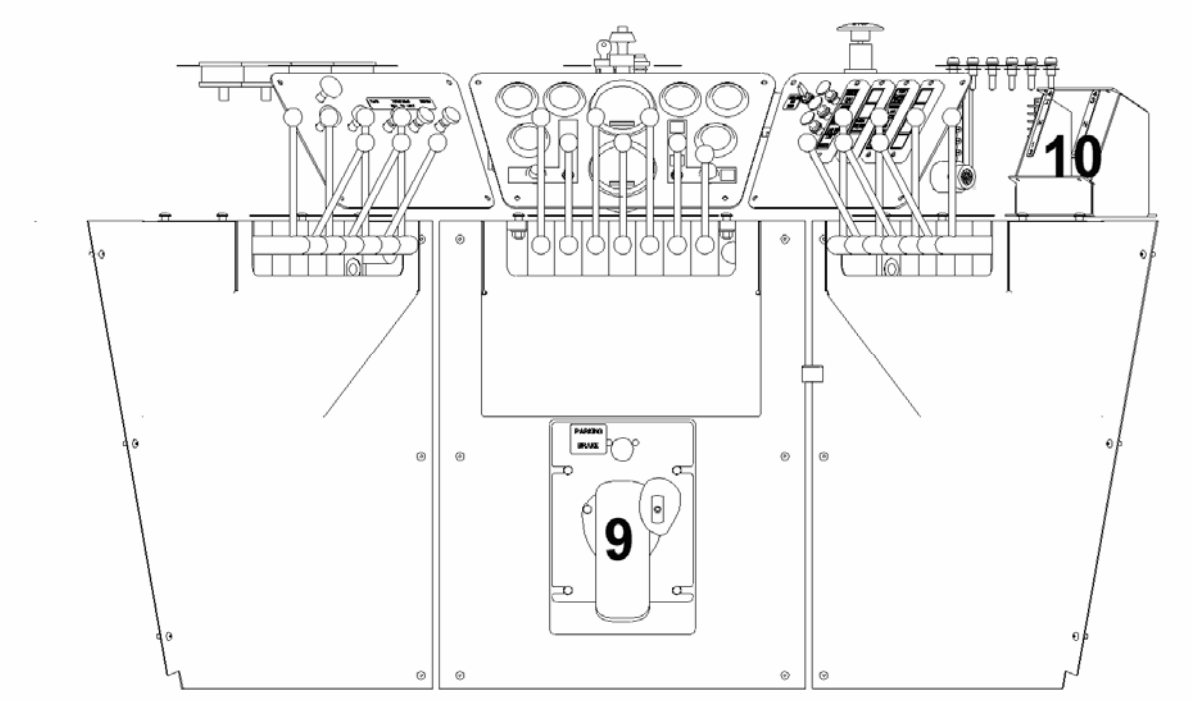
Two manual adjusting screws on the front plow carrier frame (not shown) allow the operator to lock the plow height in at a set height.



MAIN CONTROL CONSOLE



TOP VIEW

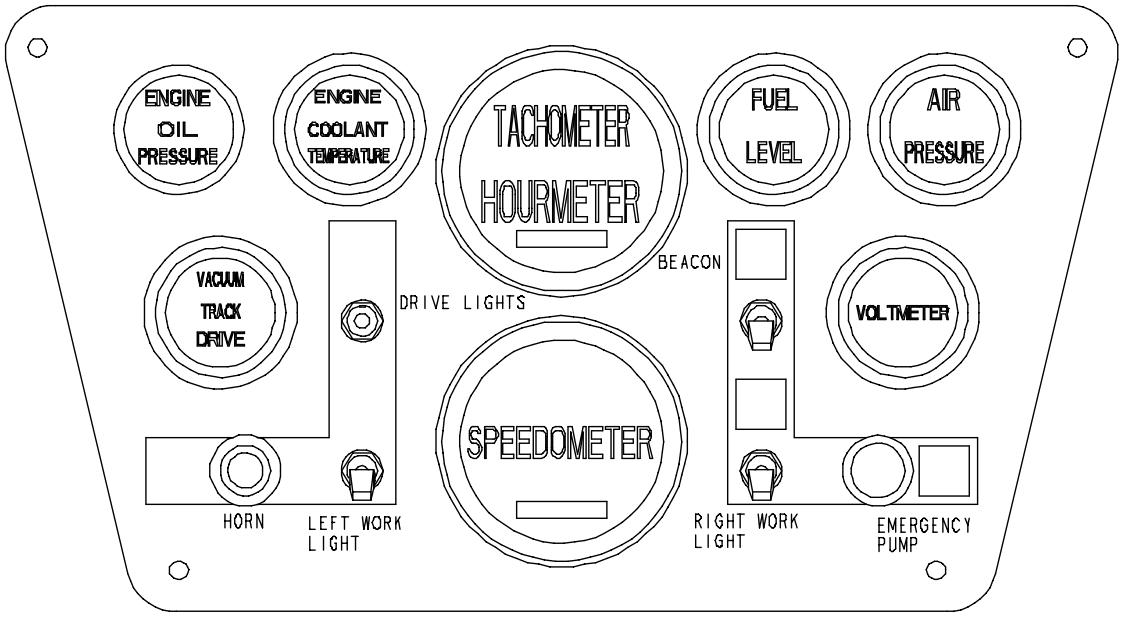


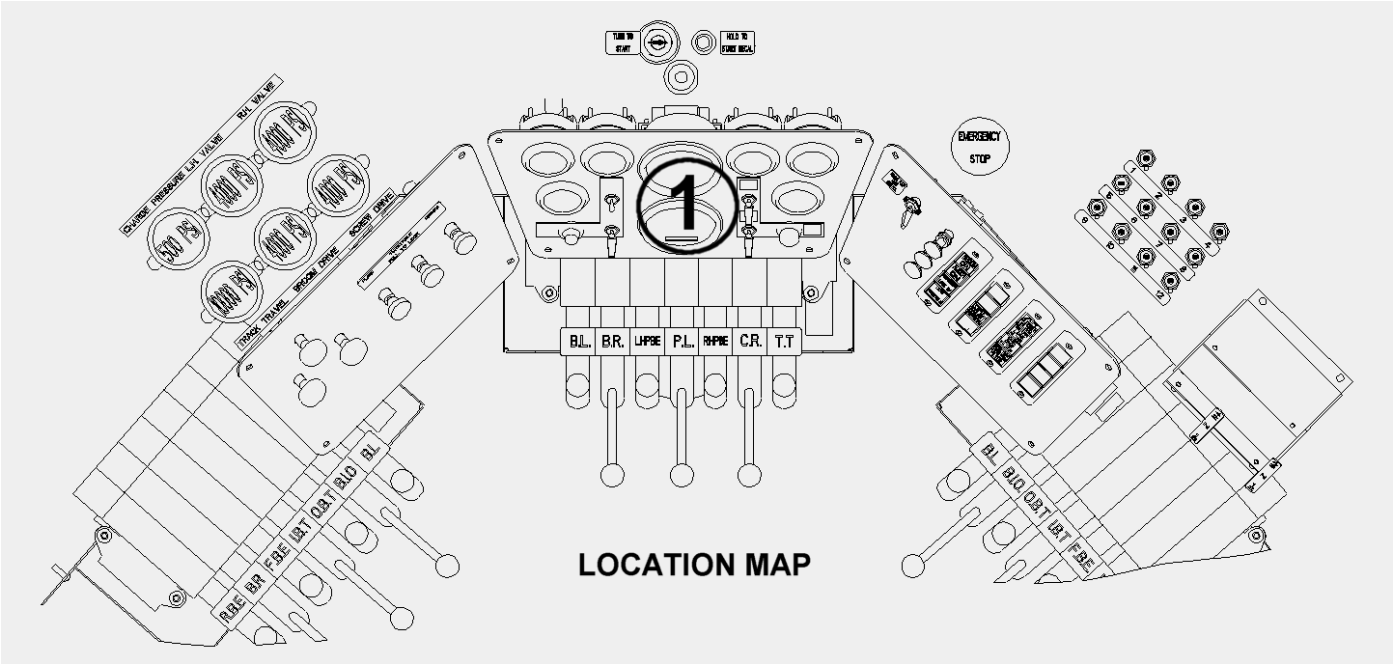
FRONT VIEW

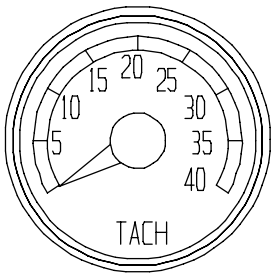
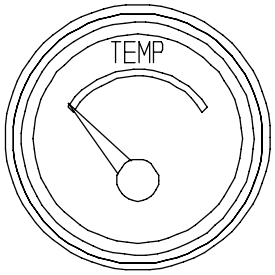
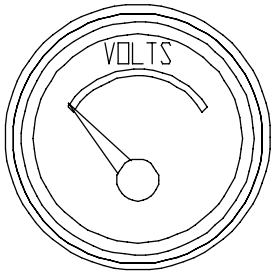
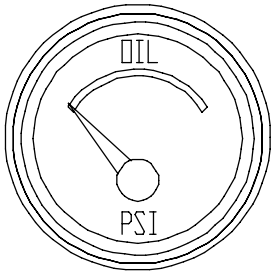
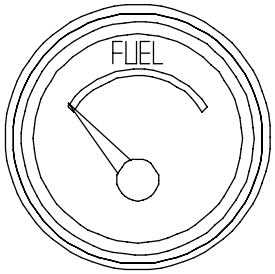
Refer to Table # for description of control functions

TABLE	TABLE NAME	CONTROLS
1	Engine Controls	Engine and Pumps
2	Working Pressure Gauges	Pressure status of equipment
3	Left Valve Bank	Left ballast plow
4	Center Valve Bank	Front plow blades, broom and turntable
5	Right Valve Bank	Right ballast plow
6	Wipers	Wipers and
7	Warning Light Panel	Status indicating lights for components on machine
8	Pump, Lights, and Horns	
9	Brake Controls	Foot pedal and parking brake use
10	Track Drive Controls	

TABLE 1. MAIN CONTROL CONSOLE
ENGINE AND PUMP CONTROLS AND GAUGES





INSTRUMENT OR CONTROL	SYMBOL	FUNCTIONAL DESCRIPTION
 **TACHOMETER/ HOURMETER**		Indicates engine speed in hundreds of rpm. Block numbers on gauge indicate engine hours.
 **Engine TEMPERATURE Gauge**		Indicates temperature of engine or cooling system. Normal reading is 160° to 185° F (71° - 85° C) for water cooled engines.
 **VOLTMETER**		Indicates voltage of battery. Normal reading 13-15 volts.
 **Engine OIL PRESSURE Gauge**		Indicates oil pressure. Does not indicate oil level. Measurement in psi graduations. Normal reading is 40-60 psi (3-4 bar).
 **FUEL GAGE**		Measures the level of diesel fuel in the fuel tank. Do not allow to go into the red zone.

INSTRUMENT OR CONTROL	SYMBOL	FUNCTIONAL DESCRIPTION
SPEEDOMETER GAGE		
AIR PRESSURE GAGE		
VACUUM GAGE		
STARTER SWITCH		
PRESS AND HOLD TO START BUTTON		
ETHER QUICK START BUTTON (Optional)		
NORMAL ENGINE STOP BUTTON		

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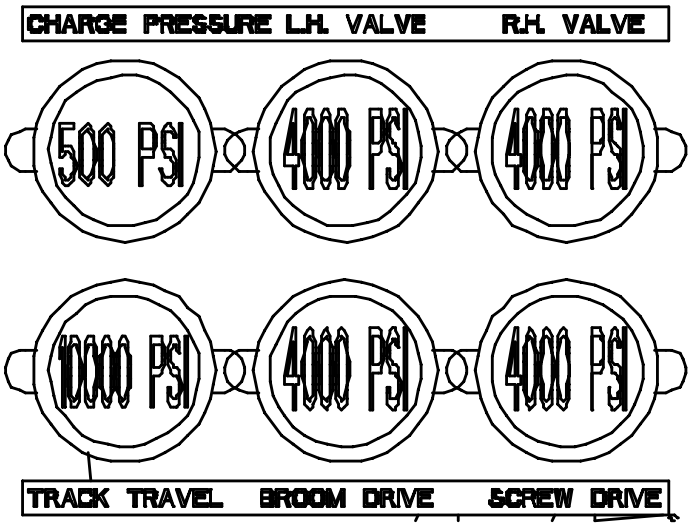
TABLE 2. CENTER CONTROL CONSOLE
WORKING PRESSURE GAUGES



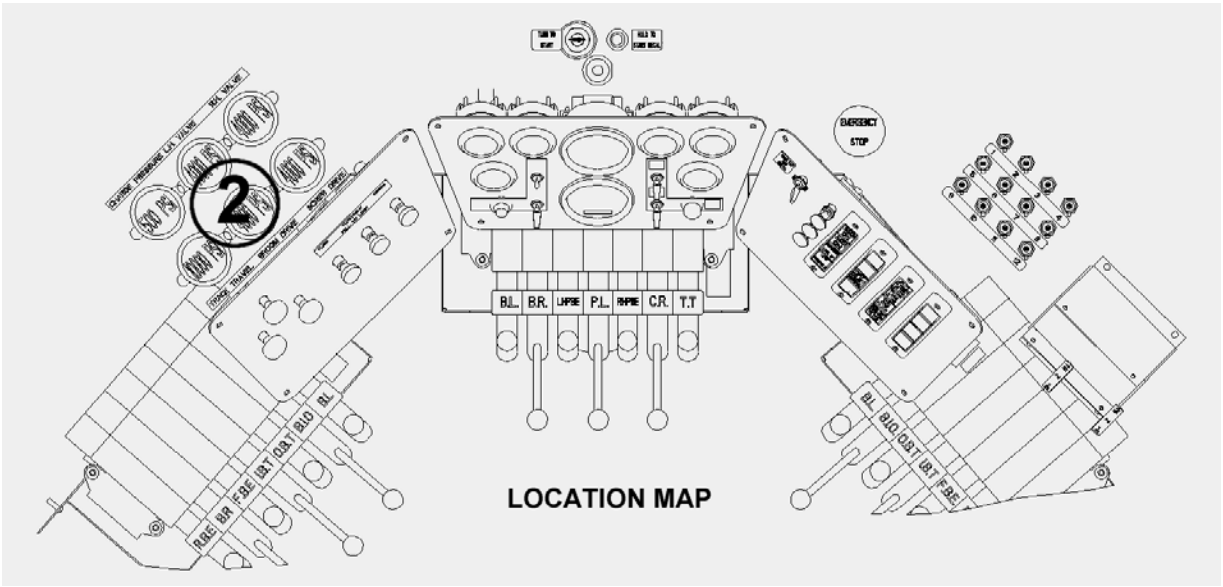
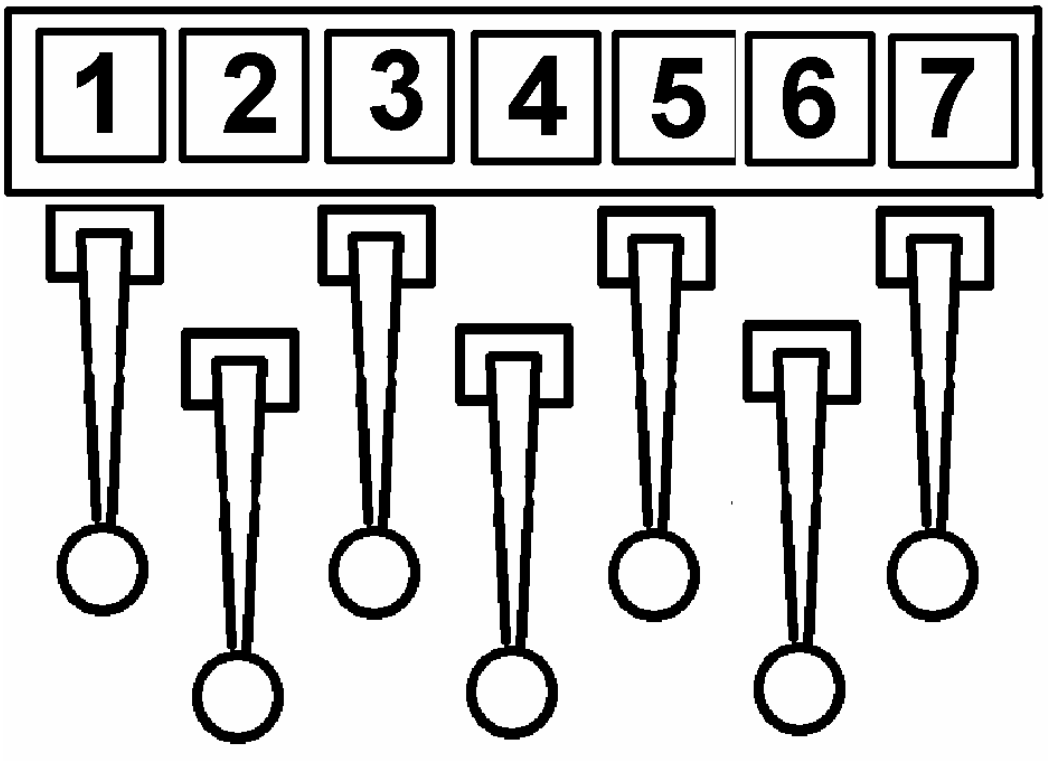


TABLE 2. CENTER CONTROL CONSOLE
WORKING PRESSURE GAUGES

INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
CHARGE PRESSURE	
LH VALVE BANK	
RH VALVE BANK	
TRACK DRIVE	
SCREW DRIVE	
BROOM DRIVE	

TABLE 3. HYDRAULIC CONTROLS
LEFT VALVE BANK



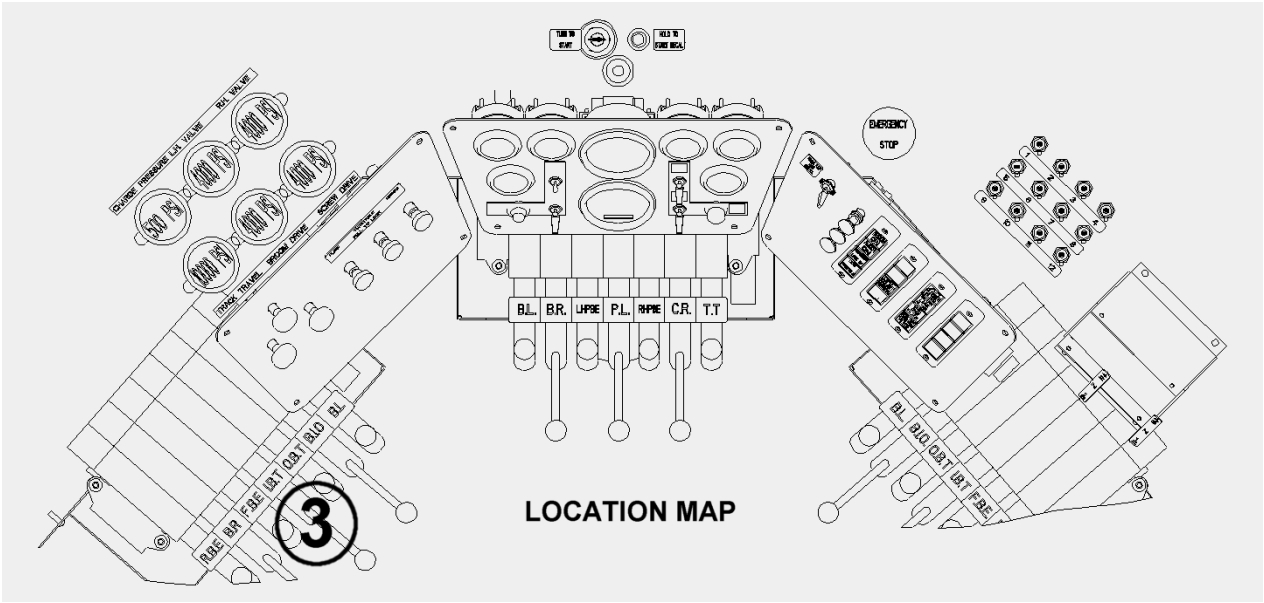
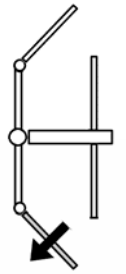
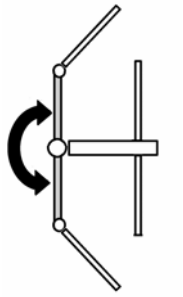
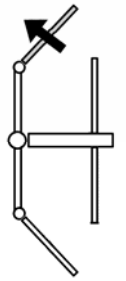
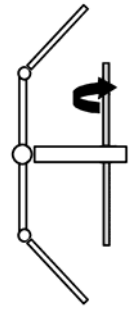
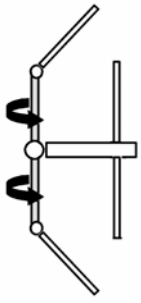


TABLE OP-3. HYDRAULIC CONTROLS LEFT VALVE BANK

ITEM #	SYMBOL	CONTROLS	FUNCTIONAL DESCRIPTION
1		**Rear Door Extend** Push - Release - Pull -	 Extends Rear Door Movement stops at last position Retracts Rear Door
2		**Outer Door Rotate** Push - Release - Pull -	 Rotates Outer Door Clockwise (CW) Movement stops at last position Rotates Outer Door Counterclockwise (CCW)
3		**Front Door Extend** Push - Release - Pull -	 Extends Front Door Movement stops at last position Retracts Front Door
4		**Inner Door Tilt** Push - Release - Pull -	 Tilts Inner Door Out Movement stops at last position Tilts Inner Door In
5		**Outer Door Tilt** Push - Release - Pull -	 Tilts Outer Door In Movement stops at last position Tilts Outer Door Out

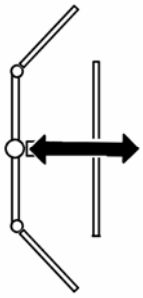
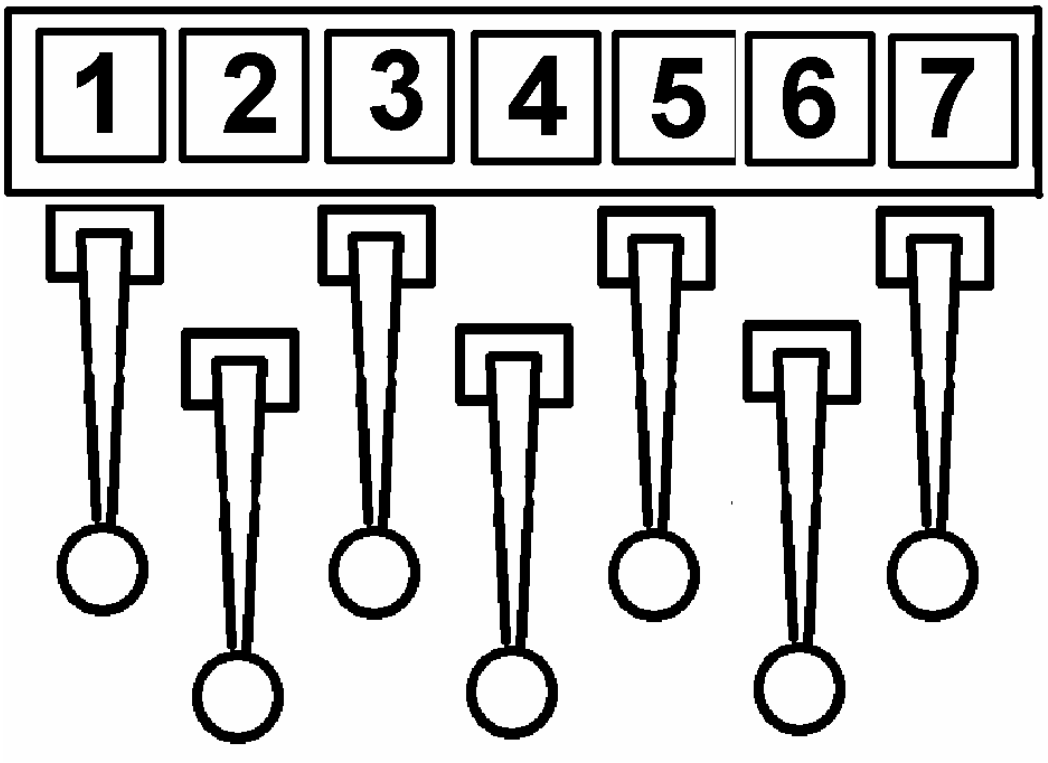
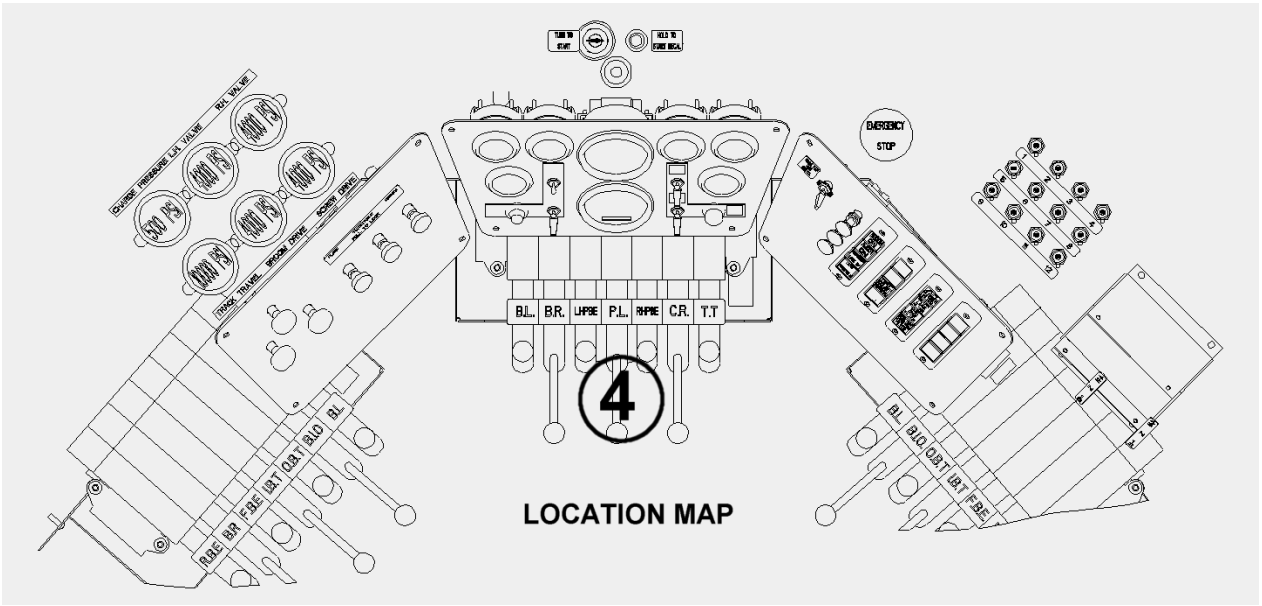
ITEM #	SYMBOL	CONTROLS	FUNCTIONAL DESCRIPTION
6		Ballast Wing In/Out Push - Release - Pull -	 Moves Wing Out Movement stops at last position Moves Wing In
7		Ballast Wing Lift Push - Release - Pull -	 Lowers Wing Movement stops at last position Raises Wing

TABLE 4. HYDRAULIC CONTROLS
CENTER VALVE BANK





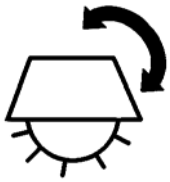
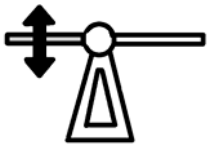
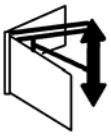
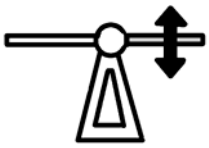
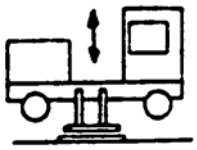
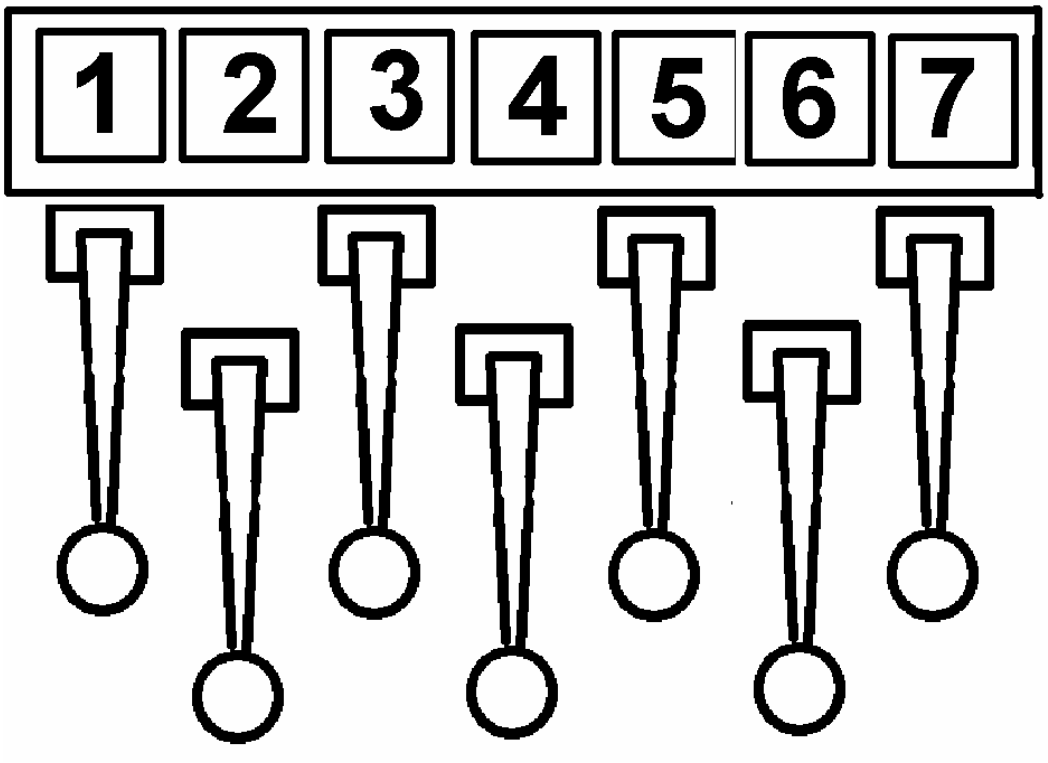
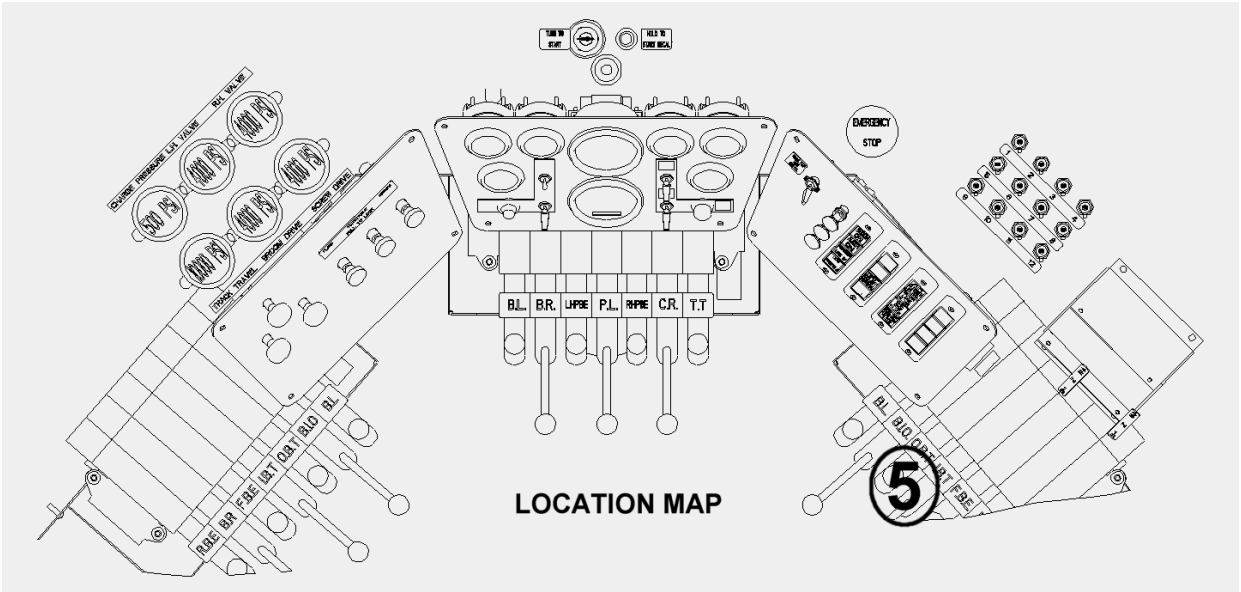
ITEM #	SYMBOL	CONTROLS	FUNCTIONAL DESCRIPTION
1		**Broom Lift** Push - Release - Pull -	 Lowers Broom Assembly Movement stops at last position Raises Broom Assembly
2		**Broom Rotate** Push - Release - Pull -	 Tilts broom down Movement stops at last position Tilts broom up
3		**Left Plow Extend** Push - Release - Pull -	 Extends (forward) Left Plow Blade Movement stops at last position Retracts (backward) Left Plow Blade
4		**Front Plow Lift** Push - Release - Pull -	 Lowers Front Plow Movement stops at last position Raises Front Plow
5		**Right Front Plow Blade Extend** Push - Release - Pull -	 Extends (forward) Right Plow Blade Movement stops at last position Retracts (backward) Right Plow Blade
6		**Chute Rotate (Opt.)** Push - Release - Pull -	 Rotates chute clockwise (CW) Movement stops at last position Rotates chute counterclockwise (CCW)
7		**Turntable Lockout** Push - **Manual Return to Center** - Pull -	 Not Used Operator must return this valve handle to center position once machine has been rotated. Unlocks the turntable valve located near the turntable. **NOTE: All other machine functions slow down until the valve handle is returned to the center or neutral position.**

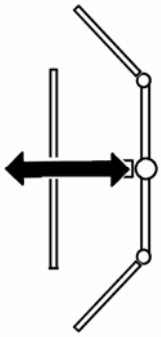
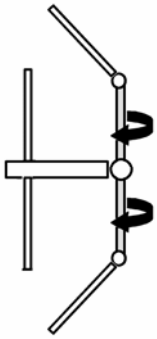
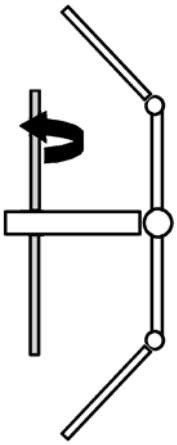
TABLE 5. HYDRAULIC CONTROLS
RIGHT VALVE BANK





LOCATION MAP

TABLE 5. HYDRAULIC CONTROLS
RIGHT VALVE BANK

ITEM #	SYMBOL	CONTROLS	FUNCTIONAL DESCRIPTION
1		**Ballast Wing Lift** Push - Release - Pull -	 Lowers Wing Movement stops at last position Raises Wing
2		**Ballast Wing In/Out** Push - Release - Pull -	 Moves wing out Movement stops at last position Moves wing in
3		**Outer Door Tilt** Push - Release - Pull -	 Tilts outer door In Movement stops at last position Tilts outer door out
4		**Inner Door Tilt** Push - Release - Pull -	 Tilts inner door In Movement stops at last position Tilts inner door out

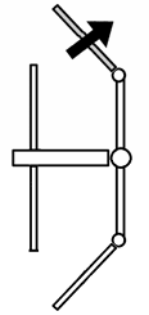
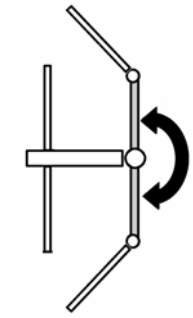
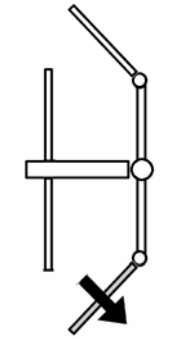
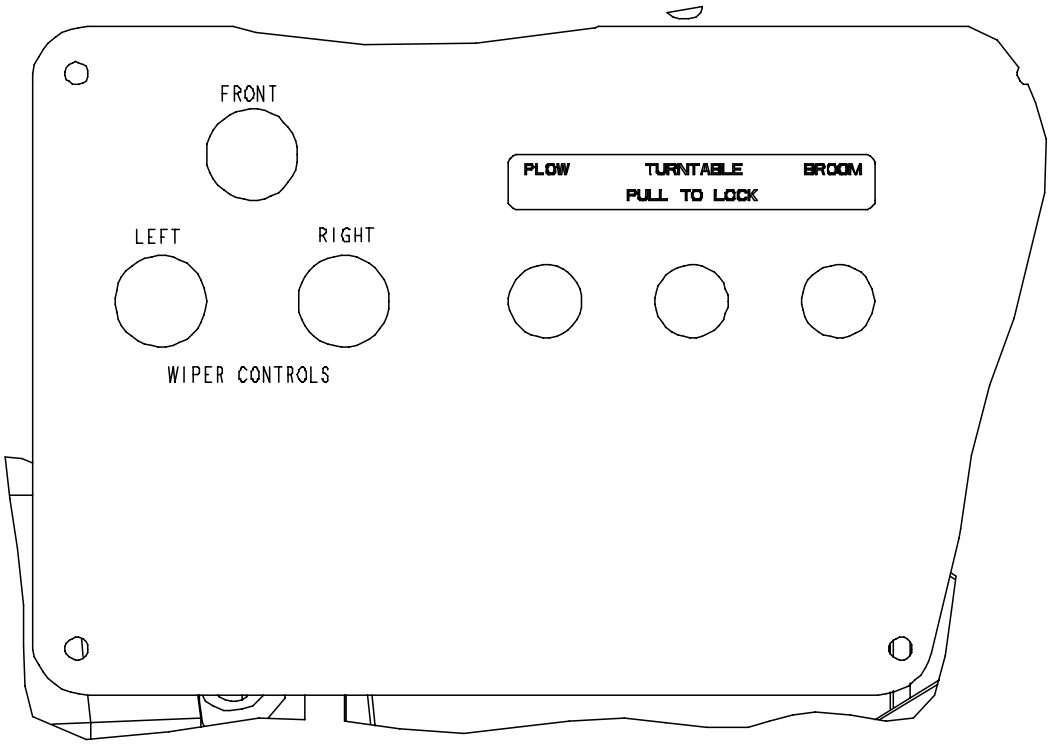
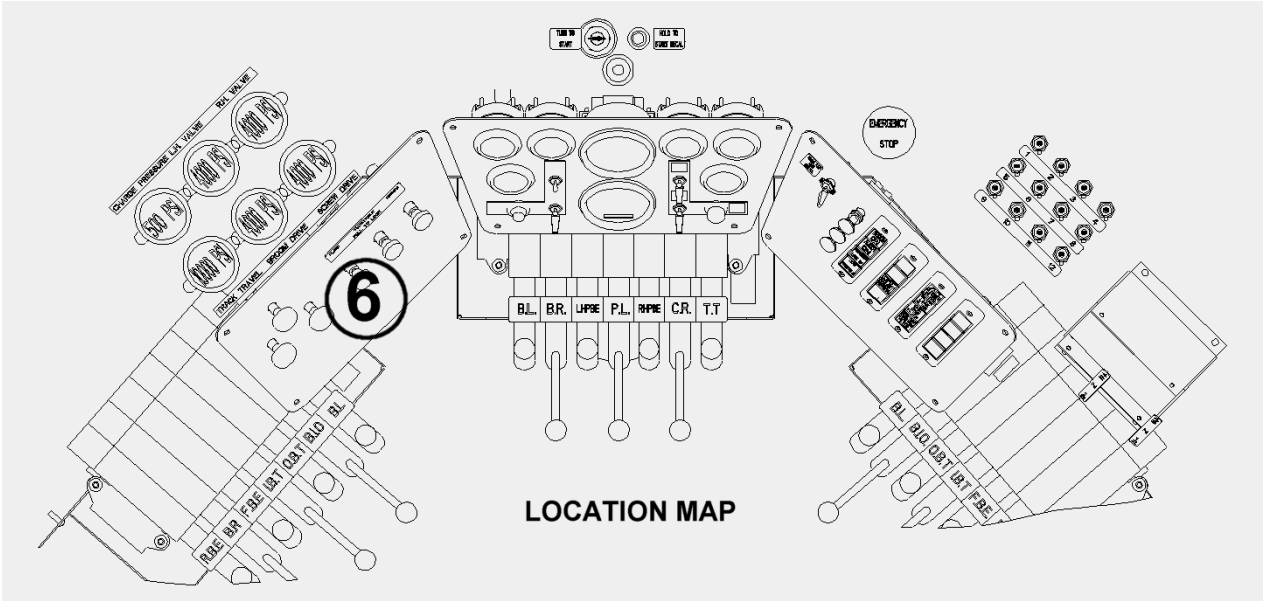
ITEM #	SYMBOL	CONTROLS	FUNCTIONAL DESCRIPTION
5		**Front Door Extend** Push - Release - Pull -	 Extends (out) Front Door Movement stops at last position Retracts (in) Front Door
6		**Outer Door Rotate** Push - Release - Pull -	 Rotates outer door clockwise (CW) Movement stops at last position Rotates outer door counterclockwise (CCW)
7		**Rear Door Extend** Push - Release - Pull -	 Extends (out) rear door Movement stops at last position Retracts (in) rear door

TABLE 6.



TURNTABLE AND WIPER CONTROLS



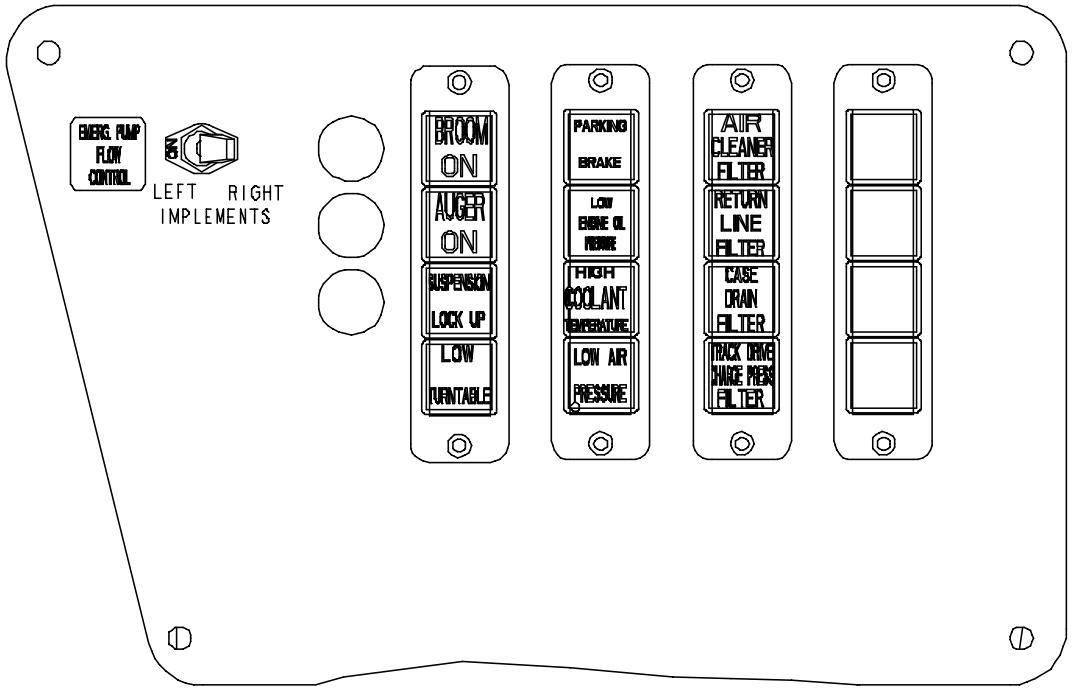
WIPER CONTROLS

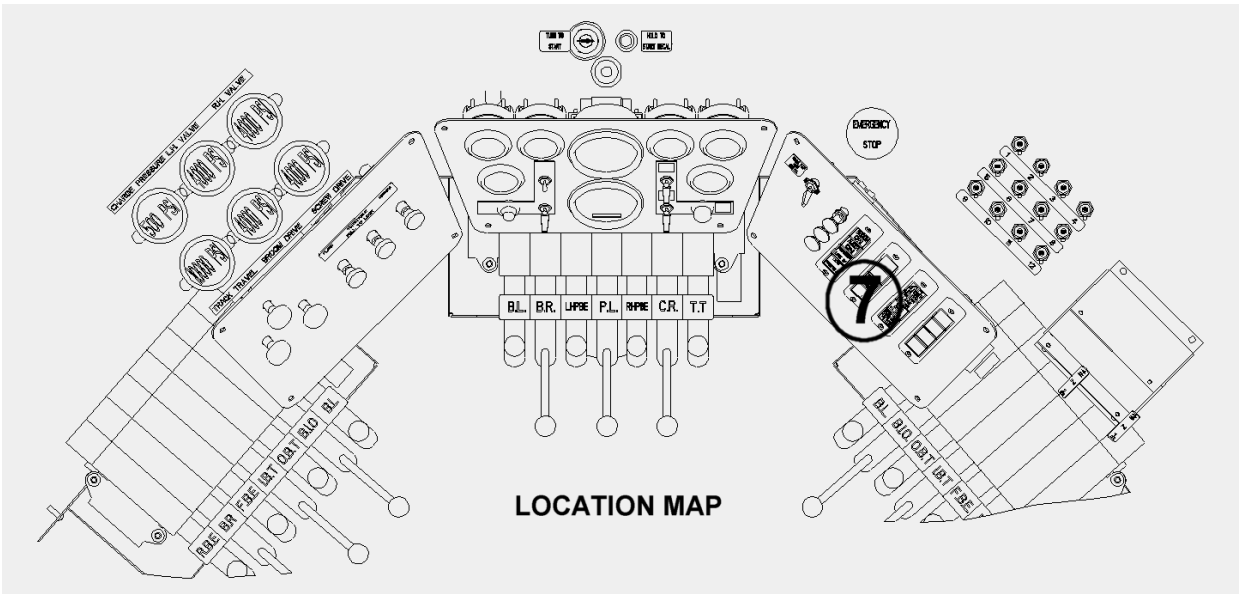
INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
Front	
Left	
Right	

LOCKS

INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
Turntable	
Broom	
Plow	

TABLE 7.
WARNING AND INDICATING LIGHTS

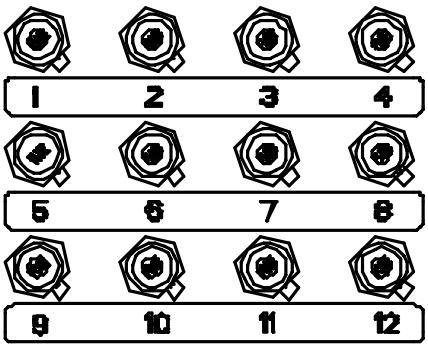


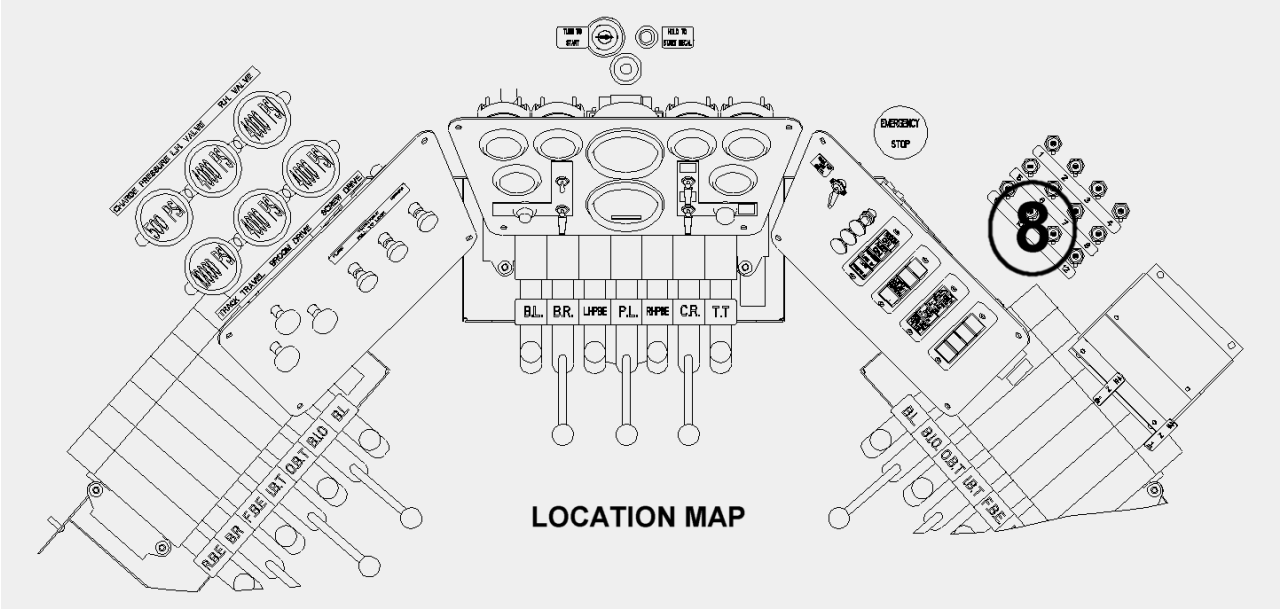


INDICATING LIGHTS

INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
Broom On	
Auger On	
Suspension Lockup	
Low Turntable	
Parking Brake	
Low Engine Oil Pressure	
High Coolant Temperature	
Low Air Pressure	
Air Cleaner Filter	
Return Line Filter	
Case Drain Filter	
Track Drive Charge Pressure Filter	
-Open-	
-Open-	
-Open-	
-Open-	

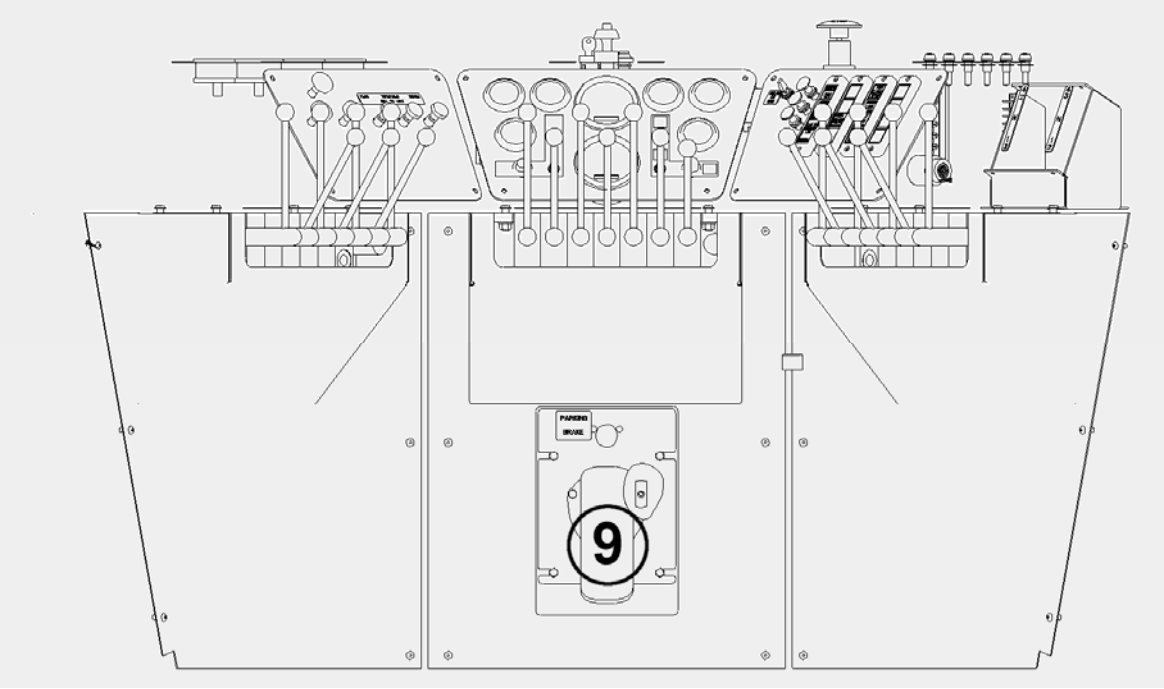
TABLE 8. MISCELLANEOUS ELECTRICAL CONTROLS





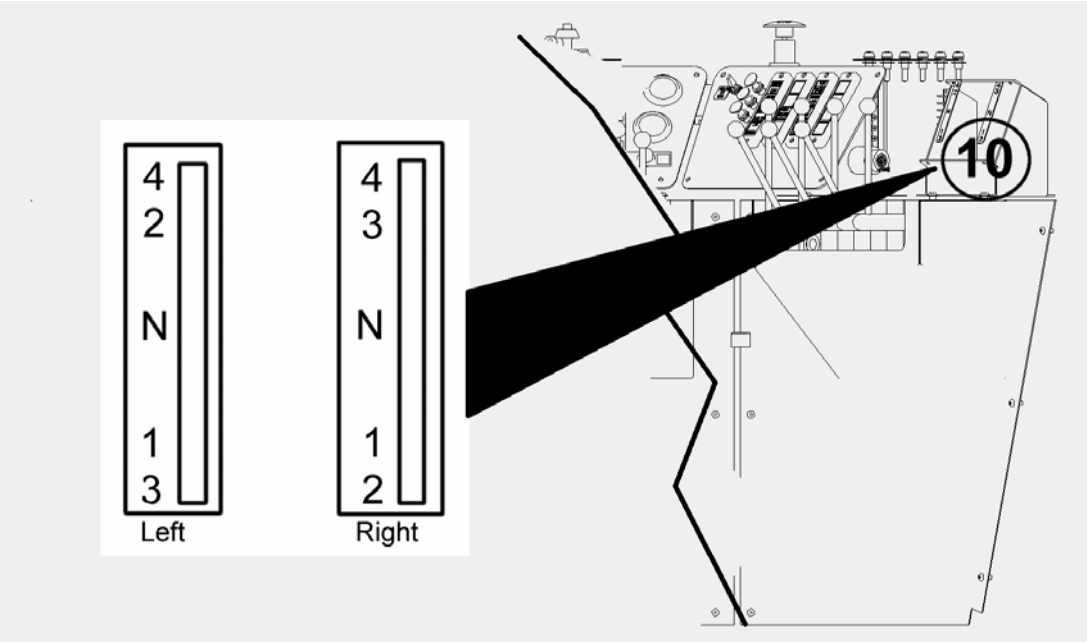
Item	Control	Description
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
	Emergency Stop	

TABLE 9. FRONT CONSOLE CONTROLS



INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
Brake	
Parking Brake Button	

TABLE 10. SIDE CONSOLE CONTROLS



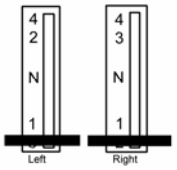
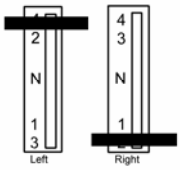
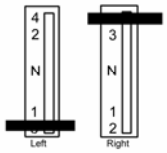
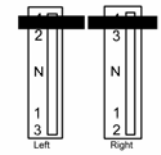
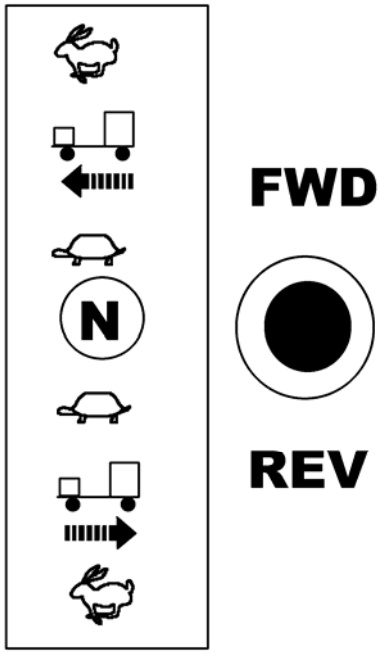
INSTRUMENT OR CONTROL	FUNCTIONAL DESCRIPTION
 1ST GEAR	**1st Gear (Low Gear)** Used during ballasting when encountering extremely large or heavy ballast.
 2nd GEAR	**2nd Gear** Used during normal working conditions.
 3rd GEAR	**3rd Gear** Used for track travel when speed is NOT a necessity.
 4th GEAR	**4th Gear (High)** Used for high speed track travel.

TABLE 11. RIGHT HAND SEAT CONTROL BOX PROPULSION CONTROLS



SYMBOL	Function
	Controls the forward propulsion of the machine. The further forward the joystick is moved, the faster the machine travels forward. Rabbit indicates "fast" Turtle indicates "slow"
	
	Controls the reverse propulsion of the machine. The further forward the joystick is moved, the faster the machine travels forward. Rabbit indicates "fast" Turtle indicates "slow"

TABLE 12. REMOTE CONTROLS AND INDICATORS

NEED PICTURE

Item	Control or Instrument	Function
1	Emergency Pump (Optional) Top Off Pump (Optional)	Located on frame near the engine. Pump is used when there is a loss of system pressure and movement of hydraulic cylinders is necessary. System pressure is supplied by pumping hand lever or by switch on electric pump. The top off pump can be either an electric or manual pump that is used for filling the hydraulic tank.
2	Battery Disconnect Switch	Located next to the battery box. Two position switch marked with "ON/OFF" plaque. This must be OFF and cover locked during service.
3	Hydraulic Oil Tank Sight Level and Optional OilTemperature Gauge	Located on hydraulic oil tank, it indicates the level of hydraulic oil in the tank. Located on the bottom of the hydraulic oil sight level. Indicates temperature of the hydraulic oil. Normal operating temperature is 80° to 150° F (49° to 66° C).
4	**Air System Drain**	Valve located on right hand side of frame in front of ISO (red) tote. Open valve to relieve air pressure.
5	**Air Tanks Drain**	Pull cords located immediately above Air System Drain valve. Pull on each cord to drain water out of air tanks.
6	**Purge Tank Drain**	The purge tank drain cord is located on the frame between the right front crawler and the engine. Pull on cord to drain tank.

EXHAUST EMISSIONS CAUSED BY THE USE OF 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 MANUFACTURERS MANUAL FOR INITIAL START INSTRUCTIONS. FAILURE TO FOLLOW THOSE INSTRUCTIONS CAN RESULT IN SERIOUS ENGINE DAMAGE.

Engine Operation

1. Check engine oil level, engine coolant level, fuel oil level, and hydraulic oil level before attempting to start engine.
2. Ensure that pump suction line gate valves are fully open.
3. Ensure that parking brake is applied, track travel pump control is in NEUTRAL and track travel motor control is at LOW position.
4. Set master cut-off switch to ON position.
5. Disengage clutch (if clutch is provided).
6. Set throttle control slightly open.
7. Depress shut-down override and hold (for machines without a shut-down override, go on to next step).
8. Turn ignition key clockwise to start engine.
9. In cold weather, when engine is difficult to start, depress ether assist button while turning over engine. (Note: Ether assist button is optional).
10. Release shutdown override when engine warning light goes out.
11. Allow engine to idle until it warms up, then bring engine slowly to full rpm.
12. Perform the startup check on the next page.

TABLE 13. STARTUP CHECKS AND PROCEDURES

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 Buttons (All Boxes)
- ☒ Horn Button (Remote Operator Boxes)

OPERATOR CONTROLS FUNCTION

- ☒ Foot switches
- ☒ Air Brakes

LOCK-UP DEVICES ENGAGED

- ☒ Front Ballast Plow
- ☒ Side Ballast Profilers
- ☒ Turntable
- ☒ Ballast/Snow Broom
- ☒ Stone Deflectors
- ☒ Suspension Lockout (if so equipped)
- ☒ High Speed V-Plow (If so equipped)
- ☒ High Speed One-Side Plow (If so equipped)
- ☒ Multi-position Plow (If so equipped)
- ☒ Side Wing Plow (If so equipped)
- ☒ Snow Screw and Blower (If so equipped)
- ☒ Snow Spreader (If so equipped)

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 in Table OP-11, 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 (safety goggles and chemical resistant gloves).

11. Determine who will be in the COMMAND position for operating the controls for the machine (both at the travel station and at the work station).

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

TABLE 14. PRE-OPERATIONAL CHECKLIST

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

MAIN CONTROL PANEL STATUS

- ☒ Gages checked for broken glass.
- ☒ Emergency Stop pushbutton is pulled out.
- ☒ Parking Brake pushbutton is pushed in.
- ☒ Control Panel Switches set as follows:
  - ☒ Pump ON/OFF switch is OFF
  - ☒ Ignition switch is in OFF
  - ☒ Track Drive is set to NEUTRAL
  - ☒ Travel Lights are OFF
  - ☒ Lockup Switches Engaged
  - ☒ Work Lights are OFF
  - ☒ Emergency Stop pushbutton is pulled out.
  - ☒ Turntable Cylinder Lock Switch is in the ON position

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

LOCK-UPS

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

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

LOCKUP	PROCEDURE
Front Ballast Plow	Raise front plow to maximum height. Engage attachment lock using control in cab. Lower plow onto lock.
Side Ballast Wing and Reversible Snow Wing	Raise wing to engage hook over mating portion in A-frame. Lower hook slowly by sliding wing in.
Ballast/Snow Broom	Attach safety chains. Raise broom to maximum height. Engage attachment lock using control in cab. Lower broom onto locks.
High Speed V-Plow	Raise plow to maximum height. Engage attachment lock using control in cab. Lower plow onto lock.
High Speed One-Side Plow	Raise plow to maximum height. Engage attachment lock using control in cab. Lower plow onto lock.
Multi-Position Plow	Raise plow to maximum height. Engage attachment lock using control in cab. Lower plow onto lock.
Turntable	Attach safety chains. Raise turntable to maximum height. Engage attachment lock using control in cab. Lower turntable onto hooks. **Note: Turntable locks MUST be removed prior to lowering or locks will be damaged.**

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.

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

ENGINE SPEEDS

Engine speed settings are slow and fast. When traveling either in the work or travel modes, you will have the engine speed in the FAST position.

PROPELLING (TRACK TRAVEL OPERATION)

Before propelling this machine, make certain that all lockups are in their proper position. Check that suspension is not locked out (for machines with optional suspension lockouts).

NOTE: All movements of the pump and motor control levers carried out in the following instructions MUST be carried out SLOWLY and SMOOTHLY.

1. Ensure that engine is at full throttle and the hydraulics are warmed up. Refer to “Engine Startup”, earlier in this section.

2. Select from the following, depending on the type of transmission provided on your machine:

    a. **For machines with four-speed manual transmissions**: Engage the 4-speed mechanical transmission by setting the transmission levers in the desired position as indicated on the decal. **NOTE:** Never shift the mechanical transmission “on-the-fly”.

    b. **For machines with Powershift transmissions:** Set transmission selector switch to 1st (low).

3. Release the parking/emergency brake.

4. To Accelerate: slowly move the pump control lever in the desired direction until the required speed is attained and then select from the following, depending on the type of transmission provided on your machine:

    a. **For machines with four-speed manual transmissions:** If more speed is required after the pump control lever has been moved to its fullest extent, move the motor control lever from the LOW position (turtle) towards the HIGH position (rabbit).

    b. **For machines with Powershift transmissions:** If more speed is required, set transmission to 2nd (HIGH) and adjust the pump control lever to attain the desired speed. Note that the transmission may be shifted from LOW to HIGH at any speed, however, it is recommended that the machine be at or near the maximum travel speed before up-shifting.

5. To Decelerate: Select from the following, depending on the type of transmission provided on your machine:

    a. **For machines with four-speed manual transmissions:** Slowly move the motor control lever from HIGH (rabbit) to LOW (turtle). If less speed is required after the motor control lever has been moved all the way to the LOW position, slow moved the pump control lever towards the N or NEUTRAL position.

    b. **For machines with Powershift transmissions:** Slowly move the pump control lever towards the N or NEUTRAL position. If downshifting to LOW is desired, first slow the machine down to 5 mph or less using the pump control lever. **DO NOT SHIFT FROM HIGH TO LOW AT SPEEDS GREATER THAN 5 MPH!**

6. To Change Direction: Bring the machine to a complete stop. Move the pump control lever in the desired direction and follow the instructions outlined in item #4, above. **NEVER CHANGE DIRECTION OF THE MACHINE WITHOUT FIRST BRINGING THE MACHINE TO A COMPLETE STOP.**

BRAKING (WORKING – SERVICE - BRAKES)

This machine is equipped with a fail-safe brake system. If there is a loss of air pressure, the brakes are spring applied.

NOTE: The track drive system is strong enough to overpower the braking system. For this reason, ALWAYS NEUTRALIZE THE TRACK DRIVE SYSTEM SLOWLY BEFORE APPLYING THE BRAKES.

One foot pedal operates the service brakes. For normal brake operation, either brake pedal may be depressed to apply the brakes. Releasing of the brake pedal releases the brake.

PARKING/EMERGENCY BRAKES

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

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

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

Machine Setup

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

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

ALWAYS TURN OFF MACHINE WHEN PERFORMING MAINTENANCE, MAKING ADJUSTMENTS, OR WHENEVER UNINTENDED MOVEMENT OF MACHINE COULD OCCUR; UNLESS DIRECTED OTHERWISE. FAILURE TO COMPLY COULD RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE MACHINE.

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

FRONT BALLAST PLOW HEIGHT ADJUSTMENT

Lower the plow assembly by pushing the valve handle forward (in conventional mode) until the bottom of the tie jumper makes only slight contact with the highest ties. If tie jumper is set too low, it will wear out rapidly. **Adjust height with suspension locked out (if so equipped).**

If the plow bottoms out before reaching the recommended position, the adjusting screws are making contact first. To correct, back screws off to allow for further lowering. Once the recommended position is obtained, lower the adjusting screws to the point that they make contact with the frame.

Test the setting by raising the plow and then letting it float. Adjust if necessary until the desired position is obtained.

MULTI-POSITION SNOW AND HIGH SPEED V-PLOW HEIGHT ADJUSTMENT

Lower the plow assembly by pushing the valve handle forward (in conventional mode) until 1-inch of clearance has been reached between the bottom surface of plow structure to top of rail. **Adjust height with suspension locked out (if so equipped).**

This position will automatically set any flanging device (optional) at their proper working heights. Note that the 1-inch clearance is required to allow for suspension travel. Cut-outs on multi-positioned snow plow should be covered with special winter grader blades. If cut-outs are left exposed, the tie jumper

must remain in place. Otherwise, use of the tie jumper is optional. It may be left on for the sake of convenience.

If the plow bottoms out before reaching the recommended position, the adjusting screws are making contact first. To correct, back screws off to allow for further lowering. Once the recommended position is obtained, lower the adjusting screws to the point that they make contact with the frame.

Test the setting by raising the plow and then letting it float. Adjust if necessary until the desired position is obtained.

BROOM ANGLE AND HEIGHT ADJUSTMENTS

Set desired angle of stone deflector using broom rotate control. "Lock In" angle using chains on broom (if provided). Lower broom using broom lift control until tips of broom hoses make contact with top of ties. Adjust screws on broom carrier frame, so they make contact with main frame. This locks in maximum depth of broom. As broom hoses wear, adjustment screws must be backed off accordingly to maintain hose contact with top of ties.

Lower broom until broom hoses make slight contact with top of ties when broom screw is rotating.

SNOW SCREW AND BLOWER

Adjust blower paddles so that there is 1/8-inch clearance between rubber paddles and housing.

MACHINE 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.

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

GENERAL OPERATION

1. Make certain all STARTUP procedures have been followed before beginning working operations.
2. Make certain all lockups have been removed and stored (as required).

FRONT BALLAST AND HIGH SPEED V-PLOWS

Plow is raised and lowered hydraulically. Before lowering, ensure that the lockup pin is removed.

The valve section for the front plow has a "float" position. To engage the "float" mode, push this valve handle forward (and keeping pushing) until the lever locks into the detent position. The plow will lower due to gravity, then bottom out. This is the desired mode for work operations.

Pull the valve handle back, and the valve section operates in a conventional mode. The conventional mode allows the plow to be positioned for travelling and for **quick height adjustments** when working (such as clearing crossings, obstructions, etc.).

IF YOUR MACHINE IS EQUIPPED WITH BLADE FLANGE DEVICES, THEY EXTEND BELOW THE TOP OF THE RAIL. FAILURE TO RAISE THE PLOW (W/FLANGES) WELL CLEAR OF THE TOP OF THE RAIL MAY RESULT IN SEVERE MACHINE DAMAGE OR PERSONAL INJURY.

To operate the front ballast or high speed V-plows:

1. Raise or lower the plow using the valve handles in the center console. Determine whether "float" or "conventional" mode will be used for operation. Remember, "float" should be used during all working operations.

2. If equipped with the optional “positioning” cylinders, rotate the plow blades fully in or fully out as required. Make certain that the plow assembly is raised clear of the rails before re-positioning the blades. **Note: The plow should always be operated with the blade rotated either fully in or fully out, not part way through their rotation. Ensure that the plow assembly is raise clear of the rails before repositioning the blades.**

MULTI-POSITION PLOWS

Plow is raised and lowered hydraulically. Before lowering, ensure that the lockup pin is removed.

The valve section for the front plow has a "float" position. To engage the "float" mode, push this valve handle forward (and keeping pushing) until the lever locks into the detent position. The plow will lower due to gravity, then bottom out. This is the desired mode for work operations.

Pull the valve handle back, and the valve section operates in a conventional mode. The conventional mode allows the plow to be positioned for travelling and for **quick height adjustments** when working (such as clearing crossings, obstructions, etc.).

To operate:

1. Raise or lower the plow using the valve handles in the right or left valve bank console. Determine whether "float" or "conventional" mode will be used for operation. Remember, "float" should be used during all working operations.

2. Make certain that the plow assembly is raised clear of the rails before re-positioning the blades. Position the blades as needed. Note: Both blades cannot be in the extended (out) position at the same time.

3. When positioning the blades for one-way plowing, the retracted blade must be set in place before the extended blade.

BALLAST WINGS

The ballast wings are hydraulically operated with the valve handles in the control panel. To lower the wings, the wing in/out lever must first be pushed to clear the storage catch. Once clear, the wing may be lowered and positioned as desired. The wing raise/lower cylinder is equipped with a "cushion" feature. Upon raising the wing, the last portion of the stroke is affected. This is particularly noticeable when the hydraulic fluid is cold.

To operate:

1. Push the Wing In/Out lever on the right or left console to clear the storage catch. Once the catch is clear, continue with step 2.
2. Raise or lower the wings using the valve handles on the right or left console.
3. Close, open, and/or tilt the ballast boxing doors using the controls on the center console. **Note: The Inner Door Tilt Cylinder/Control is optional on this machine.**

BROOM

The broom is hydraulically raised/lowered and rotated through the valve handles on the right side of the control console. Similar to the front ballast/snow plow, there is a locking pin that must be removed prior to lowering the broom. The broom should be lowered and rotated to the desired position so that the broom flail hoses just contact the top of the ties.

To operate:

1. Raise or lower the broom using the valve handles at the right side of the center console.
2. Reduce the engine speed to approximately 1500 rpm before starting the broom.
3. Start the broom by closing (rotate Clockwise – CW) the needle valve on the back wall of the cab; or by pulling the broom ON switch on the control panel.
4. Once the broom has started, gradually increase the engine speed to the governed rpm.

SNOW SCREW AND BLOWER

The snow screw and blower is raised/lowered by using a combination of the broom raise/lower and rotate valve handles. The blower discharge chute is rotated hydraulically by operating the appropriate valve handle to the right of the control panel.

Note: Mechanical stops are provided for the chute rotate, and care must be taken when rotating the chute so that the force generated does not damage the chain or associated panel.

To start the screw and blower, reduce the engine speed to approximately 1500 rpm. Close (rotate Clockwise – CW) the needle valve on the back wall of the cab. Once the screw and blower have started, gradually increase the engine speed to the governed rpm.

Emergency Procedures

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

Emergency Pump (Optional)

For operation of cylinders only:

Depress emergency pump switch in the control console panel and then operate the required valve handle to move the attachment as required. Set the valve bank selector switch (where provided) in the correct position for the left hand or right hand bank. Operate the pump in intervals, for a maximum of 15 seconds at a time. The pump is deisnged for emergency use only and should not be used for extended periods of time.

EMERGENCY STOPPING

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

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

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

Parking or Locating Machine

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

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

Rotating Machine

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

The machine has a turntable which allows the machine to be lifted off of the tracks and rotated. The only function of this turntable is to rotate the machine. The turntable base is stored under the machine and is attached to the turntable cylinder at all times. The turntable is operated by a valve handle on the right side of the control console.

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

1. Raise all assemblies clear of the track structure and any obstacles.
2. Remove the lockup chains from the turntable.
3. Remove rotate lock pin.
4. Raise and rotate the machine.
5. Ensure that the wheel flanges are properly aligned with the rail.
6. Lower the machine.
7. Completely retract the turntable.
8. Install the lockup chains.
9. Install the rotate lock pin.

NOTE: Two turntable mounting positions are provided so that the machine can be balanced depending on the attachments installed.

Towing

Maximum towing speed is 20 mph. Reduce speed accordingly as dictated by weather or track conditions. Remember that the machine weight may approach the weight of the towing vehicle. Maintain increased stopping distance accordingly.

It is strongly recommended that the prop shafts be removed before towing the machine.

Towing Machines with 4-Speed Manual Transmissions

In an emergency situation when time does not permit the removal of the prop shafts, and providing that the distance to be towed is **less than 10 miles**, it is permissible to simply neutralize the gearbox before towing. Note that this may cause the gearbox bearings to overheat. The bearings will not receive any splash lubrication since the gears do not rotate when the transmission is in neutral.

Towing Machines with Powershift Transmissions

In an emergency situation when time does not permit the removal of the prop shafts, and providing that the distance to be towed is **less than 10 miles**, it is permissible to leave the engine running, with the transmission in neutral before towing. Note that when the engine is shut-opff, there is no provision to circulate the transmission fluid, which is necessary to prevent the bearings from overheating.

The following steps must be taken before towing your machine:

1. Install Lock-Ups. See LOCK-UPS section.

2. Make certain turntable has been raised.

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

4. Inspect the towing vehicle coupler for damage or loose parts.

5. Back towing vehicle to the machine and engage the couplers. Keep hands and fingers clear of the coupling device and all other pinch points.

6. Ensure that the coupling device is fully engaged, closed, and locked.

7. Install Brake Lock Pins. See Brake Assembly in Maintenance and Service for instructions on installing brake lock pins.

8. Ensure that the coupling device and rear frame members on the towing vehicles will not interfere with or restrict motion of any part of the machine when maneuvering.

9. When towing is complete, engage brake by removing the Brake Lock Pins.

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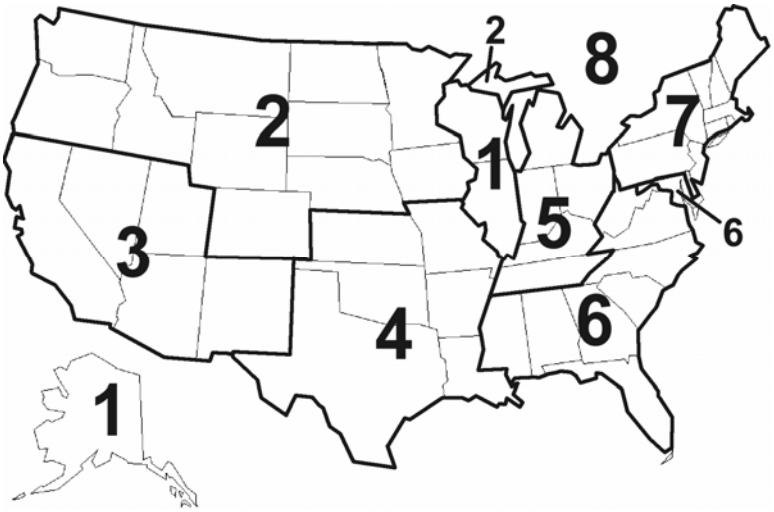
MAINTENANCE AND SERVICE

REQUESTING ASSISTANCE

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

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

SERVICE NETWORK



No.	Representative	Phone Number
1.	Nordco Service Manager (Milwaukee)	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.	North American Equipment Company Inc.	(859) 885-3353
6.	Dwayne Lambing	(770) 424-0401
7.	North American Equipment Company Inc.	(716) 677-5943
8.	North American Equipment Ltd. (Canada)	(905) 628-9997
9.	International: American Equipment Company	(561) 997-2080

LUBRICATION AND MAINTENANCE

Service points on this machine (adjustments, inspections, lubrication, etc.) are indicated on the following illustration. The items listed are preceded by a “D1, W1, M1, Q1 and A1" designation. These points 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 Designation.

NOTE: Engine lubrication and maintenance instructions are included in this manual as a reference tool only. It is NOT meant to substitute for the instructions given in the Engine Manufacturer’s Manual. If you no longer have a manual, contact Nordco Parts Sales for the local distributor of your engine.

LUBRICATION AND MAINTENANCE CHART

Sample new page

DAILY (OR 8 HOURS, WHICHEVER COMES FIRST)

Key:  = Refer to Lube Chart

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

LOC	ITEM	SYM	TASK
ENGINE	**D1.**		Check Engine Oil Level and Quality
	D2.		Check Engine Coolant Level and Quality
	D3.		Check Fuel Filter
	D4.		Inspect Cooling Fan on Engine (Cummins Engine Only)
	D5.		Inspect V-Belt for proper tension and condition
	D6.		Check Air Cleaner Indicators
	D7.		Drain Water Separator/Fuel Water Trap on Engine (if so equipped)
	D8.		Inspect Air Cleaner Dust Unloading Valve
	D9.		Inspect Engine Exhaust and Intake System for leaks and rain cap for fit.
	D10.		Check Case Drain Filter Indicator after resetting indicator
	D11.		- Reserved for Future Use -
HYD.	**D12.**		Check Hydraulic Oil Level and Quality (looking at gauge). Fill as necessary.
	D13.		Inspect Hoses and Fittings for Leaks
	D14.		Check Return Line Filter Condition Indicator
	D15.		- Reserved for Future Use -
	D16.		- Reserved for Future Use -
MISCELLANEOUS	**D17.**		Inspect Electrical Connections/Harnesses for Tightness
	D18.		Drain Air Tanks
	D19.		Fill Fuel Tank (end of day)
	D20.		Clean Windows on Cab
	D21.		Inspect wheels, wheel nuts, brake shoes and check gap between brake shoes and wheels
	D22.		Check all brake chamber caging bolts
	D23.		Inspect rail sweeps and adjust as required
	D23.		Inspect rail sweeps and adjust as required
	D24.		Check machine for cracks or other structural damage
	D25.		Clean debris from machine before letting machine sit idle
	D26.		Grease brake lever pivot
	D27.		Grease Optional Clutch
	D28.		- Reserved for Future Use -
	D29.		- Reserved for Future Use -
	D30.		- Reserved for Future Use -
CUTTER HEAD	**D31.**		Perform check on cutterhead – Blade Type Head
	D32.		Perform check on cutterhead – Saw-Blade Head
	D33.		- Reserved for Future Use -
	D34.		- Reserved for Future Use -
BOOM	**D35.**		Grease Boom Pivot Points
	D36.		Grease upper sheave assembly
	D37.		- Reserved for Future Use -
			- Reserved for Future Use -

LUBRICATION AND MAINTENANCE

DAILY (OR 8 HOURS, WHICHEVER COMES FIRST)		
ENGINE	D1.	Check Engine Oil Level and Quality
	D2.	Check Engine Coolant Level and Quality
	D3.	Check Fuel Filter
	D4.	Inspect Cooling Fan on Engine (Cummins Engine Only)
	D5.	Inspect Drive Belt (Cummins Engine Only)
	D6.	Check Air Cleaner Indicators
	D7.	Drain Water Separator/Fuel Water Trap on Engine
	D8.*	Check Transmission Fluid Level
	D9.	- Reserved for Future Use -
	D10.	- Reserved for Future Use -
HYD.	D11.	Check Hydraulic Oil Level and Quality
	D12.	Inspect Hoses and Fittings for Leaks
	D13.	- Reserved for Future Use -
	D14.	- Reserved for Future Use -
	D15.	- Reserved for Future Use -
MISC.	D16.	Inspect Electrical Connections/Harnesses for Tightness
	D17.	Drain Air Tanks
	D18.	Fill Fuel Tank (end of day)
	D19.	Clean Windows on Cab

BALLAST PLOW	D25.	Grease Ballast Plow Up/Down Guide Rod
	D26.	Grease Ballast Wing Boom Pivot
	D27.	Grease Ballast Wing Rotary Plates
	D28.	Grease Ballast Wing Boom In/Out Tubes
	D29.	- Reserved for Future Use -
BROOM	D30.	Grease Broom Housing Pivot
	D31.	Grease Broom Up/Down Guide Rod
	D32.	Grease Broom Shaft Bearing (Both Sides)
	D33.	Lubricate Broom Drive Chain Chase
	D34.	- Reserved for Future Use -
SNOW WINGS (Optional)	D35.	Grease Snow Wing Up/Down Cylinder Rod Ends
	D36.	Grease Snow Wing Up/Down Pivot Plate
	D37	Grease Snow Wing In/Out Cylinder Rod Ends
	D38.	Grease Snow Wing In/Out Pivot Plate
	D39.	- Reserved for Future Use -
SNOW BLOWER (Opt.)	D40.	Grease Snow Blower Chute Pivot
	D41.	- Reserved for Future Use -
	D42.	- Reserved for Future Use -
	D43.	- Reserved for Future Use -

WEEKLY (OR 40 HOURS, WHICHEVER COMES FIRST)		
MISCELLANEOUS	**W1.**	Perform all Daily Lubrication and Maintenance Procedures
	W2.	Check Battery Condition
	W3.	Oil Brake Adjust turnbuckle
	W4.	Grease Brake Lever Pivot and Suspension Arm Pivot
	W5.	Check Transmission Fluid Level/Quality (4-Speed Transmission Only)
	W6.	Check Fluid Level – 3 Pump Drive
	W7.	Check Clutch Disconnect for Proper Engagement (Optional)
	W8.	Check Optional A/C Filter (During peak operation)
	W9.	- Reserved for Future Use -
	W10.	- Reserved for Future Use -
	W11.	- Reserved for Future Use -
	W12.	- Reserved for Future Use -
	W13.	- Reserved for Future Use -
	W14	- Reserved for Future Use -
BALLAST PLOW	**W15.**	Check Blades for Wear
	W16.	Check Tie Jumper for Wear
	W17.	- Reserved for Future Use -
	W18.	- Reserved for Future Use -
BROOM	**W20.**	Inspect Broom Hoses for Wear
	W21.	- Reserved for Future Use -
	W22.	- Reserved for Future Use -
	W23.	- Reserved for Future Use -
SNOW WINGS (Optional)	**W25.**	Check Pivot Bushings for Wear
	W26.	Check Blades for Wear
	W27	- Reserved for Future Use -
	W31.	- Reserved for Future Use -

a. Check vacuum gage reading. Replace if necessary

MONTHLY (OR 150 HOURS, WHICHEVER COMES FIRST)		
MISCELLANEOUS	**M1.**	Perform all Daily and Weekly Lubrication and Maintenance Procedures
	M2.	- Reserved for Future Use -
	M3.	Change Engine Oil and Filters
	M4.	Check Brake Shoes for Wear
	M5.	Run Pressure Checks on Main Pump and Propulsion
	M6.	Check Oil Cooler
	M7.	Check Air Cleaner Element and Air Cleaner Restriction on Engine
	M8.	Check Air Intake System
	M9.	Lubricate Broom Drive Chain
	M10.	Lubricate Snow Blower Drive Chain (Optional)
	M11.	- Reserved for Future Use -
	M12.	- Reserved for Future Use -
	M13	- Reserved for Future Use -

QUARTERLY (OR 500 HOURS, WHICHEVER COMES FIRST)		
MISCELLANEOUS	**Q1.**	Perform all Daily, Weekly and Monthly Lubrication and Maintenance Procedures
	Q2.	Drain Fuel Tank
	Q3.	Replace Fuel Filters
	Q4.	Check Cooling System Hoses
	Q5.	Test Hydraulic Oil Cleanliness
	Q6.	Initial Engine Valve Clearance Adjustment[a]
	Q7.	Change Transmission Fluid (4-Speed Transmission)
	Q8.	Change Pump Drive Fluid
	Q9.	Test Insulation of Axles
	Q10.	Replace Hydraulic Tank Breather Filters
	Q11.	Replace Fuel Tank Breather Filters
	Q12.	Lubricate throttle cable
	Q13.	Test Engine Anti-Freeze Solution
	Q14.	- Reserved for Future Use -
	Q15.	- Reserved for Future Use -
	Q16	- Reserved for Future Use -

a. Initial Valve Adjustment: First adjustment at 500 hours, thereafter every 2 years.

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. The Model M2 Ballast Regulator 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.

For your convenience we have included copies of the electrical and hydraulic functional schematics as well as the cabling diagrams and logic board layouts drawings. These are included at the end of the Troubleshooting Tab.

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 details.

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.

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

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.

For engine problems not listed in the troubleshooting charts, please refer to the Engine Manual.

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 overcharing 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.

The Electrical Schematic for this machine can be found at the back of this TROUBLESHOOTING section and behind the Electrical tab of the manual.

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.

PROBLEM	POSSIBLE CAUSE	SOLUTION
Battery uses too much water		
Cracked Battery Case	Frozen battery	Keep battery fully charged in cold weather. Replace battery.
Low Battery Output	Low water level.	Add distilled water.
	Dirty or wet battery top causing discharge.	Clean and wipe dry battery top.
	Corroded or loose battery cables.	Clean and tighten battery cables.
	Broken Battery post.	Wiggle battery post by hand. If post wiggles or turns, replace battery.
	Wrong size replacement battery.	Replace battery with type specified under "Machine Specifications".
Starting Motor will not turn.	Battery disconnect switch turned off.	Turn switch to "ON" position.
	Defective ignition switch	Repair or replace.
	Directional Control not set to Neutral	Lift control handle up to unlock and move to Neutral position.
	Bad solenoid	Replace solenoid
	Corroded battery terminals.	Inspect and clean if necessary.
Hourmeter does not work.	Hourmeter Gauge Defective.	Replace Hourmeter.
	Wiring harness shorted	Replace wiring harness.
	Corroded or failed hourmeter groundwire.	Replace groundwire.
Voltmeter does not work.	Voltmeter Gauge Defective.	Replace meter.
	Wiring harness	Repair or replace.
	Regulator	Repair or replace.
Engine Oil Pressure Gauge does not work.	Pressure Gauge Defective.	Replace gauge.
	Wiring harness.	Repair or replace.
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

PROBLEM	POSSIBLE CAUSE	SOLUTION
		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
	Horn Defective.	Check horn, repair or replace.
	Horn Relay.	Check relay.
	Horn Switch.	Check switch, repair or replace.
Backup Alarm does not sound.	Backup Alarm switch not turned on	Turn on.
	Wiring harness	Check harness, repair or replace.
	Backup Alarm Circuit Breaker blown.	Reset circuit breaker
	Connection at alarm loose.	Tighten connection.
	Backup Alarm Defective	Check alarm, repair or replace.
	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
	Light switch defective.	Repair or replace switch.
	Connection at switch loose.	Tighten connection.
	Connection at circuit breaker panel loose.	Tighten connection.

PROBLEM	POSSIBLE CAUSE	SOLUTION
	Light defective.	Replace light.
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.
	Light switch defective.	Repair or replace switch.
	Light defective.	Replace light.
Cooling Fan not working	Loose connection at back of fan	Tighten.
	Loose connection at circuit breaker panel.	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.
	Light defective.	Replace light.

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 on suction strainer 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 Celcius) quickly harden or stiffen a rubber hose. When pressure pulses flex a hardened hose, it fails by cracking. Every increase of 25° F (14°C) 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 “Electrical” in Part 2 - PARTS INFORMATION.

HYDRAULIC SYSTEM
TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	SOLUTION
Hydraulic pump does not develop pressure	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.)	Adjust pressure setting on relief valve.
	Pump is defective.	Refer to pump manual or replace pump.
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.
Track travel not functioning in one direction. (Other direction is normal)	Pump stroking linkage slipped, and not positioned correctly.	Align linkage and tighten.
	Faulty control on pump.	Inspect, repair or replace.
	Motor high pressure relief valve stuck open (located on rear block of motor)	Interchange location of two relief valves and see if change in travel direction or malfunction. Clean, inspect or change relief valve if necessary.
Track travel not functioning in either direction.	Suction line shut-off valve closed.	Open valve and lock in open position.
	Clogged suction filter.	Check vacuum reading, if more than 10-inches of Hg at working temperature, change filter elements.

PROBLEM	POSSIBLE CAUSE	SOLUTION
	Suction line gate valve closed.	Open valve and lock in the open position.
	Four speed transmission not in gear.	Put in gear, check linkage if necessary.
	Pump control block faulty.	Inspect, repair or replace.
	Pump control cable faulty.	Inspect, repair or replace.
Track travel slow in either direction.	Shifting linkage not putting motor lever into correct position for high speed.	Check linkage and tighten.
	Faulty pump control.	Inspect, repair or replace.
	Low charge pressure a) clogged suction or charge pressure filter. b) Excessive leakage in pump or motor.	a) Change elements. b) Change both pump and motor and repair old units.
Note: for more hydrostatic trackdrive problems, please refer to component manufacturer's manual.		
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.
	Travel relief set too low	Check and reset
Hydraulic Oil Foams	Water in oil	Inspect oil for water. Drain and add correct oil as specified under "RECOMMENDED LUBRICANTS".
	Using wrong oil	Drain and add correct oil as specified under "RECOMMENDED LUBRICANTS".
	Low hydraulic level	Check level. Refill tank.
	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.

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.	Main pump not developing pressure.	See Hydraulic Troubleshooting.
	Brakes not releasing.	See next problem.
	Propulsion relief setting too low.	Increase relief setting.
	Defective motor or broken drive shaft.	Repair or replace motor or shaft.
Brakes will not release	Air Pressure too low.	Adjust regulator setting.
	Brake cylinder bypassing air.	Inspect and replace cylinder.
Brakes will not apply.	Broken brake spring.	Inspect spring and replace if necessary.
	Brake shoes worn.	Inspect shoes and replace it necessary.
Broom won't lift or lower	Lockup engaged.	Disengage lock.
	Obstruction at pinch points.	Remove obstruction.
	Pressure problem at lift cylinder.	Adjust main relief or replace cylinder.
	Carrier bushings not lubricated.	Grease bushings.
	Bent guide rods.	Replace guide rods.
Broom won't maintain RPM	Engine not at full RPM	Adjust throttle
	Brooming depth is too deep	Reset broom depth
	Too much ballast	Plow out
	System pressure problem	Adjust system pressure
	Defective broom drive motor	Repair or replace drive motor
Excessive Broom Drive Noise and Vibration	Unevenly distributed broom elements or missing elements	Replace missing or worn elements.
	Drive chain out of adjustment	Re-adjust
	Lack of lubrication in the drive housing	Fill to level plug
	Broom shaft bearing failure	Replace bearing
	Defective broom drive motor	Repair or replace drive motor

PROBLEM	POSSIBLE CAUSE	SOLUTION
2-Way Plow won't lift or lower	Safety lock engaged.	Disengage safety lock.
	Obstruction at pinch points.	Remove obstruction.
	Pressure bypass problem at lift cylinder.	Adjust main relief or replace cylinder.
	Carrier bushings not lubricated.	Grease bushings.
	Bent guide rods.	Replace guide rods.
2-Way Plow Positioning Cylinder won't function	Optional Turntable Control valve was left in detent position.	Reposition to center
	Check for foreign obstruction	Remove obstruction.
	Hinge pins not lubricated.	Lubricate.
	Cylinder is defective.	Repair or replace cylinder.
	Cross line check valve is defective.	Repair or replace valve.
Ballast Wing Won't Lift	Port relief is out of adjustment.	Readjust
	Main relief is out of adjustment.	Readjust.
	Hinge pins not lubricated.	Lubricate
Ballast Wing Won't Go into Storage Position	Foreign material at hinge point.	Remove
	Lift cylinder bearings damaged.	Repair or replace
	Lift cylinder seal damage	Repair or replace
	Hinge pins not lubricated.	
Front Door won't rotate	Damaged rotate cylinder.	Repair or replace
	Rotate mechanism damaged due to lack of lubrication	Repair and lubricate or replace and lubricate.
Outer Boom moves slow	System pressure out of adjustment.	Readjust
	Bent inner or outer boom.	Repair or replace.
Excessive Noise in Transmission	Parking brake applied.	Release
	Oil level too low.	Add oil.
Transmission jumps out of Gear	Shift cable out of adjustment.	Readjust
	Foreign object jamming shifter arm	Remove

PROBLEM	POSSIBLE CAUSE	SOLUTION
	Damaged shifter fork spring	Replace
	Transmission mounting bolts loose.	Tighten
Axle Vibration During Speed Changes	Torque link pins or bearings are damaged.	Repair or replace
Axle Housing Running Hot	Parking brake left on	Disengage
	Oil Level Low	Fill to level plug
	Pinion Bearing Damaged.	Repair or replace
Excessive Vibration During High Speed Travel	Journal bearings are dry	Replace
	Suspension wear plates are worn	Replace
	Universal joints worn	Replace
	Uneven wheel diameters.	Resurface or replace
Broom or snow blower not rotating or easily stalls	Bearing failure	Check broom shaft bearings for heat or failure and replace if necessary.
	Relief valve faulty	Repair or replace
	Pump worn or faulty	Repair or replace
	Motor worn or faulty	Repair or replace
Broom or snow blower not rotating or easily stalls	Relief valve pressure setting too low	Check pressure of system by blocking output side of relief valve and set to correct pressure
	Broken drive shaft.	Replace
	Damaged drive motor.	Repair or replace
	Low System Pressure	Check system pressure and adjust as necessary.